Stone Tools Through Space and Time

500 Years of Lithic Developments and Continuity at the Early Natufian Settlement of Wadi Hammeh 27

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Statement of authorship

Except where reference is made in the text of this thesis, the text contains no material published elsewhere or extracted in whole or in part from a thesis accepted for the award of any other degree or diploma. No other person's work has been used without due acknowledgement in the main text of the thesis. The thesis has not been submitted for the award of any degree or diploma in any other tertiary institution.

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Abstract

The site of Wadi Hammeh 27 (12,500 – 12,000 BCE) in north-western Jordan is characterised by an intricate sequence of curvilinear stone structures associated with massive amounts of flaked stone tools, faunal material and other diverse categories of artefacts. The excavation of six stratified occupational horizons has provided a rare opportunity to investigate its lithic assemblages in detail, in order to determine a complex sequence of techno-typological trends. This thesis represents the first study of such fine-scale temporal changes in an Early Natufian settlement.

The lithic reduction sequence utilised by the inhabitants of Wadi Hammeh 27 remained relatively consistent over time. Individual categories exhibit a range of diachronic trendlines, some of which are dependent on allied shifts, while others operate on a seemingly independent basis. Of note are shifts pertaining to the exclusive reduction of bladelet cores, along with an increased production of Helwan bladelets. These trends indicate increased value being placed on the maintenance of composite sickles in later phases, consistent with an increased emphasis on the collection of wild cereals. The application of GIS-aided spatial analyses in the lower phases also confirms that most lithic types were deposited as primary refuse within each domestic structure, with some of the bulkier types being deposited as secondary refuse in the context of external 'toss-zones'. Furthermore, some types exhibit a consistent spatial disconnect between one another, most notably the flake and bladelet cores.

Several key typological differences are also noted between the lower assemblages and Phase 1, with the uppermost assemblage featuring greater quantities of intact debitage types, consistent with the maintenance of an onsite stockpile of usable blanks. This fact, combined with increased presence of discrete artefact clusters, provides evidence that much of this assemblage is comprised of *de facto* refuse associated with an unplanned final abandonment of the site.

Chapter 1: Wadi Hammeh 27 and the Early Natufian period

1.1 Introduction

The end of the Epipalaeolithic in the Near East is one of the most important and well-studied milestones in human history, marking the transition from mobile hunter-gatherer societies to the sedentary lifestyle that characterised the following agrarian Neolithic period. In the southern Levant, this process is marked by the appearance of what may be classified as the first true villages, as part of the Natufian culture.

This thesis examines the flaked stone artefact (lithic) assemblages from one such settlement, the site of Wadi Hammeh 27 in north-west Jordan. These assemblages are utilised to investigate whether or not any diachronic trends are evident across the span of a single Early Natufian settlement, particularly in regards to the technological attributes of their manufacture, their typological composition and modes of disposal. The results of these inquiries are subsequently applied to explore shifts in residential occupation strategies and site economy at this crucial stage in the development of sedentary communities in the Near East.

Wadi Hammeh 27 is an open-air Early Natufian site on the eastern edge of the Jordan Valley, approximately two kilometres north of the multi-period tell site of Pella (modern Tabaqat Fahl). It is one of only a few open-air Early Natufian settlements in the southern Levant, and the only one which dates exclusively to the Early Natufian period. The site is today surrounded by a steep wadi landscape, with Wadi Hammeh 27 itself being situated atop a steep plateau overlooking the junction of the Wadi al-Hammeh and Wadi al-Himar (**Figs. 1.1 – 1.2**). It represents the final successor to a detailed sequence of human activity in this locale, with the underlying stratigraphy containing a rich sequence of Epipalaeolithic, Upper Palaeolithic and Middle Palaeolithic sites, with the latter dating as far back as 60,000 BP (Edwards 2013b: 22).

The site of Wadi Hammeh 27 was first surveyed in 1980, before being excavated by Phillip Edwards between 1983 and 1990 as part of the broader University of Sydney excavations of Pella, led by Basil Hennessy and Tony McNicoll (Edwards 2013a: 8-9). These investigations primarily resulted in a broad exposure of the uppermost occupational phase, with the

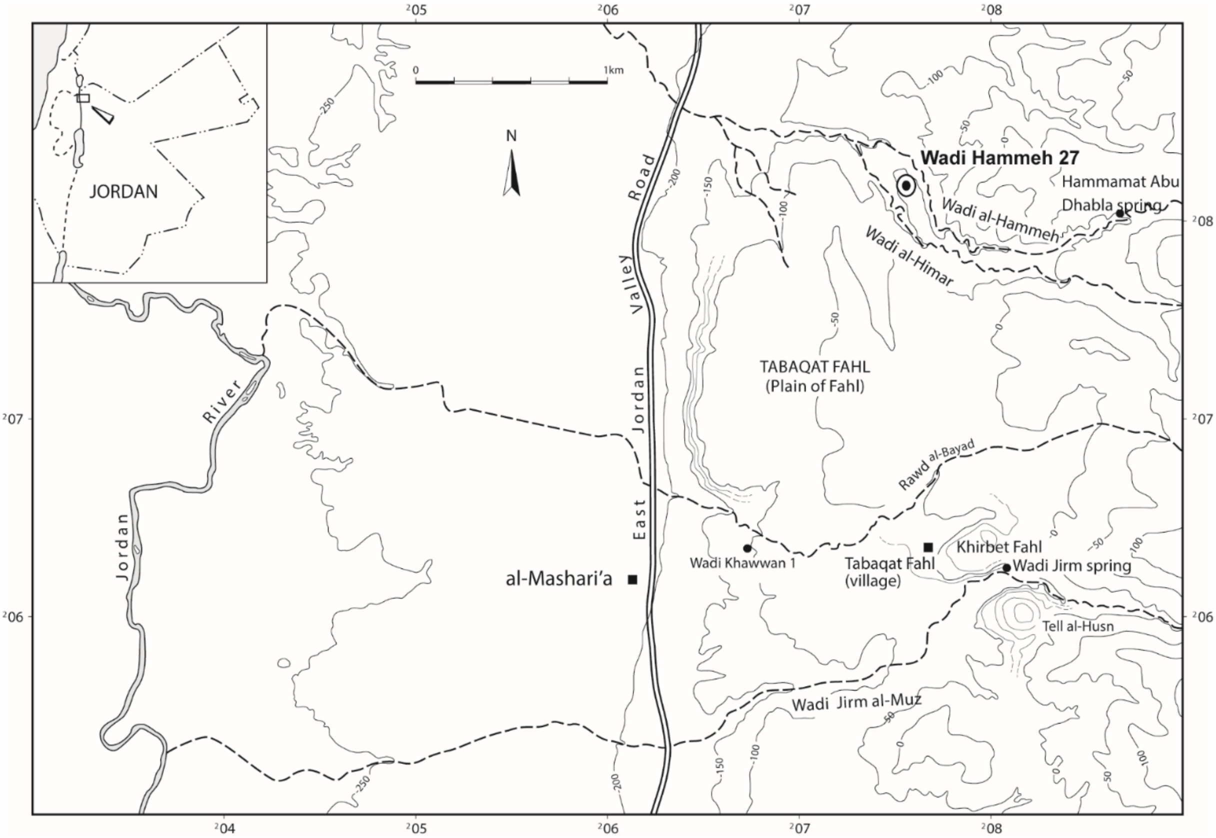


Figure 1.1: The location of Wadi Hammeh 27 in north-west Jordan.

Figure 1.2: The modern landscape of the Wadi al-Himar and Wadi al-Hammeh, with the Wadi Hammeh plateau situated in the centre. View north-west.

underlying deposits being unexplored aside from the excavation of a sondage (see Chapter 3.2).

Excavations resumed at Wadi Hammeh 27 between 2014 and 2016 as part of the ‘Ice Age Villagers of the Levant: sedentism and social connections in the Natufian period’ Australian Research Council Discovery Project (hereafter referred to as the IAV excavations), also this time under the direction of Edwards for La Trobe University. A primary aim of the renewed excavations was to excavate additional human skeletal material from the basal cemetery deposits, on which isotopic analyses could be undertaken. This approach aimed to shed light on the mobility patterns of Wadi Hammeh 27’s inhabitants, in response to lingering questions as to whether or not Early Natufian communities represent the onset of true sedentism. Another aim of the isotopic analysis was to investigate the familial relationships of the excavated individuals, with the specific goal of testing Bocquentin’s (2003) model of patrilocal inheritance.

In order to fulfill these goals, the excavation of much broader areas of the earlier strata than in the 1980s excavations was necessitated, resulting in abundant artefact assemblages being recovered from each phase. The results of these excavations are detailed in Chapter 3. This thesis focusses on the flaked stone artefact assemblages of each of the four lower phases (Phase 2, Upper Phase 3, Lower Phase 3 and Phase 4).

1.2 A brief overview of the Natufian culture

1.2.1 Phasing

Given that this study hinges on the interpretation of diachronic change at a Natufian settlement, the history of Natufian phasing must first be briefly summarised. The Natufian culture was first formally defined by Dorothy Garrod (1932) as a result of her 1928 excavations of Shukbah Cave, situated north-east of Ramallah, and subsequent excavations of El Wad in the Mount Carmel region. Garrod identified Level B of Shukbah Cave as belonging to a hitherto unknown local Mesolithic tradition, with the associated flaked stone assemblage being characterised by composite sickle elements, burins, core-scrapers and geometric lunates manufactured using abrupt backing (Garrod 1932: 257-8). Garrod christened this new archaeological culture as the ‘Natufian’, the name being derived from the nearby Wadi al-Natuf which Shukbah Cave overlooked (Garrod 1932: 261).

The first of five excavation seasons were subsequently carried out the following year by Garrod at the site of El Wad, one of several Palaeolithic cave sites situated along the Wadi al-Mughara on the western slope of Mount Carmel. As a result of these excavations, and likely building on similar conclusions reached by Charles Lambert through his own unpublished 1928 test excavations of the site (Weinstein-Evron 2009: 22-3), Garrod was able to sub-divide the Natufian occupation of El Wad into 'Upper' and 'Lower' phases (Garrod 1934: 133). This distinction was based on stratigraphic and technological variations between Levels B1 and B2, with the later phase believed to have been contemporaneous with the Shukbah Cave assemblage due to the high degree of similarity between the two assemblages, particularly the dominance of lunates with abrupt retouch (Garrod 1932: 260-1).

Conversely, she found that the assemblage from the lower deposits of Level B2 were dominated by lunates and sickle elements manufactured using a form of bifacially pressure flaked, semi-steep retouch (Garrod 1932: 261). Garrod coined this older mode of retouch as 'Helwan retouch', named after the Cairene satellite city where a small number of artefacts bearing similar retouch had been previously recovered. This technological division has largely served as the temporal benchmark dividing the Early and Late Natufian periods through to the present day.

Decades later, based on his own excavations at the multi-phase Natufian site of `Ain Mallaha in the Hula Valley, Valla (1981) argued that the 'Early' and 'Late' Natufian sub-cultures were followed by a third, 'Final' Natufian period. Originally believed to represent a much more ephemeral occupation than either the Early or Late Natufian settlements at the site (Valla 1981: 418) subsequent excavations of this Final Natufian horizon have revealed the existence of at least four durable stone structures (Samuelian 2013; Valla et al. 2013), indicating a degree of settlement continuity from the Early and Late Natufian phases.

The transition from the Early to Late Natufian periods has traditionally been interpreted as one of adaptive necessity - a reversion to a more mobile lifeway in the face of cooler, drier environmental conditions created by the onset of the Younger Dryas - and ultimately serving as a temporary setback to the Neolithisation process until its resumption was enabled by the warmer, wetter conditions provided by the Holocene (Aurenche et al. 2013: 36-7; Belfer-Cohen & Bar-Yosef 2000; Kuijt & Prentiss 2009: 261-3; Rosen & Rivera-Collazo 2012). However, discoveries in recent years have forced a reassessment of the Late Natufian period's broader significance.

While the faunal evidence from Hayonim Cave on the Mediterranean coastline indeed supports a return to greater mobility patterns in this region (Hartman et al. 2016: 4001; Munro 2004: S11-12; 2009: 152), the discovery of a complex Late Natufian architectural settlement at Nahal Ein Gev II on the western edge of Lake Galilee (Grosman et al. 2016), in addition to the Late Natufian settlement at `Ain Mallaha, demonstrates that this was hardly the case in the Jordan Valley (Hartman et al. 2016: 4001). Furthermore, the dating of some Late Natufian occupations up to 600 years prior to the onset of the Younger Dryas conclusively demonstrates that while this climatic event may be correlated with a change in mobility and subsistence patterns on the Mediterranean coast, it cannot be connected to any Late Natufian technological developments in this region (Barzilai et al. 2017: 1143-5; Hartman et al. 2016: 4001; Maher et al. 2011: 16; Stutz et al. 2009: 297). As such, the current evidence points towards an unbroken continuation of ‘village’ communities in the Jordan Valley, meaning that Wadi Hammeh 27 can be viewed as an indirect precursor to the settlements clustered around this region in the Pre-Pottery Neolithic A (PPNA) period.

1.2.2 Geographical extent and regionalisation

In addition to questions regarding the nature of the Natufian chronological sequence, considerable debate has arisen about the geographical extent of the Natufian culture and the nature of inter-site variations. Particular emphasis has been placed on whether sites can be divided between sedentary ‘base-camp’ settlements and more temporarily occupied campsites. The concept that large, architectural communities represent sedentary villages was originally raised by Perrot (1960) after his excavations of `Ain Mallaha. Bar-Yosef and Goren (1973: 67) subsequently argued that such sites could instead be better characterised as ‘base-camps’, with the presence of ‘stationary elements’ such as structural remains, graves and bulky groundstone artefacts distinguishing base-camps from ‘seasonal-transitory camps’. In contrast, they argued that lithics, bone tools and art objects were ‘secondary characteristics’ common to both types of site (Bar-Yosef & Goren 1973: 67).

Henry’s (1973: 149) model largely agreed with these points, although he considered that the presence of artistic pieces should in fact be considered another hallmark of Early Natufian base-camps, along with a total site area encompassing more than 200m^2. Henry later noted (1994) that along with featuring greater artefact densities, base-camp lithic assemblages generally include pieces representing all stages in the core reduction sequence, while assemblages from ephemerally occupied sites tend to include only finished tools and debitage resulting from their rejuvenation. This configuration, he argued, was indicative that base-camps involved increased occupation intensity, greater rate of artefact discard, as well as larger populations than ephemeral sites.

Olszewski (1991: 326) argued that Early Natufian base-camps should be expanded into three types, these being ‘hamlets’ exhibiting clearly defined stone architecture associated with human burials, sites featuring other forms of domestic architecture and sites represented purely by occupational deposits without any stone architecture. The only Early Natufian site classified into the second category at the time was El Wad (Olszewski 1991: 329), although renewed excavations have since revealed that a number of large, curvilinear structures are indeed present at this site (Goring-Morris 1995: 420-421; Weinstein-Evron et al. 2018) She argued that these differences represent variations in the settlement systems employed, with radial foraging being practiced only by the inhabitants of the ‘hamlets’ clustered in northern Palestine (Olszewski 1991: 331, 333, 339). A similar system was proposed by Bar-Yosef (1998: 162), who argued that Natufian sites can be divided into three clusters based on the area they encompass, in the ranges of small (15-100m^2), medium (400-500m^2) and large sites (greater than 1,000m^2).

Byrd (1989b) argued that instead of a base-camp/transitory site dichotomy, Early Natufian sites should be classified into three clusters (coastal, steppic and desertic) based on their geographical conditions and the composition of the retouched lithic assemblages at each site. He argued this division could subsequently be utilised to infer regional differences in site economy, with desertic sites reflecting a hunting-based economy, the steppic zone employing a broad range of subsistence activities, and more emphasis being placed on cereal processing in the coastal zone (Byrd (1989b: 181). Belfer-Cohen and Goring-Morris subsequently argued that the development of the Natufian should be viewed as a “mosaic evolution through time and space, with different paces in different places” (Goring-Morris & Belfer-Cohen 2008: 274) driven primarily by ecological variation (Goring-Morris & Belfer-Cohen 2008: 274; Goring-Morris et al. 2009: 221). They further argue that reconstructions of the Natufian ‘core-zone’ have traditionally overemphasised the common elements between sites, neglecting the stylistic variation reflective of multiple individualised, separate traditions (Belfer-Cohen & Goring-Morris 2013: 544).

In recent years, the discovery of several Early Natufian architectural settlements situated outside the traditional southern Levantine ‘core-zone’, yet which feature characteristics of the ‘base-camp’ sites from this region, has forced reassessments of the extent of the Early Natufian ‘homeland’, if such a concept is even still viable. Byrd and Garrard (2013e: 393) similarly criticise the identification of the Mediterranean coastline as a singular Natufian ‘core-zone’, due to its implication of a unidirectional, outwards dissemination of ideas from this region, something that they argue is not supported by the continuity of the Epipalaeolithic archaeological record of the Azraq Basin. This model is supported by the existence of complex Early Natufian architecture deep in the Jordanian *badia* in the form of Shubayqa 1, leading its excavators to similarly argue that the Late Epipalaeolithic Azraq Basin functioned as a separate core-zone, developed independently from its native Early and Middle Epipalaeolithic predecessors (Richter 2014: 32-3; Richter et al. 2017: 7).

The discovery of Early Natufian architectural sites in the northern Levant is also a relatively new development, with the seeming lack of settlements in this region being previously put down to the local environmental conditions not favouring their development (Byrd 2005: 251). The discovery of Early Natufian architectural sites at Jeftelik and Dederiyeh Cave in Syria has since been explained as either representative of a northwards dispersal of the Natufian culture prior to the Late Natufian (Nishiaki et al. 2017: 21; Rodríguez et al. 2013: 70) or as a localised ‘northern Natufian’ culture developed from the indigenous Middle Epipalaeolithic systems, albeit with clear cultural ties to the southern Levant (Nishiaki et al. 2017: 20).

The previous decade has witnessed several new models of tracing Natufian regionalisation. Major (2018) utilises the art objects for these means, dividing Early and Late Natufian sites between six regions based on modern phytogeographic zones. These are 1): the Mediterranean upper Jordan Valley and Mount Carmel region, 2): the desertic West Bank of the lower Jordan Valley, 3): the woodlands of Lebanon and western Syria, 4): the northern Syrian Mediterranean and steppic zone, 5) the steppic and desertic sites of southern Jordan and the Negev Desert and 6): the site of Azraq 18 on the Azraq Oasis (Major 2018: 140-1). She found that the overwhelming majority (76%) of art objects are from the first zone, while Zone 3 has the least (2%), although these proportions become much more balanced when differing artefact densities are taken into consideration (Major 2018: 141).

Edwards (2015) similarly argues for the existence of an Early Natufian sub-cultural variant localised in the Jordan Valley. The lines of evidence utilised in this model include the tendency of both base-camps and more ephemeral occupations to be open-air sites rather situated within caves, the presence of similarly worked miniature stone vessels, shared stylistic motifs and the evidence of basaltic exchange networks spanning the length of the Jordan Valley (Edwards 2015: 275-8). Edwards (2015: 279-80) further suggests that this regionalisation may be explained through the continued presence of Lake Lisan in the Natufian period, with the utilisation of watercraft facilitating an increased degree of social contact and material exchange between communities situated along its shoreline.

1.2.3 Broader significance of the Natufian period

In recent decades it has been widely recognised that the architectural features and economic strategies of the Natufian period, rather than representing an abrupt paradigm shift towards Neolithisation, are instead the result of a culmination of technological, economic and social developments made across the course of the Early and Middle Epipalaeolithic periods in the southern Levant (Edwards 1989: 240; Goring-Morris et al. 2009: 203; Maher 2018: 1021-1022; Maher et al. 2012). Quantified analyses of Natufian flaked stone artefact assemblages have likewise long emphasised that the technological range of flaked stone tools in these assemblages are almost identical with earlier Epipalaeolithic assemblages, the primary innovations being the introduction of composite sickles, bifacially knapped picks and tranchet axes to their toolkits and the dominance of Helwan retouch amongst the microlith components (Belfer-Cohen 1991: 169; Bar-Yosef 1970: 186; 1998: 173; Grosman 2013: 623; Maher et al. 2012).

While the overall composition of Epipalaeolithic lithic assemblages may have remained relatively static over time, several analyses of associated faunal and archaeobotanical assemblages do in fact indicate unidirectional trends towards the wider implementation of lower-ranked resources, consistent with a growing reliance on a broad-spectrum economy (Rosen 2010: 123; Stutz et al. 2009: 299). The exploitation of gazelle was similarly expanded at numerous sites to include the hunting of juvenile individuals, indicative of a desire to maximise the productivity of resources within a limited area, albeit at the expense of the long-term gazelle population (Munro 2009: 148, 152). These patterns are not consistently found throughout the Levant, however, as most famously exemplified by the evidence of cereal reaping as far back as 23,000 BP at Ohalo II on the banks of Lake Galilee (Groman-

Yaroslavski et al. 2016). Likewise, Yeomans and colleagues (2017) argue that variations between the Early and Late Natufian faunal assemblages of Shubayqa 1 reflect hunting adaptations to changing environmental conditions above all else.

The increasing reliance on lower ranked resources over time is consistent with a 'territorial' or 'allocation' model for the both the course of the Natufian period and the broader Neolithisation process. This model contents that territorial socio-cultural systems developed in order to alleviate the population pressure generated through increasingly dense hunter-gatherer populations being forced compete over a limited pool of resources, with each group's need to maintain ownership of their territories rendering their ability to employ a mobile, circulating lifestyle to become increasingly unfeasible (Kosse 1994; Rosenberg 1990: 407-9; 1998: 658-662). The excavation of a comprehensive sequence of occupational phases at Wadi Hammeh 27 thus allows for these theories to be tested in the context of an Early Natufian settlement.

1.3 Structure and aims of this thesis

Chapter 2 is encompassed by several literature reviews, which examine models and concepts applied to subsequent chapters. The first section summarises a range of modes put forward over the previous fifty years to explain cultural change. The second section examines functional models of interpreting flaked stone artefact assemblages, while the third one considers modes of refuse disposal and abandonment strategies.

Chapter 3 details the stratigraphy and architecture of each phase at Wadi Hammeh 27, synthesising the original 1980s excavations and the renewed 2014 – 2016 IAV excavations. This chapter serves to illustrate the potential offered by Wadi Hammeh 27 for a diachronic study, as well as functioning as a detailed reference for the individual strata and architectural features cited throughout this thesis.

The debris and debitage composition of the four lithic assemblages are discussed on a phase-by-phase basis in **Chapter 4**. The attributional data of a sample of debitage artefacts from each assemblage are also explored in this chapter. These two approaches allow a detailed inter-phase study investigation as to whether any diachronic shifts are detectable in the debitage artefacts being produced in terms of the types of raw material selection, the artefact types being produced and the knapping strategies represented in their production. The typological composition and attributional data of the core assemblages are examined in **Chapter 5**, while the same approach is applied to the retouched artefact assemblages in **Chapter 6.**

Chapter 7 examines the horizontal spatial distribution of the flaked stone artefacts in each phase using a combination of GIS-aided and statistical analyses. Through identifying and tracing meaningful patterns and variations in artefact distribution by type, an attempt is made to elucidate information regarding activity areas and refuse disposal patterns in each phase.

Chapter 8 examines the patterns of change over time for the lithic types and attributes discussed between Chapters 4 and 6. These patterns are subsequently compared with the models of cultural change discussed in Chapter 2.

Chapter 9 reconstructs the overall reduction sequence of the Wadi Hammeh 27 lithic assemblages, after which their functional significance is explored. The multi-phase nature of the investigation, combined with the depth of the data recording in each assemblage, allows for a diachronic approach to be undertaken.

Chapter 10 discusses how and why the Phase 1 assemblage at Wadi Hammeh 27 differs from those recovered from the underlying deposits, and the theoretical consequences of this shift. Particular emphasis is placed on the identification of Phase 1 as an unplanned abandonment assemblage, as represented archaeologically through the retention of significantly greater proportions of usable *de facto* refuse than in any of the earlier assemblages.

Chapter 11 compares the lithic signature of Wadi Hammeh 27 with other notable Early Natufian sites, in order to investigate the regional significance of the diachronic patterns exhibited at Wadi Hammeh 27. Once again, the multi-phase nature of the current study allows for each assemblage at Wadi Hammeh 27 to be treated as an independent entity, in order to evaluate whether their regional context remains consistent over time. Particular attention is drawn to the comparably detailed analysis of the lithic assemblages from the contemporaneous sequence at El Wad Terrace.

Chapter 2: Literature reviews

2.1 Introduction

Before the lithic assemblages of Wadi Hammeh 27 are examined, key relevant theoretical concepts are first explored here. This chapter presents literature reviews on three issues in particular, namely those relating to cultural change over time, the functional interpretation of lithic assemblages and models of artefact disposal and the detection of 'abandonment' assemblages. The concepts explored in this chapter are subsequently applied in the interpretation of the Wadi Hammeh 27 assemblages in Chapters 8, 9 and 10 respectively.

2.2 Tracking cultural change in the archaeological record

Clarke (1968: 180-1) argued that sociocultural entities – from the level of individual artefact designs to overarching cultural systems – exhibit consistent, ontogenetic lifespans. According to this model, every attribute in the archaeological record is introduced as a prototype used by a minority of users in a population, followed by a small number of these innovations achieving their modal dominance through their widespread adoption by wider society (Clarke 1968: 193-5). This dominance is capped by a final period of 'archaic' decline, representing the conservative retention of the attribute by a minority of users (Clarke 1968: 193-5). Clarke asserted that this pattern should be reflected by regular unimodal distributional plots in the archaeological record, with skewed or bimodal distributions consequently representing instances of the archaeologist having accidentally incorporated multiple analytical populations into their sample (Clarke 1968: 166-172).

In an influential case-study, Dethlefsen & Deetz (1966) were likewise able to clearly demonstrate a chronological sequence of stylistic changes in colonial North American colonial headstone designs. An absolute temporal framework was provided by the dates on each headstone, revealing that each design exhibited a unimodal, 'battleship-shaped' curve, with each design being gradually replaced by its successor. This sequence could be further correlated with broader cultural shifts, namely the gradual replacement of Puritan beliefs by rival Protestant branches.

The idea that cultural change functions in a similar to fashion to genetic evolution was pushed to the forefront in the early 1970s by a number of genetic analogue models. Dunn

(1970: 1042) argued that cultural systems function in much the same manner as genetic systems, with cultural traits transmitted between individual cultural systems through cultural flow, while the development of new cultural traits can be viewed as being analogous to genetic mutation. According to this model, cultural continuity is maintained across space and time as a result of the regular transmission of ideas, behavioural modes and their corresponding material culture through cultural flow, with geographically isolated populations subsequently having the potential to develop into cultural isolates.

As part of this wave of genetic analogy models, the notion of cultural or stylistic drift was introduced as an analogue of genetic drift. Cleland (1972) argued that stylistic drift is a passive process that can account for how a sequence of artefacts may progressively deviate over time from a prototype design. Using a sequence 17th and 18th century Jesuit finger rings as an example, he contended that the nature of drift will determine the degree to which successive designs will deviate from a prototype. He argued that the inadvertent substitution of elements will cause a break in design continuity, with the resulting divergent motif subsequently competing with the original in popularity (Cleland 1972: 209-210).

Collins' (1973) processualist model of cultural change contended that a clear distinction can be made between the processes that facilitate cultural continuity and those that drive innovation. Examples given of the first group of processes included intergenerational cultural transmission, cultural conservatism and the removal of aberrant cultural elements through natural selection, while innovative processes included invention in response to functional needs, as well as the failure to accurately replicate cultural elements (Collins 1973: 56-7). He further argued that increases in population demographics, cultural complexity and cognitive captive capacity are all factors which influence innovative processes at the expense of cultural continuity, thus explaining the gradually increasing rate of observable technological change across the course of the Palaeolithic archaeological record (Collins 1973: 57-8).

On a similar note, David (1973) made a distinction between the gradual replacement of one tool type with another which serves an identical function, which he put down to fashion or cultural drift, and relatively sudden technological or typological shifts, which must be understood as being driven by external ecological factors. He claimed, based on a comparison of the Upper Palaeolithic archaeological record in France with North American ethnographic data, that economic stress increases the speed of technological innovation in hunter-gather societies, while the breakdown of inter-cultural contact and merging of different groups for survival will promote the development of localised cultures (David 1973: 297).

Plog (1974: 50) asserted that behavioural variation can ultimately be linked to the generation and selection of new behavioural attributes. He reasoned that new attributes may be learned from a range of sources such as inter-societal contact, experimentation, or 'mislearning', while environmental pressures serve as the primary selective limitation on which attributes can actually be adopted by a society (Plog 1974: 50). Plog's model was criticised by Dunnell (1978: 195), who argued that it retained a synchronic approach to archaeological cultures reminiscent of earlier cultural historical models, rather than the gradualistic approach mandated by an explicitly Darwinian approach to cultural evolution. Dunnell further scrutinised Plog for failing to make a distinction between functional attributes, which he contended are controlled through natural selection, and adaptively neutral stylistic attributes, which evolve in a stochastic fashion (Dunnell 1978: 198-9).

Cleland's (1972) definition of cultural drift was criticised by Koerper and Stickel (1980: 466), who argued that his case study instead represented instances of diffusion and innovation. They instead maintained that cultural change is almost always strictly due the generation and selection of cultural traits, and that cultural drift should only be referred to in specific cases where attributional diversity in small or isolated communities is reduced through completely random chance, thus representing a form of cultural bottlenecking (Koerper & Stickel 1980: 466-7).

Leonard and Jones (1987: 212-14) argued that all material culture, being an expression of behavioural variability, are thus subject to the same selective pressures as functional attributes, with the differential temporal and geographical distribution of certain cultural traits serving as a measure of their 'replicative success'. O'Brien and Holland (1990: 43) stressed that archaeologists need to differentiate between the direct and indirect selection of traits, the latter process involving traits that consistently occur alongside the selected trait, but have no actual selective value themselves. Furthermore, they emphasised that as unsuccessful cultural variants are highly unlikely to leave a physical trace in any significant capacity, the comparison of varying cultural traditions in the archaeological record is almost always one between different successful adaptive variants (O'Brien & Holland 1990: 46). Likewise, Abbott and colleagues (1996: 34-5), distinguished selectionist thought from processualism in that natural selection serves as the mechanism for change rather than adaption, allowing for sorted and selectively neutral traits to also be incorporated into the model alongside those selected for adaptive purposes.

While presenting an idealised means of interpreting material change, selectionist thought possessed several glaring theoretic issues, with proponents of other approaches challenging its realisticness. Rosenberg (1990: 403-5) scrutinised selectionists for not incorporating human intentionality in explaining cultural change, arguing that the concept of unconscious natural selection and adaption directly resulting in meaningful cultural innovations is akin to the infinite monkey theorem. While Richerson and Boyd (1992) argued that cultural evolution largely functions as a Darwinian process, they likewise maintained that human intentionality and agency must be taken into account when explaining which cultural traits will be reproduced. Furthermore, they suggested that biased cultural transmission itself serves an adaptive function, with human societies possessing the ability to modify their behaviour to suit their circumstances far more rapidly than can be provided by genetic evolution (Richerson & Boyd 1992).

Bettinger and colleagues (1996) criticised the function/style dichotomy used by selectionists as being fundamentally flawed, instead arguing that stylistic change should be interpreted through the lens of an explicitly evolutionary framework, rather than the stochastic model hypothesised by Dunnell. They further asserted that selectionists had fundamentally misinterpreted Darwinian evolution by focussing entirely on natural selection and neglecting other selective processes such as sexual selection, which can account for the direct selection of traits without any adaptive value (Bettinger et al. 1996: 142-3).

Boone and Smith (1998: S142-3) criticised evolutionary archaeology from an evolutionary ecological standpoint, arguing that selectionists had both mistaken selection for phenotypic adaption to environmental variation and failed to explain how cultural traits are inherited between phenotypes. They further stressed that behavioural responses to external conditions are in themselves “a form of nonrandom, directed adaptive change” (Boone & Smith 1998: S156), which in turn serves as the primary factor controlling artefact patterning over time and space.

A new theoretical branch explaining the evolution of cultural systems arose in the 1980s – the cultural transmission, or dual inheritance, model. While the foundation of this model still involved the mutation and selection of cultural traits, these processes were explicitly non-Darwinian and entirely distinct from systems of genetic transmission, instead revolving around the inter-personal transmission of cultural traits in a variety of directions, with the potential of transmission to be directed, rather than the strict parent-offspring relationship mandated by genetic transmission (Cavalli-Sforza & Feldman 1981: 15, 54-6, 65-6; Durham 1991: 36). Cavalli-Sforza and Feldman (1981: 55) further argued that the size and complexity of the societal unit will dictate the direction of cultural transmission, with greater rates of horizontal transmission in large, socially complex units than in bands, which are instead dominated by the vertical, inter-generational transmission of cultural traits.

Cavilli-Sforza and Feldman's ideas were expanded upon by Boyd & Richerson (1985), who identified four models of cultural transmission: 'guided variation' through experimentation, the selection of one of several pre-existing variants through 'direct bias', the selection of a variant based purely on its existing popularity through 'frequency-dependent bias' and the selection of a trait based on its association with another, particularly successful individual through 'indirect bias'.

Neiman (1995: 12-14) introduced the concept of cultural innovation as an opposing force to cultural drift, whereupon an individual abandons a learned variant in favour of one of their own invention, thus ultimately serving to increase assemblage diversity. Much like cultural drift, he argued that cultural innovation is a selectively neutral process, being controlled by the rate of intergroup transmission (Neiman 1995: 27).

Bettinger and Eerkens (1997: 179) argued that rate of transmission through each of Boyd and Richerson's models is largely dependent on the size and complexity of the society under investigation, with the rate of frequency-dependent bias and indirect bias being strongest in larger societies where exposure to exotic cultural variants is relatively common, while guided variation and direct bias will be the dominant modes of transmission in smaller populations utilising relatively basic technologies.

Shennan (2004) argued that the direction of cultural transmission will influence its nature and advantageousness. He argued that while the purposeful innovation and inter-generational traits will generally function in a similar, positive fashion to natural selection, horizontal cultural transmission has the potential of spreading maladaptive traits which can override any advantageous ones (Shennan 2004: 22-5). Furthermore, he contended that the agency of individuals is always driven by their cultural inheritance, regardless of whether or not the resulting decisions are adaptively beneficial (Shennan 2004: 24). He further elaborated that patterns of material change and stability through time must be put down to a combination of cultural and evolutionary influences, although the varying directions and effects of said cultural transmissions make tracing their influences over time a difficult prospect (Shennan 2004: 25).

VanPool and colleagues (2008: 80) made a distinction between 'traditional' behaviour, which is transmitted exclusively in an inter-generational context, with other forms of cultural transmission, which can be transmitted in any direction. Likewise, 'creative' behaviour marks an inter-generational break with tradition (VanPool et al. 2008: 82). While they identified the horizontal transmission of cultural traits as the ultimate source of cultural variation, they argued that inter-generational tradition remained the dominant mode of cultural transmission for almost all pre-industrial societies, arguing that this configuration could be demonstrated by continued distinction between two Pre-Columbian pottery styles when clear evidence of inter-societal contact was otherwise present (VanPool et al. 2008: 88).

Lucas (2004: 12-14) criticised cultural evolutionary models for continuing to present the passage of time as a unidirectional process divided into discrete chronological units, despite the archaeological and historical records demonstrating that cultural developments can regress as well as progress, and that the rate of different developments can vary considerably. He subsequently argues, based on his own excavations at Skálholt, Iceland, against the practice of measuring the periodization of a site through stratigraphic sequences of individual structures, as they more often than not exhibit individualised patterns of piecemeal change and alterations which cannot be correlated with modifications made elsewhere in the settlement (Lucas 2018: 78-80). Furthermore, he notes that each individual artefact type has the potential of exhibiting its own unique pattern of periodisation which likewise cannot be easily correlated with one another (Lucas 2018: 82).

Attempts at utilising flaked stone assemblages to trace cultural change in the Near East are fairly limited in number, and are generally undertaken on an inter-site, multiperiod basis. Most notable to the current study is Bar-Yosef & Valla's (1979) lunate seriation. Building on Garrod's (1932) division of the Early and Late Natufian based on microlith retouch mode, they argued that this shift corresponds with a decline in lunate length over time (Bar-Yosef & Valla 1979). Another notable utilisation of flaked stone artefacts to trace cultural-economic trends over space and time is presented by Gopher (1994), who examined the arrowheads from a range of Neolithic sites.

2.3 Functional approaches to the interpretation of flaked stone artefact assemblages

Investigations into the relationship between technological organisation and the economic needs of their manufacturers has traditionally hinged on segregating technological systems between 'expedient' and 'curated' toolkits. This dichotomy has its roots planted firmly in processualist theory, with Binford (1977) introducing the concept of curation in his ethnographic observations of Nunamiut tool use and discard patterns. Binford (1977: 33-34) identified curated toolkits as being characterised by a high degree of technological organisation and low rate of discard in the field, with broken tools being retained for repair or recycling upon the conclusion of hunting trips, as well as the caching of intact tools in the field for future expeditions. This strategy functions as a net positive, he argued, increasing the use-life and technological efficiency of tools through maintenance and 'curational labour' (Binford 1977: 33-34). These toolkits could be easily distinguished from expedient assemblages, which are produced, used and discarded in an immediate context of use.

Binford's dichotomy was followed by similar models which contended that hunting tools may follow one of two design pathways – 'reliable' or 'maintainable' (Bleed 1986; Eerkens 1998). Reliable tools are durable, redundant pieces which are designed not to fail at all, with repairs costly when they are required, whereas maintainable tools comprise a series of components serving individual functional roles, with said components being able to be easily replaced using predesigned elements whenever the need arises (Bleed 1986: 738-740; Eerkens 1998: 42-43). This approach was criticised by Myers (1989: 87), who instead argued that reliable and maintainable qualities should be viewed as flexible attributes rather than as a dichotomy due to the potential of an assemblage to display both qualities. He further suggested that risk management plays a minimal role in the design of tools used in the collection of immobile, predictable plant resources, with the economy of such activities instead being a matter of organising the cost of labour involved (Myers 1989: 84-5).

Since the late 1980s, arguments about flaked stone assemblage economies have generally hinged on the interrelationship between mobility patterns and raw material access. In an influential paper, Parry and Kelly (1988) claimed that a positive correlation exists between the mobility of a community and organisation of the core reduction strategies employed onsite. In particular, they contended that the preparation of formal cores and blanks becomes an unnecessary step in the production of tools by sedentary societies should a reliable raw material source be located within the immediate vicinity of their settlement, with expedient, flake-based knapping strategies instead being favoured under such conditions (Parry and Kelly 1988: 300-1). This model was subsequently employed by Nelson (1994), who used it to reason that the consistent dominance of expedient flake-based toolkits between Basketmaker II and Pueblo II-III assemblages at Cedar Mesa, Utah, supported a revised model for a persistently high level of sedentism over time, rather than the traditional model which argued that Anasazi communities gradually became more sedentary across this period. A marked decrease in core size and formality was noted, however, which he suggested could be explained by a purely technological shift from the manufacture of large darts in the Basketmaker II period to Basketmaker III arrowheads, which could be made from smaller, less formal flakes (Nelson 1994: 284-5).

Bamforth and Becker (2000) disagreed with Parry and Kelly's notion that ratios between formal and informal cores can be used alone as a measurement of site mobility, arguing that the varying-use lives of different core types must be also be taken into account. This aspect, they argued, was exemplified by the evidence of greater quantities of informal flake cores being removed from the Allen Site, Nebraska, demonstrating that they had a greater use-life than both the formal bifacial also employed at the site, as well as the site itself (Bamforth & Becker 2000: 282-4).

Causal relationships between mobility patterns and the range of tools in an assemblage have also been made, usually in the context of managing economic risk. Torrence (1983) contended that assemblage variation can be negatively correlated with the amount of time required by the occupants of a site to perform the necessary onsite activities. She argued that assemblages designed to maximise productivity in this sense should exhibit a greater variety of tool classes, greater typological variety, as well as a greater complexity in the range of tools incorporated into a toolkit or comprising a composite tool (Torrence 1983: 13-14). Due to these factors, she contended that hunter-gatherer societies employing a mobile economy should employ generalised toolkits with little diversity, this due to the weight restrictions driving the usage of limited range of tools for a wide variety of activities (Torrence 1983: 13). Bamforth and Bleed (1997: 125-126) likewise argued that societies with less stringent time and resource limitations have the option of manufacturing and utilising a broader range of tools onsite. These ideas were incorporated by Edwards (2007: 873-4) in his interpretation of Artefact Cluster 9 at Wadi Hammeh 27, arguing that the incorporation of a bladelet core as part of this 'hunter-gatherer toolkit', presumably for the production of replacement lunates in the field, both represents a form of time management and reflects on the maintainable nature of Early Natufian composite projectile technology. An alternative means of assessing the relationship between toolkit structure and site mobility is employed by Clark (2020: 73-4), who argues that the percentage of retouched artefacts in an assemblage can be utilised to measure the residential stability of a site, with lower shares of tools in relation to the debitage and core components reflecting a reduced need to conserve raw materials.

Other functional approaches to flaked stone assemblages have downplayed the role of mobility patterns in determining assemblage structure. Bamforth (1991) argued that the technological organisation of a society may be just as heavily influenced by its local context as through broader shifts in mobility. This argument was exemplified by assemblages in the Santa Ynez Valley, California, which remain largely uniform over a 3,500-year period despite the corresponding increase in settlement permanence and social complexity, which Bamforth (1991: 230-231) asserted was due to similarities in raw material access, group size and range of subsistence activities. Andrefsky (1994) similarly argued that raw material access can be identified as the primary variable driving assemblage variation regardless of the mobility patterns employed, noting that both sedentary sites and hunting camps in the Pinyon Canyon, Colorado, exhibited a dominance of informal cores and debitage types when a ready access of quality knapping material was present.

Other studies have identified functional requirements as being the primary driving force behind assemblage variation. Jeske (1989) suggested that differences in the risk and importance of different activities will determine the amount of time invested in creating and maintaining the relevant tools, as well as the quality of raw material utilised. In particular, he noted that the choice to produce blade or bladelet blanks is often unrelated to mobility patterns or the conservation of raw material, being a necessary stage in the production of some composite tool components (Jeske 1989: 36). Tomka (2001) similarly contended, based on the Late Archaic-Protohistoric archaeological record of Texas, that the continued usage of formalised, hafted knives and scrapers served a need to process large quantities of game in a limited timeframe rather than coinciding with shifting mobility patterns to any extent.

A means of quantifiably measuring the relationship between the functional requirements of different sites and the structure of their associated lithic assemblages was formulated by Barton (1998) and subsequently expanded on by Riel-Salvatore and Barton (2004). Building on previous functionalist approaches such as those of Parry and Kelly, Kuhn, Bamforth and

Nelson, this model contended that archaeologists may differentiate between sites characterised by expedient or maintainable/curated toolkits through comparing the volumetric density of different assemblages with their percentage of retouched artefacts (Barton 1998; Riel-Salvatore 2004).

Building on the models of Parry and Kelly (1988) and Andrefsky (1994), Staples (2005: 6) similarly argued that curation and expedience exists at opposite ends of a continuum. She maintained that the degree to which a flaked stone assemblage will exhibit the qualities of each extreme is affected by a combination of influences relating to raw material availability, functional requirements and the mobility and settlement strategies of a sites occupants (Staples 2005: 30). This conclusion was reached through the comparison of lithic assemblages from two Jordanian Middle Bronze Age sites, Zahrat adh-Dhraʿ 1 and Tell el-Hayyat. She found that the attributes of both assemblages exhibit strong signatures for expedience, despite the other archaeological evidence indicating that Zahrat adh-Dhraʿ 1 functioned as a more seasonally-occupied agropastoralist settlement rather than a fully agricultural town like Tell el-Hayyat (Staples 2005: 18-23). She thus concluded that the assemblages deposited during sedentary periods at Zahrat adh-Dhraʿ 1 are largely indistinguishable from those of Tell el-Hayyat, regardless of the activities performed offsite during periods of mobility (Staples 2005: 28).

Core reduction strategies which prioritise the production of blade and bladelet blanks have often been taken as representative of mobile economies, although the actual rationale for this identification is equivocal. Rasic and Andrefsky (2001) reasoned that Alaskan blade-based economies are best suited for short hunting expeditions where the range of anticipated uses is relatively small and predictable, due to the limited number of forms that may be manufactured. Conversely, Delage (2005) contended that the primary allure of blade and bladelet blanks to mobile hunter-gatherers in the Near East was their malleability, with these relatively uniform pieces being able to be produced *en masse* before being carried into the field, where they could subsequently be retouched into a wide range of forms to serve whichever requirement may unexpectedly arise. He argued that the abrupt shift from the production of uniform blade and bladelet blanks from unidirectional, prismatic cores in Kebaran and Geometric Kebaran assemblages to the production of a more diverse range of blanks from regularly rotated, heavily reduced cores at Early Natufian settlements thus reflects the enabling of a more opportunist knapping strategy through the implementation of radial foraging patterns (Delage 2005: 230-231). Carr and collegues (2010: 116) alternatively suggest that the standardised, blade-based assemblages utilised across Upper Palaeolithic and Epipalaeolithic Eurasia were designed specifically for the predictable placement of raw materials within well-established, highly populated territorial units, allowing for a wider range of specialised tool forms to be employed.

2.4 Identifying different refuse modes in an Early Natufian setting

The depositional nature of different modes of refuse disposal and their archaeological signatures have been well established in the past fifty years of ethnoarchaeological research. ‘Primary refuse’ refers to artefacts deposited within their original location of manufacture, use, or refurbishment, while ‘secondary refuse’ encompasses any and all refuse which is intentionally deposited outside its original functional context (Schiffer 1987: 58-9). In sites where intensive floor sweeping is regularly performed, archaeologists have traditionally relied on the distribution of micro-debris which has been trampled into occupational surfaces in order to identify primary refuse accumulations, and subsequently the location of activity areas (Metcalfe & Heath 1990; Keeley 1991: 258; Nielsen 1991: 489-492; Ullah 2012: 123-4). Conversely, larger, bulkier artefacts may also accumulate as primary refuse in sites which either employ less rigorous floor sweeping strategies, or forego the process altogether (Schiffer 1987: 267-8).

Behm (1983: 10-12) argued that secondary refuse middens may be theoretically recognised by the presence of discrete artefact clusters in relatively uniform densities, albeit only when said clusters do not overlap with one another. This last caveat may be further complicated by the length that a site is occupied. For example, O’Connell (1987: 90-1) found that the spatial relationship between individual Alyawara structures and their respective secondary refuse middens became blurred the longer a settlement was occupied, due to the relocation of structures and features over time.

The line between primary refuse and secondary refuse may become blurred by scuffage, a taphonomic process whereby discarded objects are unintentionally displaced horizontally as a result of foot-traffic, ultimately resulting in their accumulation in marginal areas such as along the edge of the interior walls of a hut (Schiffer 1987: 18). Numerous studies have demonstrated that larger artefacts are far more susceptible to this process than smaller pieces, which are more likely to remain undisturbed as primary refuse (Nielsen 1991: 492; Stevenson 1991: 271-2, 277; Villa & Courtin 1983: 277-8). Although little evidence towards the horizontal displacement of artefacts was observed for the Phase 1 occupation of Wadi Hammeh 27 (Hardy-Smith & Edwards 2004: 266), this process must nonetheless be kept in mind when discussing distribution of artefacts in the earlier phases.

Finally, ‘de facto’ or ‘abandonment’ refuse differs from primary or secondary modes of refuse in that it refers to the usable or reusable pieces which are left behind when an activity area is abandoned rather than the intentional disposal of broken, exhausted or otherwise unwanted tools and waste products (Joyce & Johannessen 1993: 138; Schiffer 1987: 89). Such assemblages may be depleted to varying extents through ‘curate behaviour’ – the removal of artefacts and site furniture from an abandoned site to a new location (Schiffer (1987: 90). This process may either be performed by inhabitants of a structure upon its abandonment (LaMotta & Schiffer 1999: 22), or as a part of ‘delayed curation’, whereupon targeted high-value artefacts are gradually salvaged from an abandoned site as the likelihood of its reoccupation diminishes (Tomka 1993: 16-17). The rate of curation may be driven by a myriad of factors, including the curate value of the artefacts in question (measured in terms of their condition, replacement cost and portability), the distance between sites and the likelihood of an eventual reoccupation of the abandoned site (LaMotta & Schiffer 1999: 22; Schiffer 1987: 90-2; Tomka 1993: 22-3).

2.5 Conclusion

Theories of technological and cultural change have varied considerably over the past half-century, with the multi-phase site of Wadi Hammeh 27 representing an ideal opportunity for testing many of these models in the context of Early Natufian period. This potential is illustrated in the subsequent chapter, in the form of a detailed description of the archaeological sequence at Wadi Hammeh 27.

Chapter 3: The Architectural Layout and Stratigraphy of Wadi Hammeh 27 – Previous and Renewed Excavations

3.1 Introduction

This chapter summarises the stratigraphy and architectural features of Wadi Hammeh 27, with a particular emphasis placed on the loci and architectural features recorded during the most recent excavations of the site between 2014 and 2016. The purpose of this undertaking is twofold – to serve as a reference for the layout and features of the strata and features described in subsequent chapters, and to illustrate the potential of Wadi Hammeh 27 to function as a multi-phase diachronic yardstick for tracing technological developments across a significant span of the Early Natufian period.

In this chapter, each phase of Wadi Hammeh 27 is detailed in order of excavation, beginning with a summary of the 1980s investigations of Phase 1 and closing with a description of Phase 4 basal deposits uncovered in late 2016. Each of the newly excavated strata are described in two stages – first through illustrating the stratigraphic setting of the contexts comprising each phase, and secondly through documenting the architectural features associated with each occupational surface. Finally, the taphonomic factors affecting Wadi Hammeh 27 are addressed at the end of this chapter in order to evaluate the site's stratigraphic integrity.

3.2 Summary of previous excavations at Wadi Hammeh 27

The original excavations of Wadi Hammeh 27 were carried out between 1983 and 1990, under the direction of Phillip Edwards as part of the broader University of Sydney excavations of Pella. This project represented the first substantial investigations into the Palaeolithic of the Eastern Jordan Valley in almost half a century, being preceded only by the 1948 excavations of ´Ala Safat (Edwards 2013a: 7). Excavations conducted at Wadi Hammeh 27 during this period were focussed primarily on uncovering a broad horizontal exposure of the latest architectural phase of the site, represented stratigraphically by Phase 1, in order to understand the layout of the settlement (Edwards 2013a: 7).

In keeping with the expansive site division system utilised in the main Pella excavations, the entire Wadi al-Hammeh plateau was encompassed within a single excavation zone, Area XX. While suitable for the excavation of the later-period architectural ruins present at ancient Pella, located 2km to the south, this aspect of the University of Sydney site nomenclature was deemed to be ill-suited for the excavation of the Wadi al-Hammeh plateau, given the large number of earlier Palaeolithic sites it would also incorporate. The decision was subsequently made to subdivide Area XX into a series of smaller plots. Areas XX A, XX B and XX C were assigned to the excavation of the Kebaran site, Wadi Hammeh 26 (Edwards 2013a: 10). The primary excavations of Wadi Hammeh 27 were spread across seven plots, these being areas XX D, XX E, XX F, XX G, XX H, XX J and XX K (Edwards 2013a: 9-12). An additional two test-pits, Areas XX M and XX N, were also opened at the eastern and southern ends of the plateau in order to investigate the nature of the deposits in these areas (Edwards 2013c: 57-60). All deposits were comprehensively dry sieved and subsequently wet sieved, in both cases using a 1mm mesh.

Investigations into the underlying strata were conversely limited to the excavation of a sondage situated at the eastern end of Area XX F (**Fig 3.1**; hereafter 'the XX F Sondage'). This pit served to establish the deep stratification of Wadi Hammeh 27, with a sequence of four superimposed structural phases being identified as a result (Edwards 2013c: 47, 54). It originally measured 5m in length and 1.5m in width, with the width at its southern end subsequently being expanded a further 25cm to the west in order to incorporate the entirety of the Feature 8 primary burial in Phase 4 (Edwards 2013c: 47).

3.2.1 Phase 1 settlement layout and architectural features

The Phase 1 exposure of Wadi Hammeh 27 uncovered two large buildings, Structures 1 and 2 (**Fig. 3.2**), as well as the partially exposed remains of additional structures which remain mostly unexcavated (Edwards 2013c: 42; 2013d). Structures 1 and 2 are defined by extensive curvilinear walls constructed primarily using unworked limestone and travertine slabs and fragments, and vary considerably in their layout.

Structure 1 is an oval pit-house composed of two interlocking wall sections (Edwards 2013d: 73). It is the smaller of the two buildings, with its large axis measuring roughly 11m. The entrance of Structure 1 is situated at its south-west end, and is flanked by two stone-ringed postholes on each side (Features 11, 12, 13 and 17; Edwards 2013d: 73). An additional

Figure 3.1: The Phase 1 surface of Area XX F, with the partially excavated sondage in the foreground. View west.

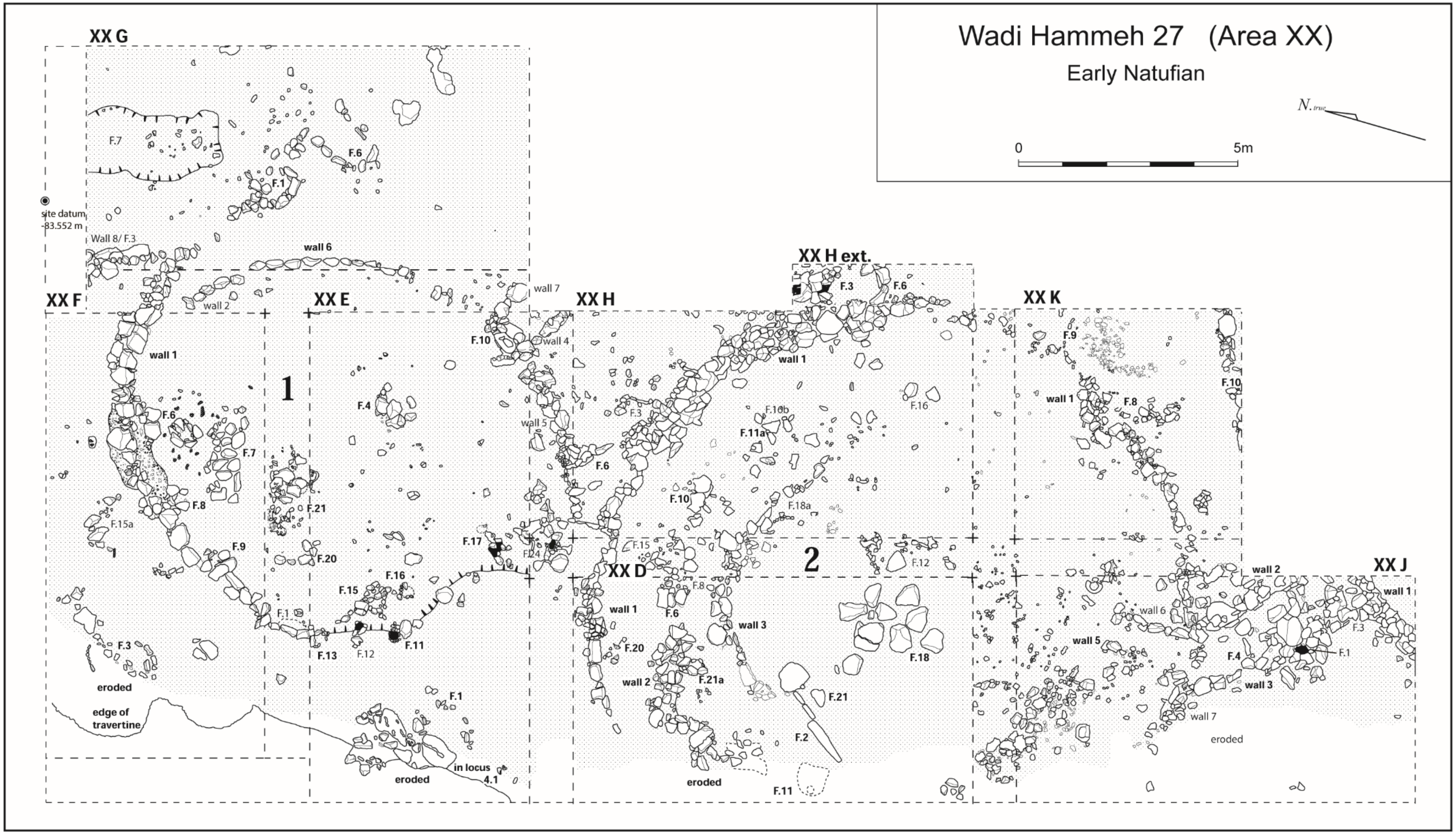


Figure 3.2: Wadi Hammeh 27, Phase 1 plan.

sequence of postholes (Features 8, 9 and 13) were uncovered running along the northern arc of Structure 1 (Wall 1), and are hypothesised to have held support posts (Edwards 2013d: 73).

A number of stone constructions were uncovered in association with the interior Phase 1 floor of Structure 1, including an additional three stone circles (Features 6, 15 and 21). Feature 21, positioned between Areas XX E and XX F, likely also functioned as a posthole due to its placement in the centre the building, while a potential function as a workstation was hypothesised for Feature 6 in Area XX F due to the presence of an intact pestle inside its rim (Edwards 2013d: 73). Also of note was an elongated platform of tightly clustered limestone blocks and slabs (Feature 7), which was situated directly to the south of Features 6 and 8 in Area XX F (Edwards 2013d: 73). This feature was removed towards the end of the 1980s excavations in order to determine if it covered a human burial (Edwards 2013d: 73), resulting in the Phase 2 and Upper Phase 3 occupational deposits being absent from the area it encompassed at the initiation of the La Trobe University excavations.

Structure 2 is a large structure measuring 14m by 11m in diameter, with its westernmost edge having eroded into the Wadi al-Himar during antiquity (Edwards 2013d: 74-5). The interior floor layout of Structure 2 differs considerably from Structure 1, with its outer wall (Wall 1) enclosing an additional two walls (Walls 2 and 3) in a concentric, terraced orientation (Edwards 2013d: 75). Most notable amongst the interior floor features of Structure 2 is the southern termination of Wall 3, where a series of three upright worked limestone and siltstone slabs were uncovered (Edwards 2013d: 83). These slabs are engraved with a pattern of nested concentric squares, which was likely derived from the patterns exhibited by the shell of the spur-thighed tortoise *(Testudo graeca*), a species with which the inhabitants of Wadi Hammeh 27 and other Natufian settlements were well acquainted (Edwards et al. 2019: 619-20).

Three radiocarbon dates were recovered from the Phase 1 deposits, dating to 11,920 ± 150 BP (OxA-393), 12,220 ± 160 BP (OxA-394) and 11,950 ± 160 BP (OxA-507; **Fig. 3.3**). An additional, later date of 11,100 ± 120 BP (ANU-120) was also retrieved from *Melanopsis* shells in the upper topsoil in order to estimate the date at which sedimentation ceased at the plateau.

3.2.2 Artefactual material

The dark, humic interior deposits of Structures 1 and 2 proved to be rich in artefactual material, especially when compared with the relatively low artefact densities present in the exterior loci (Edwards 2013c: 47; Edwards & Hardy-Smith 2013: 120). The Phase 1 deposits are first and foremost characterised by a prolific flaked stone artefact assemblage, including a varied range of retouched types (Edwards 2013e). The faunal assemblage is dominated by the remains of large ungulates, particularly gazelle, with smaller game comprising only 12% of the faunal remains (Edwards & Martin 2013: 344).

A diverse assemblage of groundstone artefacts is also present, including large, finely worked mortars and pestles, vessels of various size, handstones and shaft straighteners (Edwards & Webb 2013). These pieces were primarily manufactured from fine-grained basaltic rock, with the raw materials utilised for some artefacts being imported from sources as distant as the Dead Sea region (Edwards & Webb 2013: 212). Large numbers of worked bone artefacts, primarily points, sickle hafts and gazelle phalanx pendants, were also recovered from the interior deposits of Structures 1 and 2 (Edwards & Le Dosseur 2013: 250), as were a moderate quantity of beads manufactured from marine scaphopod (*Antalis* sp.) shells (Edwards et al. 2013: 283).

An ample collection of objects decorated with non-utilitarian artistic motifs were also recovered, these pieces ranging in size from the aforementioned engraved slabs, to a variety of smaller incised figurative and abstract limestone and bone pieces (Edwards 2013f). Many of the key Phase 1 finds were discovered in discrete Artefact Clusters placed upon the Phase 1 surface, indicating the presence of a relatively high amount of *de facto* refuse (Edwards & Hardy-Smith 2013).

3.3 Renewed excavations at Wadi Hammeh 27 (2014 – 2016)

In contrast to the broad exposure of the original University of Sydney excavations, the 2014 – 2016 La Trobe University investigations were conducted entirely within Plot XX F (**Fig. 3.4**), proceeding in a westerly direction from the 1980s sondage. In order to preserve the remaining walls of Structure 1, only the area of XX F situated inside the interior of Wall 1 was excavated. This stipulation resulted in the initial sample area roughly taking on the form of a

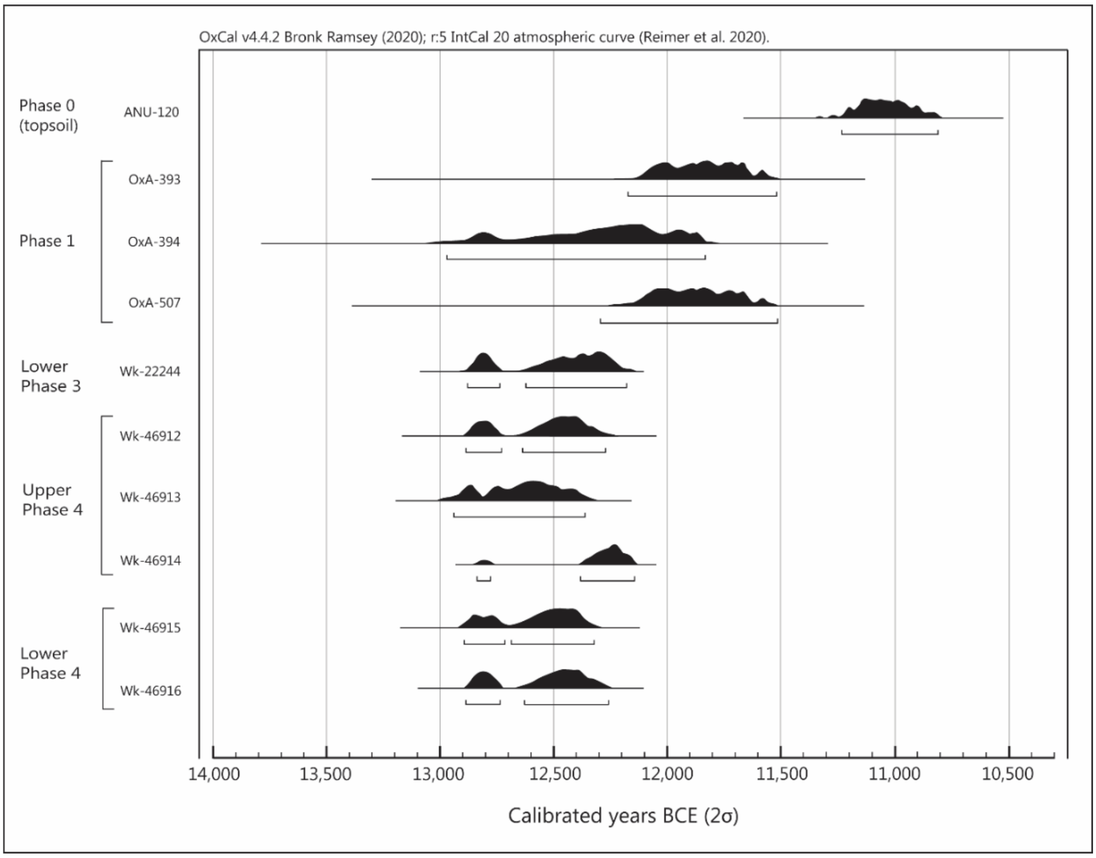


Figure 3.3: The stratified sequence of radiocarbon dates from Wadi Hammeh 27.

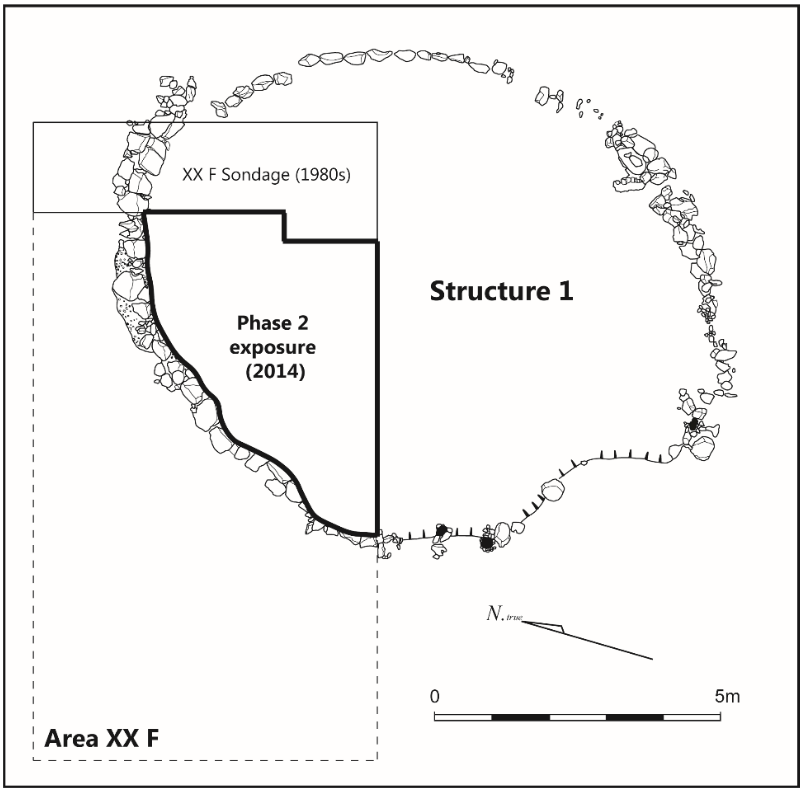


Figure 3.4: Location of renewed excavations within Area XX F.

truncated semi-circle, with its eastern and southern margins measuring 3.5m and 5.25m in length respectively.

The first IAV dig season was carried out over seven weeks through November and December 2014, and was concerned mostly with excavating the Phase 2 deposits. The subsequent 2015 field season succeeded in excavating the Upper Phase 3 strata over a similar span of time, whereas the 2016 season involved the removal of the Lower Phase 3 deposits and most of the Phase 4 loci.

3.3.1 Phase 2

3.3.1.1 Stratigraphy

The Phase 2 deposits of area XX F are represented by a single deposit, Locus 2.5 (**Figs. 3.5 – 3.6**). A total volume of 1.38m^3 of sediment belonging to this layer was excavated during the 2014 dig season. Its thickness varies considerably by square, with it gradually thinning out towards the western edge of the excavated area. For example, Locus 2.5 reaches a maximum depth of 25cm in square E3, whereas the Phase 2 floor was reached in E7 at a depth of only 5cm.

The lateral extent of Locus 2.5 is interrupted by the presence of an elongated, oblong pit dating to the Phase 1 occupation (**Figs. 3.7-3.8**). This pit penetrates the Phase 2 strata entirely, with its base reaching the Lower Phase 3 deposits. It measures 2m in length and covers a width of approximately 0.75m. It is primarily situated in squares C3, C4, D3 and D4, with marginal protrusions into D2 and D5. This pit was uncovered and excavated during the 1980s excavations beneath Phase 1's Feature 7, a similarly sized stone platform (Edwards 2013d: 73).

The north-western quarter of Wall 1, which had previously been uncovered during the exposure of the Phase 1 floor of Structure 1 (Edwards 2013d: 70, 73), was also stratigraphically associated with the Locus 2.5 occupational surface. This wall was found to have been constructed directly upon the base of Locus 2.5 in every square it which it was encountered, with a single exception in Square B4, where it was pedestalled to a significant degree, likely due to later renovations being made to this section of the wall in Phase 1. All-in-all, this evidence indicates that Locus 2.5 represents the earliest interior occupation deposits associated with Structure 1, with the building remaining in use throughout Phase 1.

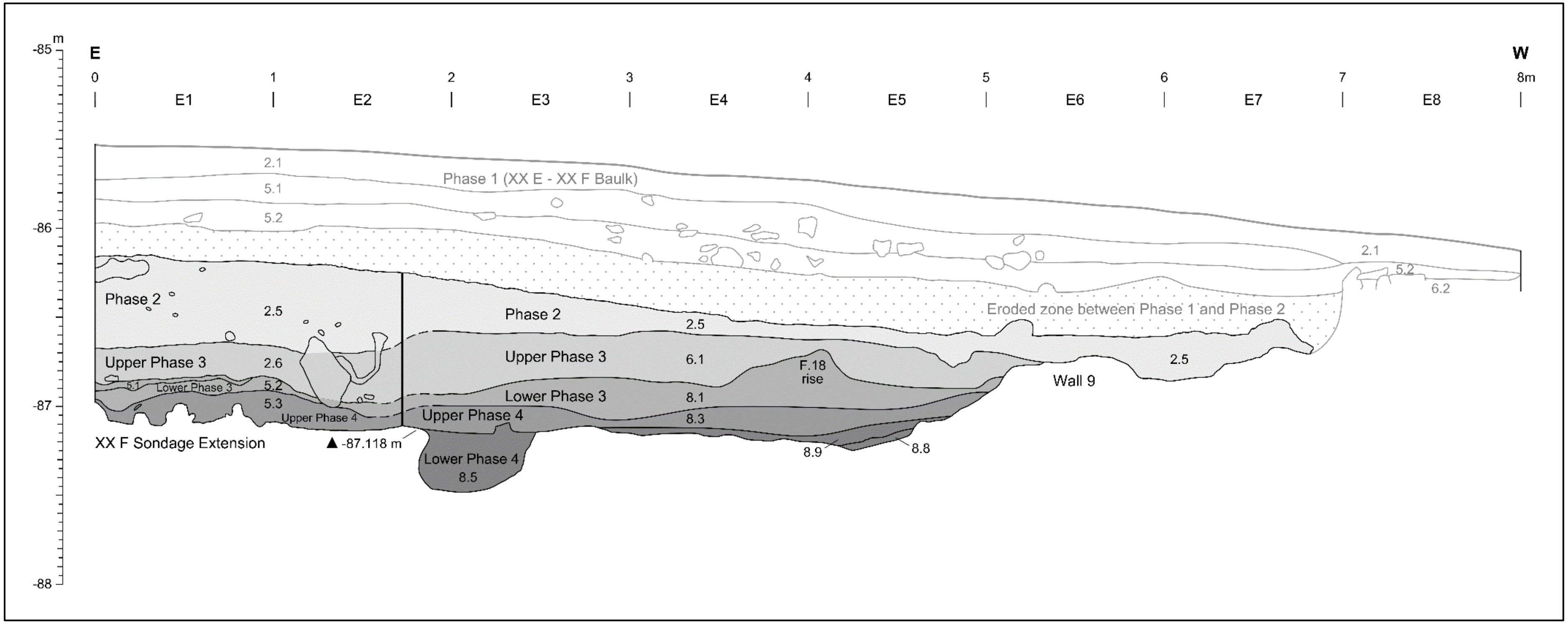


Figure 3.5: Southern stratigraphic section for Wadi Hammeh 27, Area XX F.

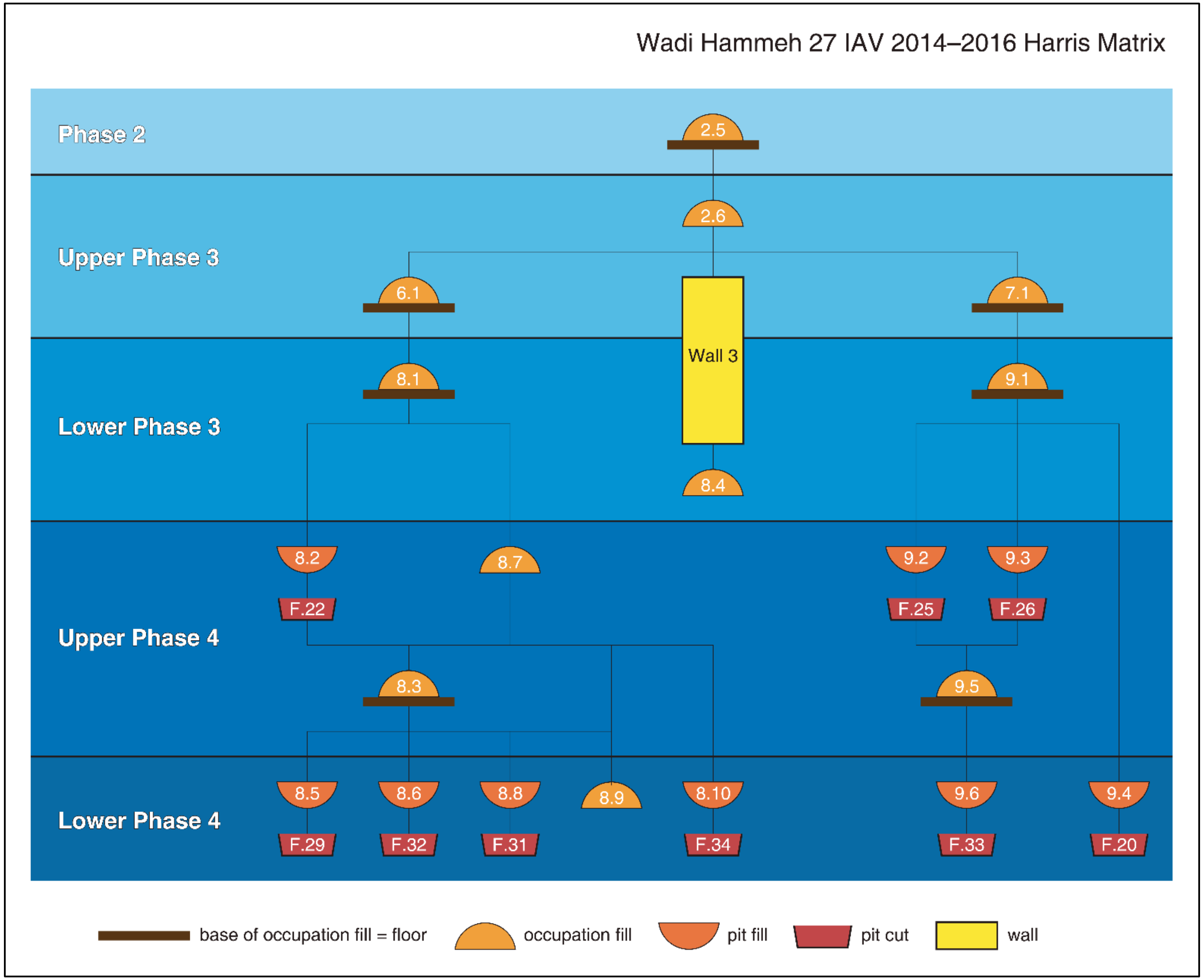


Figure 3.6: Harris matrix for the 2014-2016 excavations of Area XX F.

Figure 3.7: The Phase 2 surface of Area XX F, view west.

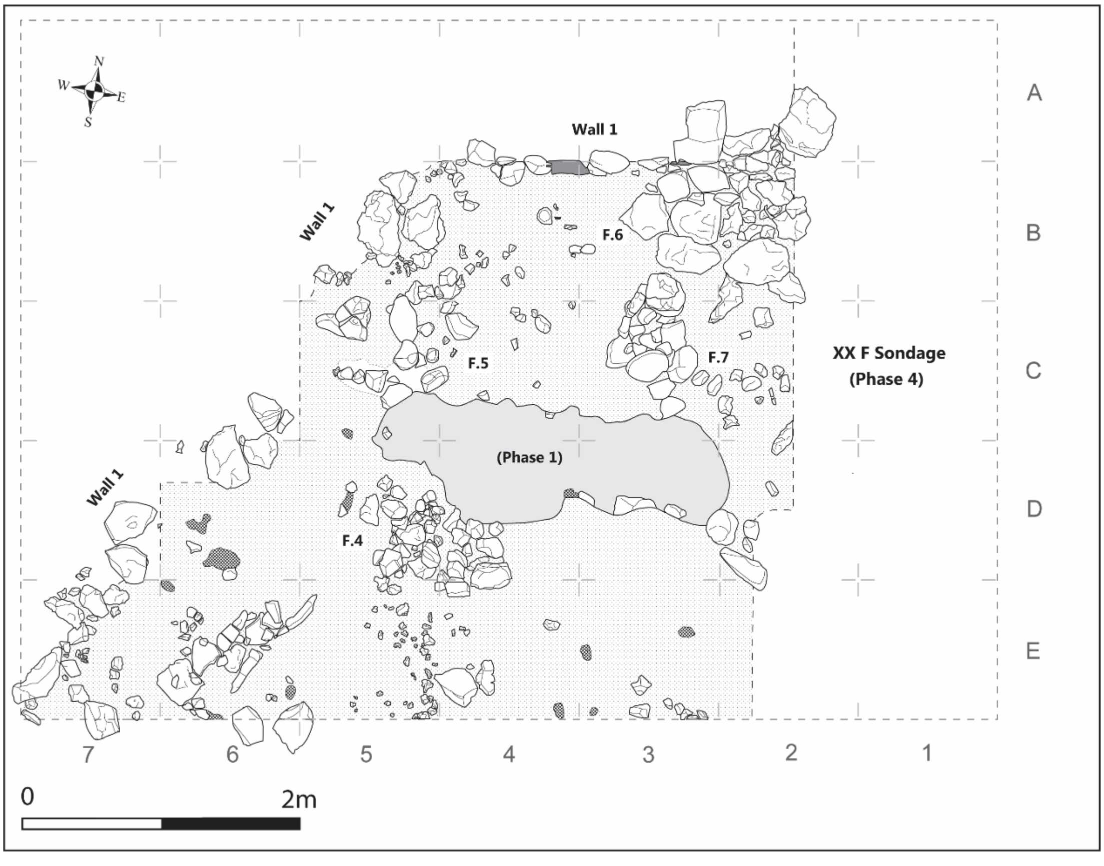


Figure 3.8: Wadi Hammeh 27, Area XX F, Phase 2 plan.

3.3.1.2 Features

Four constructed stone features were uncovered in association with the Phase 2 floor of Structure 1 (**Fig. 3.8**). Feature 6, located immediately south of Wall 1 in Squares B2 and B3, comprises two courses of tightly clustered limestone and travertine cobbles of varying sizes. This feature represents a direct continuation of the lower wall previously encountered during the excavation of the XX F sondage ('Feature 5'), with the exposure of the two features together encompassing a length of 2.82m (Edwards et al. 2018a: 8). Feature 6 slopes upwards to connect with Wall 1 in square B3, suggesting that it was the original Structure 1 wall during the Phase 2 occupation, with the diversion of Wall 1 in these squares representing a Phase 1 renovation.

Two stone circles were also uncovered in association with the Locus 2.5 floor. The first of these arrangements, Feature 7, is a well-defined construction comprising two courses in height (**Fig. 3.9**). It was uncovered directly beneath a similar Phase 1 posthole (Phase 1's 'Feature 6'; Edwards 2013d: 73). A second stone circle (Feature 5) was uncovered two metres west of Feature 7 in Square C5. This circle is more poorly preserved than Feature 7, with its circumference broken by two openings to the north and west. It is likewise situated beneath a Phase 1 successor, Phase 1's 'Feature 8' (Edwards 2013d: 73).

Finally, a large stone platform (Feature 4) measuring 1.14m in length and 0.76m in width was uncovered immediately south-west of the Phase 1 pit. This feature consists of a single course of tightly packed limestone and siltstone cobbles placed atop the Locus 2.5 floor. It is centred on the boundary between squares D4 and D5, with marginal protrusions into E4 and E5. The presence of a single flat slab surrounded by stones suggest that this feature may also have functioned as a posthole. None of these newly uncovered Phase 2 features incorporate any worked stones or recycled groundstone fragments in their construction.

<u>3.3.2 Upper Phase 3</u>

3.3.2.1 Stratigraphy

The upper deposits of Phase 3 are represented by three loci, these being Locus 2.6, 6.1 and 7.1 (**Figs. 3.5 – 3.6**). Loci 6.1 and 7.1 represent the interior and exterior fill of Structure 3 respectively, with the horizontal division between the two strata defined by Wall 9, which was uncovered early on in the 2015 dig season. Locus 2.6 was opened prior to the discovery of Wall 9, and as such any external deposits belonging to this stratum equate to Locus 7.1 outside of Wall 9. The thickness of the interior Locus 6.1 fill is largely uniform, with an average depth of 26cm. The exterior Locus 7.1 deposits are slightly shallower, with a mean depth of 16cm.

3.3.2.2 Features

The major feature of Phase 3 is the wall of the northern half of a curvilinear hut (Structure 3, **Figs. 3.10 – 3.11**). This building is represented primarily by Wall 9, which protrudes from the southern baulk in Square E6, arches through D5, D4 and D3, before re-entering the southern baulk in E2. This final segment of the wall passing through E2 was previously encountered and removed during the excavation of the XX F Sondage, being recorded at the time as Wall 2 (Edwards 2013c: 52). The circumference of the exposed section of the wall measures 6.2m.

Wall 9 is exceptionally well-constructed, with part of its interior face lined by a series of upright, squared and dressed limestone slabs (Feature 19). It remained in use throughout both the Upper and Lower Phase 3 deposits, being constructed upon the base of Locus 8.1. A 70cm-long opening gap in Wall 9 (Feature 24, Square D4) was identified as a north-facing entrance to Structure 3.

A number of stone-ringed postholes were uncovered across the Upper Phase 3 floor, continuing the stratigraphic sequence from Phases 1 and 2. Much like its Phase 2 successor (Feature 7), Feature 12 is a well-constructed feature consisting of two stone courses (**Fig. 3.12**). The positioning of Feature 12 is nonetheless slightly offset from Feature 7, with the earlier construction protruding slightly into square B3. The upper course of Feature 12 is level with the Locus 7.1 surface, while the lower course (visible only in the interior of the posthole) continues to a depth of 20cm below the surrounding occupational floor. One of the stones lining the interior of the lower course is the recycled fragment of a large limestone vessel. Immediately to the south of Feature 12, within Square C3, is Feature 13, a 1m-long rectangular platform composed of tightly packed stones constructed atop the Locus 7.1 floor. One of the stones utilised in the construction of this feature is also a fragment of a large basaltic vessel.

Figure 3.9: Close-up of Feature 7, view east.

Figure 3.10: The Upper Phase 3 surface of Area XX F during the 2015 Wadi Hammeh 27 excavations, view west.

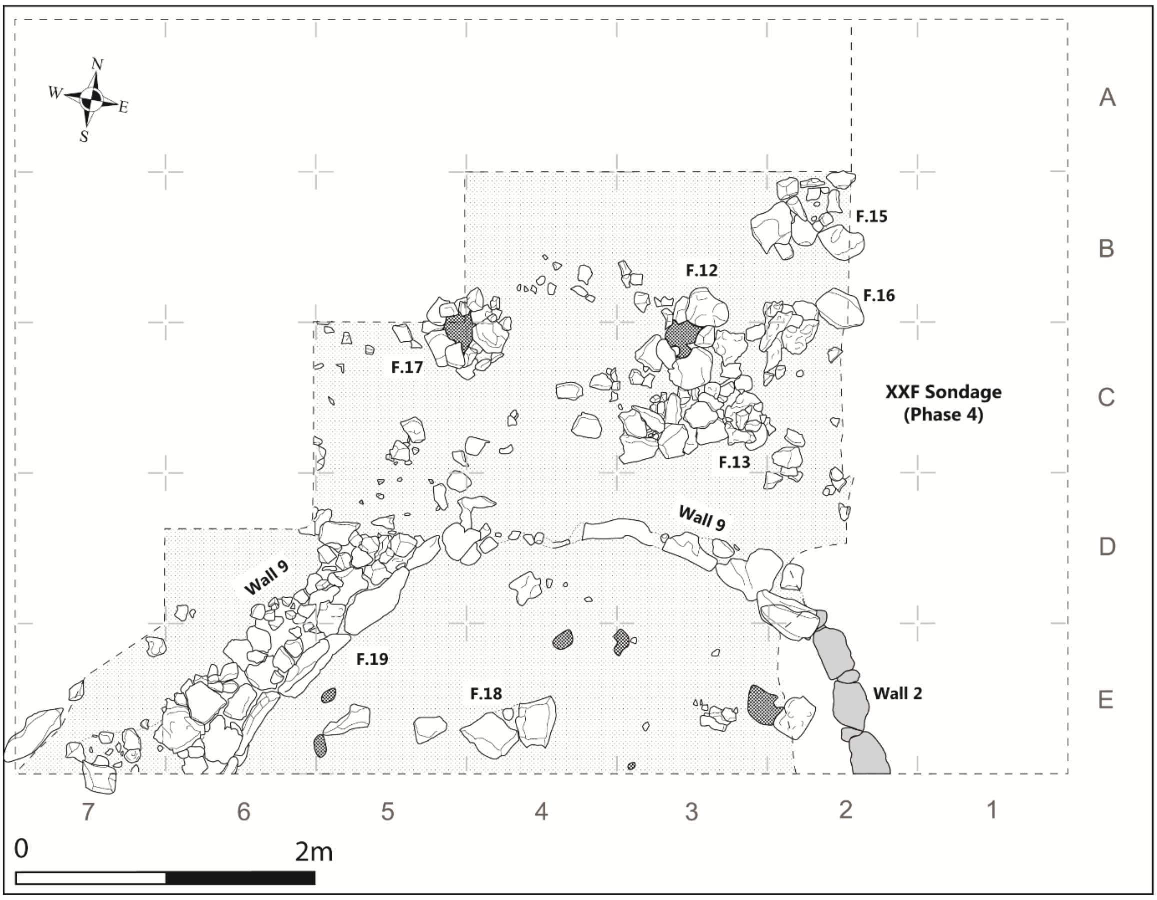


Figure 3.11: Wadi Hammeh 27, Area XX F, Upper Phase 3 plan.

At a distance of 1.5m to the west of Feature 12 stands Feature 17, another stone-ringed feature, this time representing the Upper Phase 3 predecessor of Feature 5 (**Fig. 3.13**). Feature 17 is considerably better preserved than its Phase 2 successor, with the both of its stone courses preserved intact. Its location is also slightly offset from the positioning of Feature 5, being centred on the junction between squares B4, C4, C5 and the unexcavated B5 deposits. Feature 17 differs significantly from Feature 12 in that it was built entirely on the Locus 7.1 floor, with no interior posthole or other pits penetrating into the underlying strata.

Excluding Wall 9, only a single stone construction was uncovered in association with the interior Locus 6.1 deposits. This is Feature 18, a linear arrangement of four large limestone blocks distributed across Squares E4 and E5. The two largest stones in E4 are built into a raised earthen platform, resulting in the maximum height of this construction reaching 35cm above the surrounding Locus 6.1 floor.

3.3.3 Lower Phase 3

3.3.3.1 Stratigraphy

The Lower Phase 3 strata follow the interior-exterior dichotomy established by Locus 6.1 and 7.1, with Locus 8.1 and 9.1 representing the interior and exterior deposits of Structure 3 respectively (**Figs. 3.5 – 3.6**). Locus 8.1 is slightly shallower than Locus 6.1, with an average depth of 16cm. The exterior Locus 9.1 deposits, on the other hand, are thicker than the Phase 3 or Phase 2 strata, with an average depth of 20cm. Prior to the opening of the 2016 dig season, it was decided that the Locus 9.1 deposits in squares D5, E6 and E7 would remain unexcavated in order to preserve of the western section of Wall 9 and its associated Feature 19 dressed slabs. Finally, the sediment associated with the eastern course of Wall 9 was excavated as Locus 8.4 in order to access to underlying Phase 4 deposits. A single radiocarbon sample was retrieved from Lower Phase 3 (Wk-22244), yielding an uncalibrated date of 12,349 ± 44 BP (**Fig. 3.3**).

3.3.3.2 Features

The removal of Locus 9.1 revealed a number of exterior stone features (**Figs 3.14 - 3.15**), the most notable of which is Feature 20, an oblong cluster of stones measuring approximately

Figure 3.12: Close-up of Features 12 (left) and 13 (right), view east.

Figure 3.13: Close-up of Feature 17, view North.

Figure 3.14: The Lower Phase 3 surface of Area XX F during the 2016 excavations, view west.

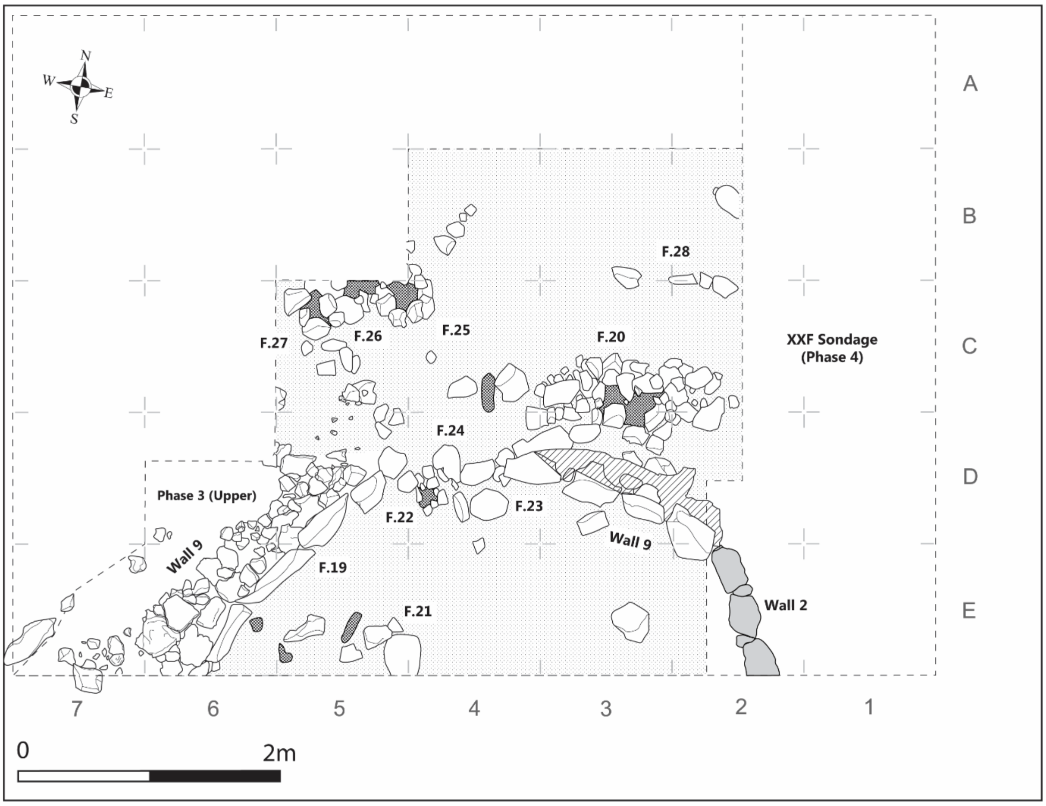


Figure 3.15: Wadi Hammeh 27, Area XX F, Lower Phase 3 plan

1.5m in length, which caps a pit dug into basal travertine layer (**Fig. 3.16**). Two well-defined, partially conjoined postholes are positioned in the centre of this construction, the construction of which incorporates three large basaltic and limestone mortar fragments. The interior fill of Feature 20 was subsequently excavated as a Lower Phase 4 stratum, Locus 9.4.

A line of three stones (Feature 28) were also uncovered running in an east-western orientation along the southern end of Square B2. The westernmost stone of the main cluster is a worked limestone slab firmly embedded lengthways into the natural travertine surface. 50cm to the west of this slab, in Square B3, stands another slab that had similarly been embedded lengthways into the underlying travertine surface. The linear arrangement of these stones combined with the lack of built features to its north is significant, and suggests that they may have functioned as a boundary marker in some capacity.

Several notable stone features were also discovered in association with interior Locus 8.1 surface. Much like Feature 18, Feature 21 represents two large stones set into a clay platform at the division of Squares E4 and E5. A large block of travertine was also deposited in Square E3 on the Locus 8.1 floor in the exact location of the underlying Feature 25 burial, possibly in order to mark its location.

3.3.4 Phase 4

3.3.4.1 Stratigraphy

The most artefact-rich stratum of Upper Phase 4 is Locus 8.3, which underlies Locus 8.1 and caps a multitude of Lower Phase 4 pit deposits (**Figs 3.5 - 3.6**). Wall 9 was clearly pedestalled once Locus 8.3 was removed, demonstrating that the Upper Phase 4 deposits in the 'interior' predate the foundation of Structure 3 (**Fig. 3.17**). Unlike the thick, artefact rich deposits associated with Locus 8.3 and its various stratigraphic predecessors, the Upper Phase 4 deposits in the 'exterior' area are relatively ephemeral. Locus 9.5 represents the northern counterpart to Locus 8.3, being a thin layer of hard-packed sediment situated between Locus 9.1 and the natural layer of travertine. It is entirely absent in the eastern end of the excavated

Figure 3.16: Close up of Feature 20 prior to and after the removal of Locus 9.4, view south.

Figure 3.17: The Locus 8.3 ('Upper Phase 4') surface, view west.

area, suggesting that the travertine bedrock layer was only partially obscured by sediment at this stage of the settlement.

Locus 8.3 covers several underlying pits excavated into the natural travertine surface, with six additional Lower Phase 4 loci identified in association with these features. They are Locus 8.2, the posthole fill of Feature 22; Locus 8.5, the fill within the Feature 29 double burial; Locus 8.6, the fill associated with the Feature 32 pit; Locus 8.8, the fill associated with the Feature 31 stone-capped pit; Locus 8.9, the sediment overlying Feature 35 pit and some of its surrounding deposits and finally Locus 8.10, the fill inside the Feature 34 posthole. To the north, Locus 9.4 represents the sediment within Feature 20's rock-filled pit, while the interior fill of a natural cavity in the travertine surface in Square C4 (Feature 33) was excavated as Locus 9.6. Finally, Locus 9.2 represents the interior deposits of Feature 25, while Locus 9.3 consists of the fill excavated during the investigation of a possible posthole within Feature 26.

Usable charcoal samples were more plentiful in the Phase 4 strata than previously encountered in the Wadi Hammeh 27 sediments. Uncalibrated radiocarbon dates of 12,383 ± 29 BP (Wk-46912), 12,438 ± 28 BP (Wk-46913) and 12,290 ± 28 BP (Wk-46914) were retrieved from the Upper Phase 4 loci, whereas the Lower Phase 4 deposits yielded dates of 12,404 ± 30 BP (Wk-46915) and 12,379 ± 30 BP (Wk-46916). The relative concurrence of these dates with one another, as well as with the Lower Phase 3 sample, point to a rapid rate of sedimentation at this stage of Wadi Hammeh 27's occupation (**Fig. 3.3**).

3.3.4.2 Features

An exceptionally small posthole (Feature 22) was uncovered in Square D4 in association with Locus 8.3. The interior fill (Locus 8.2) of this feature reaches a mere depth of 8cm, and represents the only locus excavated during the renewed excavations of Wadi Hammeh 27 to be entirely absent of flaked stone artefacts. Two stone features are found in association with the Locus 8.3 floor. The first of these constructions is Feature 36, a loose cluster of stones placed on the Locus 8.3 surface in Square E4. This feature is associated with a number of clustered artefacts, the most notable of these being RN 160252, a massive basaltic pestle measuring 36cm in length and 10cm in maximum width (Edwards et al. 2018c: 9), as well as one of the largest burins to be recovered from the site. Immediately to the west of this feature stands Feature 30, another concentration of large limestone blocks which was identified as the Upper Phase 4 predecessor to Features 21 and 18.

On the exterior, Feature 25 was identified as the Upper Phase 4 predecessor to the Feature 17 posthole. Unlike Feature 17, however, the interior fill of Feature 25 protrudes deep into the underlying sediment, reaching a depth of 16cm below the Lower Phase 3 floor. Immediately to the west of Feature 25, within Square C5, is a cluster of tightly packed stones identified as a separate feature (Feature 26), although the two constructions may in fact represent a single arrangement. A small depression inside this feature at the junction between Square C5 and the unexcavated B5 deposits was investigated as a possible posthole, although a function as such seems unlikely given the shallow depth exhibited by the associated Locus 9.3 fill.

Of the Lower Phase 4 pit features revealed beneath Locus 8.3 (**Figs. 3.18-3.19**), only one was completely excavated to its travertine base, this being Feature 29 and its associated double burial. The first of these interments to be uncovered was Homo 9, a child estimated to have died at an age between five and seven years. This burial was deposited above Homo 10, the remains of another child aged between eight and 11 years (**Fig. 3.20**). Although a layer of sediment up to 10cm thick accumulated after the internment of Homo 10 and prior to the burial of Homo 9, the crania of the two individuals are in direct contact with one another, indicating a simultaneous burial event (Edwards et al. 2018c: 5-6). Both individuals display evidence of delayed sediment infilling, suggesting that they were originally interred within containers manufactured from perishable materials. Grave goods are limited to the poorly preserved remains of a tusk shell necklace worn by Homo 10 (Edwards et al. 2018c: 5-6).

Immediately adjacent to the north of Feature 29 is Feature 32, another pit dug into the travertine surface. This cavity was excavated to a depth of 23cm during the 2016 season, before a lack of time necessitated its closure. Despite the fact that the resulting Locus 8.6 sediment only reaches a volume of 0.055m^3, it yielded a total of four bone points, pointing to their deliberate caching. A single human vertebra was also uncovered from this pit, and it is thus likely that additional human remains are present within the unexcavated strata.

To the west of Feature 29 is Feature 35. The edge of this pit stretched from the rim of Feature 29 to the western end of square E4, making it the largest pit by area to be uncovered during the 2016 dig season. Excavations in the pit ceased when a human maxilla was reached, with no attempt being made to excavate any deeper due to time constraints. A final stone-capped pit (Feature 31) was uncovered at the junction between Squares E5 and E6, although the

Figure 3.18: The Lower Phase 4 surface of Area XX F at the close of 2016 excavations, view west.

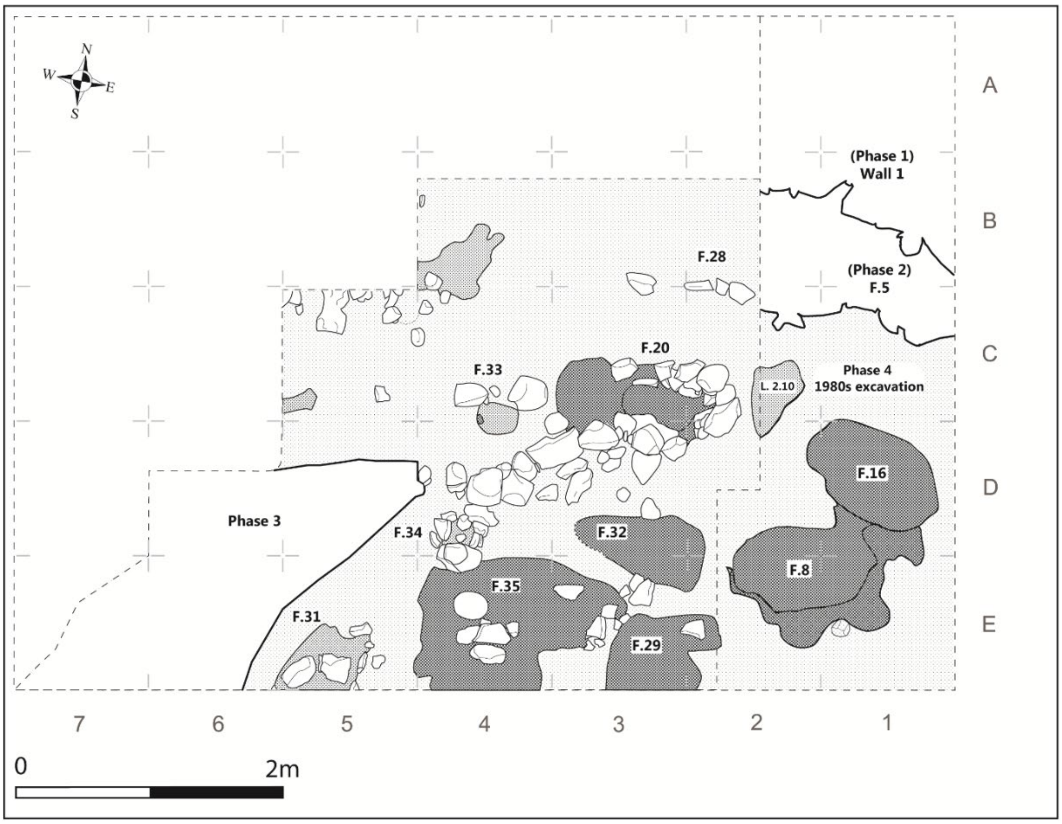


Figure 3.19: Wadi Hammeh 27, Area XX F, Lower Phase 4 plan.

Figure 3.20: Homo 9 (above) and Homo 10 (below) *in situ* within Feature 29.

excavation of this feature was limited to clearing around the uppermost course of stones due to the fact that it extends into the southern baulk. Finally, a stone-ringed posthole (Feature 34) was uncovered in Square D4, directly beneath Feature 22. With a depth of 30cm, this is the deepest posthole to be uncovered during the IAV project. No additional stone features were uncovered with the removal of the 'exterior' Locus 9.5 deposits.

3.4 Taphonomic factors

While it would be unreasonable to assume that no admixture occurred at all between the various phases at Wadi Hammeh 27, this appears to have been a relatively minimal factor within the area under examination, with the architectural features in each phase being associated with deep, *in situ* deposits which remained fairly undisturbed by the earth moving activities of later occupants. The fact that Wadi Hammeh 27 was established directly atop a 3m thick layer of limestone travertine (Edwards 2013a: 9) highlights the stratigraphic integrity of the site, as this served as a barrier to any artefactual intrusions from underlying deposits.

While bioturbation, floralturbation and argilliturbation (the expansion and contraction of clays due to fluctuating weather conditions) were identified as taphonomic influences at Wadi Hammeh 27, the effect these processes played on the lateral and vertical movement of artefacts appears to have been limited (Edwards 2013c: 54-7). The Phase 1 occupational surface was particularly disturbed by the borrowing activities of subterranean rodents, with *Spalax ehrenbergi* (Palestine mole rat) and *Microtus guentheri* (Levant vole) being determined as the most likely culprits (Edwards 2013c: 54-5). While some of these burrows penetrate into the lower phases, the extent of the resulting disturbance is relatively limited compared to the situation in Phase 1, with a steep, incremental decline in the number of identifiable burrows deeper into the Wadi Hammeh 27 strata. Likewise, Edwards (2013c: 55) found that the majority of intrusive potsherds at Wadi Hammeh 27 from later periods are found within the topsoil deposits, followed by the Phase 1 fill to a much lesser extent and dropping off sharply in number in the earlier phases (Edwards 2013c: 55). This pattern is supported by the renewed excavations of Wadi Hammeh 27, where only ten intrusive artefacts from historical periods were recovered. These artefacts are most prominent in Phase 2, which features three potsherds and a fragment of glass, and least common in Phase 4, from which only a single potsherd was retrieved.

3.5 Summary

The combined University of Sydney and La Trobe University excavations of Wadi Hammeh 27 have uncovered broad, expansive exposures for the entire occupational sequence of the site. The fine-scale excavation of a clear sequence of domestic occupations thus provides an ideal opportunity for investigating intra-site technological change within the lifespan of a single Early Natufian settlement. In addition to in-depth diachronic analysis of Wadi Hammeh 27, the fact that each assemblage was catalogued in its entirety by excavation square means that detailed horizontal analyses may also be undertaken using a combination of statistical analysis and GIS-aided density plots, thus allowing for direct correlations to be made between artefact distribution and the floor features discussed in this chapter. Having thus established a comprehensive overview of each structural phase at Wadi Hammeh 27, a diachronic approach to technological and typological change may now be undertaken, beginning with an overview of each flaked stone assemblage and the properties of the debitage component.

Chapter 4: The Wadi Hammeh 27 lithic assemblages – overall composition and debitage attributes

4.1 Introduction

This chapter focusses on the overall composition of the flaked stone assemblages of Wadi Hammeh 27, with particular emphases placed on the typological composition of the debitage artefacts and their technological attributes. The flaked stone assemblages are described chronologically based on their order of deposition, beginning with the Phase 4 deposits and concluding with the Phase 2 occupation of Structure 1. A comparative assemblage from the original 1980s excavations of Phase 1 is then discussed in relation to the newly analysed assemblages in order to provide an inclusive perspective of the entire archaeological sequence. Similarly detailed analyses of the core and retouched artefact assemblages may be found in Chapters 5 and 6 respectively. This and the following two chapters serve first and foremost to establish the data of each assemblage. A more comprehensive reconstruction of the Wadi Hammeh 27 reduction sequence and its functional influences may be found in Chapter 9.

Throughout the three seasons of renewed excavations at Wadi Hammeh 27, a total of 490,891 flaked stone artefacts were recovered, together comprising a total artefact mass weighing over 261 kilograms. The flaked stone assemblages from all three seasons were catalogued in their entirety over a period of 14 months, this period encompassing the 2015 and 2016 excavations, followed by ten months of dedicated data collection at the American Centre of Oriental Research (ACOR) in Amman. As a result of comprehensive sampling regimen applied, detailed typological comparisons are able be undertaken via several approaches.

4.2 On debris and debitage terminologies

The debris and debitage types utilised in the current study follow those utilised by Edwards (2013e) to analyse the 1980s assemblages of Wadi Hammeh, which was itself built upon the schemes developed by Henry (1973) and Marks (1976), with additional attribute definitions borrowed from Holdaway and Stern (2004). Following Andrefsky (2001: 7-8) and Sullivan and Rozen (1985: 755-8), the analysis of the Wadi Hammeh 27 debitage focusses on broad types defined by replicable characteristics, with the aim of maximising their comparative compatibility with other Epipalaeolithic Levantine assemblages. This qualification means that no attempt was made during the initial cataloguing process to segregate the debitage into 'primary', 'secondary' and 'tertiary' types based on the amount of cortex coverage on the dorsal surface of each artefact. Such types are ill-defined in Southern Levantine lithic classification systems to begin with, with Henry (1973: 60) characterising a primary element as encompassing any piece with cortex on at least a third of its dorsal surface, whereas Marks (1976: 376) extended this prerequisite to half of the dorsal surface.

Cortical presence on debitage items is instead appraised towards the end of this chapter using attribute data. In addition to recording the percentage of cortical coverage on the dorsal surface of artefacts, this approach also involved recording the placement of this cortex through the utilisation of a quadrat system (Holdaway & Stern 2004: 144-5). The quadrats proceed clockwise in numerical order, beginning with Quadrat 1 at the proximal end of the artefact. The 'core trimming flake' type, previously utilised by Edwards in analysing the Phase 1 material from Wadi Hammeh 27, has also been excluded from the current study due to the subjectivity involved in discerning these pieces from regularly knapped flakes (Edwards 2013e: 130).

The definition of debris artefacts in the current study are synonymous with Holdaway and Stern's (2004: 113) 'angular fragments', in that they are identified primarily through their lack of debitage characteristics. The distinction between 'chips' and 'chunks' follows the dimension-based means of identification utilised by Henry (1973: 58), with 'chips' representing the minute, thin shatter fragments measuring no more than 1cm in maximum dimension, whereas the chunks are larger, more amorphous pieces. Contrary to Marks (1976: 374), these 'chunks' encompass pieces of any size, so long as they do not possess any identifiable negative flake scars, which would instead classify them as core fragments. The chunks at Wadi Hammeh 27 mostly represent pieces of chert nodules fractured through thermal processes, with this attribution supported by the consistently high number of chunks featuring one or more thermal shatter scars.

The distinction made between the 'blade' and 'bladelet' types utilised in the current study is a combination of the *sensu lato* and *sensu stricto* definitions offered by Marks (1976: 372-3). Both types meet the *sensu lato* criteria in that they all involve pieces twice as long as they are wide, so long as they do not feature characteristics of other core trimming debitage types. The *sensu stricto* division between blades and bladelets has only been partially followed, however, with a length of 50mm being the only dividing line between the two types. No attempt has been made to differentiate between blades and bladelets based on their width in the current study.

The 'broken flake' type utilised in this study is a comprehensive one, encompassing all flakes missing their platform or termination, or having been longitudinally split. The same approach is applied to the 'broken blades and bladelets', in this case also without any attempt being made to individually identify these pieces as representing either broken blades or bladelets.

The category of 'flakes <2cm' incorporates any complete pieces with flake dimensions under 2cm, so long as they feature an identifiable bulb of percussion. As a result, there exists no lower limit for classifying these objects, with many pieces exhibiting similar dimensions as the chips. Given that microflakes are routinely produced as knapping by-products (Edwards 2013e: 121; MacDonald 1991: 87-90; Shott 1995: 63-6), many of these artefacts could thus be considered as another form of debris rather than intentionally manufactured debitage blanks. This question is further complicated, however, by the presence of a number of diminutive flake cores, indicating that flakes falling into this size range were intentionally knapped to a degree.

4.3 Raw material usage at Wadi Hammeh 27

The raw materials utilised at Wadi Hammeh 27 remain consistent over time, with fine-grained, homogenous, light brown cherts dominating all four flaked stone assemblages analysed in the current study. This bias is reflected by the Munsell readings, where colours described as 'brown' are predominant in all four assemblages (**Tables 4.1, 4.2**). These pieces are supplemented primarily by much smaller proportions of artefacts manufactured from 'pale brown' and 'yellowish brown' cherts. The Munsell readings are likewise uniform across artefact types, suggesting that each type of chert was regularly utilised in an extensive reduction sequence at Wadi Hammeh 27, as opposed to significant quantities of exotic materials being imported to the site in the form of debitage blanks.

The brown cherts typifying the analysed assemblages are consistent with the Muwaqqar Chalk Marl Type 4 cherts (MCM-04) previously identified as being favoured by the Early Natufian inhabitants of Wadi Hammeh 27 (Delage et al. 2020: 8-9; Edwards et al. 2018a:

Table 4.1: Munsell readings for unburnt lithic artefacts at Wadi Hammeh 27, by phase. Only readings with at least one occurrence have been listed.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		**Total**	
	N	%	N	%	N	%	N	%	**N**	**%**
5R 4/3: Weak red	0	0.0	0	0.0	1	0.1	0	0.0	**1**	**0.0**
10R 2.5/1: Reddish black	0	0.0	0	0.0	1	0.1	0	0.0	**1**	**0.0**
10R 3/2: Dusky red	0	0.0	1	0.1	0	0.0	0	0.0	**1**	**0.0**
10R 3/3: Dusky red	0	0.0	0	0.0	2	0.3	0	0.0	**2**	**0.1**
10R 3/4: Dusky red	1	0.1	0	0.0	0	0.0	0	0.0	**1**	**0.0**
10R 4/1: Dark reddish gray	0	0.0	2	0.3	1	0.1	0	0.0	**3**	**0.1**
10R 4/2: Weak red	0	0.0	1	0.1	0	0.0	0	0.0	**1**	**0.0**
10R 4/3: Weak red	0	0.0	1	0.1	0	0.0	0	0.0	**1**	**0.0**
10R 4/4: Weak red	0	0.0	0	0.0	0	0.0	1	0.2	**1**	**0.0**
10R 5/1: Reddish gray	0	0.0	1	0.1	0	0.0	0	0.0	**1**	**0.0**
2.5YR 2.5/1: Reddish black	0	0.0	0	0.0	0	0.0	1	0.2	**1**	**0.0**
2.5YR 2.5/2: Very dusky red	0	0.0	1	0.1	0	0.0	0	0.0	**1**	**0.0**
2.5YR 3/1: Dark reddish gray	0	0.0	1	0.1	0	0.0	1	0.2	**2**	**0.1**
2.5YR 3/2: Dusky red	0	0.0	1	0.1	1	0.1	0	0.0	**2**	**0.1**
2.5YR 3/3: Dark reddish brown	0	0.0	1	0.1	3	0.4	0	0.0	**4**	**0.1**
2.5YR 4/1: Dark reddish gray	7	0.8	3	0.4	8	1.0	4	1.0	**22**	**0.8**
2.5 YR 4/2: Weak red	7	0.8	2	0.3	12	1.5	2	0.5	**23**	**0.8**
2.5YR 4/3: Reddish brown	0	0.0	5	0.7	1	0.1	1	0.2	**7**	**0.3**
2.5YR 4/4: Reddish brown	1	0.1	0	0.0	0	0.0	0	0.0	**1**	**0.0**
2.5YR 5/1: Reddish gray	6	0.7	3	0.4	8	1.0	2	0.5	**19**	**0.7**
2.5YR 5/2: Weak red	1	0.1	3	0.4	5	0.6	1	0.2	**10**	**0.4**
2.5YR 6.1: Reddish gray	1	0.1	0	0.0	0	0.0	0	0.0	**1**	**0.0**
2.5YR 6/2: Pale red	1	0.1	0	0.0	0	0.0	0	0.0	**1**	**0.0**
2.5YR 7/1: Light reddish gray	0	0.0	0	0.0	1	0.1	0	0.0	**1**	**0.0**
5YR 2.5/1: Black	0	0.0	0	0.0	1	0.1	0	0.0	**1**	**0.0**
5YR 3/1: Very dark gray	2	0.2	0	0.0	0	0.0	0	0.0	**2**	**0.1**
5YR 3/2: Dark reddish brown	2	0.2	2	0.3	8	1.0	2	0.5	**14**	**0.5**
5YR 3/3: Dark reddish brown	0	0.0	1	0.1	1	0.1	0	0.0	**2**	**0.1**
5YR 4/1: Dark gray	6	0.7	7	0.9	8	1.0	8	1.9	**29**	**1.0**
5YR 4/2: Dark reddish gray	11	1.3	11	1.4	8	1.0	2	0.5	**32**	**1.1**
5YR 4/3: Reddish brown	1	0.1	3	0.4	4	0.5	0	0.0	**8**	**0.3**
5YR 4/4: Reddish brown	2	0.2	0	0.0	1	0.1	0	0.0	**3**	**0.1**
5YR 5/1: Gray	5	0.6	9	1.2	15	1.9	4	1.0	**33**	**1.2**
5YR 5/2: Reddish gray	5	0.6	14	1.8	10	1.3	10	2.4	**39**	**1.4**
5YR 5/3: Reddish brown	5	0.6	4	0.5	4	0.5	1	0.2	**14**	**0.5**
5YR 5/4: Reddish brown	0	0.0	3	0.4	0	0.0	0	0.0	**3**	**0.1**

5YR 6/1: Gray	1	0.1	1	0.1	2	0.3	0	0.0	**4**	**0.1**
5YR 6/2: Pinkish gray	2	0.2	2	0.3	0	0.0	0	0.0	**4**	**0.1**
7.5YR 2.5/1: Black	0	0.0	0	0.0	1	0.1	0	0.0	**1**	**0.0**
7.5YR 3/2: Dark brown	0	0.0	1	0.1	2	0.3	0	0.0	**3**	**0.1**
7.5YR 3/3: Dark brown	0	0.0	1	0.1	0	0.0	0	0.0	**1**	**0.0**
7.5YR 4/1: Dark gray	7	0.8	7	0.9	5	0.6	4	1.0	**23**	**0.8**
7.5YR 4/2: Brown	61	7.4	43	5.6	28	3.5	13	3.1	**145**	**5.2**
7.5YR 4/3: Brown	22	2.7	14	1.8	19	2.4	1	0.2	**56**	**2.0**
7.5YR 4/4: Brown	4	0.5	3	0.4	7	0.9	2	0.5	**16**	**0.6**
7.5YR 4/6: Strong brown	0	0.0	1	0.1	0	0.0	0	0.0	**1**	**0.0**
7.5YR 5/1: Gray	17	2.1	12	1.6	18	2.3	8	1.9	**55**	**2.0**
7.5YR 5/2: Brown	113	13.7	85	11.2	93	11.8	41	9.9	**332**	**11.9**
7.5YR 5/3: Brown	45	5.5	44	5.8	39	4.9	28	6.7	**156**	**5.6**
7.5YR 5/4: Brown	14	1.7	12	1.6	15	1.9	9	2.2	**50**	**1.8**
7.5YR 5/6: Strong brown	2	0.2	4	0.5	4	0.5	1	0.2	**11**	**0.4**
7.5YR 6/1: Gray	2	0.2	1	0.1	6	0.8	2	0.5	**11**	**0.4**
7.5YR 6/2: Pinkish gray	14	1.7	27	3.5	15	1.9	11	2.6	**67**	**2.4**
7.5YR 6/3: Light brown	7	0.8	13	1.7	6	0.8	6	1.4	**32**	**1.1**
7.5YR 6/4: Light brown	1	0.1	4	0.5	5	0.6	6	1.4	**16**	**0.6**
7.5YR 6/6: Reddish yellow	0	0.0	2	0.3	1	0.1	0	0.0	**3**	**0.1**
7.5YR 7/1: Light gray	0	0.0	1	0.1	1	0.1	0	0.0	**2**	**0.1**
7.5YR 7/2: Pinkish gray	4	0.5	2	0.3	2	0.3	0	0.0	**8**	**0.3**
7.5YR 8/1: White	0	0.0	1	0.1	0	0.0	0	0.0	**1**	**0.0**
7.5YR 8/2: Pinkish white	1	0.1	0	0.0	0	0.0	0	0.0	**1**	**0.0**
10YR 2/1: Black	1	0.1	1	0.1	3	0.4	0	0.0	**5**	**0.2**
10YR 3/1: Very dark grayish brown	1	0.1	0	0.0	0	0.0	2	0.5	**3**	**0.1**
10YR 3/2: Very dark grayish brown	2	0.2	0	0.0	2	0.3	0	0.0	**4**	**0.1**
10YR 3/3: Dark brown	0	0.0	3	0.4	2	0.3	0	0.0	**5**	**0.2**
10YR 3/4: Dark yellowish brown	1	0.1	0	0.0	0	0.0	0	0.0	**1**	**0.0**
10YR 4/1: Dark gray	0	0.0	0	0.0	1	0.1	1	0.2	**2**	**0.1**
10YR 4/2: Dark grayish brown	15	1.8	10	1.3	8	1.0	4	1.0	**37**	**1.3**
10YR 4/3: Brown	32	3.9	26	3.4	27	3.4	9	2.2	**94**	**3.4**
10YR 4/4: Dark yellowish brown	13	1.6	13	1.7	17	2.1	5	1.2	**48**	**1.7**
10YR 4/6: Dark yellowish brown	2	0.2	3	0.4	2	0.3	0	0.0	**7**	**0.3**
10YR 5/1: Gray	6	0.7	2	0.3	4	0.5	4	1.0	**16**	**0.6**
10YR 5/2: Grayish brown	41	5.0	21	2.8	26	3.2	20	4.8	**108**	**3.9**
10YR 5/3: Brown	141	17.1	104	13.6	112	14.2	68	16.3	**425**	**15.2**
10YR 5/4: Yellowish brown	43	5.2	65	8.5	63	8.0	35	8.4	**206**	**7.4**

10YR 5/6: Yellowish brown	1	0.1	8	1.0	9	1.1	2	0.5	**20**	**0.7**
10YR 6/1: Gray	2	0.2	1	0.1	2	0.3	2	0.5	**7**	**0.3**
10YR 6/2: Light brownish gray	35	4.2	21	2.8	24	3.0	27	6.5	**107**	**3.8**
10YR 6/3: Pale brown	62	7.5	56	7.3	54	6.8	38	9.1	**210**	**7.5**
10YR 6/4: Light yellowish brown	17	2.1	36	4.7	43	5.4	13	3.1	**109**	**3.9**
10YR 6/6: Brownish yellow	1	0.1	4	0.5	2	0.3	1	0.2	**8**	**0.3**
10YR 7/1: Light gray	0	0.0	2	0.3	0	0.0	1	0.2	**3**	**0.1**
10YR 7/2: Light gray	8	1.0	9	1.2	5	0.6	3	0.7	**25**	**0.9**
10YR 7/3: Very pale brown	10	1.2	6	0.8	7	0.9	4	1.0	**27**	**1.0**
10YR 7/4: Very pale brown	3	0.4	1	0.1	2	0.3	1	0.2	**7**	**0.3**
10YR 8/1: White	1	0.1	2	0.3	0	0.0	0	0.0	**3**	**0.1**
10YR 8/2: Very pale brown	1	0.1	1	0.1	0	0.0	0	0.0	**2**	**0.1**
10YR 8/3: Very pale brown	0	0.0	1	0.1	0	0.0	0	0.0	**1**	**0.0**
2.5Y 2.5/1: Black	0	0.0	1	0.1	0	0.0	0	0.0	**1**	**0.0**
2.5Y 5/2: Grayish brown	1	0.1	0	0.0	0	0.0	0	0.0	**1**	**0.0**
2.5Y 5/3: Light olive brown	1	0.1	1	0.1	0	0.0	0	0.0	**2**	**0.1**
2.5Y 6/1: Gray	0	0.0	0	0.0	0	0.0	1	0.2	**1**	**0.0**
2.5Y 6/2: Light brownish gray	0	0.0	0	0.0	1	0.1	0	0.0	**1**	**0.0**
2.5Y 6/3: Light yellowish brown	1	0.1	1	0.1	2	0.3	0	0.0	**4**	**0.1**
2.5Y 8/1: White	1	0.1	0	0.0	0	0.0	1	0.2	**2**	**0.1**
GLEY 1 3/N: Very dark gray	0	0.0	1	0.1	0	0.0	0	0.0	**1**	**0.0**
GLEY 1 5/N: Gray	0	0.0	0	0.0	0	0.0	1	0.2	**1**	**0.0**
GLEY 1 6/N: Gray	0	0.0	1	0.1	0	0.0	1	0.2	**2**	**0.1**
Total	**824**	**99.0**	**762**	**99.3**	**791**	**99.3**	**416**	**99.5**	**2,793**	**99.4**

Table 4.2: Munsell readings for unburnt lithic artefacts at Wadi Hammeh 27 (abridged by description), by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		**Total**	
	N	%	N	%	N	%	N	%	**N**	**%**
Black	1	0.1	2	0.3	5	0.6	0	0.0	**8**	**0.3**
Reddish black	0	0.0	0	0.0	1	0.1	1	0.2	**2**	**0.1**
Gray	33	4.0	27	3.5	47	5.9	23	5.5	**130**	**4.7**
Dark gray	13	1.6	14	1.8	14	1.8	12	2.9	**53**	**1.9**
Very dark gray	2	0.2	1	0.1	0	0.0	2	0.5	**5**	**0.2**
Reddish gray	6	0.7	18	2.4	18	2.3	12	2.9	**54**	**1.9**
Dark reddish gray	18	2.2	17	2.2	17	2.1	7	1.7	**59**	**2.1**
Light gray	8	1.0	12	1.6	6	0.8	4	1.0	**30**	**1.1**
Light reddish gray	0	0.0	0	0.0	1	0.1	0	0.0	**1**	**0.0**
Light brownish gray	35	4.3	21	2.8	25	3.2	27	6.5	**108**	**3.9**
Pinkish gray	20	2.4	31	4.1	17	2.1	11	2.7	**79**	**2.8**
White	2	0.2	3	0.4	0	0.0	1	0.2	**6**	**0.2**
Pinkish white	1	0.1	0	0.0	0	0.0	0	0.0	**1**	**0.0**
Weak red	8	1.0	7	0.9	18	2.3	4	1.0	**37**	**1.3**
Pale red	1	0.1	0	0.0	0	0.0	0	0.0	**1**	**0.0**
Dusky red	1	0.1	2	0.3	3	0.4	0	0.0	**6**	**0.2**
Very dusky red	0	0.0	1	0.1	0	0.0	0	0.0	**1**	**0.0**
Brown	432	52.8	331	43.4	340	43.0	171	41.2	**1,274**	**45.7**
Light brown	8	1.9	17	2.2	11	1.4	12	2.9	**48**	**1.7**
Pale brown	62	7.6	56	7.3	54	6.8	38	9.2	**210**	**7.5**
Very pale brown	14	1.7	9	1.2	9	1.1	5	1.2	**37**	**1.3**
Dark brown	0	0.0	5	0.7	4	0.5	0	0.0	**9**	**0.3**
Strong brown	2	0.2	5	0.7	4	0.5	1	0.2	**12**	**0.4**
Reddish brown	9	1.1	15	2.0	10	1.3	2	0.5	**36**	**1.3**
Dark reddish brown	2	0.2	4	0.5	12	1.5	2	0.5	**20**	**0.7**
Light yellowish brown	18	2.2	37	4.9	45	5.7	13	3.1	**113**	**4.1**
Yellowish brown	44	5.4	73	9.6	72	9.1	37	8.9	**226**	**8.1**
Dark yellowish brown	16	2.0	16	2.1	19	2.4	5	1.2	**56**	**2.0**
Grayish brown	42	5.1	21	2.8	26	3.3	20	4.8	**109**	**3.9**
Dark grayish brown	15	1.8	10	1.3	8	1.0	4	1.0	**37**	**1.3**
Very dark grayish brown	3	0.4	0	0.0	2	0.3	0	0.0	**5**	**0.2**
Light olive brown	1	0.1	1	0.1	0	0.0	0	0.0	**2**	**0.1**
Reddish yellow	0	0.0	2	0.3	1	0.1	0	0.0	**3**	**0.1**
Brownish yellow	1	0.1	4	0.5	2	0.3	1	0.2	**8**	**0.3**
Total	**818**	**100.6**	**762**	**100.1**	**791**	**100.0**	**415**	**100.0**	**2,786**	**99.7**

249; 2018b: 263). Muwaqqar Chalk Marl deposits, formed during the Maastrichtian-Paleocene boundary, are widespread upstream from the site along the eastern ridge of the Jordan Valley (Delage et al. 2020: 8). It is hypothesised that the inhabitants of Wadi Hammeh 27 primarily exploited cobbles of this chert type which were transported downstream through erosion and fluvial action, and ultimately deposited in an as-yet undiscovered secondary deposit either along the shores of Lake Lisan or Lake Damiya on the Valley Floor, or as part of the Miocene Waqqas Conglomerate at the base of the modern valley foothills (Delage et al. 2020: 8-9). In any case, the consistent dominance of MCM-04 cherts over time at Wadi Hammeh 27 demonstrates that its inhabitants possessed ready access to a reliable source of this raw material throughout the occupation of the settlement. This abundance allowed preferred raw materials to be persistently selected above the broad range of other poorer quality chert widely available in secondary contexts in the immediate vicinity of the site (Edwards et al. 2018a: 249).

While artefacts manufactured from MCM-04 cherts numerically dominate each assemblage, a parallel reduction sequence revolving around the exploitation of a type of translucent chert resembling chalcedony has also been observed. This material is consistent with the brecciated, translucent cherts found in a primary context within Campanian age Amman Silicified Limestone (ASL) deposits, and available in a secondary context in the wadi floors surrounding Wadi Hammeh 27 (Delage et al. 2020 Supplementary Material). However, its brecciated nature means that nodules of this type tend to fracture into pieces not exceeding 5cm in maximum dimension when worked (Delage et al. 2020 Supplementary Material; Edwards et al. 2018b: 262), significantly restricting the range of artefacts which it could be used to manufacture.

The overall percentage of debitage artefacts manufactured from translucent or semi-translucent chert varieties remains relatively low over time, with several noticeable variations between assemblage and debitage type detected (**Table 4.3**). Ten of the 330 cores analysed from the lower Wadi Hammeh 27 are of translucent chert types. This share varies across assemblages, reaching a maximum of 4% in Upper Phase 3 and a low of 2% in Phase 2. A bias towards bladelet cores is also present, with only two translucent flake cores being recovered, both of which are from Lower Phase 3. None of the seven blade cores analysed were manufactured from translucent chert varieties. A notable decline in the percentage of debitage artefacts manufactured from translucent chert can be observed between the Phase 4

Table 4.3: Number of analysed artefacts manufactured from translucent chert varieties, by phase.

	Flakes		Blades		Bladelets		Core trimming elements		Cores		Retouched artefacts		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Phase 4	15	3.5	1	11.1	11	4.8	5	7.7	2	3.1	13	3.8	47	4.1
Lower Phase 3	1	0.4	0	0.0	7	3.4	0	0.0	3	2.9	9	2.1	20	1.9
Upper Phase 3	5	1.8	1	7.7	2	1.0	0	0.0	4	3.8	10	2.6	22	2.0
Phase 2	1	0.6	0	0.0	4	3.4	0	0.0	1	2.0	4	1.7	10	1.7
Total	**22**	**2.0**	**2**	**4.3**	**24**	**3.1**	**5**	**2.4**	**10**	**3.1**	**36**	**2.6**	**99**	**2.6**

(4.3%) and Lower Phase 3 (1.5%) samples, with this latter figure remaining consistent with the subsequent two assemblages.

The preponderance towards translucent artefacts in Phase 4 is evident in the case of the core trimming elements from this assemblage (3.5%), with only isolated examples being found in the Lower Phase 3 (0.4%) and Phase 2 assemblages (0.6%). Conversely, the percentage of translucent bladelets remains relatively stable throughout the four assemblages. While Phase 4 once again features the highest percentage of translucent bladelets (4.8%), the subsequent Lower Phase 3 and Phase 2 assemblages also feature a relatively high proportion (3.4%), with the Upper Phase 3 bladelets (1.0%) presenting the only low anomaly. Overall, the scarcity of translucent knapping elements other than bladelets in Phases 3 and 2 indicates a decline in the extensive knapping of translucent cherts over time within the area sampled. At the same time, the consistent presence of translucent bladelets in each assemblage indicates a continued access to this material for a small number of specialised bladelet cores, presumably in order to produce lunates.

4.3.1 Artefact burning

The four lithic assemblages considered here each present a high proportion of burnt artefacts - a testament to the intensiveness and longevity of the Natufian occupation (**Table 4.4; Fig. 4.1**). Debris artefacts appear to have been exposed to uncontrolled burning to a far greater extent than any of the debitage types, with the chunks and chips continuously displaying a degree of burning unrivalled by any of the debitage types. This is particularly prevalent in the case of the chunks, which exhibit a burning rate between 87-88% in each assemblage. The chips display a slightly lower percentage of artefact burning, ranging between 68% in Lower Phase 3 and 77% of the Phase 4 chips.

Similar inter-assemblage consistencies are present in the proportions of burnt debitage artefact types. Intact blades and bladelets regularly exhibit a relatively low percentage of burnt artefacts compared to their broken counterparts, indicating that these artefacts were more often exposed to fire damage once their potential for further use had already expired. At the same time, many of the intact blades and bladelets would have fractured as a direct result of thermal exposure. The percentages of burnt intact flakes (both above and below 2cm in maximum dimension) are also consistently lower than that of the broken flakes, albeit to a

Table 4.4: Burnt flaked stone artefacts, by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N burnt	% burnt	N burnt	% burnt	N burnt	% burnt	N burnt	% burnt	N burnt	% burnt
Debris										
Chunks	3,213	88.1	11,800	86.9	9,977	87.3	11,568	87.9	36,558	87.4
Chips	34,891	71.1	69,310	67.6	85,523	70.3	37,548	75.9	227,272	70.4
Sub-total	**38,104**	**72.3**	**81,110**	**69.9**	**95,500**	**71.7**	**49,116**	**78.4**	**263,830**	**72.4**
Debris										
Flakes	480	38.5	1,002	37.2	1,068	36.6	752	48.4	3,302	39.3
Flakes (< 2cm)	3,947	58.7	6,017	39.8	6,028	42.8	2,704	40.6	18,696	43.9
Broken Flakes	2,274	56.8	7,509	61.1	6,868	60.5	2,639	60.2	19,290	60.3
Blades	3	18.8	4	14.3	3	11.1	7	29.2	17	17.9
Bladelets	95	28.4	216	32.5	191	24.9	167	33.1	669	29.4
Broken Blades and Bladelets	2,239	54.6	4,748	51.6	4,553	49.5	2,441	49.8	13,981	51.0
Bladelets (< 2cm)	187	32.6	308	30.3	298	26.9	172	31.9	965	29.8
Core Trimming Elements	125	49.6	261	42.8	214	42.3	90	45.5	690	44.1
Burin Spalls										
Plain	79	46.5	111	35.4	209	44.7	198	57.2	597	46.0
Truncation	40	38.8	56	32.4	63	32.5	27	36.5	186	34.2
Microburin technique										
Microburins	1	100.0	2	100.0	6	42.9	3	20.0	12	37.5
Piquant triedres	0	0	0	0.0	0	0.0	1	50.0	1	16.7
Sub-total	**9,470**	**54.0**	**20,234**	**48.1**	**19,501**	**48.0**	**9,201**	**47.9**	**58,406**	**48.9**
Cores	45	37.2	123	44.2	138	45.0	75	45.2	381	43.7
Retouched tools	371	40.0	703	36.1	800	36.7	373	39.3	2,247	37.4
Total	**47,990**	**67.3**	**102,170**	**63.7**	**115,939**	**65.8**	**58,765**	**70.8**	**324,864**	**66.2**

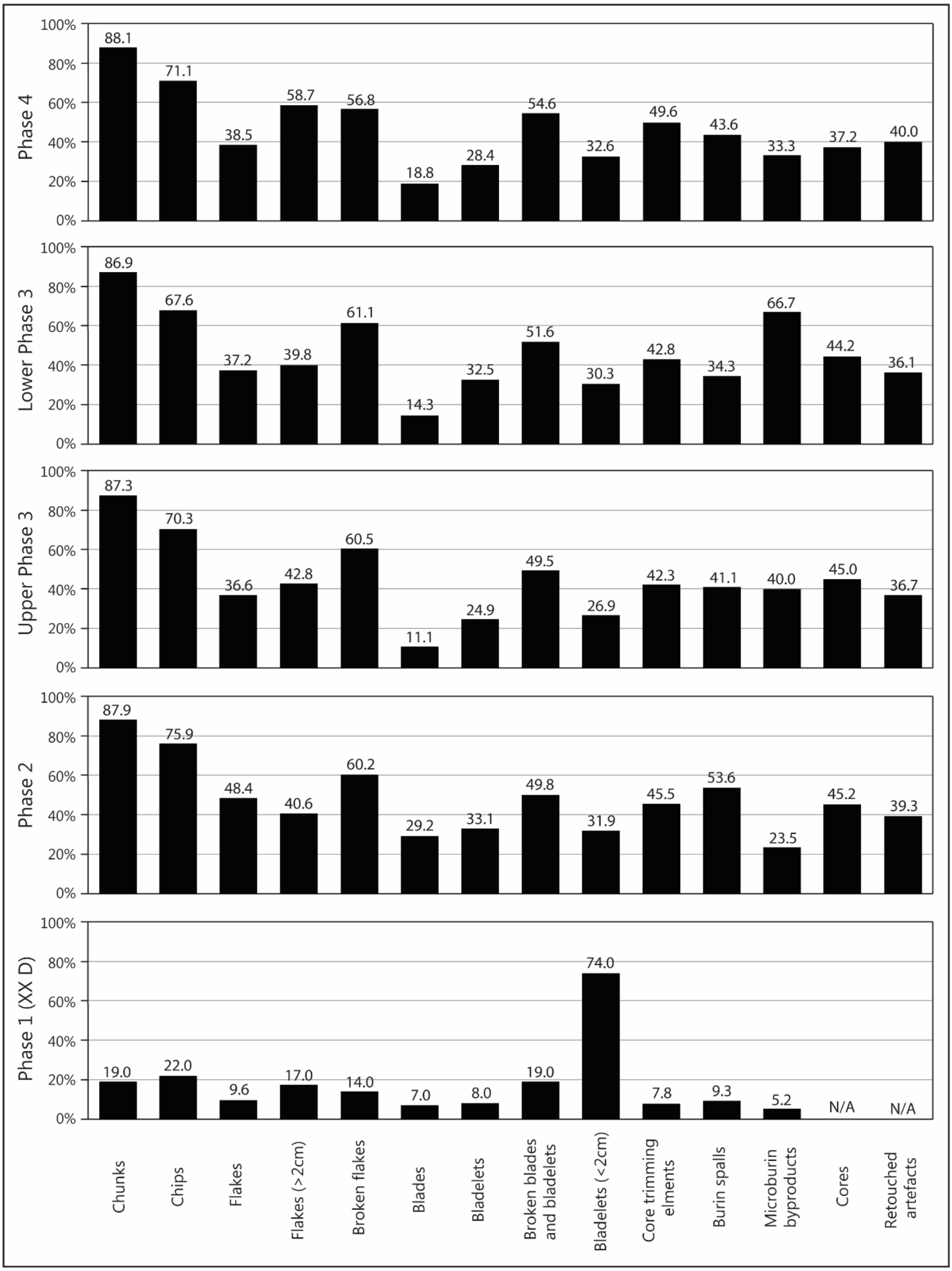


Figure 4.1: Percentage of artefacts with evidence of burning, by phase. Phase 1 data from Edwards 2013e: 144.

slightly reduced extent. The percentage of burnt core trimming elements likewise remain similar to the flakes.

The percentages of burnt cores are also consistent between Phases 4 and 2, albeit with a slight jump after Phase 4. These numbers include both the intact cores as well as the core fragments, with the latter artefacts regularly displaying a higher rate of burning. The percentage of burnt retouched artefacts remains static between assemblages, ranging between 36% in the Phase 3 assemblages and 40% in Phase 4.

In contrast to the inter-assemblage consistency exhibited between Phases 4 and 2, the Phase 1 comparative assemblage exhibits sharply reduced percentages of burnt artefacts. Almost every debris and debitage type exhibit their lowest rate of burning out of the occupational sequence of Wadi Hammeh 27, with this drop being particularly pronounced in the case of the chips, chunks, broken flakes and broken blades and bladelets. The bladelets under 2cm in length present the only exception to this decline, with this type instead exhibiting a rate of burning (74.0%) over twice as high as in any of the preceding assemblages.

4.3.2 Dual lustre and the identification of heat treatment

The presence of both matte and lustrous surfaces on a single artefact – dual lustre – has been widely recognised as an ideal means of identifying heat treatment within lithic assemblages (Delage & Sunseri 2004: 165; Domanski & Webb 2007: 156-8). The percentage of artefacts featuring this attribute vary by both phase and debitage type at Wadi Hammeh 27.

It must be stressed that the proportions of artefacts exhibiting dual lustred surfaces do not correspond with the total number of artefacts knapped after heat treatment was applied, but rather those that retain a portion of the initial surface of the heat-treated core. Many artefacts at Wadi Hammeh 27 solely feature the similar lustrous surfaces as seen on these pieces, and it is thus likely that heat treatment was considerably more common than the consideration of dual-lustre alone would suggest. At the same time, the MCM-04 cherts utilised by the Early Natufian inhabitants of Wadi Hammeh are fairly lustrous in their untreated state to begin with, and thus basing the presence of heat treatment on this attribute alone risks a high likelihood of overestimation. Tracing the presence of dual lustred surfaces thus provides an objective, reliable means of identifying heat treatment, if only to its minimum extent.

A total of 114 pieces with dual lustred surfaces were identified from the lower Wadi Hammeh 27 deposits (**Table 4.5**). These pieces are particularly prevalent in the Phase 4 deposits, where they comprise 7.5% of the total number of artefacts analysed. They occur in smaller proportions in the Lower (4.5%) and Upper Phase 3 assemblages (5.4%), before all but disappearing in Phase 2 (1.6%). Only nine examples dual lustre were recorded from the 606 artefacts analysed from this assemblage – a massive drop from the preceding phases. This trend corresponds with Edwards' Phase 1 findings, where "only a few" artefacts featuring dual lustre were identified (Edwards 2013e: 144).

Core trimming elements (10.0%) and blades (8.5%) possess the greatest proportions of pieces featuring dual lustre, indicating that these objects were more often removed earlier on in the core-reduction cycle, when the core retained a greater amount of its initial heat-treated, matte surface. Similarly, over a tenth (11.2%) of the analysed cores retain a portion of this surface.

4.4 The lithic assemblages of Wadi Hammeh 27

With a total of 364,570 artefacts, debris artefacts dominate the lower phases of Wadi Hammeh 27 numerically, encompassing almost three quarters (74.3%) of the combined flaked stone assemblages. Most of the remaining flaked stone pieces are debitage artefacts (N = 119,447; 24.3%), with cores (N = 872; 0.2%) and retouched pieces (N = 6,002; 1.2%) comprising relatively marginal proportions of the combined assemblages.

4.4.1 Phase 4 assemblage

A total of 71,296 flaked stone artefacts weighing 44.4kg were recovered from the ten loci constituting Phase 4. This number, while substantial, nonetheless represents the smallest analytical sample out of the four earlier assemblages. The Phase 4 assemblage also demonstrates the lowest density of artefacts, with 50,926 pieces present per cubic metre (**Table 4.6**). Over half of artefacts from this phase (N = 39,729) were excavated from Locus 8.3, and are supplemented primarily by significant numbers of pieces (N = 12,516) recovered from the underlying Locus 8.9 deposits. Most of the remainder of the Phase 4 assemblage pieces were recovered from the Locus 8.5 deposits associated with Feature 29 (N = 6,669), the Locus 8.6 fill within Feature 32 (N = 2,722), the Locus 9.4 deposits of Feature 20 (N = 2,199) and the 'exterior' Locus 9.5 deposits (N = 5,699). The following discussion relates to

Table 4.5: Number of analysed artefacts displaying dual lustre, by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2	
	N	%	N	%	N	%	N	%
Flakes	33	7.6	8	3.2	12	4.4	3	1.8
Blades	1	11.1	2	13.3	1	7.7	0	0.0
Bladelets	16	7.0	7	3.4	9	4.3	1	0.8
Core trimming elements	5	7.7	7	10.6	8	14.0	1	4.3
Total debitage	*55*	*7.5*	*24*	*4.5*	*30*	*5.4*	*5*	*1.6*
Cores	8	11.9	17	16.2	11	10.3	1	2.0
Retouched artefacts	22	6.5	29	6.9	25	6.4	3	1.3
Total	**85**	**7.6**	**70**	**6.6**	**66**	**6.3**	**9**	**1.5**

Table 4.6: Flaked stone artefact densities at Wadi Hammeh 27, by phase.

	Excavated volume (m^3)	Lithic no.	Volumetric no.	Weight (kg)	Volumetric weight (kg)
Phase 4	1.40	71,296	50,926	44.4	31.7
Lower Phase 3	2.20	160,434	72,925	80.6	36.7
Upper Phase 3	2.03	176,211	86,803	89.6	44.2
Phase 2	1.38	82,950	60,109	46.4	33.6
Total	**7.01**	**490,891**	**70,027**	**261.1**	**37.2**

the Phase 4 assemblage as a whole, with divergences between the assemblages of individual loci discussed in Chapter 7 as part of the spatial analysis of this phase.

As with the later deposits, debris artefacts dominate the Phase 4 assemblage (N = 38,104, 72.3%; **Fig. 4.2**) indicating that large amounts of primary knapping refuse were allowed to accumulate onsite at Wadi Hammeh 27 prior to the establishment of Structure 3. It is worth noting, however, that this category composes only 29.6% (13.2kg) of the total Phase 4 raw material mass – its lowest allotment out of all four assemblages (**Fig 4.3**). Debitage artefacts contribute 24.6% (N = 17,532) to the Phase 4 assemblage numerically and 38.3% (17.0kg) of its mass – proportions consistent with the subsequent assemblages. The Phase 4 cores (N = 121, 0.2%) and retouched artefacts (N = 927, 1.3%) similarly comprise numerical shares almost identical to those of the other assemblages. However, both of these artefact classes encompass a greater allotment of the Phase 4 lithic mass (15.8% and 16.2% respectively) than is seen in any of the subsequent assemblages. The Phase 4 assemblage furthermore narrowly exhibits the highest debris to core (436 : 1) and core to tool (1 : 8) ratios out of the analysed assemblages (**Table 4.7**).

4.4.1.1 Debris

Like the other assemblages, the Phase 4 debris assemblage is dominated by chips (N = 49,067; 68.8% of the phase total). This share represents the second highest attained by this type out of the four assemblages, with only the Upper Phase 3 chips occurring in greater proportions (**Table 4.8**). Conversely, Phase 4 features the lowest proportion of chunks out of the four assemblages (N = 3,649; 5.1% of the phase total). This emphasis on chips over chunks is reflected in the typological distribution of the Phase 4 assemblage weights, with this assemblage being the only instance where debris does not reach a third of the total mass (**Table 4.9; Fig. 4.3**). Furthermore, the Phase 4 chunks (8.0kg; 18.0%) only narrowly outweigh the chips (5.2kg; 11.6%) – a far cry from the broad ratios seen in subsequent assemblages.

4.4.1.2 Debitage

A total of 17,532 flaked stone debitage artefacts were recovered from the various Phase 4 deposits. Of these pieces, flakes <2cm are the most common type (N = 6,724; 9.4%; **Table**

Table 4.7: Ratios between major flaked stone artefact classes, by phase.

	Debris : debitage	Debris : cores	Debris : tools	Debitage : cores	Debitage : tools	Cores : tools
Phase 4	3:1	436:1	57:1	145:1	19:1	1:8
Lower Phase 3	3:1	418:1	60:1	151:1	22:1	1:7
Upper Phase 3	3:1	434:1	61:1	132:1	19:1	1:7
Phase 2	3:1	377:1	66:1	116:1	20:1	1:6
Phase 1 (XX D)	1:1	136:1	29:1	107:1	23:1	1:5

Table 4.8: Total flaked-stone artefact assemblage from the renewed Wadi Hammeh 27 excavations, by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
Debris										
Chunks	3,649	5.1	13,582	8.5	11,422	6.5	13,166	15.9	41,819	8.5
Chips	49,067	68.8	102,529	63.9	121,683	69.1	49,472	59.6	322,751	65.7
Sub-total	**52,716**	**73.9**	**116,111**	**72.4**	**133,105**	**75.5**	**62,638**	**75.5**	**364,570**	**74.3**
Debitage										
Flakes	1,248	1.8	2,691	1.7	2,919	1.7	1,554	1.9	8,412	1.7
Flakes (< 2cm)	6,724	9.4	15,113	9.4	14,081	8.0	6,658	8.0	42,576	8.7
Broken Flakes	4,003	5.6	12,282	7.7	11,343	6.4	4,383	5.3	32,011	6.5
Blades	16	0.0	28	0.0	27	0.0	24	0.0	95	0.0
Bladelets	335	0.5	664	0.4	768	0.4	505	0.6	2,272	0.5
Broken Blades and Bladelets	4,104	5.8	9,207	5.7	9,192	5.2	4,897	5.9	27,400	5.6
Bladelets (< 2cm)	574	0.8	1,015	0.6	1,106	0.6	540	0.7	3,235	0.7
Core Trimming Elements	252	0.4	610	0.4	506	0.3	198	0.2	1,566	0.3
Burin Spalls										
Plain	170	0.2	314	0.2	468	0.3	346	0.4	1,298	0.3
Truncation	103	0.1	173	0.1	194	0.1	74	0.1	544	0.1
Microburin technique										
Microburins	1	0.0	2	0.0	14	0.0	15	0.0	32	0.0
Piquant triédres	2	0.0	1	0.0	1	0.0	2	0.0	6	0.0
Sub-total	**17,532**	**24.6**	**42,100**	**26.2**	**40,619**	**23.1**	**19,196**	**23.1**	**119,447**	**24.3**
Cores	121	0.2	278	0.2	307	0.2	166	0.2	872	0.2
Retouched tools	927	1.3	1,945	1.2	2,180	1.2	950	1.1	6,002	1.2
Total	**71,296**	**100.0**	**160,434**	**100.0**	**176,211**	**100.0**	**82,950**	**99.9**	**490,891**	**100.0**

Table 4.9: Total flaked-stone assemblage weight (g), by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
Debris										
Chunks	7,994.1	18.0	19,502.3	24.2	20,880.5	23.3	15,546.0	33.5	63,922.9	24.5
Chips	5,161.2	11.6	8,038.5	10.0	10,185.7	11.4	4,150.0	8.9	27,535.4	10.5
Sub-total	**13,155.3**	**29.6**	**27,540.8**	**34.2**	**31,066.2**	**34.7**	**19,696.0**	**42.4**	**91,458.3**	**35.0**
Debitage										
Flakes	5,465.4	12.3	9,978.4	12.4	12,595.0	14.1	6,342.3	13.7	34,381.1	13.2
Flakes (< 2cm)	1,719.5	3.9	3,426.7	4.2	3,678.9	4.1	1,653.0	3.6	10,478.1	4.0
Broken Flakes	5,052.0	11.4	11,804.0	14.6	12,664.9	14.1	5,340.0	11.5	34,860.9	13.4
Blades	134.2	0.3	339.9	0.4	262.7	0.3	199.5	0.4	936.3	0.4
Bladelets	428.8	1.0	807.8	1.0	958.9	1.1	741.4	1.6	2,936.9	1.1
Broken Blades and Bladelets	2,319.0	5.2	4,404.3	5.5	5,293.6	5.9	2,949.0	6.4	14,965.9	5.7
Bladelets (< 2cm)	105.2	0.2	146.0	0.2	172.6	0.2	90.9	0.2	514.7	0.2
Core Trimming Elements	1,340.7	3.0	2,618.5	3.2	2,576.8	2.9	1,108.0	2.4	7,644.4	2.9
Burin Spalls										
Plain	180.1	0.4	333.3	0.4	475.8	0.5	232.4	0.5	1,221.6	0.5
Truncation	258.8	0.6	363.6	0.5	391.7	0.4	81.4	0.2	1,095.5	0.4
Microburin technique										
Microburins	1.1	0.0	1.5	0.0	13.6	0.0	17.1	0.0	33.3	0.0
Piquant triedres	2.4	0.0	1.1	0.0	0.7	0.0	2.9	0.0	7.1	0.0
Sub-total	**17,007.2**	**38.3**	**34,225.1**	**42.4**	**39,085.6**	**43.6**	**18,757.9**	**40.4**	**109,075.8**	**41.8**
Cores	7,023.2	15.8	8,050.7	10.0	7,853.0	8.8	3,832.9	8.3	26,759.8	10.2
Retouched tools	7,209.1	16.2	10,823.4	13.4	11,639.1	13.0	4,143.0	8.9	33,814.6	13.0
Total	**44,394.8**	**99.9**	**80,640.0**	**100.0**	**89,643.9**	**100.1**	**46,429.8**	**100.0**	**261,108.5**	**100.0**

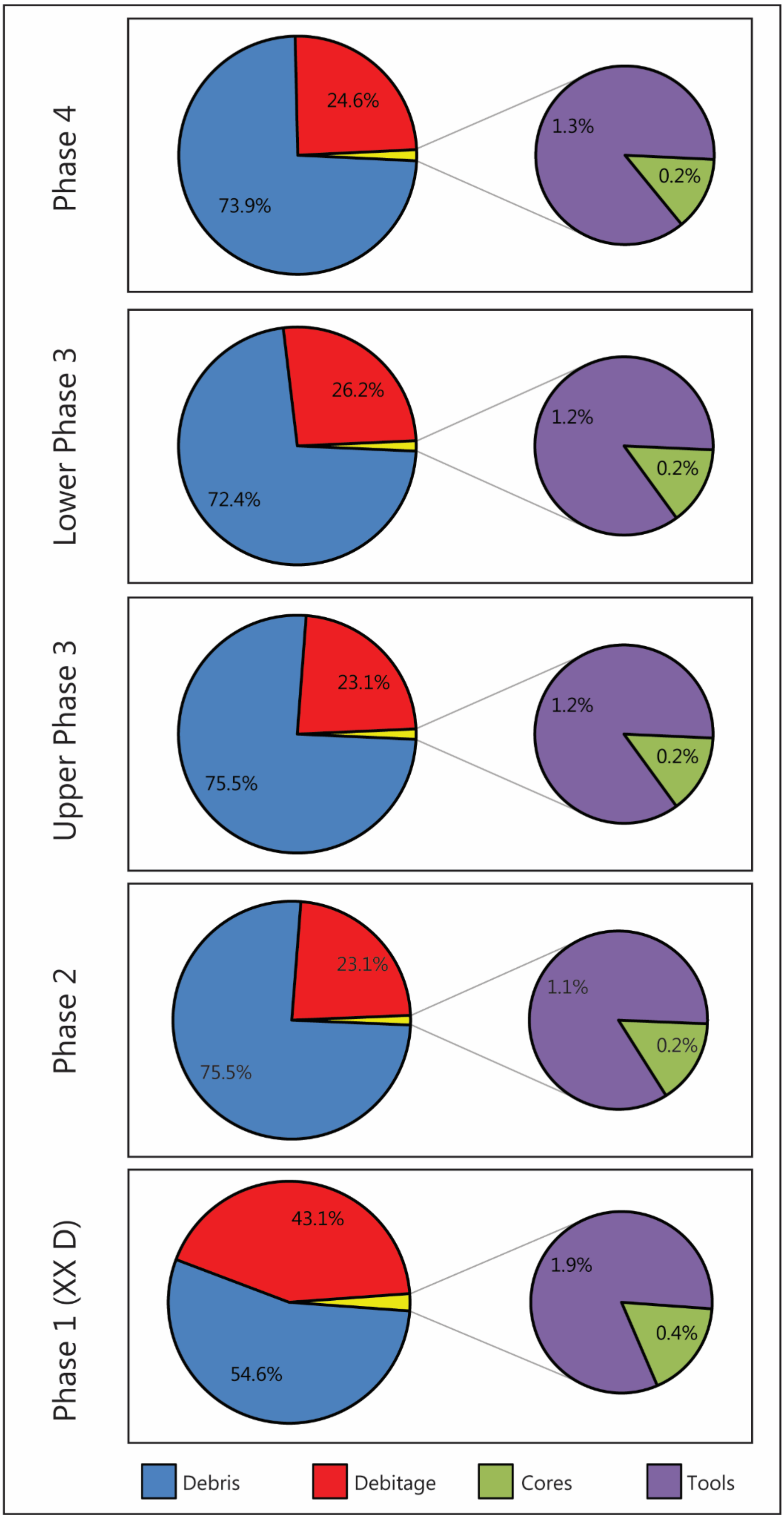


Figure 4.2: Area XX F flaked stone artefact assemblage composition, by phase.

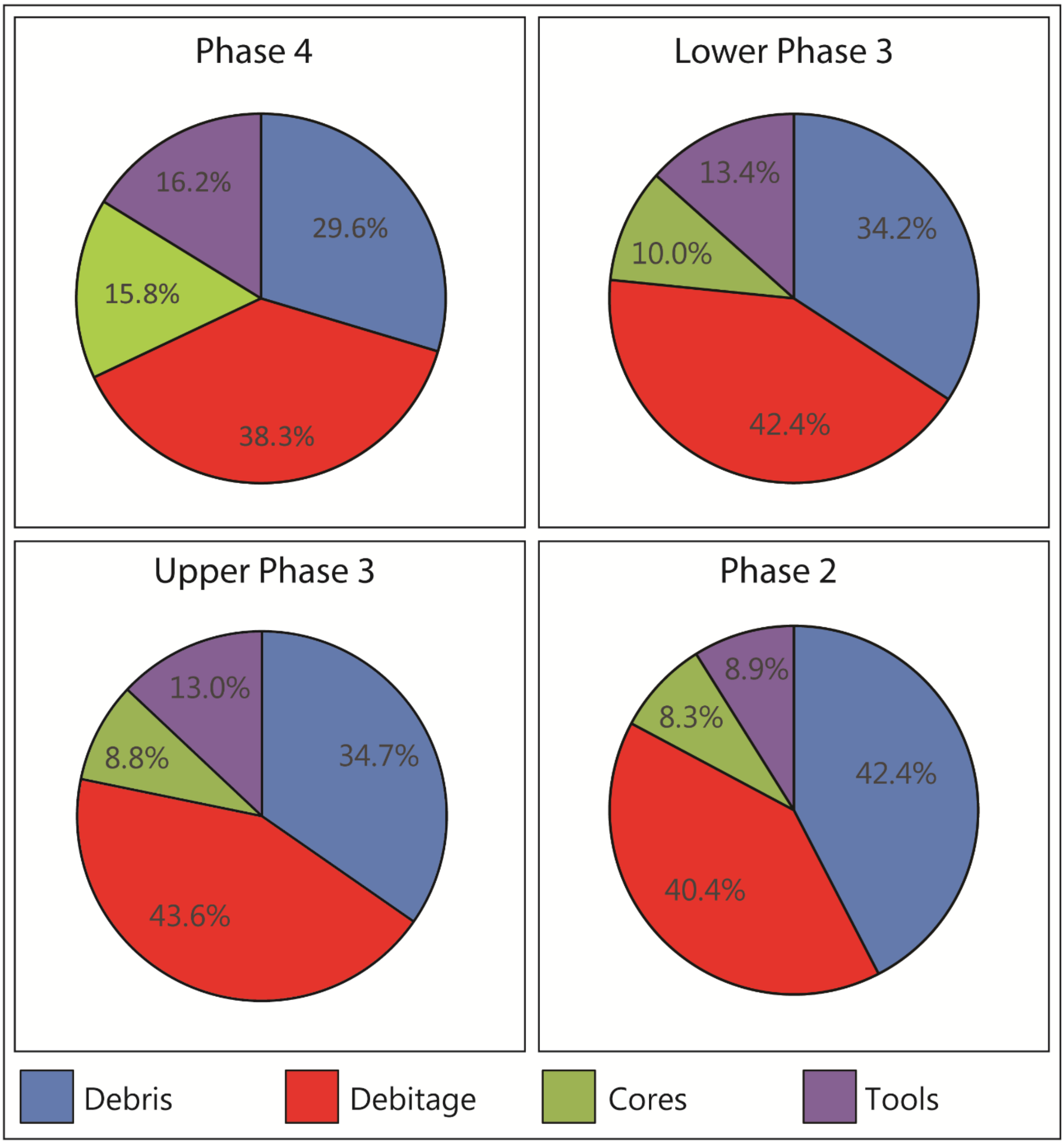


Figure 4.3: Area XX F flaked-stone artefact assemblage mass, by phase.

4.8; Fig. 4.4). This numerical dominance is not reflected in the total distribution by weight, however, with this type representing only 3.9% of the total assemblage mass. These microflakes are supplemented by almost equal numbers of broken blades and bladelets (N = 4,104; 5.8%) and broken flakes (N = 4,003; 5.6%). While whole flakes over 2cm in length comprise a relatively low share of the Phase 4 lithics (N = 1,248; 1.8%), they represent the heaviest debitage type (5.5kg; 12.3%), demonstrating that large, unretouched flakes are a conspicuous element of the Wadi Hammeh 27 assemblages from its earliest occupation. Excluding microflakes, intact flakes amount to slightly under a quarter of the total flakes deposited onsite during this phase (**Table 4.10**).

Whole bladelets, both above and below 2cm in length, occur in much smaller numbers compared to the flakes. The bladelets <2cm (N = 574; 0.8%) outnumber the regular bladelets (N = 335; 0.5%), while blades occur in marginal proportions (N = 16; 0.0%). Broken blades and bladelets overwhelmingly outnumber their intact counterparts, with almost 12 broken pieces present in the Phase 4 deposits for every intact blade and bladelet above 2cm in length (**Table 4.10**). Core trimming elements comprise 0.4% (N = 252) of the Phase 4 assemblage, a figure consistent with the subsequent Phase 3 assemblages.

Although composing minor proportions of the overall numerical total and mass, burin spalls are well represented in Phase 4 assemblage, demonstrating that burins were being manufactured onsite from the earliest occupation of Wadi Hammeh 27. While plain spalls (N = 170; 0.2%) outnumber truncation spalls (N = 103; 0.1%), the ratio between the two types (1.65 : 1) is the lowest out of the Wadi Hammeh 27 deposits. Likewise, while microburin products are rare throughout the Wadi Hammeh 27 deposits, this scarcity is particularly pronounced within the Phase 4 assemblage, with only one microburin and two *piquant triédres* present.

4.4.2 Lower Phase 3 assemblage

A total of 160,434 artefacts weighing 80.6kg were recovered from the Lower Phase 3 deposits – the second largest assemblage analysed. The density of artefacts deposited also increases substantially from the Phase 4 deposits, with an average of 72,925 artefacts recovered per cubic metre (**Table 4.6**). Debris artefacts again constitute the majority of the overall assemblage, with similar share of the assemblage numerical total (N = 116,111;

Table 4.10: Ratios between intact and fragmentary debitage, by phase. Flakes and bladelets under two centimetres in maximum dimension have been excluded.

	Flakes			Blades and bladelets		
	N	% broken	Intact : broken ratio	N	% broken	Intact : broken ratio
Phase 4	5,251	76.2	1 : 3.2	4,455	92.1	1 : 11.7
Lower Phase 3	14,973	82.0	1 : 4.6	9,899	93.0	1 : 13.3
Upper Phase 3	14,262	79.5	1 : 3.9	9,987	92.0	1 : 11.6
Phase 2	5,937	73.8	1 : 2.8	5,426	90.3	1 : 9.3
Phase 1 (XX D)	26,394	61.5	1 : 1.6	10,379	70.8	1 : 2.4

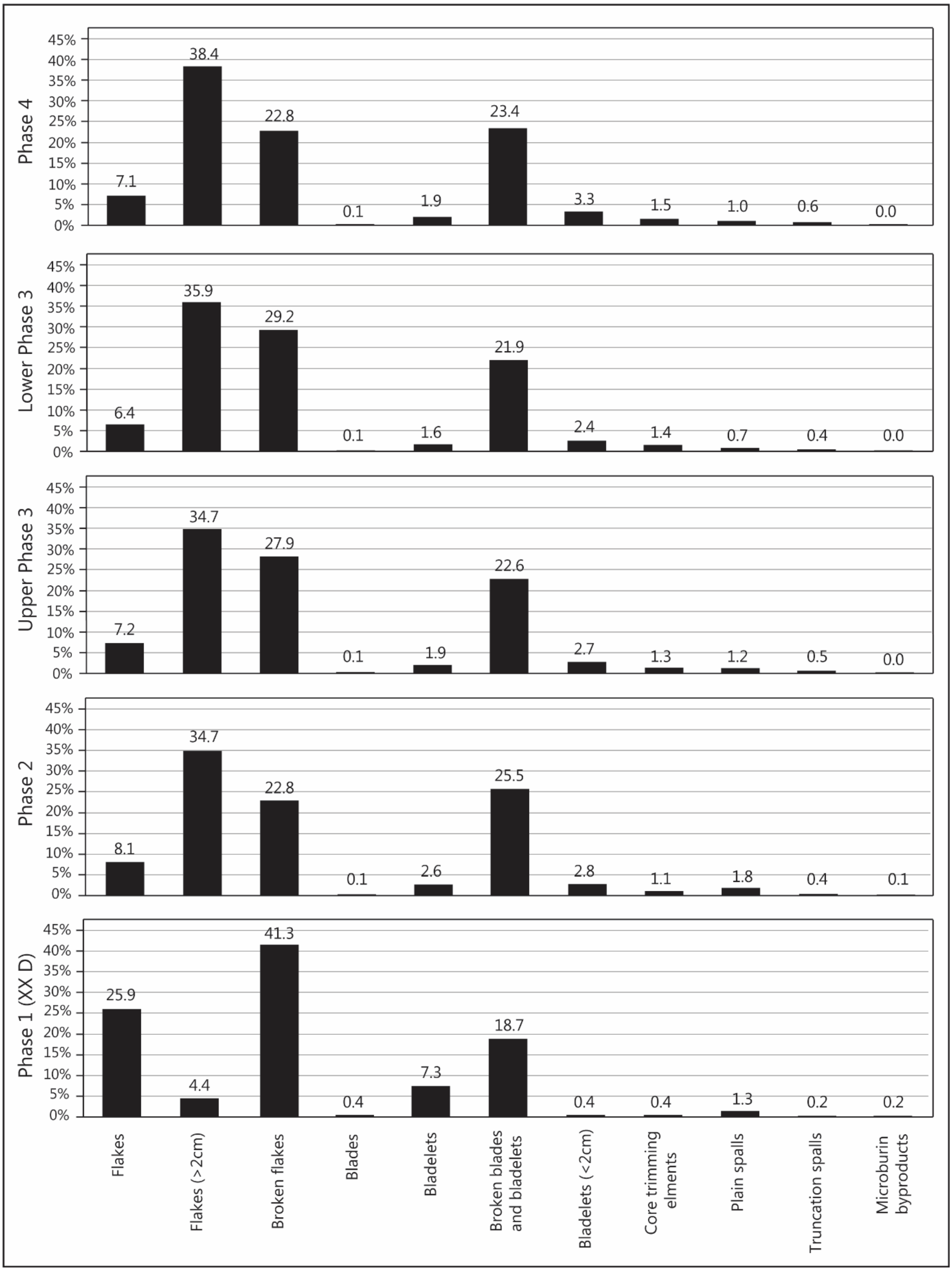


Figure 4.4: Debitage typological composition, by phase.

72.4%) to that of the Phase 4 assemblage, but a greater division of the mass (27.5kg; 34.2%; **Tables 4.8 – 4.9; Figs. 4.2 – 4.3**).

Debitage artefacts comprise slightly over a quarter (N = 42,100; 26.2%) of the Lower Phase 3 assemblage, while the percentage of cores (N = 278; 0.2%) and retouched artefacts (N = 1,945; 1.2%) are consistent with the other phases. The relative mass of both cores and retouched artefacts nonetheless exhibit a notable decrease from the Phase 4 assemblage, with the Lower Phase 3 cores amounting to only 10% (8.1kg) of the assemblage weight, whereas the retouched artefacts compose 13.4% (10.8kg).

The ratios between different flaked stone artefact classes in the Lower Phase 3 assemblage remain largely identical with the Phase 4 assemblage, albeit with some variation (**Table 4.7**). The ratio between debitage and cores rises slightly from the preceding assemblage (151 : 1), with this representing the greatest divergence between these categories among the analysed assemblages. The Lower Phase 3 debitage to tool ratio (22 : 1) also rises from the previous assemblage, with only the Phase 1 ratio for these artefacts being greater. The debris to debitage ratio also slightly increases from Phase 4 (60 : 1), while the core to tool ratio marginally declines (1 : 7).

4.4.2.1 Debris

Aside from a slight decline in the percentage of chips (N = 102,529; 63.9%) and increase in the number of chunks (N = 13,582; 8.5%), the Lower Phase 3 debris assemblage bears a strong typological similarity to that of the Phase 4 deposits (**Table 4.8**). This increased emphasis on chunks over chips accounts for the Lower Phase 3 debris contributing a greater share of the total mass of this assemblage compared with Phase 4.

4.4.2.2 Debitage

Flakes <2cm are again the most common debitage type within the Lower Phase 3 assemblage, with this type comprising an almost identical numerical proportion (N = 15,113; 9.4%) as they did in Phase 4 (**Table 4.8; Fig. 4.4**). Aside from a slight increase in the relative number (N = 12,282; 7.7%) and weight (11.8kg; 14.6%) of broken flakes, the remaining debitage types also occur in similar proportions as in Phase 4. This consistency extends to microburin by-products, with only two microburins and a single *piquant triédre* present. Burin spall proportions likewise remain consistent with the previous assemblage, with plain spalls (N = 314; 0.2%) again outnumbering truncation spalls (N = 173, 0.1%). The ratio between the two types marginally increases from the previous phase, with 1.81 plain spalls for every truncation spall.

The Lower Phase 3 debitage assemblage presents an exceptionally high rate of fragmentation. The flakes exhibit the highest percentage of broken pieces out of the entire occupational sequence of the site, with slightly under five broken flakes deposited for every whole one (**Table 4.10**). The same can be said for the blades and bladelets from this phase, with 13.3 broken blades and bladelets present for every intact piece.

4.4.3 Upper Phase 3 assemblage

A total of 176,211 flaked stone artefacts were excavated from the Upper Phase 3 deposits, making this the largest assemblage to be excavated from a single phase of Area XX F. This assemblage is also unsurprisingly the heaviest, weighing in at 89.6kg, as well as the most densely packed, with 86,803 artefacts recovered per cubic metre (**Table 4.6**).

Despite representing two successive floors of a single structure and subsequently sharing many typological similarities as a result, several key variations between the Upper and Lower Phase 3 assemblages may be noted. The numerical dividend comprised by the Upper Phase 3 debris artefacts slightly increases (N = 133,105; 75.5%) from the previous assemblage, while their contribution to the total assemblage mass (31.1kg; 34.7%) remains consistent (**Tables 4.8 – 4.9; Figs 4.2 – 4.3**). While the percentage of debitage artefacts declines slightly from the two preceding phases (N = 40,619; 23.1%), these artefacts nonetheless make up the greatest share of the mass (39.1kg; 43.6%) out of all four assemblages.

The numerical proportions of cores (N = 307; 0.2%) and retouched artefacts (N = 2,180; 1.2%) are virtually identical to the Lower Phase 3 assemblage. While the relative weight of the retouched tools (11.6kg; 13.0%) also remains consistent with the preceding assemblage, the contribution by mass of the cores continues to decline (7.9kg; 8.8%). The ratios between the major Upper Phase 3 flaked stone artefact classes do not deviate from the Lower Phase 3 assemblage to any major extent (**Table 4.7**), with the only significant variation being a decline in the debitage to core ratio (132 : 1). Of note is the fact that the Upper Phase 3 core to tool ratio (1 : 7) does not change from that of the Lower Phase 3 assemblage - this representing the only break in an otherwise constant, incremental drop across time at Wadi Hammeh 27.

4.4.3.1 Debris

The composition of the Upper Phase 3 debris artefacts is reminiscent of the Phase 4 assemblage rather than its immediate predecessor, with a greater emphasis on chips (N = 121,683; 69.1%) over chunks (N = 11,422; 6.5%). These proportions represent the greatest proportion of small shatter - as well as the greatest skew towards a single artefact type - observed in any of the Wadi Hammeh 27 assemblages. Unlike the Phase 4 assemblage, however, the Upper Phase 3 chunks comprise a mass (20.9kg; 23.3%) twice that of the chips (10.2kg; 11.4%).

4.4.3.2 Debitage

Flakes <2cm are once again the most common debitage type in Upper Phase 3, albeit in slightly reduced numbers (N = 14,081; 8.0%; **Table 4.8; Fig. 4.4**). Marginally lower proportions of broken flakes (N = 11,343; 6.4%) and broken blades and bladelets (N = 9,192; 5.2%) were also recorded compared with the previous assemblage. The proportion of plain spalls (N = 468; 0.3%) rises compared to the two previous phases, whereas the proportion of truncation spalls (N = 194; 0.1%) remains static, causing the ratio between the two types to become even more pronounced (2.4 : 1).

The remaining debitage classes appear in similar proportions to the two previous assemblages, with one exception: a distinct increase in the number of microburin by-products. A total of 14 microburins and a single *piquant triédre* were identified within the Upper Phase 3 assemblage. While this sum represents a substantial increase from the two preceding assemblages, it must be stressed that both types remain exceedingly rare, with neither reaching 0.1% of the total debitage. Aside from a slight increase in weight of the whole flakes (12.6kg; 14.1%) the distribution of artefact mass amongst the debitage types are consistent with the previous assemblage. The proportions of intact debitage also do not deviate from the two preceding assemblages, with 20.5% of the flakes and 8% of the blades and bladelets in this category (**Table 4.10**).

4.4.4 Phase 2

The Phase 2 assemblage proved to be considerably smaller than either of the Phase 3 assemblages, comprising a total of 82,950 artefacts weighing 46.4kg. The density of artefacts is also more akin to the Phase 4 assemblage, with the Phase 2 deposits containing an average of 60,109 artefacts per cubic metre (**Table 4.6**). The majority of these artefacts are again classified as debris, with these pieces encompassing an identical share (N = 62,638; 75.5%) to the Upper Phase 3 assemblage (**Table 4.8; Fig. 4.2**). The percentages of Phase 2 debitage artefacts (N = 19,196; 23.1%) and cores (N = 166; 0.2%) are also identical to the previous assemblage, while a marginal decline in the proportion of retouched artefacts (N = 950; 1.1%) is noted.

The Phase 2 assemblage diverges from the three preceding ones in that it is the only one where debris artefacts (19.7kg; 42.4%) outweigh the debitage (18.8kg; 40.4%; **Table 4.9; Fig. 4.3**). The Phase 2 cores once again display a marginal decline in their contribution to the total assemblage weight (3.8kg; 8.3%), with these artefacts exhibiting their lowest proportional share out of the four catalogued assemblages. A similar pattern can be seen with the weight of the Phase 2 retouched artefacts, although unlike the cores this shift represents a massive decline in representative mass (4.1kg; 8.9%) compared with the Upper Phase 3 assemblage.

While the Phase 2 ratios from debris to debitage (3 : 1) and debitage to tools (20 : 1) remain consistent with the preceding three assemblages, the others vary somewhat, with those relating to the cores exhibiting noticeable drops (**Table 4.7**). In the cases of the debris to cores (377 : 1) and debitage to cores (116 : 1), the changes represent an abrupt fall compared to the previous assemblages, whereas the lower core to tool ratio in Phase 2 (1 : 6) resumes the unidirectional, diachronic decline previously mentioned.

4.4.4.1 Debris

Although chips remain the most common flaked stone artefact type of the Phase 2 assemblage (N = 49,472; 59.6%), they nonetheless exhibit a substantial decline compared to the previous assemblages, suggesting a shift in refuse disposal strategies within Area XX F after the establishment of Structure 1. The Phase 2 debris further stands out from the other assemblages due to the chunks comprising a greater portion of the overall assemblage (N =

13,166; 15.9%). These artefacts also constitute a third (15.5kg; 33.5%) of the total Phase 2 mass – the largest share attained by the chunks out of the catalogued assemblages.

4.4.4.2 Debitage

Flakes <2cm are once again the most common debitage type, comprising an identical proportion (N = 6,658; 8.0%) as in Upper Phase 3 (**Table 4.8; Fig 4.4**). They are again tailed by the broken blades and bladelets (N = 4,897; 5.9%) and broken flakes (N = 4,383; 5.3%). Intact flakes, blades and bladelets also occur in similar proportions as in the earlier phases, while core trimming elements reached their lowest representation (N = 198; 0.2%) out of the four assemblages. The divide between burin spall types established in Upper Phase 3 becomes even more pronounced in Phase 2, with plain spalls (N = 346; 0.4%) being almost five times as common as truncation spalls (N = 74; 0.1%). By-products associated with the microburin technique occur in similar numbers as in the Upper Phase 3 assemblage, with fifteen microburins and two *piquant triédres* identified, demonstrating that these increased proportions are not an Upper Phase 3 anomaly. The percentages of intact debitage blanks deposited in the Phase 2 assemblages rise slightly from the three preceding assemblages, with just under three broken flakes and slightly over nine broken blades and bladelets present for their corresponding debitage types (**Table 4.10**).

4.4.5 Comparison with the Phase 1 assemblage

While the overall composition of the four lithic assemblages analysed in the current study remain largely consistent, several quantitative divergences were noted between these assemblages and those previously analysed by Edwards (2013e) from Phase 1. The Plot XX D assemblage has been employed as a comparative Phase 1 analogue for the current study, as it is similar in size (N = 91,671) to each of the earlier assemblages discussed in this chapter.

Debris artefacts are far less common in Phase 1 than in any of the other assemblages, encompassing just over half of the numerical total (**Fig. 4.2**). This share represents a massive decline compared with the underlying deposits, where debris artefacts consistently comprise between 72% and 76% of each assemblage. This drop is represented purely by a reduction in the quantity of chips (N = 37,256; 40.6%): the percentage of chunks remains static between the Phase 2 (15.9%) and Phase 1 (14.0%) assemblages. Flakes and bladelets measuring less than 2cm are likewise less prevalent in Phase 1 than any of the earlier assemblages (**Fig. 4.4**). This widespread underrepresentation of the smallest flaked stone artefacts suggests the influence of taphonomic processes (see Chapter 10.3.1), since the methods of artefact retrieval and analysis remained consistent between Phases 1 and 2.

The proportions of intact debitage types are far greater in the Phase 1 assemblage than in any of the underlying deposits. Whole flakes and bladelets are five times as common in Phase 1 than within the earlier assemblages, while intact blades are seven times as common. These proportions have been heavily inflated through the underrepresentation of flakes and bladelets <2cm in the Phase 1 assemblage, with the proportions of intact flakes, blades and bladelets being only twice as common when these types are removed from the equation entirely on an inter-assemblage comparative basis (**Figure 4.5**).

These revised proportions nonetheless still represent abrupt increases from the earlier assemblages, demonstrating that greater quantities of debitage entered the archaeological record intact in the final occupational phase of the site. In contrast, the proportions of broken blades and bladelets are halved (19.5%) from the preceding assemblages, whereas the percentage of broken flakes in Phase 1 remains consistent with the earlier phases (43.1%). The rise in intact debitage proportions is clearly reflected when comparing the percentage of Phase 1 intact pieces with earlier assemblages (**Table 4.10**), with only 1.6 broken flakes and 2.4 broken blades and bladelets present for each intact piece of debitage.

The overall proportion of burin spalls continue to increase in Phase 1, comprising 0.7% of the total assemblage, although this share is also significantly influenced by the lack of chips and microdebitage in this assemblage. The ratio between spall types also becomes more pronounced, with plain spalls being almost six times as common as truncation spalls. While they remained uncommon, amounting to only 0.1% of the Phase 1 total (0.2% excluding microdebitage), microburins continue their unidirectional rise in representation at Wadi Hammeh 27, with four times as many microburins being recorded from the Phase 1 sample than Phase 2.

While the overall proportions of cores and retouched artefacts remain consistent across the four lower assemblages, both classes comprise notably greater shares of the total Phase 1 assemblage, although this configuration is again likely influenced by the lack of debris items. This increased numerical representation is particularly evident with the cores, which attain a proportion twice that of each of the lower assemblages (0.4%). The proportion of retouched

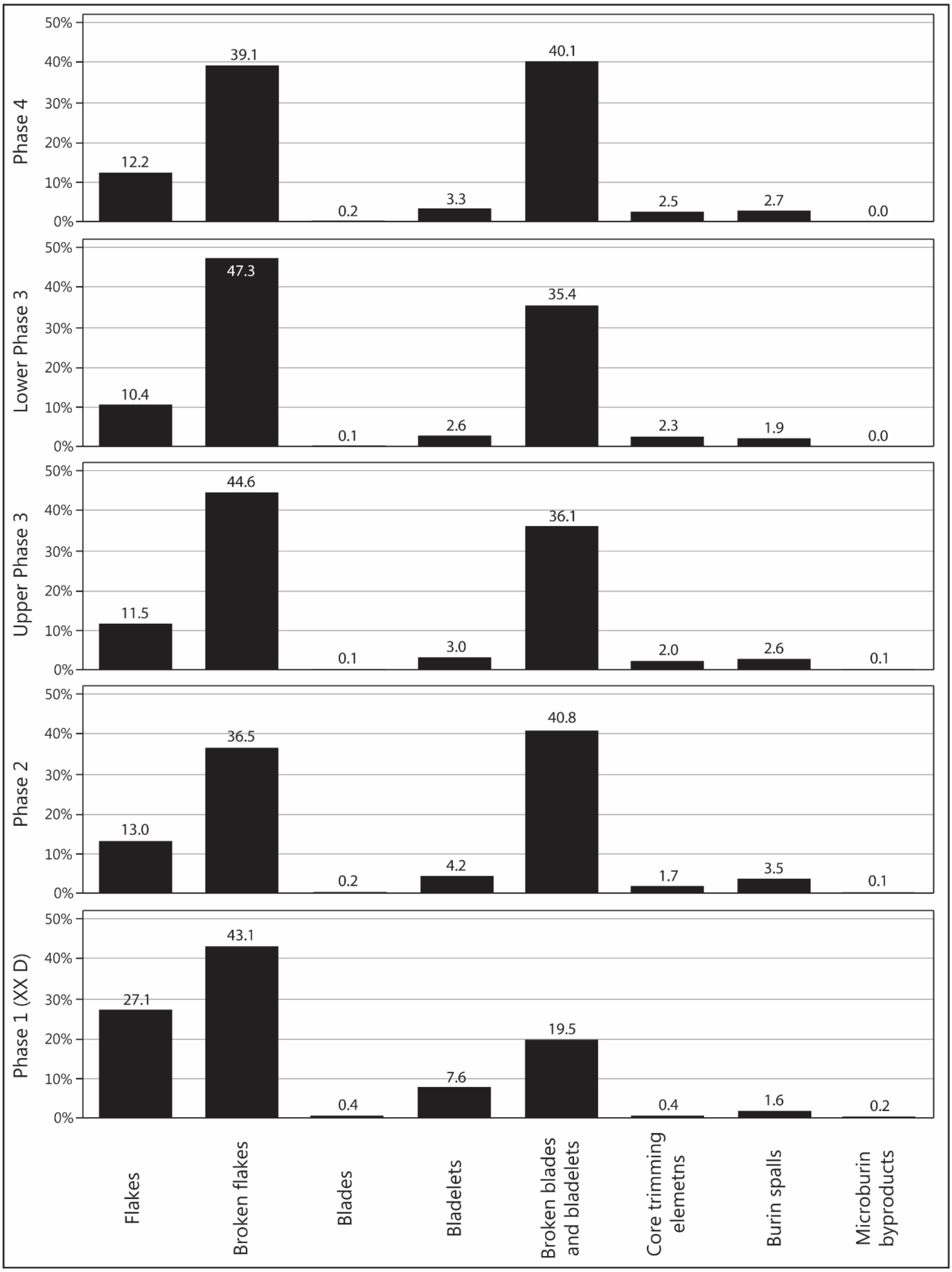


Figure 4.5: Debitage typological composition (excluding debitage <2cm), by phase.

artefacts is also greater in Phase 1, although the actual number of artefacts involved in this increased representation (N = 1,707) is outnumbered by both of the Phase 3 assemblages analysed in the current study.

The ratios between major flaked stone artefacts in the Phase 1 assemblage are almost all lower than in the preceding assemblages **(Table 4.7)**, the only exception being an increase in the Phase 1 debitage to tool ratio (23 : 1). Ratios relating to the debris artefacts unsurprisingly exhibit the greatest reduction in Phase 1 given the underrepresentation of chips, although the debitage to core (107 : 1) and core to tool (1 : 5) ratios also drop to their lowest levels out of the analysed assemblages.

4.5 Debitage attributes

Detailed attribute data were recorded for a total of 1,934 intact debitage artefacts sampled from across the four assemblages. Over half of these objects are whole flakes measuring more than two centimetres in maximum dimension (N = 1,122), with large numbers of bladelets (N = 765) also being analysed. Given the scarcity of intact blades at Wadi Hammeh 27, the sample of these artefacts for analysis is correspondingly smaller (N = 47). The presence of platform lipping has not been recorded as part of this analysis, given that experimental studies indicate that it is an unreliable means of identifying different knapping strategies (Buchanan et al. 2016: 746-7).

4.5.1 Flakes

The unretouched debitage assemblages analysed from the lower deposits of Wadi Hammeh 27 demonstrate a large range of dimensional variability. Flake dimensions are varied (**Table 4.11; Fig. 4.6**), with lengths ranging from 8.9mm to 71.7mm and widths between 9.9mm and 60.1mm, while their weight ranges from 0.2g to a maximum of 66.6g. The average Wadi Hammeh 27 flake nonetheless remains consistent in size over time, measuring 25.5mm in length, 23.0mm in width and weighing 3.8g.

Plain platforms are the most common type for all four flake assemblages (28.9%), with this dominance slightly increasing from 27.0% in Phase 4 to 30.8% in Phase 2, before surging to slightly under half of the Phase 1 flakes (**Table 4.12**; **Fig. 4.7**). Flakes with punctiform

Table 4.11: Flake dimensions, by phase. Phase 1 data from Edwards (2013e: 135).

	N	Length (mm)			Width (mm)			Thickness (mm)			Weight (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	434	25.8	8.3	8.9 - 66.5	23.1	7.8	10.4 - 60.1	5.7	3.2	1.6 - 21.7	4.1	5.9	0.3 - 66.6
Lower Phase 3	247	25.3	7.4	9.8 - 51.7	22.4	7.0	10.5 - 49.7	5.5	2.9	1.4 - 17.7	3.5	3.9	0.3 - 29.1
Upper Phase 3	272	24.7	7.1	9.4 - 55.9	23.8	8.3	9.9 - 53.7	5.8	3.0	1.5 - 21.8	3.7	4.3	0.2 - 37.4
Phase 2	168	25.9	8.2	9.4 - 71.7	22.4	5.9	11.6 - 42.5	5.7	2.8	1.6 - 17.7	3.6	4.2	0.3 - 35.0
Phase 1 (XX E, H, J & K)	550	25.1	9.3	5.9 - 66.0	21.7	8.6	7.4 - 82.0	6.1	3.1	1.1 - 20.0	3.8	5.6	0.1 - 61.1

Table 4.12: Flake attributes, by phase. Phase 1 data from Edwards (2013: 136).

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Phase 1 (XX E, H, J & K)	
	N	%	N	%	N	%	N	%	N	%
Platform										
Absent	53	12.2	38	15.4	44	16.2	33	19.5	105	19.1
Cortical	28	6.5	25	10.1	23	8.5	9	5.3	34	6.2
Crushed	65	15.0	27	10.9	34	12.5	22	13.0	71	12.9
Dihedral Facetted	47	10.8	24	9.7	32	11.8	13	7.7	8	1.5
Multifacetted	38	8.8	15	6.1	20	7.4	8	4.7	15	2.7
Plain	117	27.0	73	29.6	82	30.1	52	30.8	268	48.7
Punctiform	86	19.8	45	18.2	37	13.6	32	18.9	49	8.9
Total	**434**	**100.1**	**247**	**100.0**	**272**	**100.1**	**169**	**99.9**	**550**	**100.0**
Bulb of percussion										
Diffuse	100	23.0	45	18.2	60	22.1	41	24.3	191	34.9
Normal	163	37.6	93	37.7	93	34.2	75	44.4	257	46.9
Prominent	171	39.4	109	44.1	119	43.8	53	31.4	100	18.2
Total	**434**	**100.0**	**247**	**100.0**	**272**	**100.1**	**169**	**100.1**	**548**	**100.0**
Bulbar scar										
Present	222	51.2	129	52.4	129	47.4	88	52.1	244	44.4
Absent	212	48.8	117	47.6	143	52.6	81	47.9	306	55.6
Total	**434**	**100.0**	**246**	**100.0**	**272**	**100.0**	**169**	**100.0**	**550**	**100.0**
Overhang removal										
Present	124	28.6	92	37.2	88	32.4	44	45.4	-	-
Absent	310	71.4	155	62.8	184	67.6	53	54.6	-	-
Total	**434**	**100.0**	**247**	**100.0**	**272**	**100.0**	**97**	**100.0**	**-**	**-**

Flake scar orientation										
Bi-directional crossed	38	8.8	18	7.4	15	5.6	12	7.2	18	3.3
Bi-directional along axis	3	0.7	1	0.4	2	0.7	0	0.0	9	1.6
Change of orientation	142	32.8	82	33.7	102	37.8	53	31.7	235	42.7
Radial	72	16.6	40	16.5	26	9.6	14	8.4	10	1.8
Unidirectional	178	41.1	102	42.0	125	46.3	88	52.7	257	46.7
Total	**433**	**100.0**	**243**	**100.0**	**270**	**100.0**	**167**	**100.0**	**550**	**96.1**
Shape										
Canted	104	24.0	59	23.9	66	24.3	36	21.3	29	5.3
Expanding	55	12.7	48	19.4	42	15.4	17	10.1	70	12.7
Irregular	46	10.6	17	6.9	18	6.6	12	7.1	112	20.4
Ovoid	106	24.4	49	19.8	59	21.7	34	20.1	71	12.9
Rectangular	67	15.4	39	15.8	48	17.6	39	23.1	205	37.3
Triangular	56	12.9	35	14.2	39	14.3	31	18.3	63	11.5
Total	**434**	**100.0**	**247**	**100.0**	**272**	**99.9**	**169**	**100.0**	**550**	**100.1**
Profile										
Flat	105	24.2	71	28.7	85	31.3	55	32.5	69	12.5
Incurvate	251	57.8	126	51.0	135	49.6	97	57.4	349	63.5
Outcurving	45	10.4	28	11.3	41	15.1	12	7.1	117	21.3
Twisted	33	7.6	22	8.9	11	4.0	5	3.0	47	8.5
Total	**434**	**100.0**	**247**	**99.9**	**272**	**100.0**	**169**	**100.0**	**550**	**105.8**
Cross-section										
Lenticular	124	28.6	85	34.4	96	35.3	54	32.0	113	20.5
Trapezoidal	101	23.3	65	26.3	86	31.6	72	42.6	197	35.8
Triangular	83	19.1	44	17.8	50	18.4	33	19.5	193	35.1
Other	126	29.0	53	21.5	40	14.7	10	5.9	47	8.5
Total	**434**	**100.0**	**247**	**100.0**	**272**	**100.0**	**169**	**100.0**	**550**	**99.9**
Termination										
Feathered	245	56.5	138	55.9	131	48.2	82	49.1	209	40.0
Hinged	74	17.1	51	20.6	64	23.5	32	19.2	168	32.2
Plunging	37	8.5	19	7.7	15	5.5	12	7.2	79	15.1
Stepped	78	18.0	39	15.8	62	22.8	41	24.6	66	12.6
Total	**434**	**100.1**	**247**	**100.0**	**272**	**100.0**	**167**	**100.1**	**522**	**99.9**

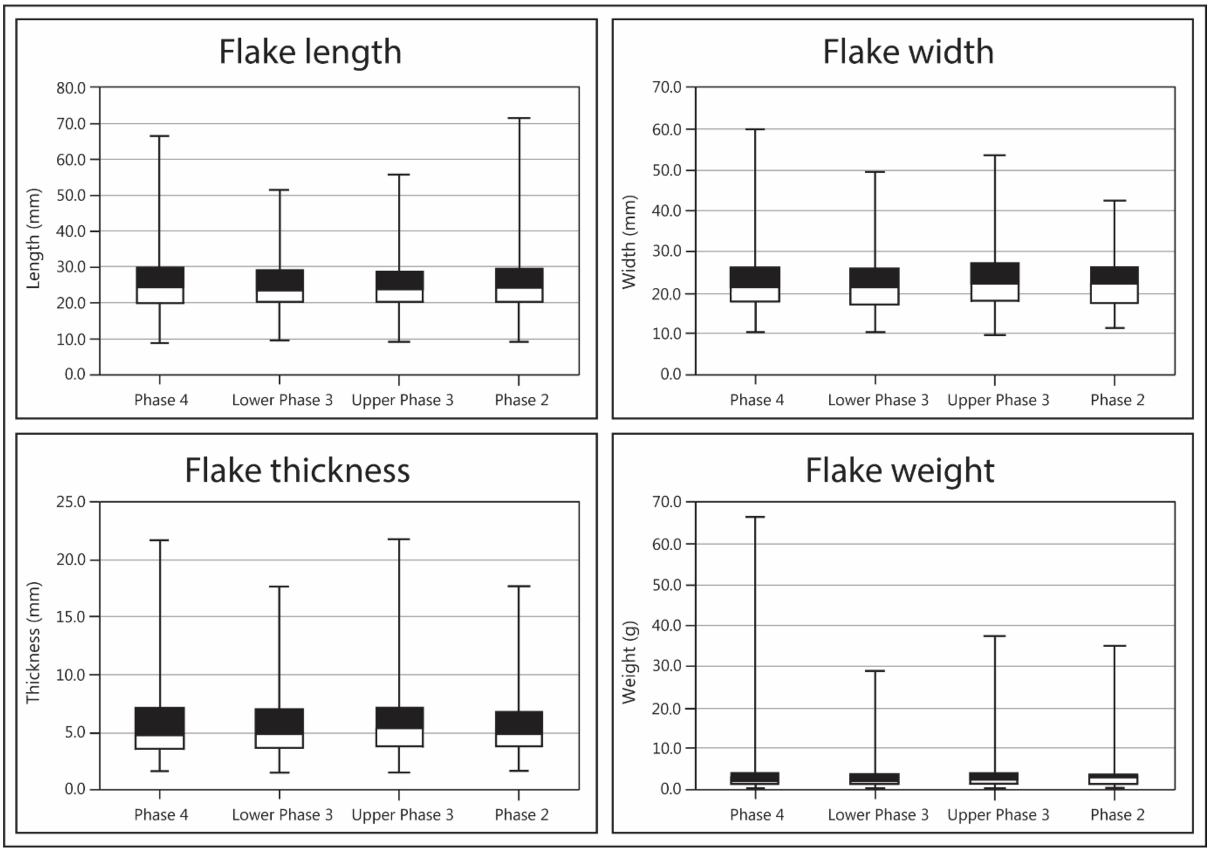


Figure 4.6: Flake dimensions, by phase.

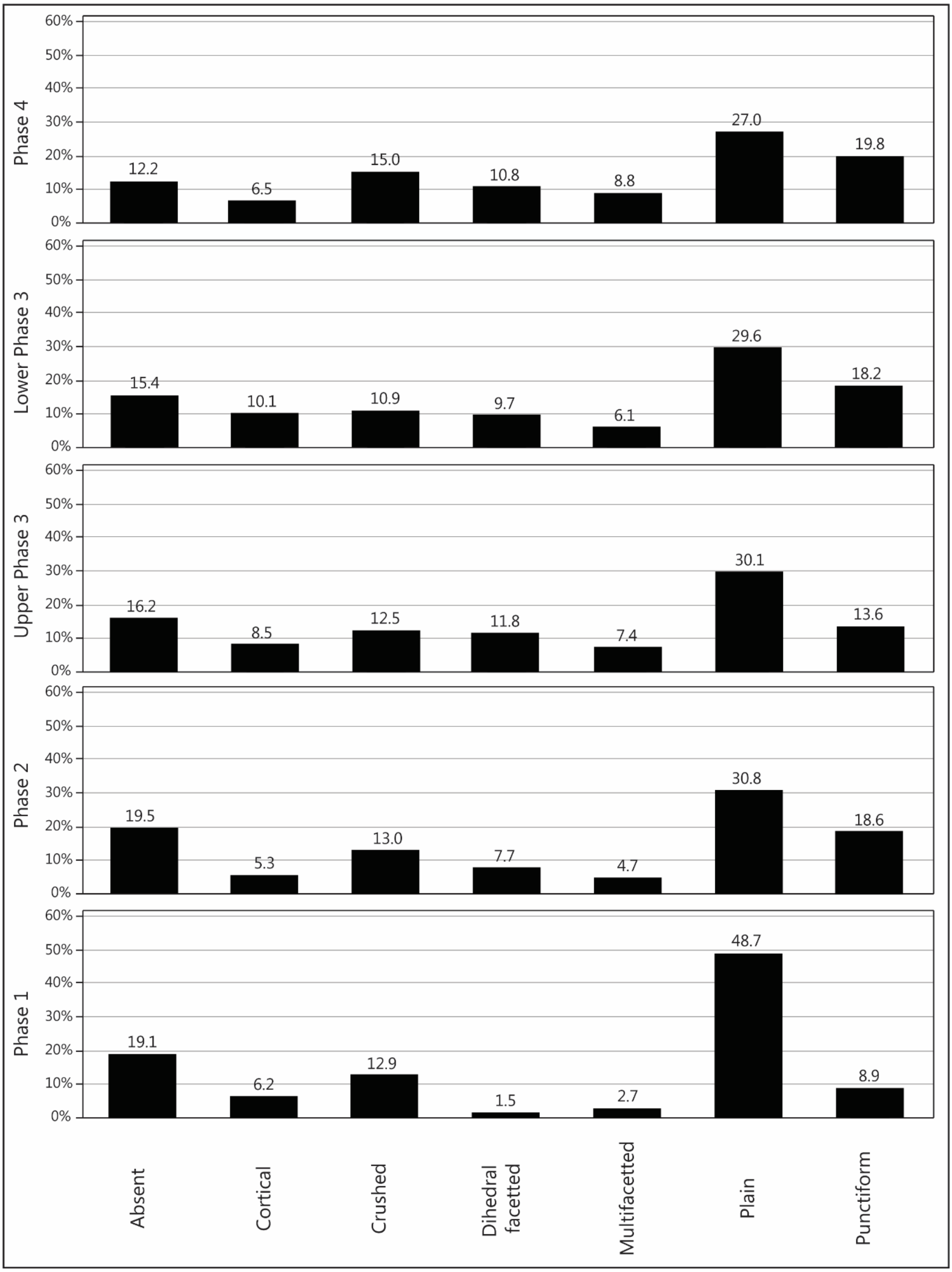


Figure 4.7: Flake platform types, by phase. Phase 1 data from Edwards 2013e: 136.

platforms are the second most common type in the Phase 4 (19.8%) and Lower Phase 3 assemblages (18.2%), while flakes with absent platforms follow with 16.2% in Upper Phase 3, 19.5% in Phase 2 and 19.1% in Phase 1. Flakes with multifaceted platforms are the least common variety in every assemblage aside from Phase 4 (8.8%) where they outnumber flakes with cortical platforms (6.5%), and Phase 1 (2.7%), where they slightly outnumber flakes with dihedral facetted platforms (1.5%). Flakes with cortical platforms are relatively uncommon throughout the deposits, with the slight exception of the Lower Phase 3 flakes, where this type (10.1%) outnumber flakes with and dihedral facetted (9.7%) and multifaceted (6.1%) platforms. The proportions of flakes with crushed platforms likewise remain static over time, comprising between 11% and 15% of each assemblage.

The platform angles exhibited by the flakes are consistent between Phase 4 and Upper Phase 3, with each assemblage exhibiting a unimodal distribution centred around the ‘71º – 75º’ and ‘76º – 80º’ ranges (**Fig. 4.8**). Flake platform angles are slightly higher in Phase 2, with the unimodal distribution in this assemblage instead being centred around the ‘81º – 85º’ range, and featuring far fewer proportions of flakes with platform angles of 60º and below. Flakes with obtuse platform angles are uncommon in each assemblage, becoming particularly scarce in Phase 2. Platform angles remain largely consistent regardless of the type of platform present, with flakes with plain platforms narrowly possessing the lowest average angle (74.4º), while those with cortical platforms demonstrate both the highest average platform angle (81.4º) as well as the highest standard deviation value (16.8º; **Table 4.13**). The average flake platform angle slightly rises over time, from 74.7º in Phase 4 to 79.8º in Phase 2 (**Table 4.14**).

Several positive correlations may be observed between flake platform angles and their dimensions (**Table 4.15; Fig. 4.9**). The small number of flakes with platform angles of 45˚ or less (N = 7) tend to be short, broad, thick pieces, with these flakes demonstrating the lowest average length (20.5mm), greatest average width (35.1mm) and greatest average weight (7.6g). Flake length gradually increases alongside the platform angle, reaching a maximum average length of 27.3mm for flakes with platform angles ranging from 91º and 105º. However, flakes with a platform angle greater than 105º subsequently demonstrate a noticeable decline in length (24.8mm). Conversely, the width, thickness and weight of the flakes in relation to the platform angle all demonstrate bimodal distributions centred on the lowest and highest angle ranges, with platform angles between 61º and 75º corresponding with the lowest average values for all three of these variables.

Table 4.13: Debitage platform angle range, by platform type (Phases 2 - 4).

	N	Platform angle		
		Mean	SD	Range
Flakes				
Cortical	64	81.4	16.8	36-125
Dihedral facetted	114	76.1	15.2	39-120
Multiple facetted	81	79.0	14.0	46-120
Plain	323	74.4	14.0	37-125
Punctiform	199	77.5	13.3	47-124
Sub-total	**781**	**76.5**	**14.4**	**36-125**
Blades				
Cortical	0	-	-	-
Dihedral facetted	6	68.0	12.5	50-84
Multiple facetted	3	85.0	6.2	78-90
Plain	10	77.8	11.8	55-93
Punctiform	13	78.9	9.6	64-104
Sub-total	**32**	**77.1**	**11.3**	**50-104**
Bladelets				
Cortical	5	75.4	7.8	66-85
Dihedral facetted	49	76.4	12.0	55-115
Multiple facetted	9	79.1	9.6	64-94
Plain	62	76.4	14.9	48-129
Punctiform	214	74.4	11.7	46-130
Sub-total	**339**	**75.2**	**12.3**	**46-130**

Table 4.14: Debitage platform angle range, by phase.

	N	Platform angle		
		Mean	SD	Range
Flakes				
Phase 4	304	74.7°	13.6	43° - 125°
Lower Phase 3	175	75.7°	14.4	43° - 119°
Upper Phase 3	188	78.2°	16.5	36° - 125°
Phase 2	114	79.8°	11.8	47° - 120°
Blades (all phases)	32	77.1°	11.3	50° - 104°
Bladelets				
Phase 4	97	73.5°	11.8	48° - 109°
Lower Phase 3	96	72.8°	9.9	47° - 105°
Upper Phase 3	95	77.3°	12.7	46° - 129°
Phase 2	51	79.3°	14.9	57° - 130°

Table 4.15: Debitage dimensions, by platform angle (Phases 2 - 4).

	N	Length (mm)			Width (mm)			Thickness (mm)			Weight (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Flakes													
<46°	7	20.5	7.9	11.3-32.6	35.1	10.2	25.3-54.0	7.9	4.1	4.5-16.6	7.6	10.5	1.6-31.1
46° - 60°	98	23.5	9.5	9.8-66.5	24.3	8.1	11.5-54.6	5.6	2.7	1.7-18.7	3.8	5.0	0.3-31.5
61° - 75°	271	24.4	8.1	9.4-71.7	23.0	7.3	10.6-60.1	5.5	2.8	1.5-19.8	3.7	5.0	0.4-39.7
76° - 90°	290	26.8	7.9	8.9-63.8	23.5	7.0	11.1-51.4	6.0	3.0	1.6-21.8	4.2	4.4	0.3-28.9
91° - 105°	97	27.3	8.1	13.2-62.8	25.2	8.9	10.7-53.7	6.8	3.3	2.3-21.7	5.2	7.9	0.3-66.6
>105°	17	24.8	7.3	15.6-37.7	25.9	6.7	17.1-42.5	8.3	4.1	2.8-17.7	5.3	5.3	1.0-22.9
Blades													
<46°	0	-	-	-	-	-	-	-	-	-	-	-	-
46° - 60°	2	59.5	8.1	53.7-65.2	25.8	0.2	25.6-25.9	7.8	4.4	4.7-10.9	9.9	3.9	7.1-12.6
61° - 75°	10	64.0	10.8	50.5-80.4	24.7	4.0	19.4-30.9	7.0	2.2	3.6-11.2	12.2	6.8	5.5-24.6
76° - 90°	18	61.3	9.1	50.1-79.1	24.0	4.6	15.4-34.2	7.0	2.7	3.6-12.8	11.3	7.4	3.2-29.8
91° - 105°	2	54.3	3.8	51.7-57.0	20.2	0.5	19.8-20.5	6.6	0.8	6.0-7.1	6.7	0.4	6.4-7.0
>105°	0	-	-	-	-	-	-	-	-	-	-	-	-
Bladelets													
<46°	0	-	-	-	-	-	-	-	-	-	-	-	-
46° - 60°	34	30.8	7.8	20.3-49.7	12.8	3.6	7.0-20.6	3.3	1.3	1.9-6.4	1.5	1.3	0.2-4.5
61° - 75°	143	29.4	6.8	20.2-46.9	12.0	3.1	4.8-21.6	3.4	1.4	1.3-9.3	1.3	1.3	0.1-7.7
76° - 90°	136	31.0	7.2	20.1-48.8	12.6	3.5	5.6-22.0	3.6	1.6	1.3-14.2	1.6	1.7	0.1-15.0
91° - 105°	20	31.1	7.5	21.8-49.5	12.6	3.4	7.3-22.3	4.1	1.5	1.8-7.7	1.8	1.8	0.5-8.9
>105°	6	27.4	3.8	22.7-32.9	11.0	1.8	9.3-13.8	3.3	1.0	1.8-4.6	1.0	0.5	0.4-1.5

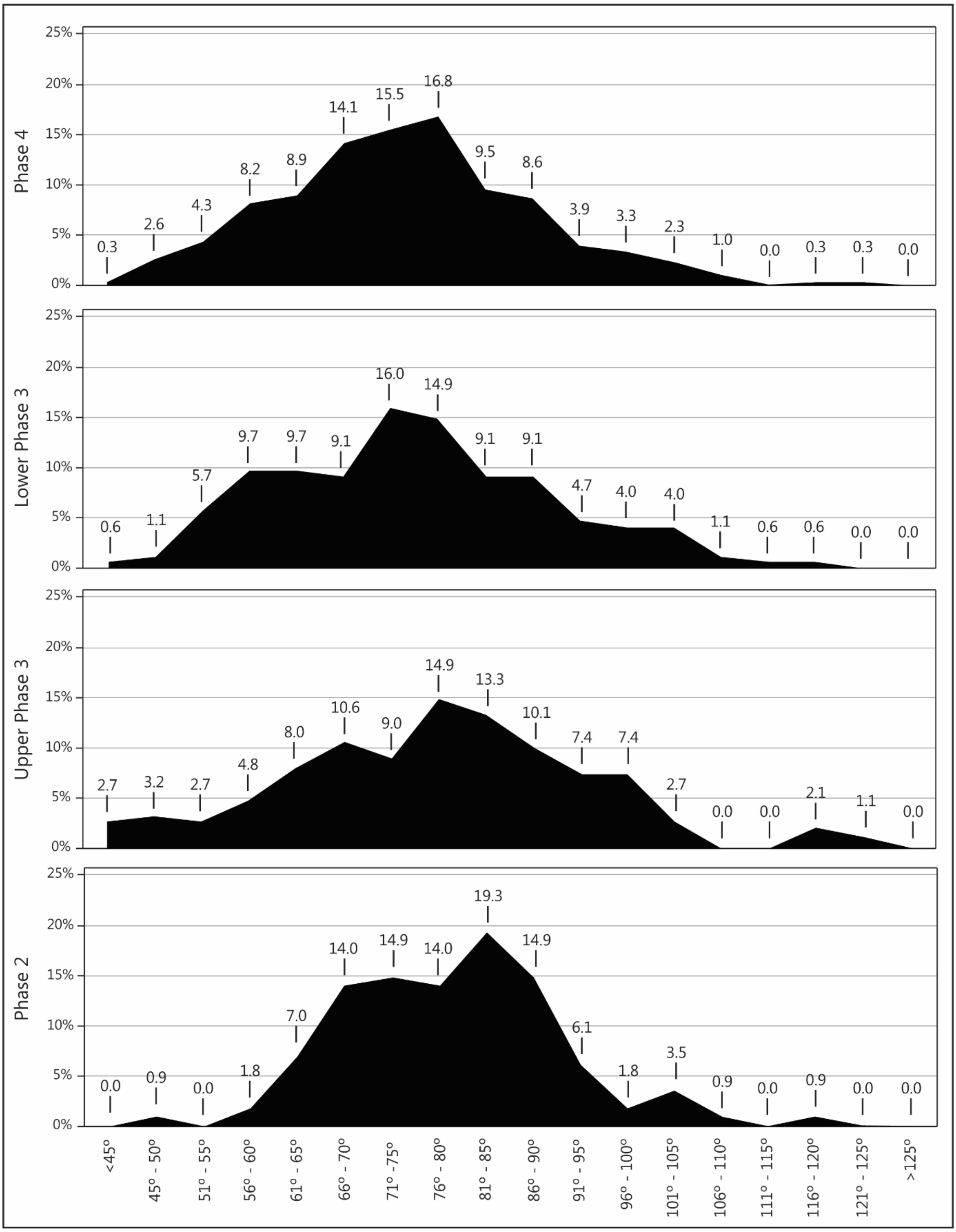


Figure. 4.8: Flake platform angle variety, by phase.

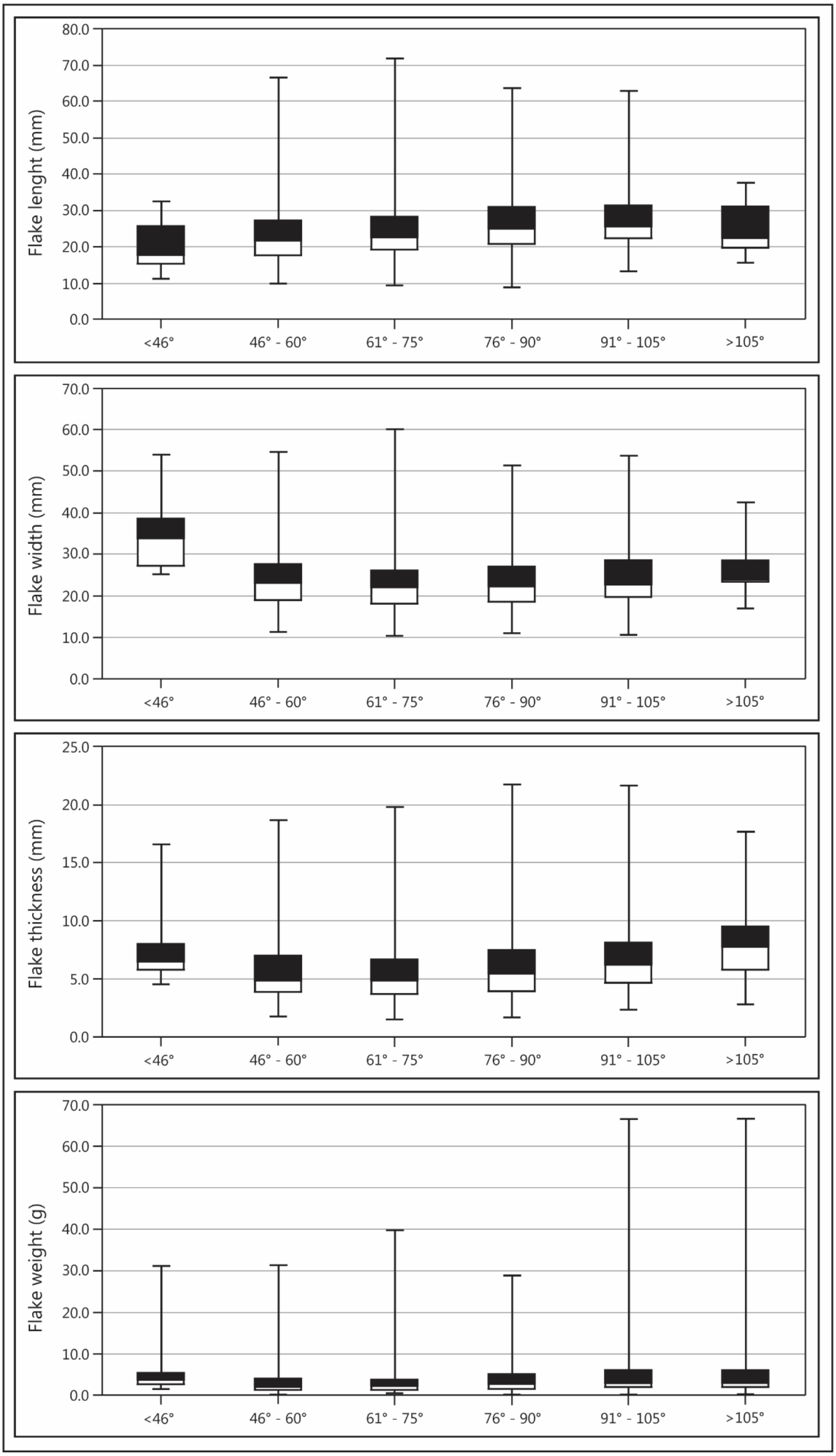


Figure 4.9: Flake dimensions, by platform angle (Phases 4 – 2).

Percussion bulbs lean towards the pronounced side in each of the earliest Wadi Hammeh 27 flake assemblages, with ‘prominent’ bulbs narrowly outnumbering flakes with ‘normal’ bulbs in each assemblage between Phase 4 and Upper Phase 3 (**Table 4.12**). This situation changes in the final two assemblages, where flakes with ‘normal’ flakes become the most common variety, at the growing expense of flakes with ‘prominent’ bulbs. Meanwhile, flakes with ‘diffuse’ percussion bulbs remain uncommon between Phase 4 and 2, where they represent less than a quarter of each assemblage, before rising to over a third of the Phase 1 flakes. Bulbar scars are widespread in each flake assemblage, with a narrow majority of the Phase 4, Lower Phase 3 and Phase 2 flakes displaying this attribute, whereas flakes without bulbar scars are slightly more common in the Upper Phase 3 and Phase 1 assemblages.

A majority of flakes in each assemblage exhibit feathered terminations, although this dominance gradually declines over time, falling from 56.1% of the Phase 4 flakes to 40% of those in Phase 1 (**Table 4.12**; **Fig. 4.10**). The other termination types exhibit no clear unidirectional patterns, with a notable, abrupt rise in the proportions of hinged and plunging flakes terminations in Phase 1. Flakes with incurvate profiles dominate each assemblage (**Table 4.12; Fig. 4.11**), with the Upper Phase 3 assemblage being the only instance where these pieces do not constitute a majority. Incurvate flakes are primary supplemented by those with a flat profile in each assemblage aside from Phase 1, where they are instead complemented by a comparatively large proportion of flakes with outcurving profiles.

The shape of flakes produced throughout the occupation of Wadi Hammeh 27 are diverse, with no single category reaching a quarter of each assemblages aside from in Phase 1 (**Table 4.12**; **Fig 4.12**). Flakes with an ovoid shape are the most common variety in Phase 4 (24.4%), while canted flakes are the most common shape in both the Lower (23.9%) and Upper Phase 3 deposits (24.3%). Finally, rectangular flakes are narrowly the most common shape in the Phase 2 assemblage (23.1%), before reaching a clear majority amongst the Phase 1 sample (37.3%).

Flakes exhibiting a unidirectional dorsal scar pattern form the most common layout in all four assemblages, with this group gradually increasing from 41.1% in Phase 4 to 52.7% in Phase 2 (**Table 4.12**; **Fig 4.13**). These flaked are supplemented mainly by pieces featuring a 90º change of orientation scar pattern, with these objects comprising approximately one third of the total flakes in each assemblage. The proportions of flakes with radial flake scar patterning gradually decline over time, falling from 16.6% in Phase 4 to 8.4% in Phase 2. Flakes with

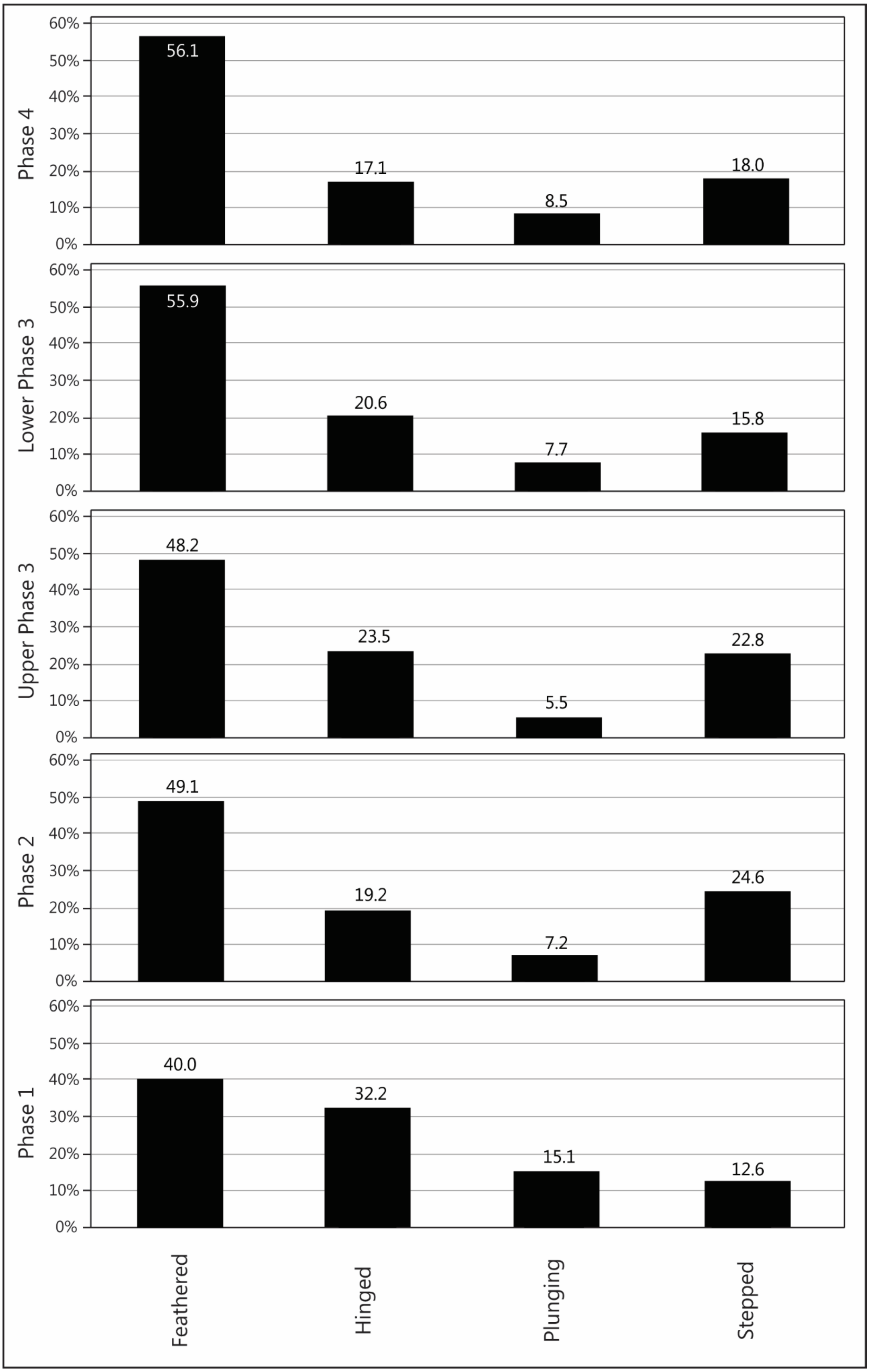


Figure 4.10: Flake termination types, by phase. Phase 1 data from Edwards 2013e: 136.

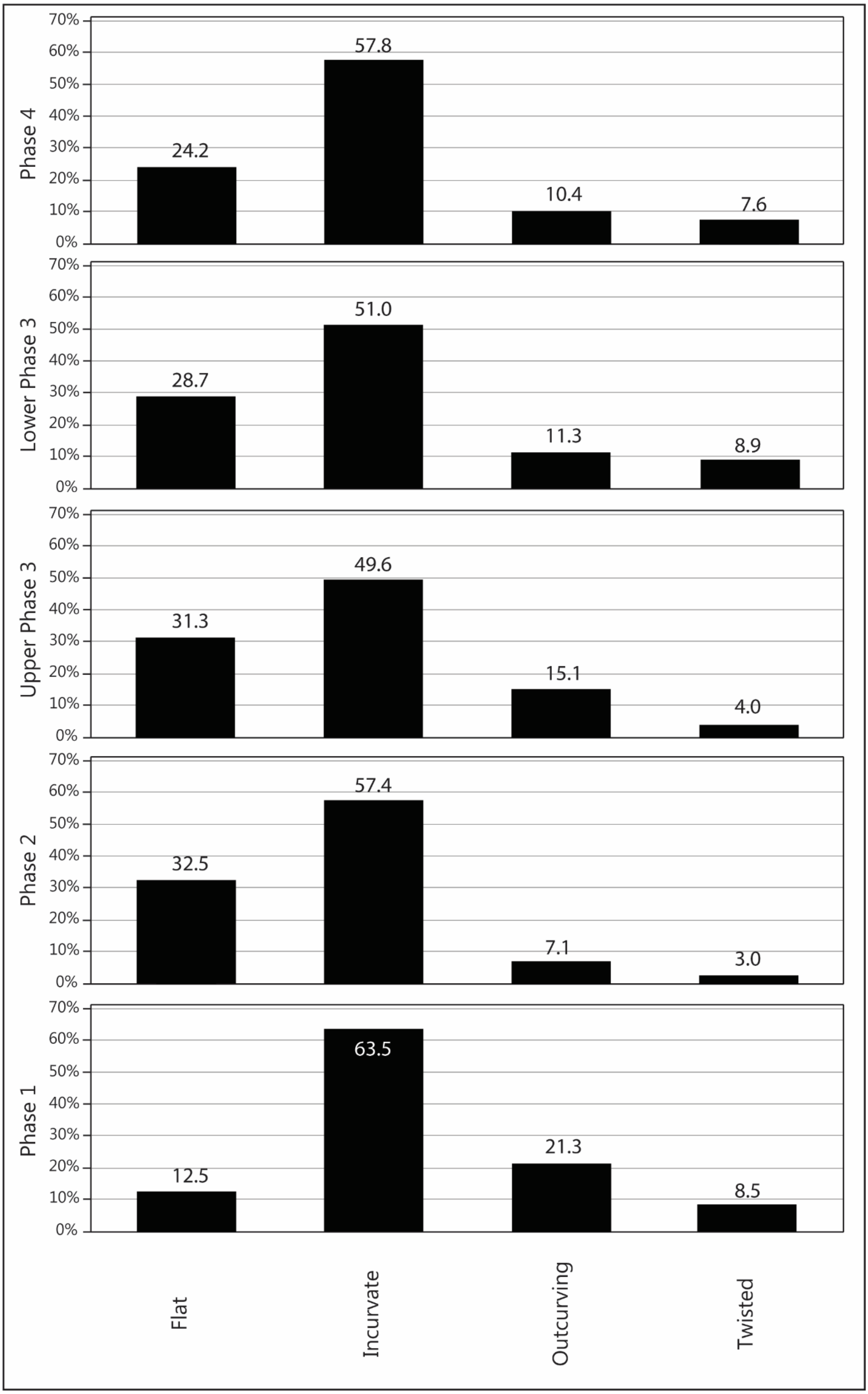


Figure 4.11: Flake profiles, by phase. Phase 1 data from Edwards 2013e: 136.

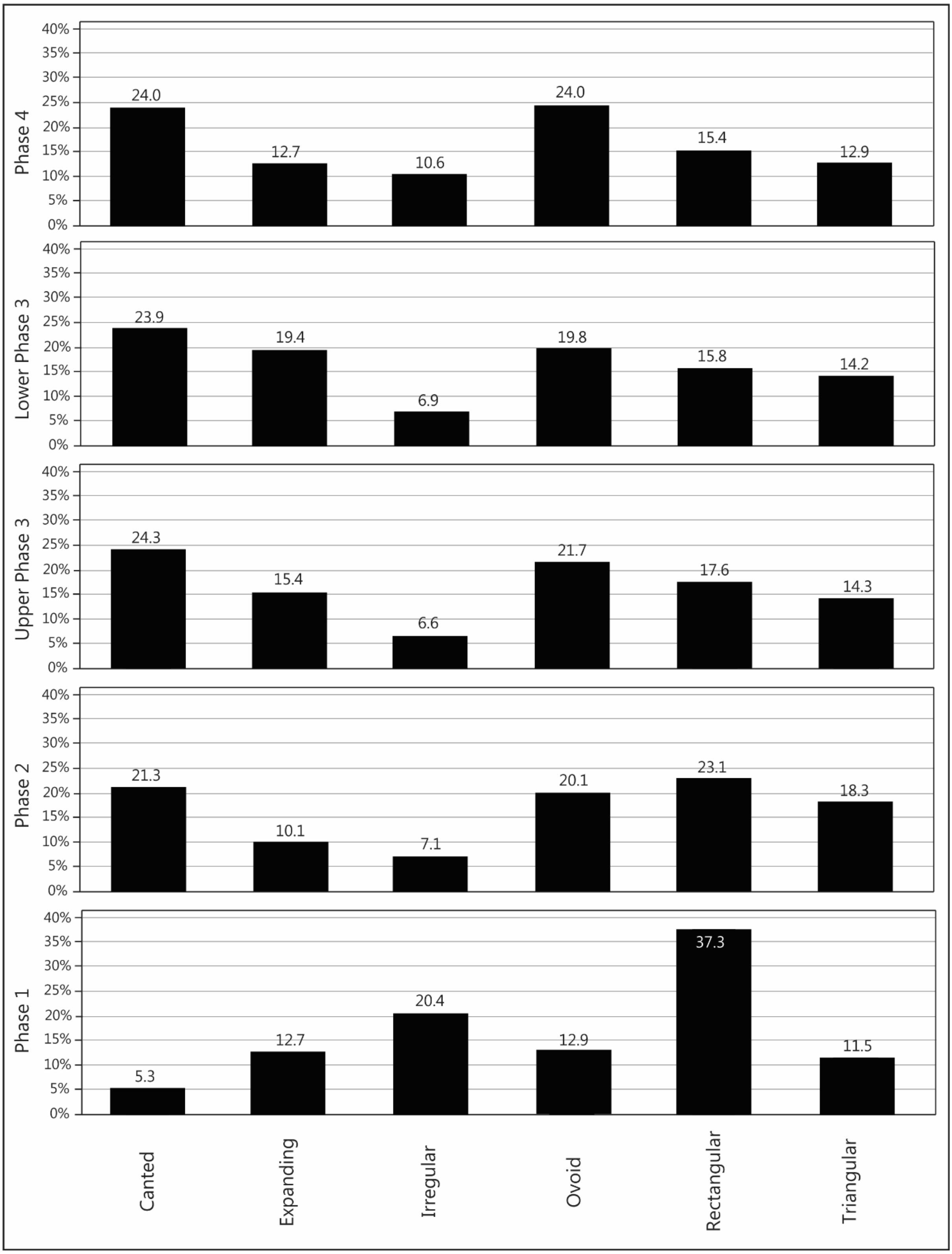


Figure 4.12: Flake shape, by phase. Phase 1 data from Edwards 2013e: 136.

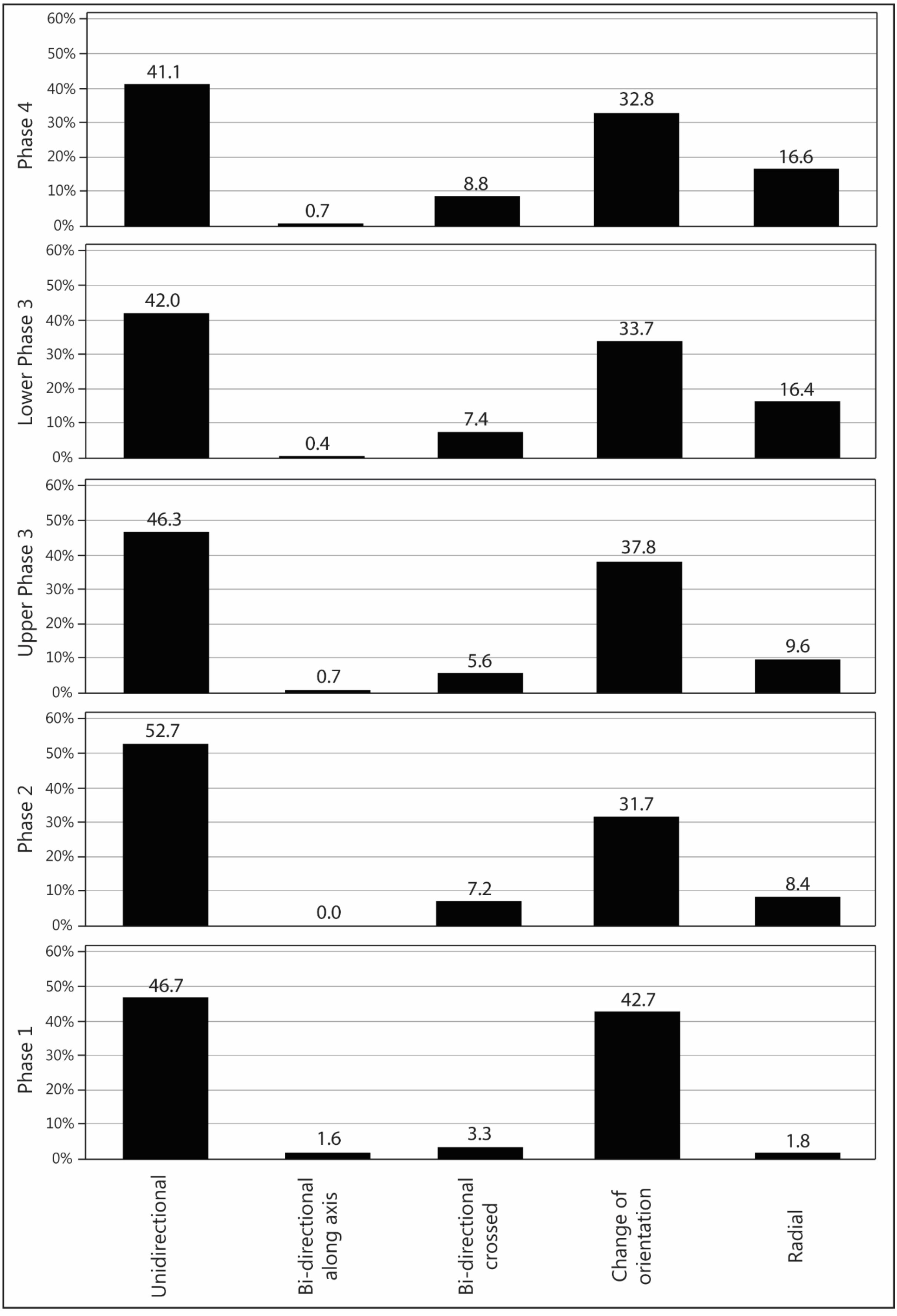


Figure 4.13: Flake dorsal scar orientation, by phase. Phase 1 data from Edwards 2013e: 136.

‘bi-directional along axis’ orientations are rare, amounting to less than 1% of the flakes in the earliest three assemblages and being entirely absent from Phase 2. The Phase 1 flake scar orientations display a continuation of the patterns seen in the lower deposits, with unidirectional and change of orientation dorsal scar layouts dominating at the expense of radial and bi-directional patterns to an even greater extent.

The number of flake scars featured on dorsal flake surfaces remains relatively consistent over time, with the Phase 4, Lower Phase 3 and Upper Phase 3 assemblages all exhibiting a unimodal distribution centred on flakes with four scars (**Fig 4.14**). This value varies slightly in Phase 2, where the unimodal distribution is instead narrowly centred on flakes featuring three dorsal scars. The number also varies slightly by scar orientation, with radial orientations possessing a slightly greater number than other patterns in every assemblage aside from Phase 4 **(Table 4.16**). The proportions of flakes possessing trapezoidal cross-section also increase over time, rising from 23.3% in Phase 4 to 42.6% in Phase 2 **(Table 4.12**; **Fig. 4.15)**. This increase largely corresponds with a decline in those with ‘other’ cross-sections, from 29.0% to 8.5%.

No significant diachronic variation in the amount of cortex coverage on flake dorsal surfaces can be detected, with around 60% of each flake assemblage being completely free of cortex (**Table 4.17**; **Figs. 4.16**). The mean and standard deviation values of cortex in the flake assemblages likewise remain almost identical across the four assemblages (**Table 4.18**). The distribution of cortex by quadrats is relatively diverse, however, with no single quadrat combination reaching a quarter of the total analysed flake assemblages (**Table 4.19**; **Fig. 4.17**). Aside from a slight increase (from 16.2% to 19.4%) in the proportion of flakes with cortex restricted to the distal termination (ie: only in quadrat 3), no clear unidirectional trends are evident. This combination is the most common variation in every assemblage aside from Phase 2, where they are marginally outnumbered by a relatively large proportion of flakes with cortex in all four quadrats (20.9%). Flakes with cortex restricted around their termination and a portion of one lateral edge (quadrat combinations 2/3 or 3/4) are also common in each flake assemblage.

Overall, the consistent scarcity of cortex indicates that most flakes were intentionally manufactured debitage blanks rather than primary core reduction elements. The same can be said for pieces featuring minor amounts of cortex towards their distal end, with these similarly representing the incidental removal of cortex situated opposite the striking platform.

Table 4.16: Debitage negative flake scar count and orientation, by phase.

	Flakes			Blades			Bladelets		
	No. of artefacts	Flake scar range	Mean no of flake scars	No. of artefacts	Flake scar range	Mean no of flake scars	No. of artefacts	Flake scar range	Mean no of flake scars
Phase 2									
Unidirectional	88	1-10	4	8	1-7	4	77	1-9	4
Bi-directional crossed	12	3-8	5	0	-	-	17	3-8	5
Bi-directional along axis	0	-	-	0	-	-	0	-	-
Change of orientation	53	1-11	4	0	-	-	19	3-11	6
Radial	14	3-10	6	2	6-10	8	6	5-10	7
Upper Phase 3									
Unidirectional	125	1-10	4	4	3-7	5	129	2-8	4
Bi-directional crossed	15	3-8	5	3	5-7	6	18	3-11	5
Bi-directional along axis	2	1-3	2	0	-	-	1	2	-
Change of orientation	102	1-10	4	6	4-11	6	53	2-9	5
Radial	26	2-9	6	0	-	-	9	3-7	5
Lower Phase 3									
Unidirectional	102	1-9	4	6	3-6	5	128	2-9	4
Bi-directional crossed	18	2-12	5	1	7	-	14	4-8	6
Bi-directional along axis	1	2	-	0	-	-	0	-	-
Change of orientation	82	1-10	5	5	4-7	5	58	3-10	5
Radial	40	2-11	6	3	6-13	10	7	4-10	6
Phase 4									
Unidirectional	178	1-12	4	4	4-10	6	142	1-10	4
Bi-directional crossed	38	2-13	5	1	5	-	18	2-10	6
Bi-directional along axis	3	1-9	4	0	-	-	1	2	-
Change of orientation	142	1-12	4	4	5-7	6	53	3-12	5
Radial	72	2-10	5	0	-	-	15	4-12	7

Table 4.17: Percentage of cortex coverage on debitage dorsal surfaces, by phase.

	0%		1-19%		20-39%		40-59%		60-79%		80-99%		100%		N
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Flakes															
Phase 4	249	57.4	70	16.1	48	11.1	34	7.8	19	4.4	13	3.0	1	0.2	434
Lower Phase 3	140	56.7	45	18.2	32	13.0	11	4.5	8	3.2	7	2.8	4	1.6	247
Upper Phase 3	169	62.1	43	15.8	30	11.0	13	4.8	9	3.3	6	2.2	2	0.7	272
Phase 2	102	60.4	23	13.6	18	10.7	10	5.9	9	5.3	6	3.6	1	0.6	169
Total	**660**	**58.8**	**181**	**16.1**	**128**	**11.4**	**68**	**6.1**	**45**	**4.0**	**32**	**2.9**	**8**	**0.7**	**1,122**
Blades															
Phase 4	6	66.7	2	22.2	1	11.1	0	0.0	0	0.0	0	0.0	0	0.0	9
Lower Phase 3	8	53.3	5	33.3	2	13.3	0	0.0	0	0.0	0	0.0	0	0.0	15
Upper Phase 3	8	61.5	4	30.8	1	7.7	0	0.0	0	0.0	0	0.0	0	0.0	13
Phase 2	5	50.0	4	40.0	0	0.0	0	0.0	0	0.0	1	10.0	0	0.0	10
Total	**27**	**57.4**	**15**	**31.9**	**4**	**8.5**	**0**	**0.0**	**0**	**0.0**	**1**	**2.1**	**0**	**0.0**	**47**
Bladelets															
Phase 4	171	74.7	35	15.3	15	6.6	7	3.1	1	0.4	0	0.0	0	0.0	229
Lower Phase 3	160	77.3	31	15.0	11	5.3	4	1.9	1	0.5	0	0.0	0	0.0	207
Upper Phase 3	171	81.4	29	13.8	6	2.9	2	1.0	2	1.0	0	0.0	0	0.0	210
Phase 2	94	79.0	16	13.4	6	5.0	3	2.5	0	0.0	0	0.0	0	0.0	119
Total	**596**	**77.9**	**111**	**14.5**	**38**	**5.0**	**16**	**2.1**	**4**	**0.5**	**0**	**0.0**	**0**	**0.0**	**765**

Table 4.18: Mean and standard deviation of debitage cortex coverage, by phase.

	Flakes			Blades			Bladelets		
	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD
Phase 4	0-100	13.8	22.9	0-35	5.0	11.5	0-60	4.7	10.5
Lower Phase 3	0-100	13.1	23.1	0-25	7.7	9.0	0-70	3.9	9.8
Upper Phase 3	0-100	11.0	20.8	0-30	5.4	9.2	0-65	3.0	8.8
Phase 2	0-100	13.8	24.0	0-90	12.5	27.6	0-50	3.9	10.0

Table 4.19: Distribution of cortex on debitage artefacts, by quadrat (Phases 2 - 4).

	Flake		Blades		Bladelets		Core trimming elements	
	N	%	N	%	N	%	N	%
One quadrat								
1	9	1.9	0	-	6	3.6	3	2.5
2	25	5.4	0	-	2	1.2	10	8.3
3	79	17.1	7	35.0	56	33.1	7	5.8
4	29	6.3	1	5.0	3	1.8	5	4.1
Sub-total	**142**	**30.7**	**8**	**40.0**	**67**	**39.6**	**25**	**20.7**
Two quadrats								
1,2	33	7.1	4	20.0	9	5.3	6	5.0
1,3	2	0.2	0	-	2	1.2	1	0.8
1,4	24	5.2	0	-	8	4.7	3	2.5
2,3	40	8.7	2	10.0	28	16.6	10	8.3
2,4	5	1.1	0	-	0	-	1	0.8
3,4	46	10.0	1	5.0	22	13.0	9	7.4
Sub-total	**150**	**32.5**	**7**	**35.0**	**69**	**40.8**	**30**	**24.8**
Three quadrats								
1,2,3	29	6.3	1	5.0	11	6.5	19	15.7
1,2,4	6	1.3	0	-	0	-	6	5.0
1,3,4	36	7.8	1	5.0	12	7.1	17	14.0
2,3,4	35	7.6	1	5.0	6	3.6	7	5.8
Sub-total	**106**	**22.9**	**3**	**15.0**	**29**	**17.2**	**49**	**40.5**
Four quadrats								
Sub-total	**64**	**13.9**	**2**	**10.0**	**4**	**2.4**	**17**	**14.0**
Total	**462**	**100.0**	**20**	**100.0**	**169**	**100.0**	**121**	**100.0**

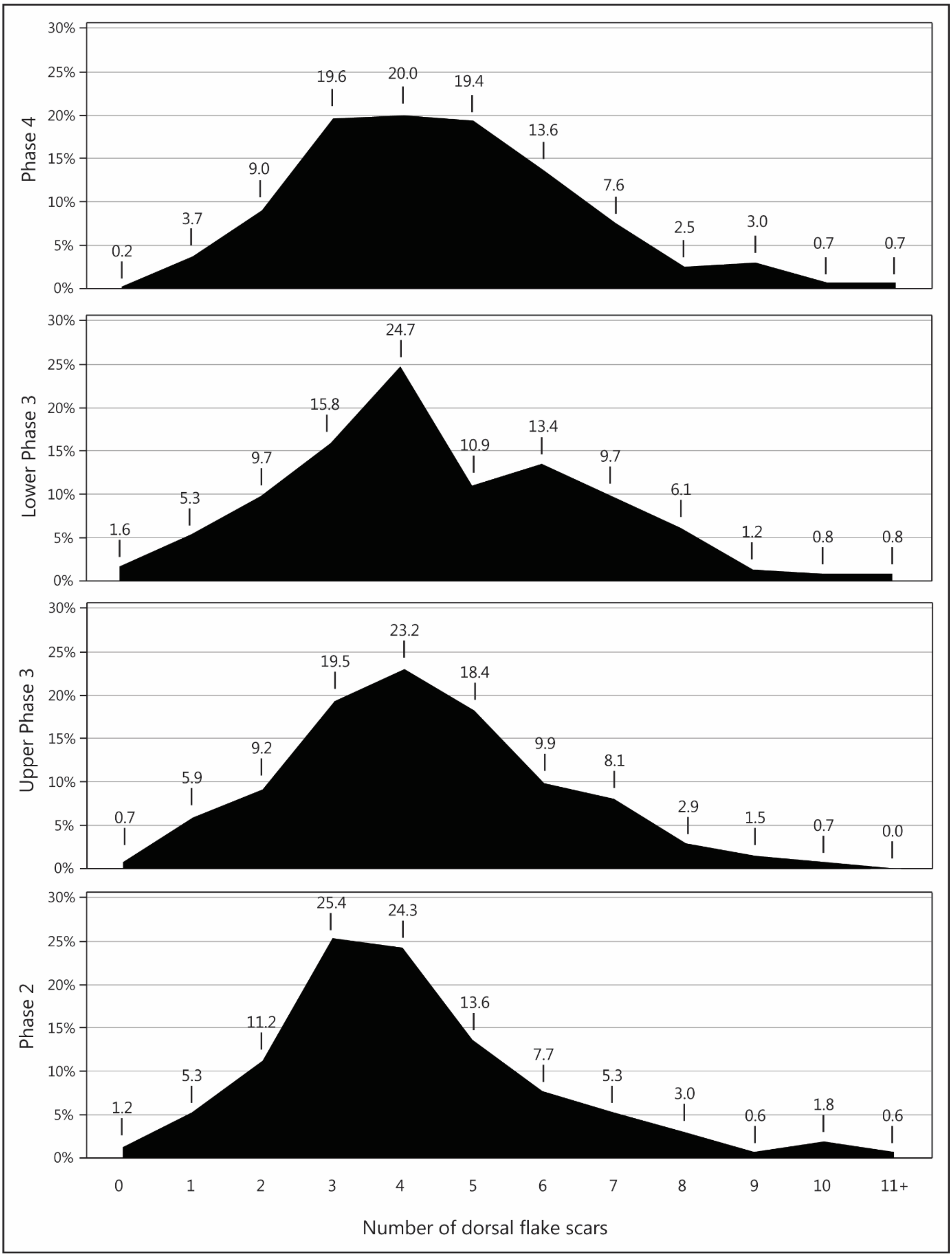


Figure 4.14: Numbers of dorsal scars on flakes, by phase.

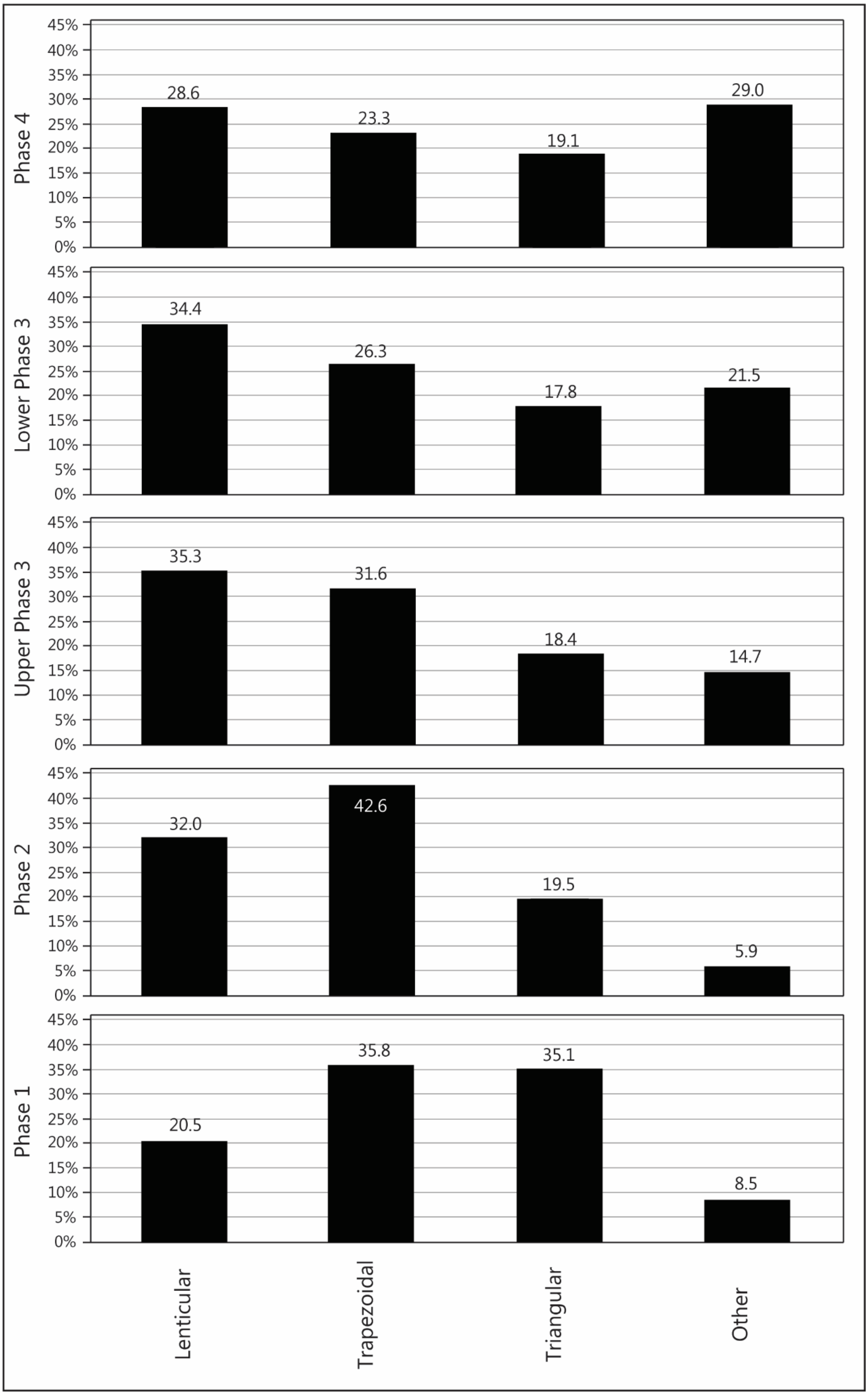


Figure 4.15: Flake cross-section types, by phase. Phase 1 data from Edwards 2013e: 136.

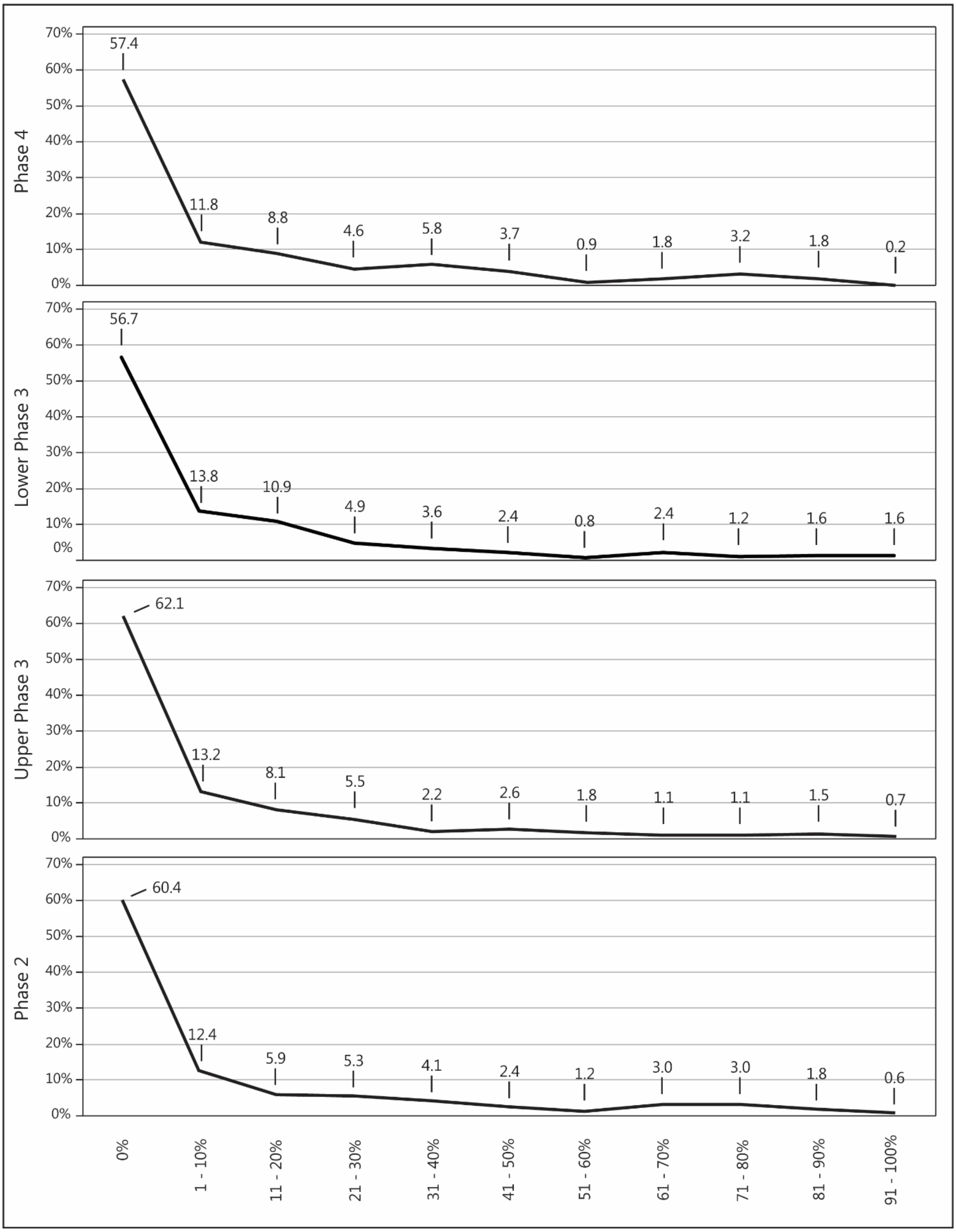


Figure 4.16: Flake dorsal surface cortex coverage, by phase.

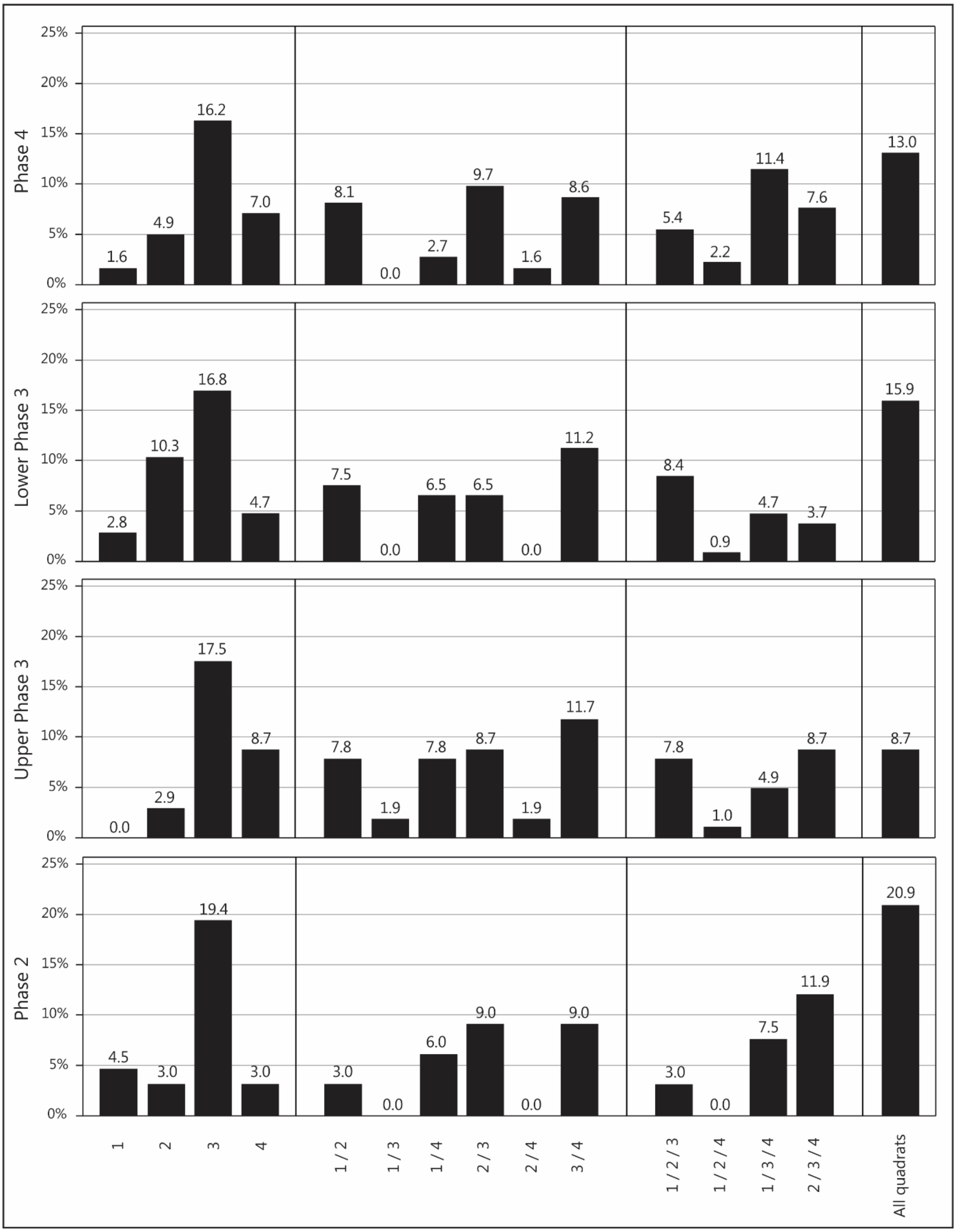


Figure 4.17: Flake cortex quadrat combinations, by phase.

Assuming that flakes with cortical coverage on three or four quadrats are indicative of a primary core-shaping process, then primary elements can be said to comprise between 12% and 17% of the flakes present in each assemblage.

4.5.2 Blades

The division between blades and bladelets at Wadi Hammeh 27 is essentially arbitrary, with the shortest blades and longest bladelets in each assemblage bordering the 50mm mark. Blade dimensions generally remain consistent through time aside from two exceptions. The first of these is in the Lower Phase 3, where the blades demonstrate slightly greater mean dimensions than the other three assemblages (**Table 4.20; Fig. 4.18**). However, given the low sample size, this situation may simply reflect bias created by the relatively low numbers in this sample.

Blade blanks differ from the flakes in that punctiform platforms exhibit an overall ascendancy (27.7%) over other platform variants. This attribute varies considerably over time, however, occurring on only a single blade from Phase 4, whereas half (N = 5) of the Phase 2 blades feature this attribute **(Table 4.21; Fig. 4.19**). Blades with plain platforms are also prominent in every assemblage aside from Lower Phase 3, from which only a single example was recorded. Blades with cortical platforms are entirely absent from each assemblage.

An even spread was recorded for the nine Phase 4 blades in terms of bulb prominence, whereas the later blade assemblages exhibit a rise in the proportion of blades with normal bulbs at the expense of those with diffuse bulbs (**Table 4.21**). Blades with multifaceted platforms feature higher platform angles than other varieties (**Table 4.13**), although this is likely biased due to the small sample size (N = 3) for these artefacts.

The proportions of blade termination types vary across the assemblages, again most likely reflecting the effect of low sample size. The Phase 4 and Upper Phase 3 blade assemblages exhibit a majority of feathered terminations, whereas the Lower Phase 3 and Phase 2 assemblages display a more even combination of blades with feathered and stepped terminations (**Table 4.21; Fig. 4.20**). Plunging terminations are far more common with the blades than with the flakes or bladelet assemblages. This aspect is particularly pronounced in the Upper Phase 3 assemblage, where over a third of the analysed blades exhibit plunging

Table 4.20: Blade dimensions, by phase.

	N	Length (mm)			Width (mm)			Thickness (mm)			Weight (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	9	57.7	9.4	50.2-78.7	21.8	4.1	13.6-27.0	7.3	2.9	4.5-13.3	8.6	4.3	2.9-18.8
Lower Phase 3	15	65.3	8.7	52.7-80.4	24.3	5.5	15.4-34.9	7.9	2.6	3.6-12.8	14.1	8.4	3.5-29.8
Upper Phase 3	13	59.4	8.7	50.5-79.1	22.2	6.2	12.5-34.2	6.3	2.8	2.7-10.9	8.7	6.5	1.9-25.9
Phase 2	10	58.0	11.8	50.1-89.2	21.6	2.6	17.3-26.2	5.3	1.8	3.2-9.4	6.8	3.9	2.2-14.7

Table 4.21: Blade attributes, by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2	
	N	%	N	%	N	%	N	%
Platform								
Absent	1	11.1	2	13.3	3	23.1	2	20.0
Cortical	0	0.0	0	0.0	0	0.0	0	0.0
Crushed	2	22.2	3	20.0	2	15.4	0	0.0
Dihedral Facetted	2	22.2	4	26.7	0	0.0	0	0.0
Multifacetted	0	0.0	2	13.3	1	7.7	0	0.0
Plain	3	33.3	1	6.7	3	23.1	3	30.0
Punctiform	1	11.1	3	20.0	4	30.8	5	50.0
Total	**9**	**99.9**	**15**	**100.0**	**13**	**100.1**	**10**	**100.0**
Bulb of percussion								
Diffuse	3	33.3	2	13.3	3	23.1	1	10.0
Normal	3	33.3	8	53.3	6	46.2	6	60.0
Prominent	3	33.3	5	33.3	4	30.8	3	30.0
Total	**9**	**99.9**	**15**	**99.9**	**13**	**100.1**	**10**	**100.0**
Bulbar scar								
Present	2	22.2	7	46.7	6	46.2	3	30.0
Absent	7	77.8	8	53.3	7	53.8	7	70.0
Total	**9**	**100.0**	**15**	**100.0**	**13**	**100.0**	**10**	**100.0**
Overhang removal								
Present	5	55.6	9	60.0	5	38.5	4	50.0
Absent	4	44.4	6	40.0	8	61.5	4	50.0
Total	**9**	**100.0**	**15**	**100.0**	**13**	**100.0**	**8**	**100.0**
Flake scar orientation								
Bi-directional crossed	1	11.1	1	6.7	3	23.1	0	0.0
Bi-directional along axis	0	0.0	0	0.0	0	0.0	0	0.0
Change of orientation	4	44.4	5	33.3	6	46.2	0	0.0
Radial	0	0.0	3	20.0	0	0.0	2	20.0
Unidirectional	4	44.4	6	40.0	4	30.8	8	80.0

Total	**9**	**99.9**	**15**	**100.0**	**13**	**100.1**	**10**	**100.0**
Shape								
Canted	1	11.1	2	13.3	3	23.1	3	30.0
Expanding	2	22.2	4	26.7	2	15.4	1	10.0
Irregular	1	11.1	1	6.7	1	7.7	0	0.0
Ovoid	0	0.0	0	0.0	0	0.0	0	0.0
Rectangular	2	22.2	7	46.7	3	23.1	1	10.0
Triangular	3	33.3	1	6.7	4	30.8	5	50.0
Total	**9**	**99.9**	**15**	**100.1**	**13**	**100.1**	**10**	**100.0**
Profile								
Flat	2	22.2	2	13.3	3	23.1	2	20.0
Incurvate	5	55.6	9	60.0	8	61.5	7	70.0
Outcurving	1	11.1	1	6.7	0	0.0	0	0.0
Twisted	1	11.1	3	20.0	2	15.4	1	10.0
Total	**9**	**100.0**	**15**	**100.0**	**13**	**100.0**	**10**	**100.0**
Cross-section								
Lenticular	2	22.2	2	13.3	0	0.0	1	10.0
Trapezoidal	6	66.7	7	46.7	7	53.8	5	50.0
Triangular	1	11.1	4	26.7	5	38.5	3	30.0
Other	0	0.0	2	13.3	1	7.7	1	10.0
Total	**9**	**100.0**	**15**	**100.0**	**13**	**100.0**	**10**	**100.0**
Termination								
Feathered	6	66.7	5	33.3	7	53.8	4	40.0
Hinged	0	0.0	3	20.0	1	7.7	2	20.0
Plunging	2	22.2	2	13.3	5	38.5	1	10.0
Stepped	1	11.1	5	33.3	0	0.0	3	30.0
Total	**9**	**100.0**	**15**	**99.9**	**13**	**100.0**	**10**	**100.0**

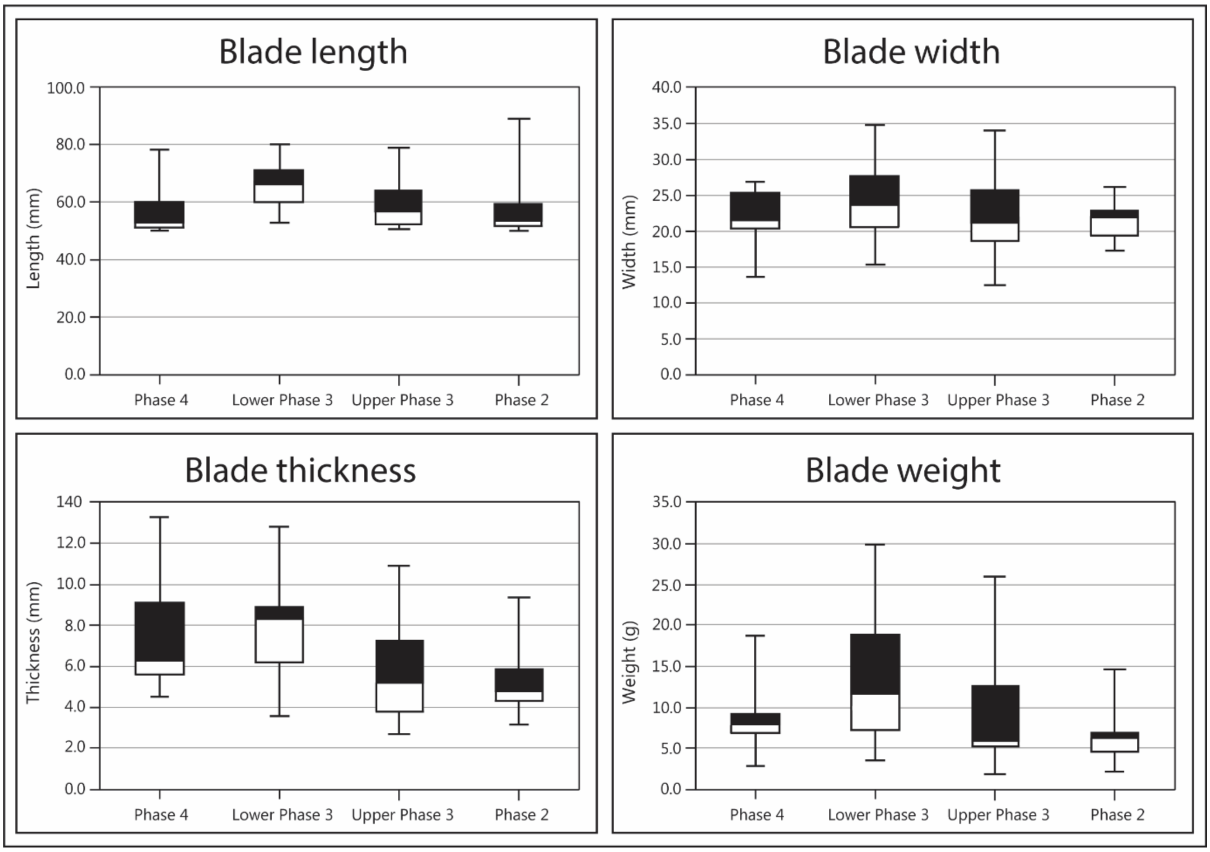


Figure 4.18: Blade dimensions, by phase.

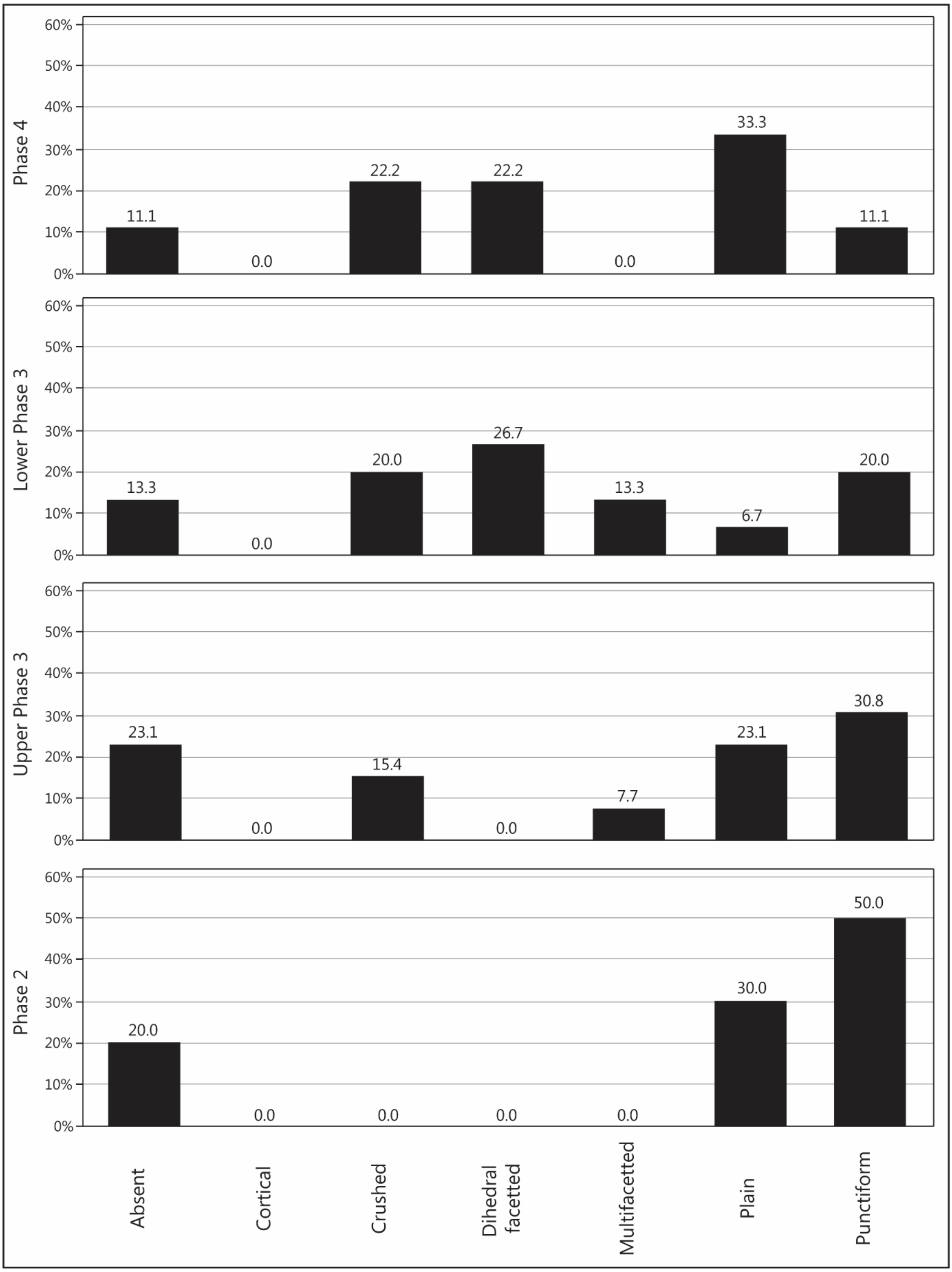


Figure 4.19: Blade platform types, by phase.

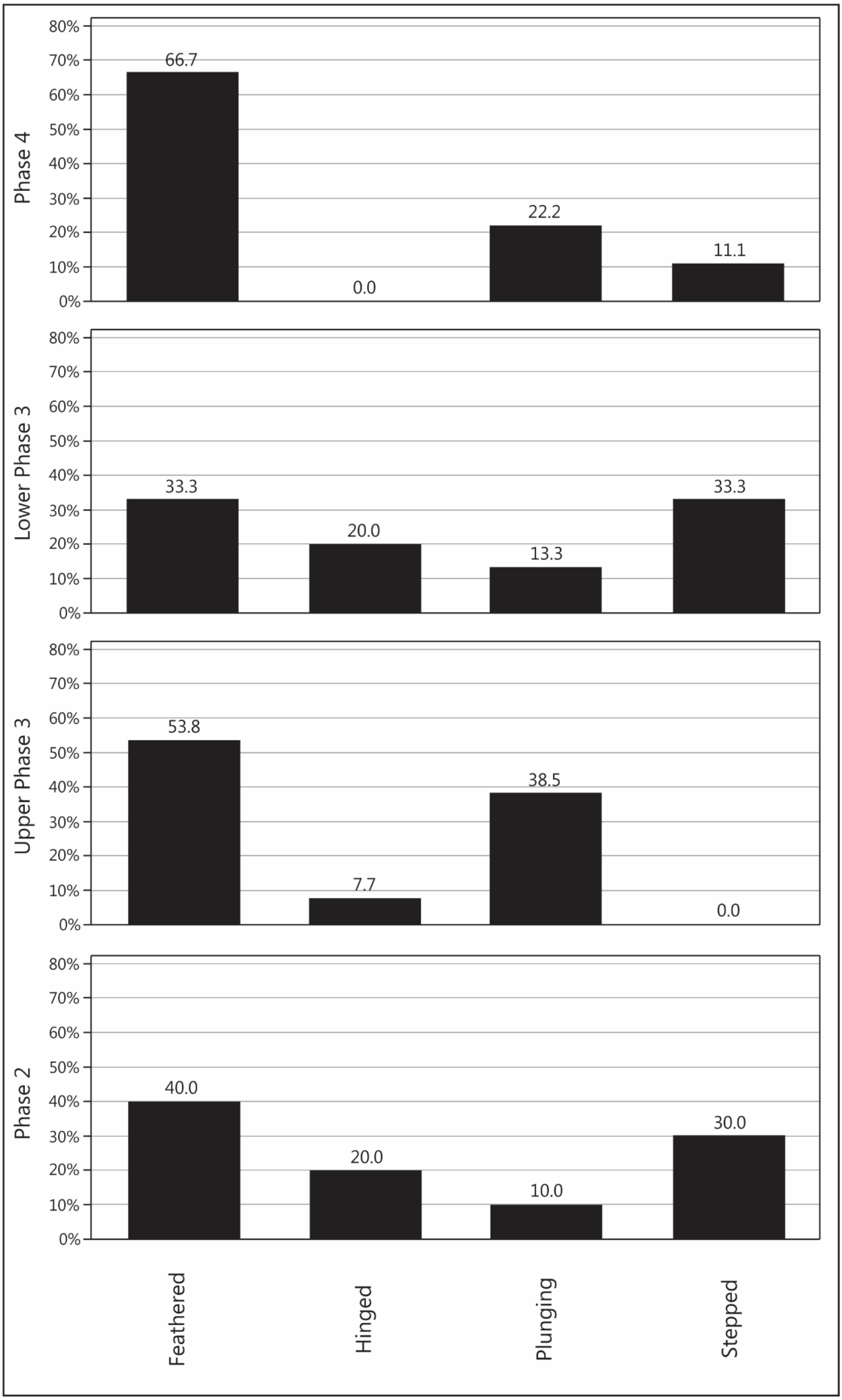


Figure 4.20: Blade termination types, by phase.

terminations (38.5%; N = 5). Blade profiles are overwhelmingly incurvate in each assemblage (**Table 4.21; Fig. 4.21**), with this dominance gradually becoming more pronounced between Phase 4 (55.6%, N = 5) and Phase 2 (70.0%, N = 7).

Blade shapes vary over time, with the rectangular blades in Lower Phase 3 (46.7%, N = 7) and Phase 2 triangular blades (50.0%, N = 5) exhibiting clear majorities, whereas the Phase 4 and Upper Phase 3 samples display more even spreads (**Table 4.21; Fig. 4.22**). Ovoid blades are non-existent at Wadi Hammeh 27, an unsurprising result given the intrinsic restrictions placed on blade form by definition.

The dorsal flake scar orientation on blades varies by phase (**Table 4.21**; **Fig. 4.23**). The Phase 4 assemblage is characterised by unidirectional and change of orientation blades (44.4%; N = 4), with no examples of radial blades. Blades with a unidirectional layout (40.0%; N = 6) narrowly outnumbered those with a change of orientation layout in the Lower Phase 3 (33.3%; N = 5), with some examples of radial blades (20.0%; N = 3) also present. This trend is then reversed in the Upper Phase 3 assemblage, where change of orientation blades (46.2%; N = 6) outnumber unidirectional blades (30.8%; N = 4). Blades with a bi-directional (crossed) pattern are also relatively common in this assemblage (23.1%; N = 3), while radial blades are absent. This pattern is once again inverted in Phase 2, where unidirectional blades dominate the assemblage (80.0%; N = 8), being supplemented by two blades with radial scar orientations.

Blades with a radial flake scar pattern possess far more flake scars on average than the other orientations, with a mean of ten flake scars in Lower Phase 3 and eight in Phase 2 (**Table 4.16**). The mean number of flake scars on unidirectional blades appears to decline over time, with six in Phase 4 and four in Phase 2. The blades of each assemblage generally possess trapezoidal cross-sections (**Table 4.21**; **Fig. 4.24**), being supplemented primarily by triangular blades in every assemblage aside from Phase 4, where blades with a lenticular cross-section are instead more common.

While the mean and standard deviation values of cortex coverage on the blades varies across assemblages (**Table 4.18**), this is probably due to the inclusion of cortex-rich outliers in the small samples rather than representative of any identifiable trend. The placement of cortex shows an even greater bias towards the distal end of the blades than seen with the flakes, with half of the analysed blades featuring cortex in either quadrat 3 or a combination of quadrats 2/3 or 3/4 (**Table 4.19**).

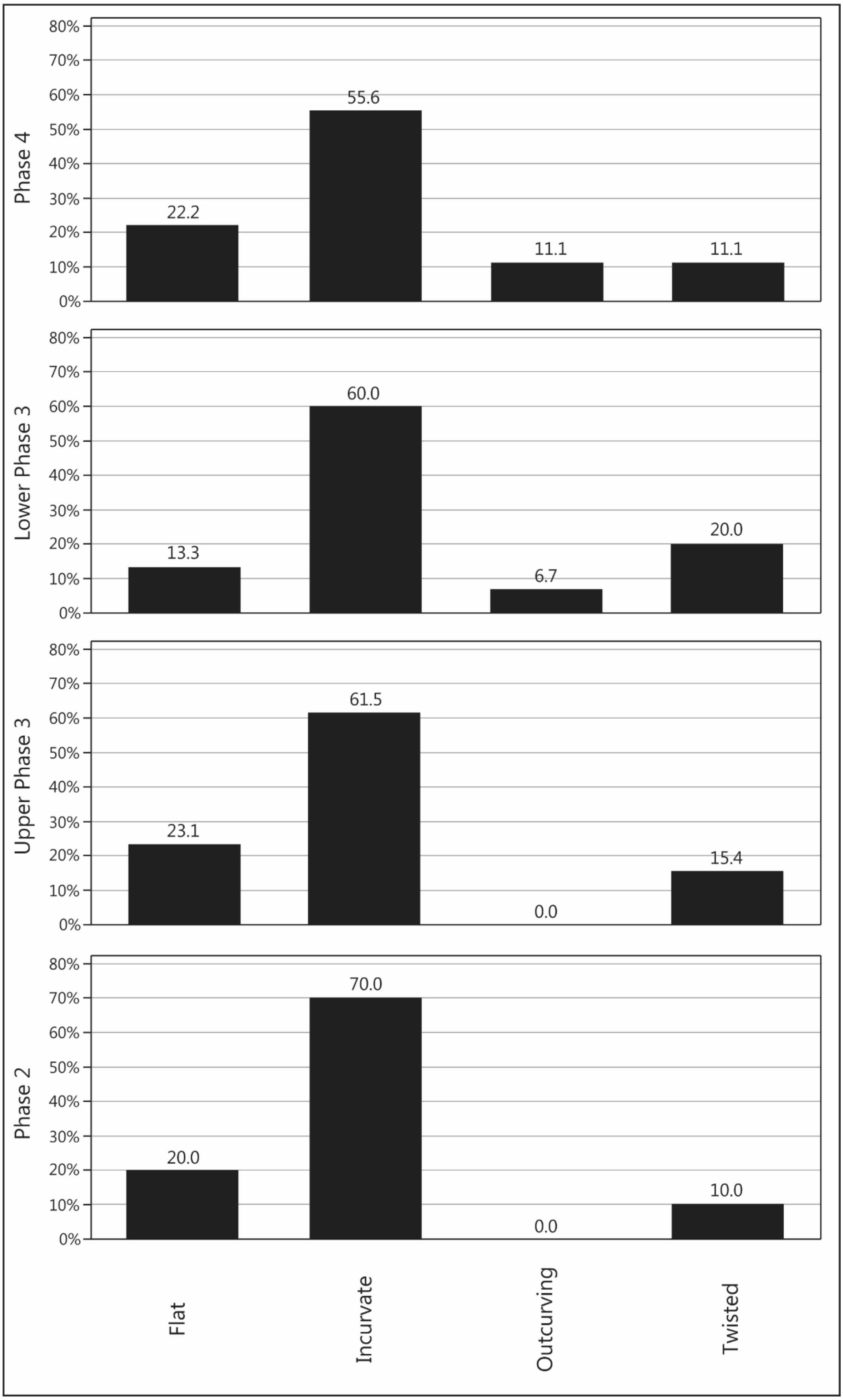


Figure 4.21: Blade profile types, by phase.

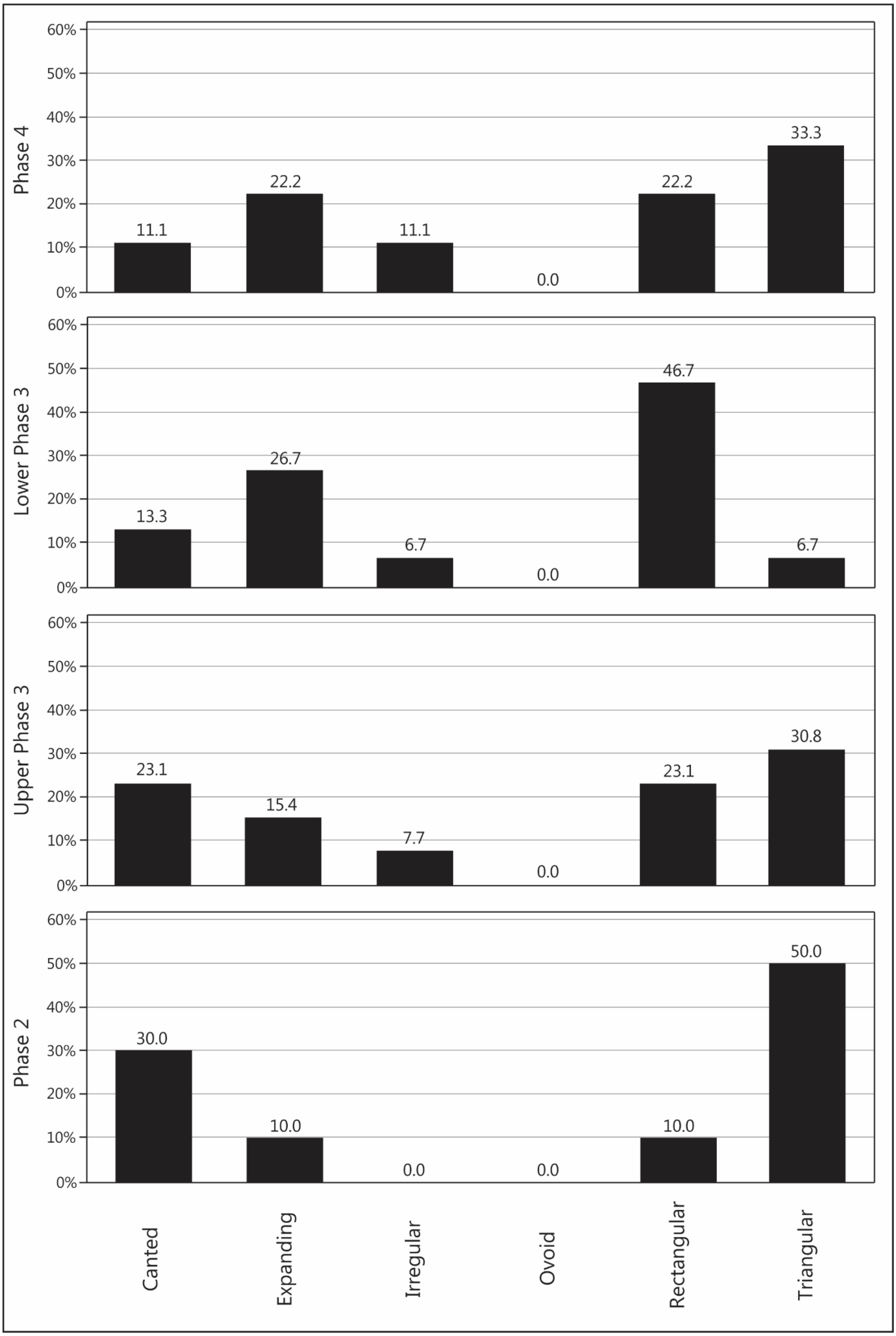


Figure 4.22: Blade shape, by phase.

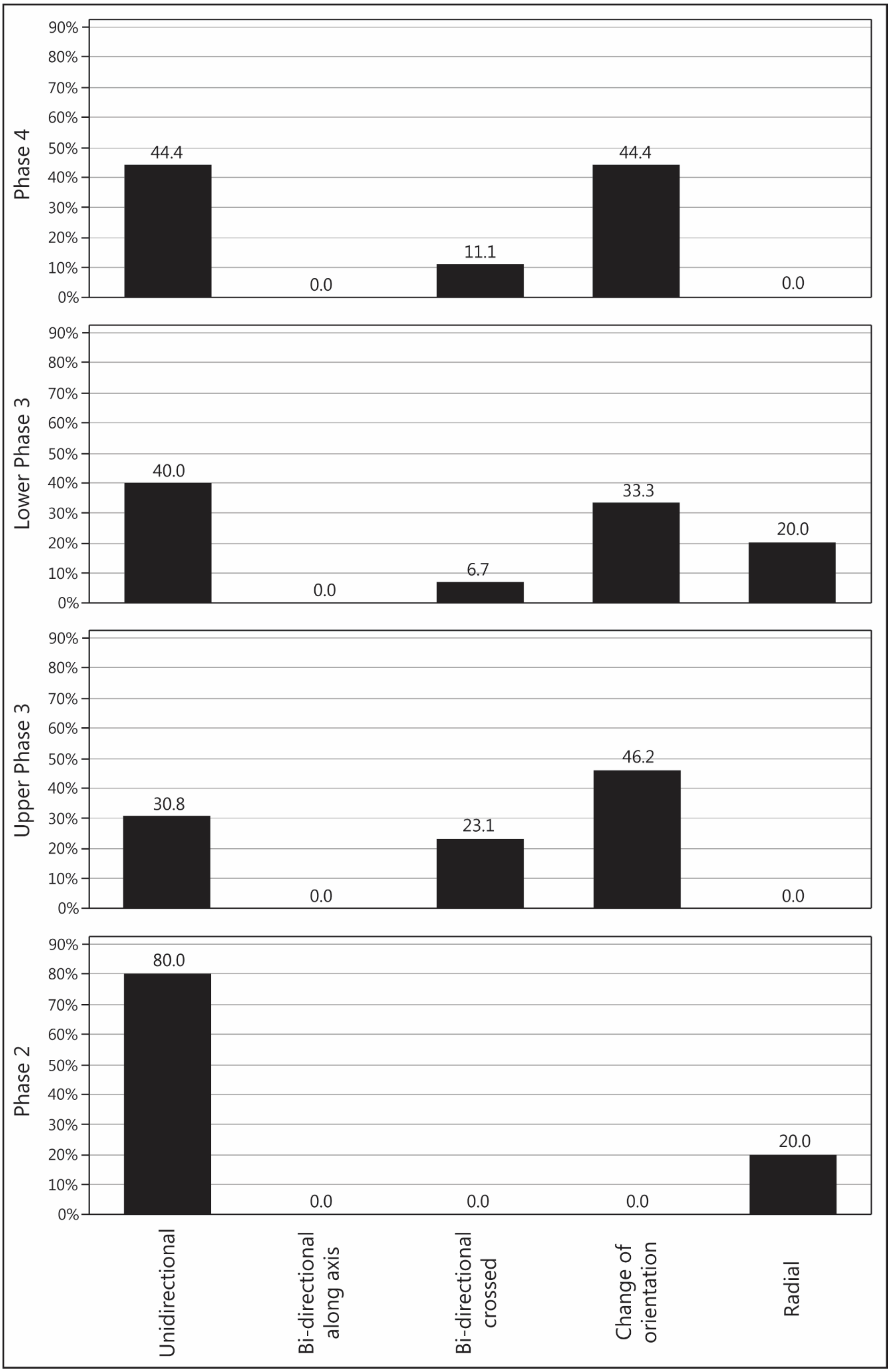


Figure 4.23: Blade dorsal scar orientation, by phase.

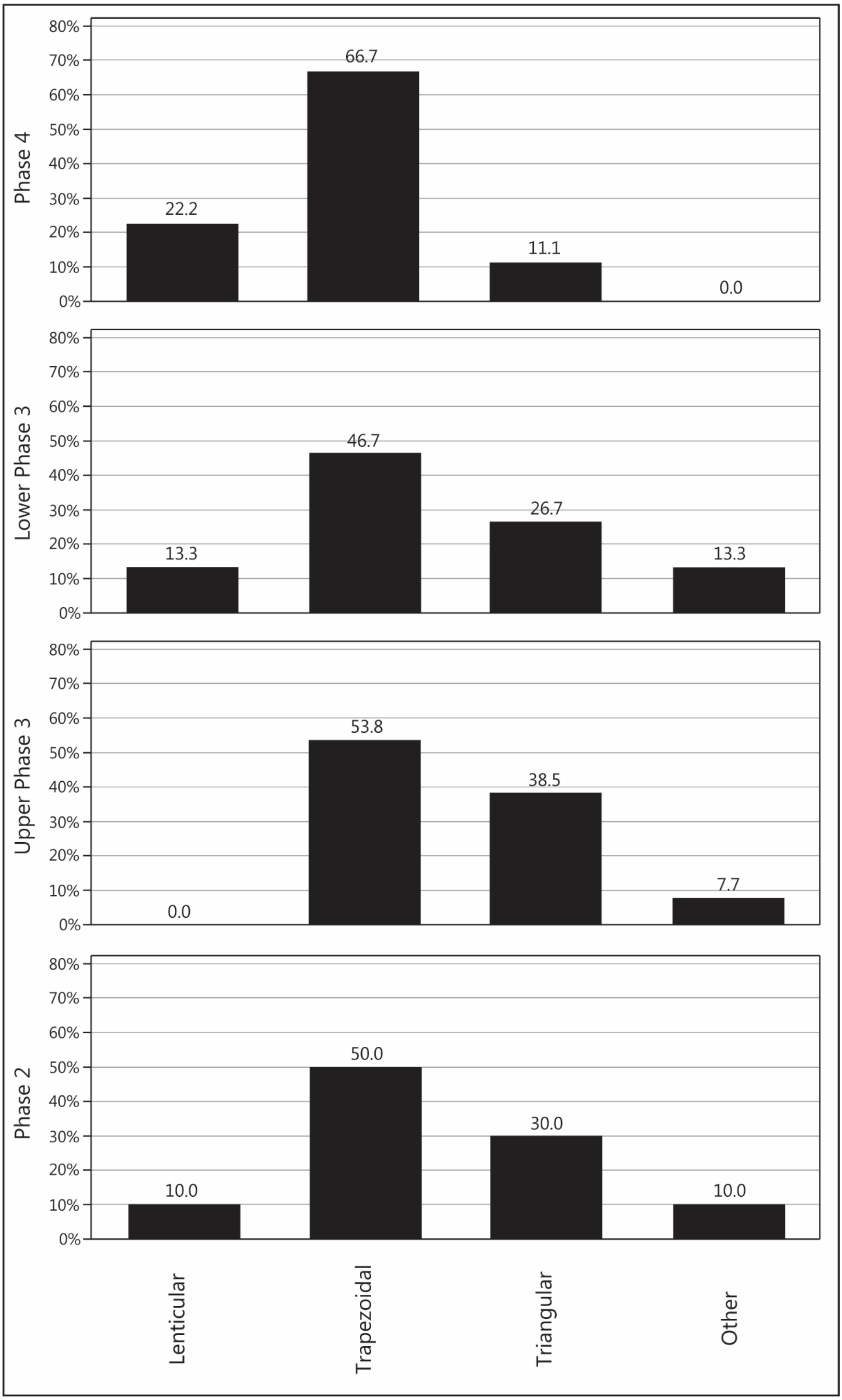


Figure 4.24: Blade cross-section types, by phase.

4.5.3 Bladelets

The intact bladelets exhibit consistent dimensions across the four assemblages, with mean lengths clustered tightly between 29mm to 30mm (**Table 4.22**; **Fig. 4.25**). Standard deviation values remain low for width, thickness and weight, although bladelet length demonstrate a relatively greater amount of variation.

As with the blades, punctiform platforms are commonly encountered amongst the bladelets of Wadi Hammeh 27 (**Table 4.23**; **Fig. 4.26**). This attribute peaks in Lower Phase 3 (36.2%; N = 75), before gradually declining to their lowest representation in Phase 1 (11.4%; N = 24). Bladelets with 'absent' platforms are also well represented in the earlier assemblages of Wadi Hammeh 27, before dropping considerably in Phase 1. The proportions of crushed bladelet platforms remain static over time, encompassing a quarter of each assemblage. Facetted platforms on bladelets are consistently uncommon between Phase 4 and Phase 2, before all but disappearing in the Phase 1 assemblages. In contrast, the proportion of bladelets featuring plain platforms skyrockets in Phase 1, a drastic shift considering that this platform type is regularly outnumbered by punctiform, crushed and platforms in the preceding assemblages. The scarcity of cortical bladelet platforms in each assemblage recalls blade assemblages, in that both classes were largely produced subsequent to the initial core-shaping process.

Bladelets with a normal-sized bulb of percussion are most common in every assemblage aside from Phase 1, which instead features a greater proportion of bladelets with diffuse bulbs at the expense of the other two types (**Table 4.23**). Bladelets with acute platform angles were consistently manufactured at Wadi Hammeh 27, with each assemblage exhibiting a unimodal distribution peaking between 71º - 80º (**Fig. 4.27**). Unlike the flakes, bladelet platform angles remain consistently similar regardless of the corresponding platform type (**Table 4.13**), although they exhibit a similar, overall increase over time between 73.5º in Phase 4 to 79.3º in Phase 2 (**Table 4.14**).

Feathered terminations are easily the most common variant amongst the Wadi Hammeh 27 bladelets, albeit with significant inter-phase fluctuation (**Table 4.23; Fig. 4.28**). This variation largely correlates with the occurrence of punctiform platforms amongst the bladelets, with a maximum proportion of feathered bladelets present in the Lower Phase 3 assemblage (73.9%; N = 153), before gradually declining to a low point in Phase 1 (45.3%; N = 87). This trendline is mirrored by the occurrence of bladelets with plunging and stepped platforms, which are least common in Lower Phase 3 and most common in Phase 1. Bladelet

Table 4.22: Bladelet dimensions, by phase. Phase 1 data from Edwards (2013e: 138).

	N	Length (mm)			Width (mm)			Thickness (mm)			Weight (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	229	29.8	7.5	20.0-49.5	11.7	3.3	4.8-22.3	3.1	1.3	1.2-8.7	1.2	1.2	0.1-8.9
Lower Phase 3	207	28.8	6.5	20.0-46.4	11.5	3.3	5.8-22.0	3.1	1.2	1.3-7.9	1.1	1.0	0.1-7.0
Upper Phase 3	210	29.3	6.7	20.2-49.7	11.8	3.3	5.0-23.6	3.2	1.2	1.3-9.2	1.2	1.1	0.1-7.2
Phase 2	119	30.5	7.5	20.3-48.8	12.1	3.3	6.3-22.0	3.5	1.7	1.3-14.2	1.6	1.9	0.1-15.0
Phase 1 (XX E)	135	28.7	6.8	9.0-45.2	12.9	3.3	6.0-23.0	4.6	1.9	2.0-11.0	1.6	1.4	0.2-8.8

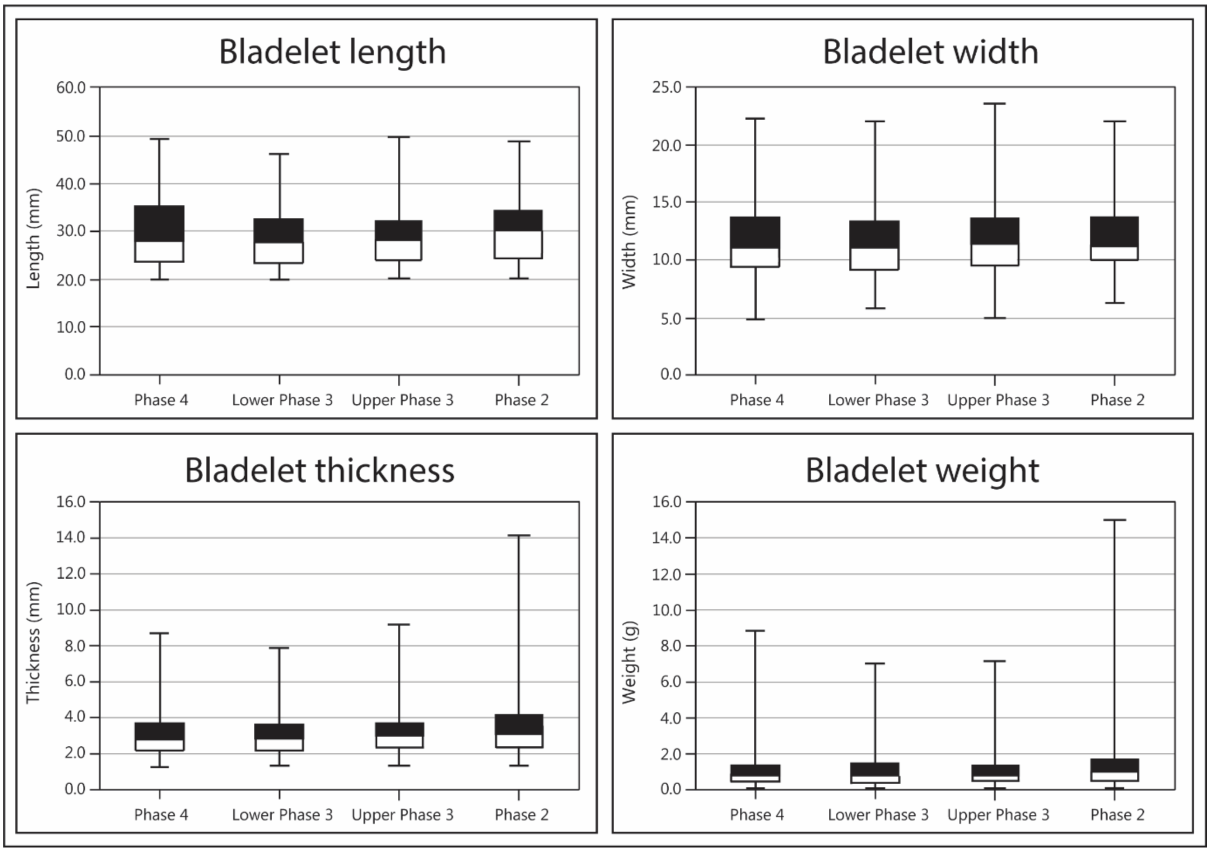


Figure 4.25: Bladelet dimensions, by phase.

Table 4.23: Bladelet attributes, by phase. Phase 1 data from Edwards (2013: 139).

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Phase 1 (XX D, E, J & K)	
	N	%	N	%	N	%	N	%	N	%
Platform										
Absent	70	30.6	51	24.6	55	26.2	37	31.1	25	11.9
Cortical	5	2.2	0	0.0	2	1.0	0	0.0	10	4.8
Crushed	60	26.2	59	28.5	60	28.6	31	26.1	53	25.2
Dihedral Facetted	12	5.2	14	6.8	14	6.7	9	7.6	0	0.0
Multifacetted	3	1.3	1	0.5	1	0.5	4	3.4	3	1.4
Plain	23	10.0	7	3.4	18	8.6	15	12.6	95	45.2
Punctiform	56	24.5	75	36.2	60	28.6	23	19.3	24	11.4
Total	**229**	**100.0**	**207**	**100.0**	**210**	**100.2**	**119**	**100.1**	**210**	**99.9**
Bulb of percussion										
Diffuse	70	30.6	45	21.7	45	21.4	34	28.6	116	55.2
Normal	116	50.7	112	54.1	110	52.4	59	49.6	72	34.3
Prominent	43	18.8	50	24.2	55	26.2	26	21.8	22	10.5
Total	**229**	**100.1**	**207**	**100.0**	**210**	**100.0**	**119**	**100.0**	**210**	**100.0**
Bulbar scar										
Present	97	42.4	71	34.3	83	39.5	57	47.9	112	53.3
Absent	132	57.6	136	65.7	127	60.5	62	52.1	98	46.7
Total	**229**	**100.0**	**207**	**100.0**	**210**	**100.0**	**119**	**100.0**	**210**	**100.0**
Overhang removal										
Present	108	47.2	105	50.7	102	48.6	23	31.9	-	-
Absent	121	52.8	102	49.3	108	51.4	49	68.1	-	-
Total	**229**	**100.0**	**207**	**100.0**	**210**	**100.0**	**72**	**100.0**	**-**	**-**
Dorsal scar orientation										
Bi-directional crossed	18	7.9	14	6.8	18	8.6	17	14.3	17	8.2
Bi-directional along axis	1	0.4	0	0.0	1	0.5	0	0.0	4	1.9
Change of orientation	53	23.1	58	28.0	53	25.2	19	16.0	76	36.7
Radial	15	6.6	7	3.4	9	4.3	6	5.0	2	1.0
Unidirectional	142	62.0	128	61.8	129	61.4	77	64.7	108	52.2
Total	**229**	**100.0**	**207**	**100.0**	**210**	**100.0**	**119**	**100.0**	**207**	**100.0**
Shape										
Canted	37	16.2	31	15.0	21	10.0	17	14.3	18	8.6
Expanding	22	9.6	19	9.2	32	15.2	12	10.1	5	2.4
Irregular	11	4.8	12	5.8	9	4.3	2	1.7	43	20.5
Ovoid	0	0.0	2	1.0	1	0.5	0	0.0	10	4.8
Rectangular	92	40.2	88	42.5	88	41.9	67	56.3	101	48.1
Triangular	67	29.3	55	26.6	59	28.1	21	17.6	33	15.7
Total	**229**	**100.1**	**207**	**100.1**	**210**	**100.0**	**119**	**100.0**	**210**	**100.1**
Profile										
Flat	27	11.8	31	15.0	36	17.1	18	15.1	22	10.5
Incurvate	160	69.9	142	68.6	140	66.7	83	69.7	160	76.2
Outcurving	5	2.2	2	1.0	2	1.0	0	0.0	6	2.9
Twisted	37	16.2	32	15.5	32	15.2	18	15.1	22	10.5
Total	**229**	**100.1**	**207**	**100.1**	**210**	**100.0**	**119**	**99.9**	**210**	**100.1**
Cross-section										

Lenticular	32	14.0	40	19.3	47	22.4	10	8.4	25	11.9
Trapezoidal	87	38.0	72	34.8	71	33.8	52	43.7	61	29.0
Triangular	76	33.2	73	35.3	78	37.1	48	40.3	111	52.9
Other	34	14.8	22	10.6	14	6.7	9	7.6	13	6.2
Total	**229**	**100.0**	**207**	**100.0**	**210**	**100.0**	**119**	**100.0**	**210**	**100.0**
Termination										
Feathered	146	63.8	153	73.9	122	58.1	63	52.9	87	45.3
Hinged	14	6.1	20	9.7	26	12.4	14	11.8	27	14.1
Plunging	18	7.9	11	5.3	14	6.7	14	11.8	26	13.5
Stepped	51	22.3	23	11.1	48	22.9	28	23.5	52	27.1
Total	**229**	**100.1**	**207**	**100.0**	**210**	**100.1**	**119**	**100.0**	**192**	**100.0**

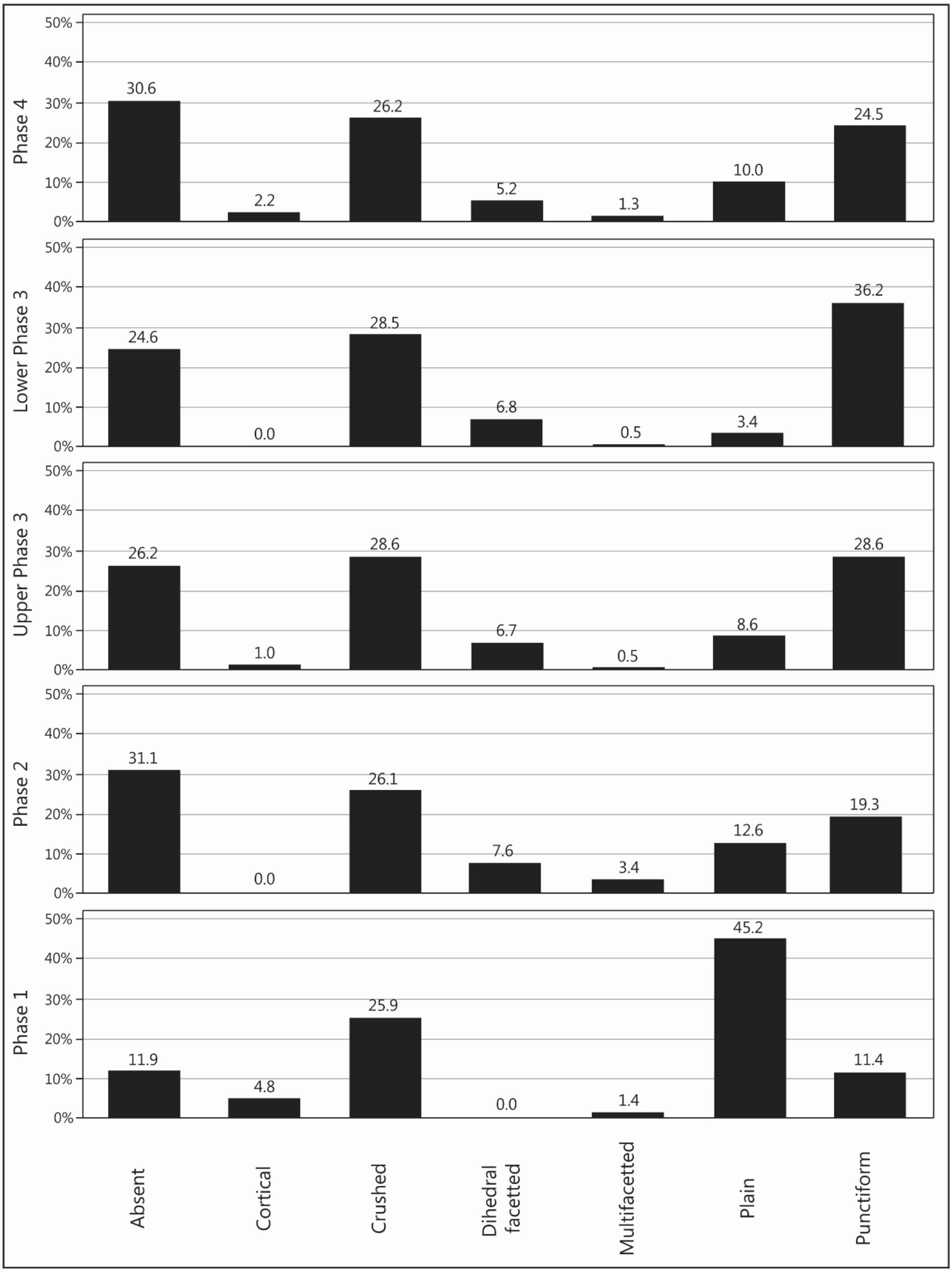


Figure 4.26: Bladelet platform types, by phase. Phase 1 data from Edwards 2013e: 139.

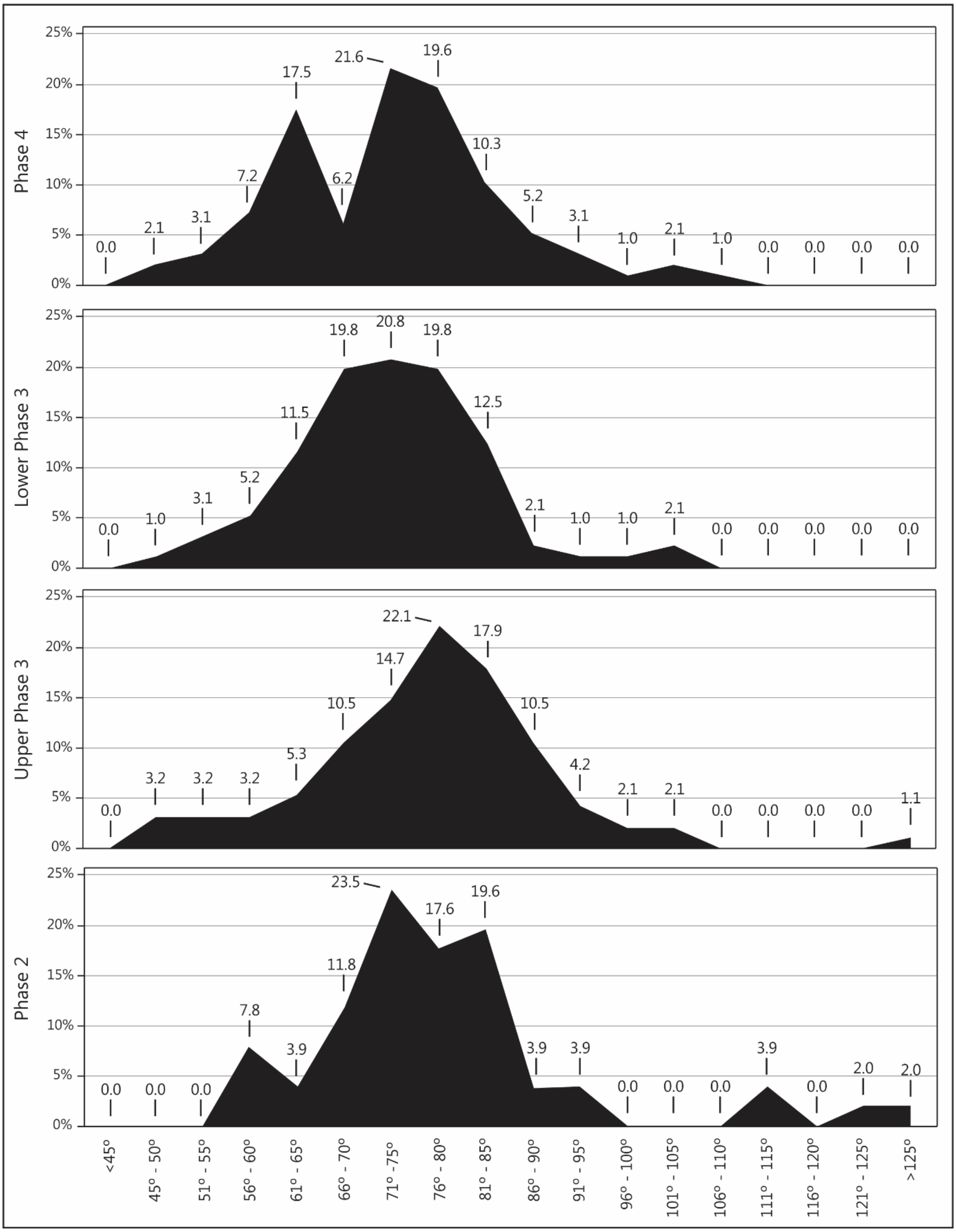


Figure 4.27: Bladelet platform angle variation, by phase.

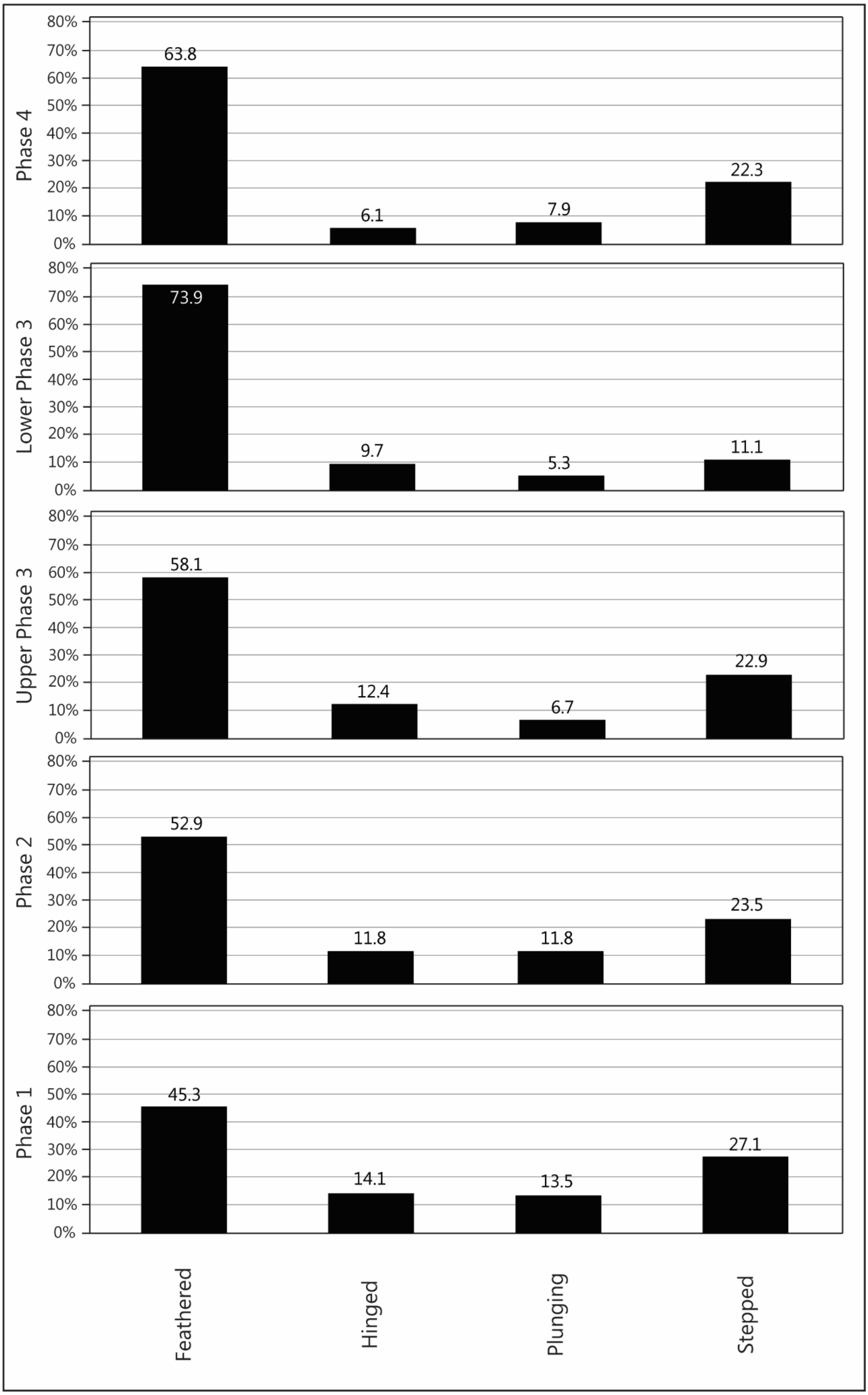


Figure. 4.28: Bladelet termination types, by phase. Phase 1 data from Edwards 2013e: 139.

profiles are reminiscent of the blades, with incurvate bladelets consistently dominating each assemblage (**Table 4.23; Fig. 4.29**).

The bladelets differ from the flakes and blades in that pieces with a rectangular shape characterise each assemblage, becoming especially pronounced in Phases 2 and 1 (**Table 4.23; Fig. 4.30**). In contrast, the proportions of bladelets with a triangular form drop in the final two assemblages, with triangular bladelets being the second most common variant between Phase 4 and Upper Phase 3. While canted and expanding bladelets occur in relatively low proportions between Phase 4 and 2, these shapes also become scarce in Phase 1. Conversely, bladelets with irregular and ovoid forms are far more common in Phase 1 compared to the underlying deposits.

Bladelets with unidirectional scar orientations dominate each assemblage, comprising a little over 60% of the pieces from Phase 4 through to Phase 2, before dropping slightly in Phase 1 (**Table 4.23**; **Fig. 4.31**). These specimens are supplemented primarily by change of orientation bladelets in every assemblage aside from Phase 2, where bladelets with a 'bi-directional crossed' orientation occur in almost equal numbers to change of orientation bladelets. The numerical distribution of dorsal scars on the bladelets mirror that of the flakes, with the Phase 4 and Phase 3 assemblages all exhibiting a unimodal distribution centred on pieces with four flake scars, whereas the focus in Phase 2 shifts to pieces with three dorsal scars (**Table 4.16; Fig. 4.32**). Unidirectional bladelets possess an average of four flake scars on their dorsal surface in every assemblage, with the other varieties consistently possessing larger numbers.

Bladelets generally possess either trapezoidal or triangular cross-sections, with little variation exhibited between Phases 4 and 2. (**Table 4.23**; **Fig. 4.33**). In contrast, the Phase 1 bladelets demonstrate a clear bias towards pieces with a triangular cross-section. A massive decline in the proportion of bladelets with lenticular profiles is also observable between the Upper Phase 3 and Phase 2 assemblages.

Cortex is considerably scarcer on the bladelets than any other type of debitage, with approximately three quarters of the Phase 4 and Upper Phase 3 bladelets being free of cortex, along with half of the Lower Phase 3 and Phase 2 assemblages (**Tables 4.17 - 4.18**; **Fig. 4.34**). Of the pieces which do feature cortex, a clear distributional bias towards the distal end of the bladelets is noted (**Table 4.19**; **Fig. 4.35**). This aspect is particularly evident with the Upper Phase 3 bladelets, where cortex is restricted to quadrat 3 in almost half of the cases

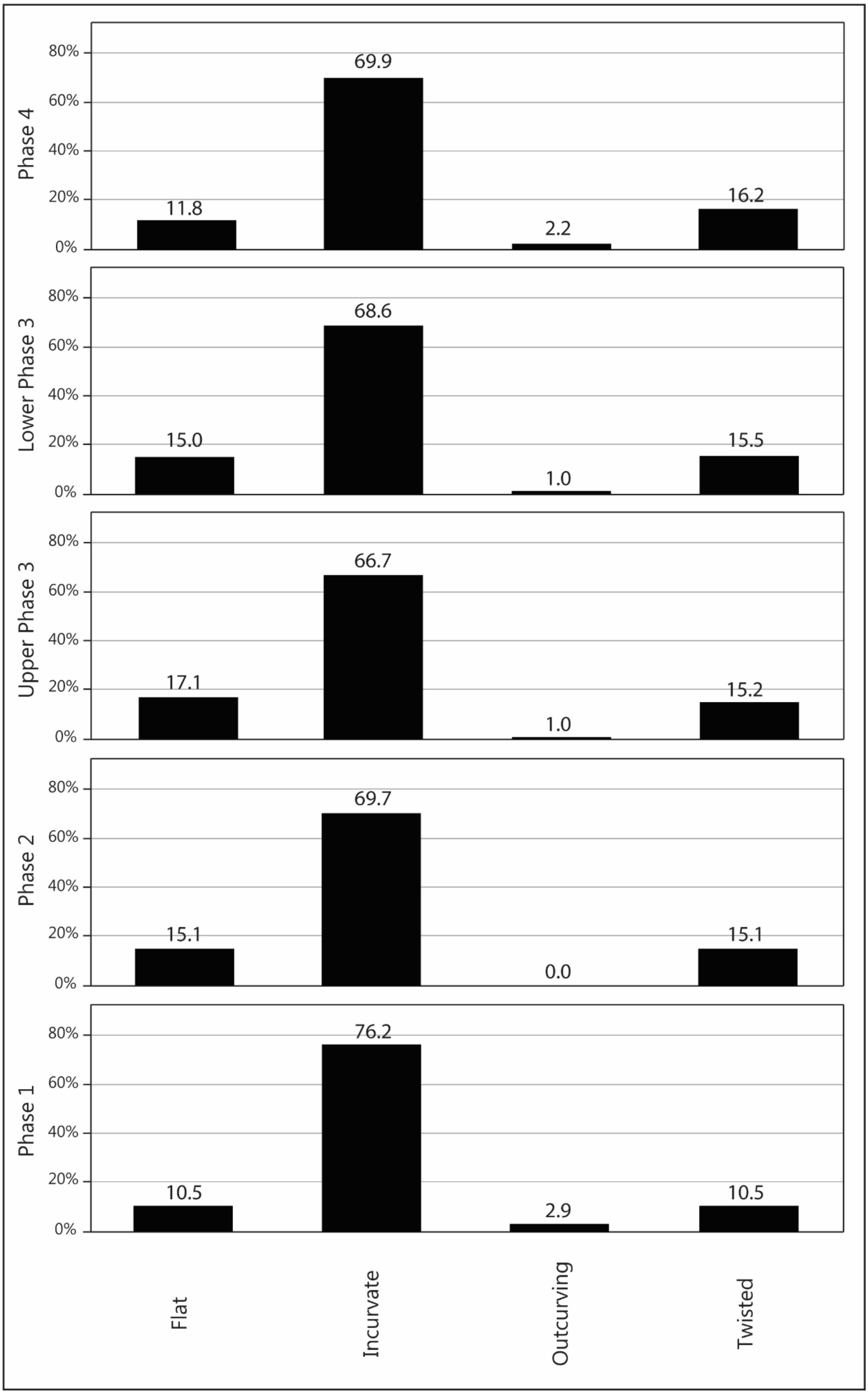


Figure 4.29: Bladelet profiles, by phase. Phase 1 data from Edwards 2013e: 139.

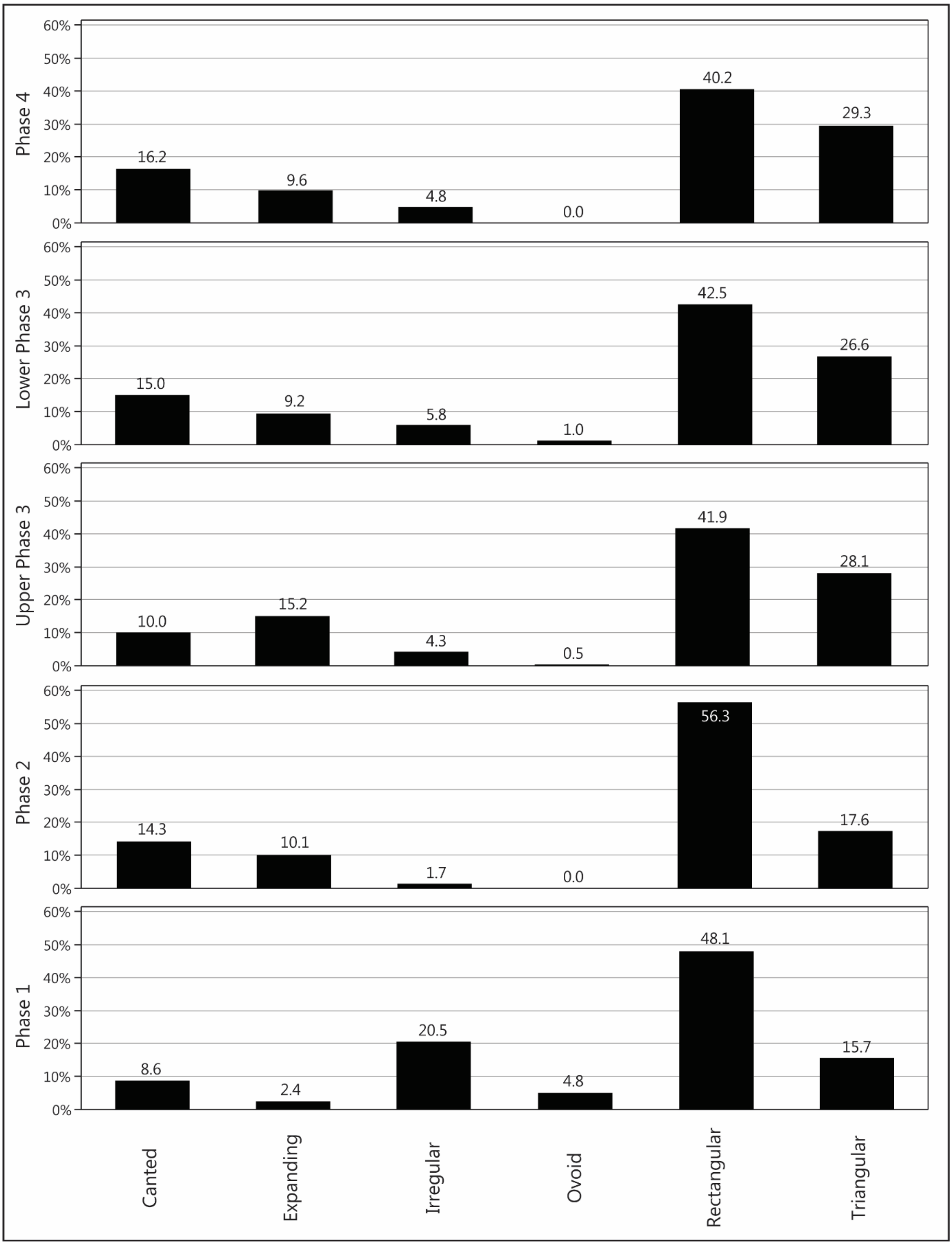


Figure 4.30: Bladelet shape, by phase. Phase 1 data from Edwards 2013e: 139.

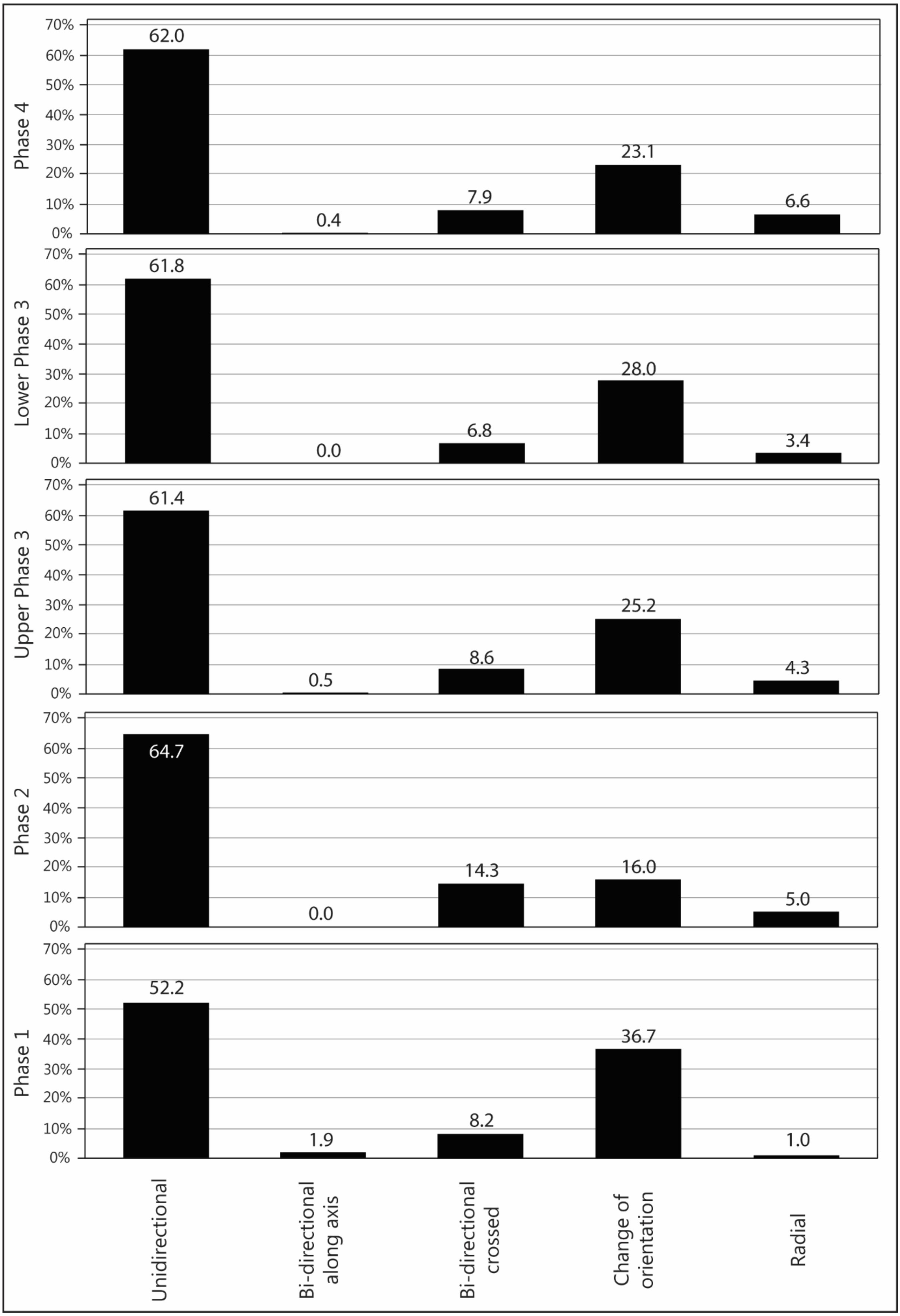


Figure 4.31: Bladelet dorsal scar orientation, by phase.

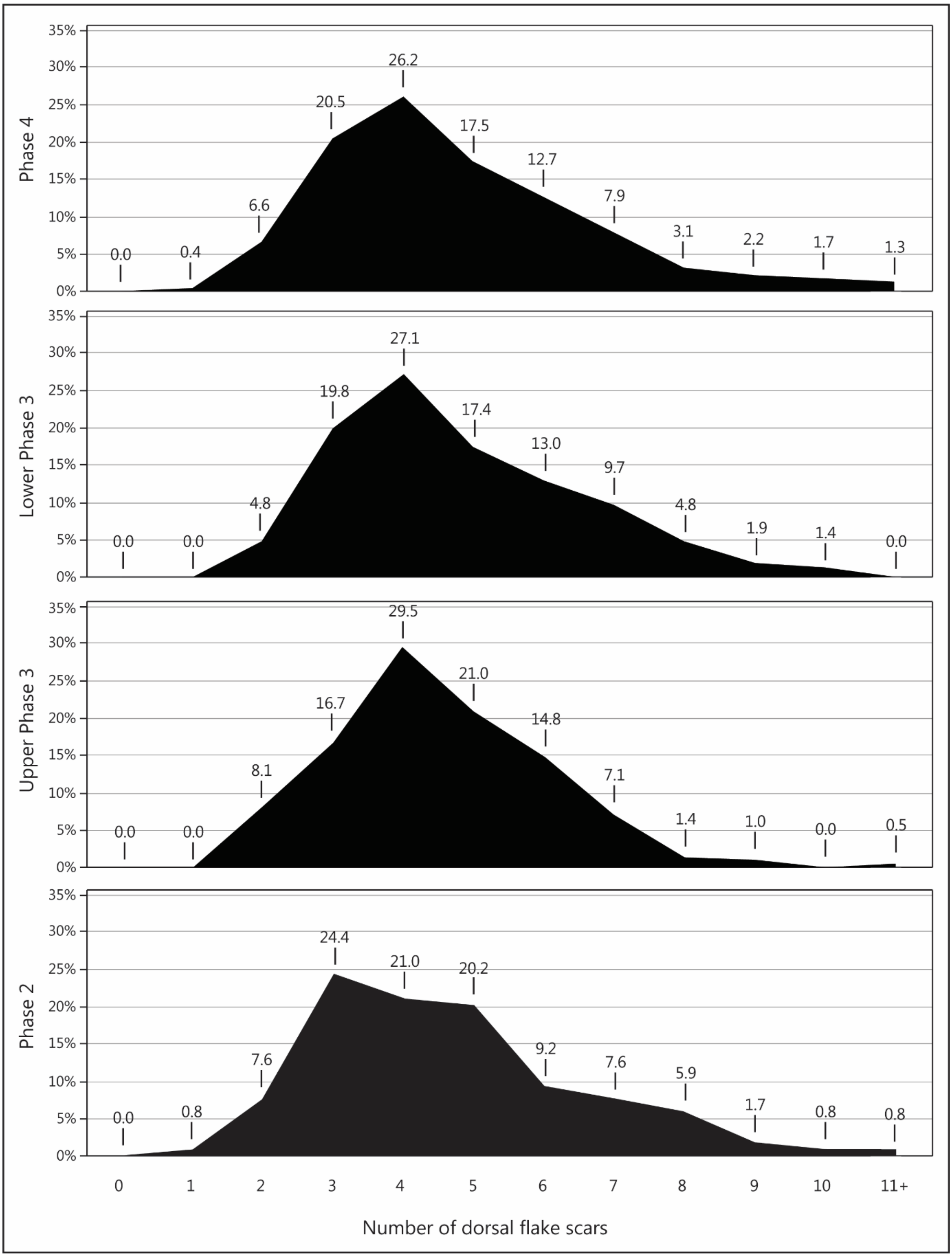


Figure 4.32: Number of dorsal flake scars on bladelets, by phase.

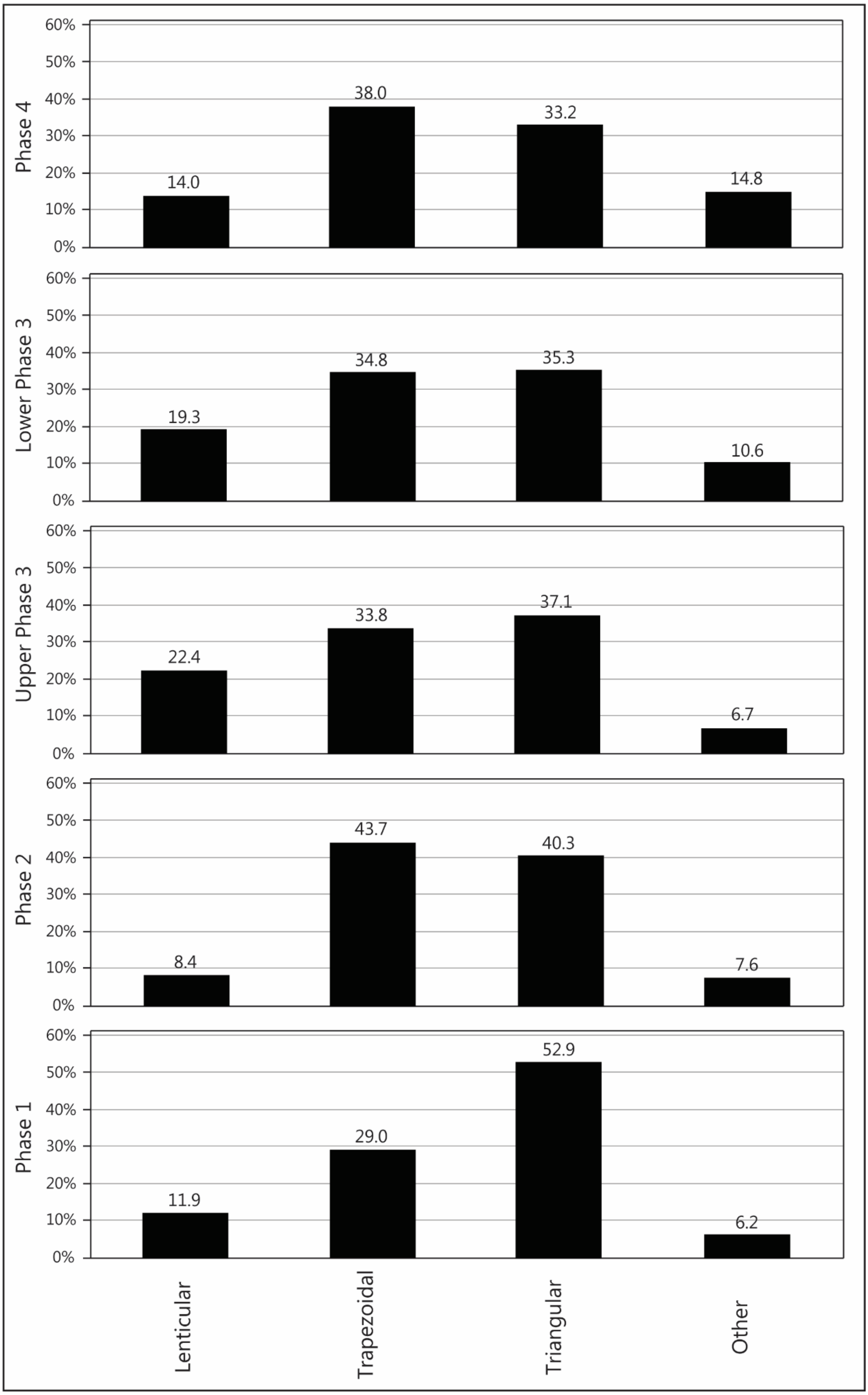


Figure 4.33: Bladelet cross-section types, by phase. Phase 1 data from Edwards 2013e: 139.

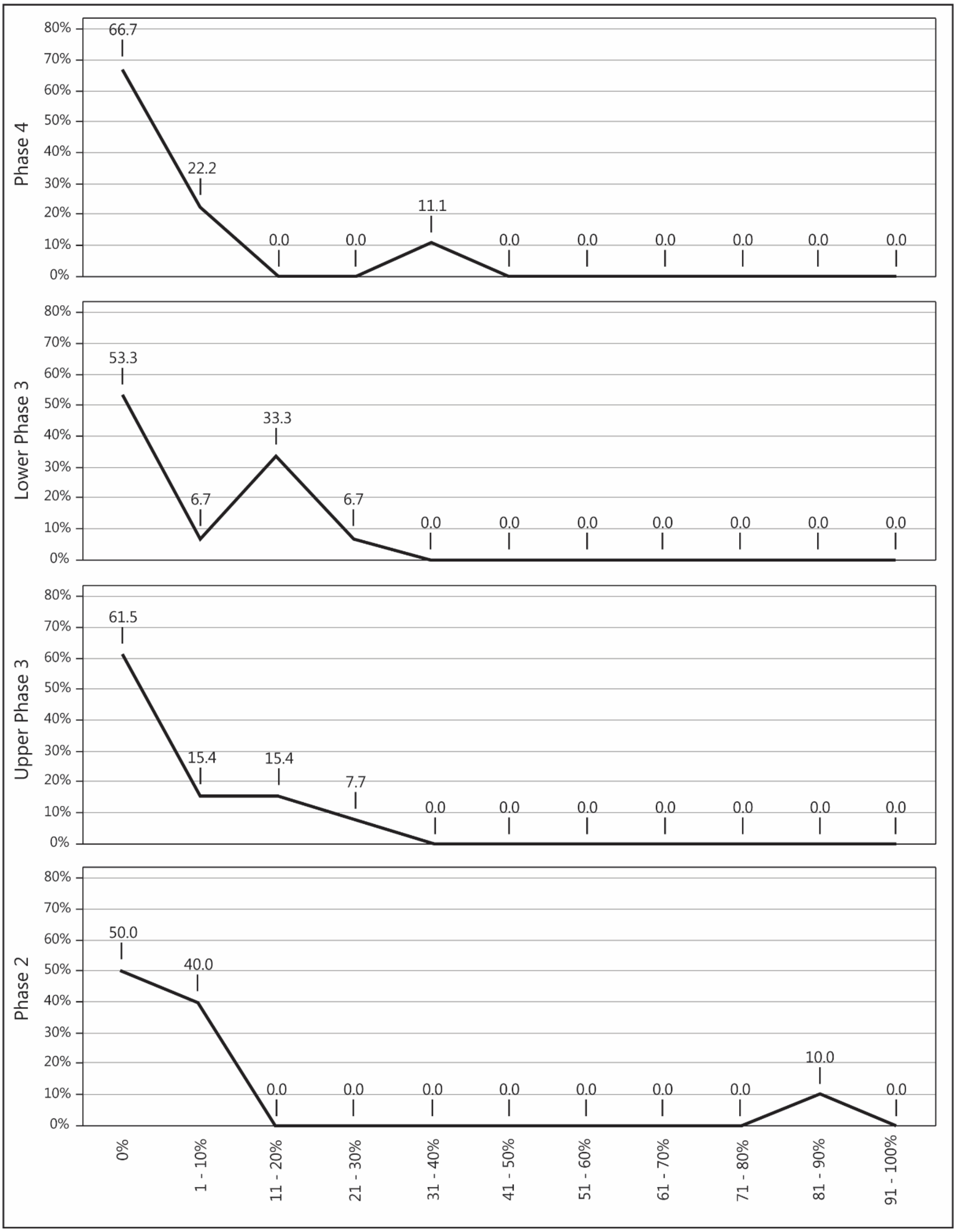


Fig. 4.34: Bladelet cortex coverage, by phase.

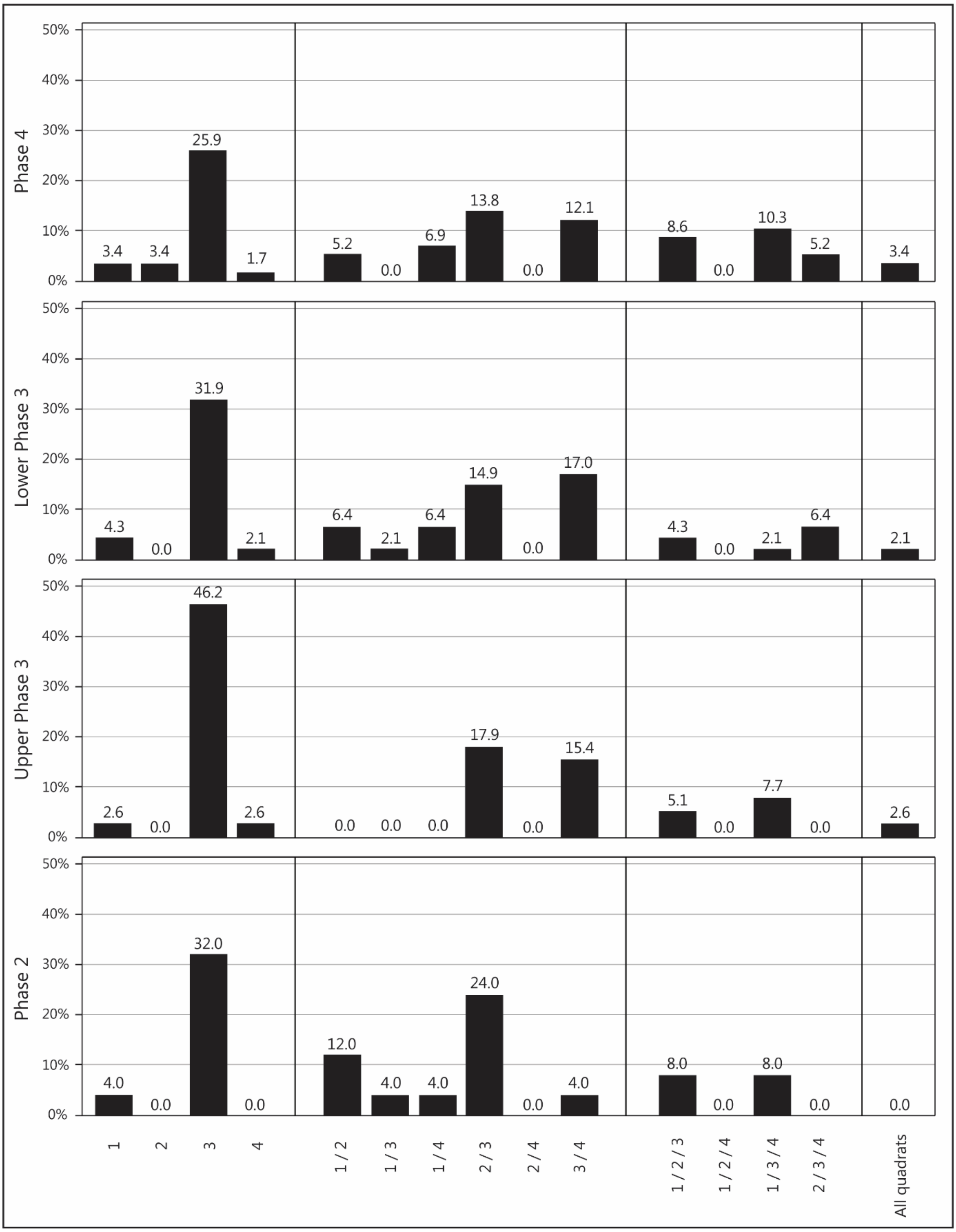


Figure 4.35: Bladelet cortex quadrat combinations, by phase

recorded. As with the flake and blades, this alignment occurs in conjunction with considerable numbers of bladelets with quadrat 2/3 and 3/4 combinations. As such, the overwhelming majority of cases of cortex on bladelets can be viewed as residual cortex from the production of bladelet blanks from small, single platform cores which retained some degree of cortex on the surfaces opposite the platform after the initial roughout stage of core manufacture. That said, bladelets with cortex running along one lateral margin (covering quadrats 1/2/3 or 1/3/4) consistently occur in every assemblage, with these two combinations recorded on almost a fifth of the Phase 4 and Phase 2 bladelets. This find suggests that at least some of the bladelets were produced through the initial stage of creating bladelet cores from small, cortex-rich cobbles, or alternatively through their rotation. Such an explanation can also be given for the marginal numbers of bladelets with cortex in all four quadrats in each assemblage aside from Phase 2. These bladelets do not appear to have been favoured for retouch into sickle components, as suggested by the even lower rate of cortex displayed by the non-geometric microlith assemblages (see Chapter 6.4.4.4).

4.6 Summary

All in all, the overall composition of the lithic assemblages of Wadi Hammeh 27 remain consistent over time, with most major variations representing an abrupt break between Phases 2 and 1. Most of these differences can be thus be correlated with an identification of Phase 1 as an abandonment assemblage, as discussed in detail in Chapters 8 and 10. Some gradualistic technological trends are nonetheless evident when it comes to the debitage, namely a steadily rising divide in the proportions of plain and truncated burin spalls, along with a marginal increase in the proportion of by-products relating to the microburin technique.

All five assemblages discussed in this chapter are represented by a complete range of artefacts representing each stage of reduction. These range from exhausted cores, cortex rich primary flakes, debitage blanks of various shapes and sizes, and a substantial number of retouched tools, all of which are associated with massive quantities of knapping debris. Each lithic assemblage at Wadi Hammeh 27 can thus safely be classified as a Juncture 1 assemblage (Pecora 2001), with all knapping stages being performed onsite either within, or within close proximity to, the areas sampled. However, before this reduction sequence can be properly reconstructed, the rich core and tool assemblages of Wadi Hammeh 27 must first be discussed in the following two chapters.

Chapter 5: The core assemblages of Wadi Hammeh 27

5.1 Introduction

Having detailed the typological composition and technological data for the Wadi Hammeh 27 debris and debitage in the previous chapter, the same approach may now be undertaken for the corresponding core assemblages. A significant collection of cores and core fragments, numbering 872 pieces in total, were recovered between 2014 and 2016 at Wadi Hammeh 27. As with the debris and debitage, the fact that each core assemblage was catalogued in its entirety means that the typological figures presented in this chapter provide comprehensive characterisations of each assemblage, while the attributional data were sourced from approximately a third of the intact specimens.

5.2 Methodology and typology

The core types utilised in the current study are identical to those utilised by Edwards (2013e) in analysing the Phase 1 material. Much like with the debitage, this typology largely follows Henry (1973: 66) in defining core types based on the number and orientation of the core platforms that they possess. Additionally, Marks' system (1976: 376) has been utilised in the differention between 'unfacetted' and 'facetted' platforms, with the latter type characterising any platform comprising two or more flaked facets created from previous knapping activities. Facetted platforms include both intentional faceting as a platform preparation technique, as well as flake scars remaining from previous core reduction activity. The unfacetted single platform cores primarily involve plain platforms created through the removal of a core tablet struck at a perpendicular angle from the primary flaking orientation. Multiple platform cores incorporate any core with three or more platforms. This typology has been systematically followed whenever feasible, with only a small number of small, expediently knapped, amorphous cobbles relegated to types under the 'other' label.

Cores have been identified as belonging to either the 'flake', 'blade' or 'bladelet' groups based on the dimensions of the flake scars they exhibit. Given that Early Natufian bladelet cores often present negative scars that may be better described as gracile flake scars (Edwards 2013e: 127), the identification of bladelet cores has been performed on a fairly liberal basis in the current study. Any core featuring a single complete negative scar with bladelet dimensions was thus classified as a bladelet core, even if its other scars all possessed flake dimensions. The same guidelines were utilised in the identification of blade cores, with the only divergence being a scar length greater than 50mm. Several of the 'multiple platform bladelet cores' only feature bladelet scars struck from a single platform, with the other two platforms only exhibiting scars with flake dimensions. As such, the bladelet core types in the current study also incorporate pieces which would be characterised as 'mixed cores' under certain typological regimes.

The lengths of single platform and opposed platform cores were recorded along their flaking orientation, while the maximum dimension was instead recorded for the 90° change of orientation and multiple platforms cores. In addition to the base metrics, the platform area of each core was also calculated through multiplying their length and width. For cores with two or more platforms, only the largest platform was measured. Given that the cores rarely possess a perfectly rectangular platform, these measurements can thus be considered as approximations.

As with the debitage, the Plot XX D cores (Edwards 2013e: 128) are utilised here as a comparative Phase 1 typological assemblage.

5.3 Core typological composition, by phase

5.3.1 Phase 4

A total of 121 cores were recovered from the various Phase 4 strata. Whereas core fragments consistently comprise a third of each core assemblage between Lower Phase 3 and Phase 2, these pieces are notably less common in Phase 4, comprising just under a quarter (24.0%) of this core assemblage (**Table 5.1; Fig. 5.1**). Bladelet cores are the most common group within this assemblage (42.1%), being supplemented by a large proportion of flake cores (32.2%). Bladelet cores narrowly comprise an absolute majority (55.4%) when core fragments are excluded (**Table 5.2**). Blade cores are rare, with only two examples recovered from the Phase 4 deposits.

Table 5.1: Wadi Hammeh 27 core assemblage, by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
Flake Cores										
Single Platform, Unfacetted	3	2.5	7	2.5	11	3.6	3	1.8	24	2.8
Single Platform, Facetted	2	1.7	13	4.7	15	4.9	3	1.8	33	3.8
Opposed Platform, Same Side	2	1.7	2	0.7	3	1.0	1	0.6	8	0.9
Opposed Platform, Opposite Side	3	2.5	3	1.1	1	0.3	2	1.2	9	1.0
Opposed Platform, Combination	4	3.3	4	1.4	1	0.3	1	0.6	10	1.1
Change of Orientation	10	8.3	18	6.5	20	6.5	4	2.4	52	6.0
Multiple Platform	14	11.6	27	9.7	39	12.7	15	9.0	95	10.9
Other	1	0.8	2	0.7	0	0.0	0	0.0	3	0.3
Sub-total	**39**	**32.2**	**76**	**27.3**	**90**	**29.3**	**29**	**17.5**	**234**	**26.8**
Blade Cores										
Single Platform, Unfacetted	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Single Platform, Facetted	0	0.0	0	0.0	1	0.3	0	0.0	1	0.1
Opposed Platform, Same Side	0	0.0	0	0.0	0	0.0	1	0.6	1	0.1
Opposed Platform, Opposite Side	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Opposed Platform, Combination	0	0.0	1	0.4	0	0.0	0	0.0	1	0.1
Change of Orientation	0	0.0	0	0.0	1	0.3	1	0.6	2	0.2
Multiple Platform	2	1.7	1	0.4	0	0.0	0	0.0	3	0.3
Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Sub-total	**2**	**1.7**	**2**	**0.7**	**2**	**0.7**	**2**	**1.2**	**8**	**0.9**
Bladelet Cores										
Single Platform, Unfacetted	8	6.6	12	4.3	24	7.8	18	10.8	62	7.1
Single Platform, Facetted	10	8.3	23	8.3	22	7.2	8	4.8	63	7.2
Opposed Platform, Same Side	5	4.1	5	1.8	7	2.3	8	4.8	25	2.9
Opposed Platform, Opposite Side	2	1.7	4	1.4	5	1.6	3	1.8	14	1.6
Opposed Platform, Combination	2	1.7	2	0.7	3	1.0	4	2.4	11	1.3
Change of Orientation	9	7.4	37	13.3	30	9.8	16	9.6	92	10.6
Multiple Platform	15	12.4	21	7.6	19	6.2	19	11.4	74	8.5
Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Sub-total	**51**	**42.1**	**104**	**37.4**	**110**	**35.8**	**76**	**45.8**	**341**	**39.1**
Core Fragments	29	24.0	96	34.5	105	34.2	59	35.5	289	33.1
Total	**121**	**100.0**	**278**	**99.9**	**307**	**100.0**	**166**	**100.0**	**872**	**99.9**

Table 5.2: Wadi Hammeh 27 core assemblage (abridged), by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
Flake Cores										
Single Platform	5	5.4	20	11.0	26	12.9	6	5.6	57	9.8
Opposed Platform	9	9.8	9	4.9	5	2.5	4	3.7	27	4.6
Change of Orientation	10	10.9	18	9.9	20	9.9	4	3.7	52	8.9
Multiple Platform	14	15.2	27	14.8	39	19.3	15	14.0	95	16.3
Other	1	1.1	2	1.1	0	0.0	0	0.0	3	0.5
Sub-total	**39**	**42.4**	**76**	**41.8**	**90**	**44.6**	**29**	**27.1**	**234**	**40.1**
Blade Cores										
Single Platform	0	0.0	0	0.0	1	0.5	0	0.0	1	0.2
Opposed Platform	0	0.0	1	0.5	0	0.0	1	0.9	2	0.3
Change of Orientation	0	0.0	0	0.0	1	0.5	1	0.9	2	0.3
Multiple Platform	2	2.2	1	0.5	0	0.0	0	0.0	3	0.5
Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Sub-total	**2**	**2.2**	**2**	**1.1**	**2**	**1.0**	**2**	**1.9**	**8**	**1.4**
Bladelet Cores										
Single Platform	18	19.6	35	19.2	46	22.8	26	24.3	125	21.4
Opposed Platform	9	9.8	11	6.0	15	7.4	15	14.0	50	8.6
Change of Orientation	9	9.8	37	20.3	30	14.9	16	15.0	92	15.8
Multiple Platform	15	16.3	21	11.5	19	9.4	19	17.8	74	12.7
Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Sub-total	**51**	**55.4**	**104**	**57.1**	**110**	**54.5**	**76**	**71.0**	**341**	**58.5**
Total	**92**	**100.0**	**182**	**100.0**	**202**	**100.1**	**107**	**100.0**	**583**	**100.0**

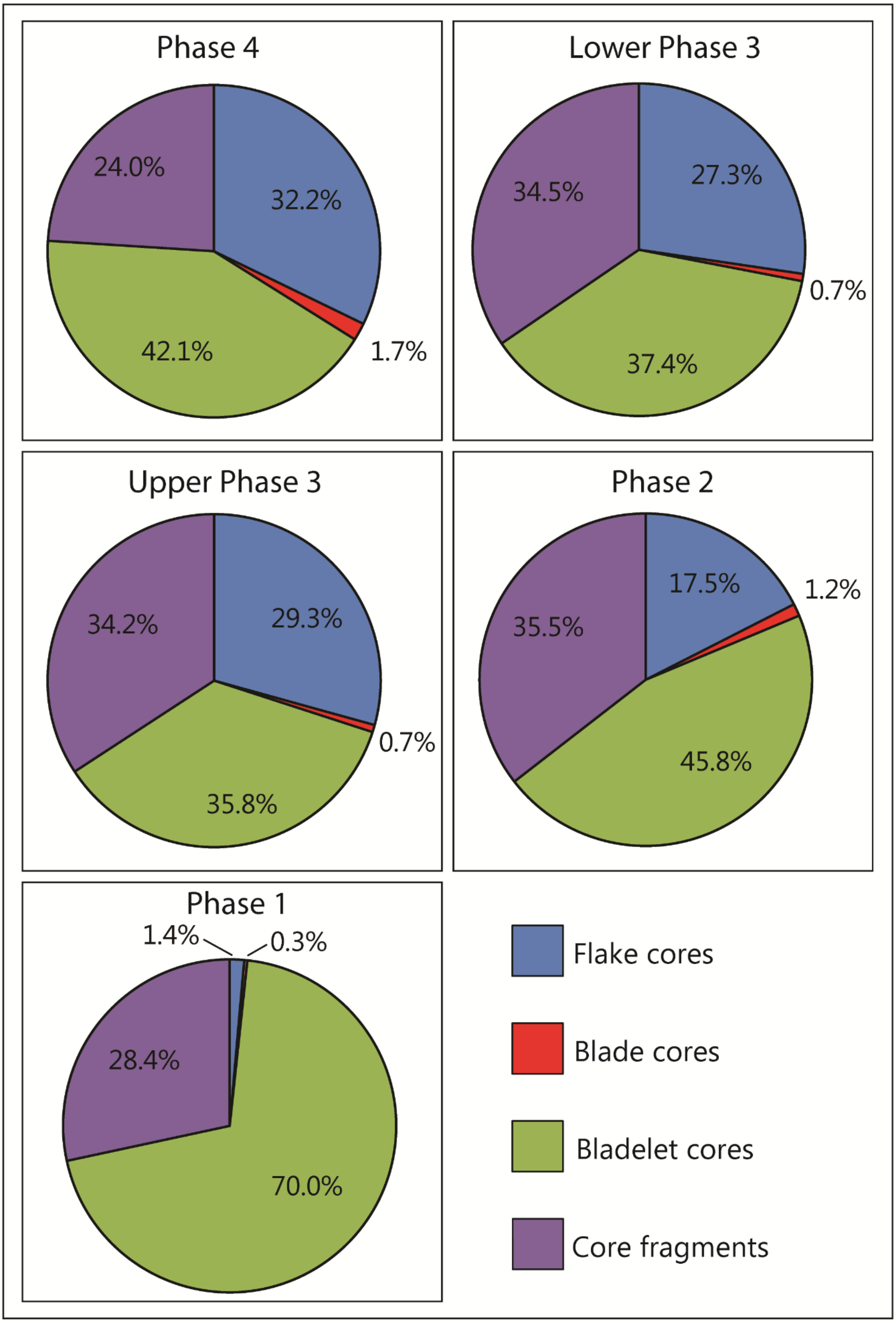


Figure 5.1: Core assemblage composition, by phase.

5.3.1.1 Flake cores

Thirty-nine flake cores were recovered from the Phase 4 deposits. Among these pieces, multiple platform cores are the most common type (35.9%), followed by change of orientation (25.6%) and opposed platform (23.1%) types (**Fig. 5.2**). Of the individual opposed platform types, those knapped on a combination of sides are most common (10.3%), outnumbering those flaked on opposite sides (7.7%) or the same side (5.1%). Single platform flake cores are noticeably rare compared to the other flake core assemblages, with only five of these artefacts (12.8%) uncovered (**Fig. 5.3**: 6). No preference towards plain (7.7%) or facetted single platform cores (5.1%) is apparent.

5.3.1.2 Blade cores

The two Phase 4 blade cores - comprising 1.7% of the Phase 4 total - are both of the multiple platform type.

5.3.1.3 Bladelet cores

Fifty-one bladelet cores were recovered from the Phase 4 deposits. Unlike the flake cores, single platform types are the most common bladelet core orientation, comprising a third of this assemblage. No preference for a particular single platform type is evident, with facetted cores (19.6%; **Fig. 5.4**: 1) only narrowly outnumbering those with an unfacetted platform (15.7%; **Fig. 5.5**). Multiple platform bladelet cores are the most common singular type (29.4%), while the remainder of the Phase 4 cores are divided between the change of orientation and opposed platform types (each with 17.6%). Of the opposed platform bladelet cores, a bias towards those flaked on a single side is observable, with this type (9.8%) outnumbering both the opposite side and combination varieties (each with 3.9%).

5.3.2 Lower Phase 3

A total of 278 cores were recovered from the Lower Phase 3 deposits. A clear increase in the proportion of core fragments is evident amongst these pieces, with this type constituting over a third (34.5%) of the Lower Phase 3 specimens (**Table 5.1; Fig. 5.1**). As a result, both the flake (27.3%) and bladelet (37.4%) core groups comprise lower shares than in Phase 4. The

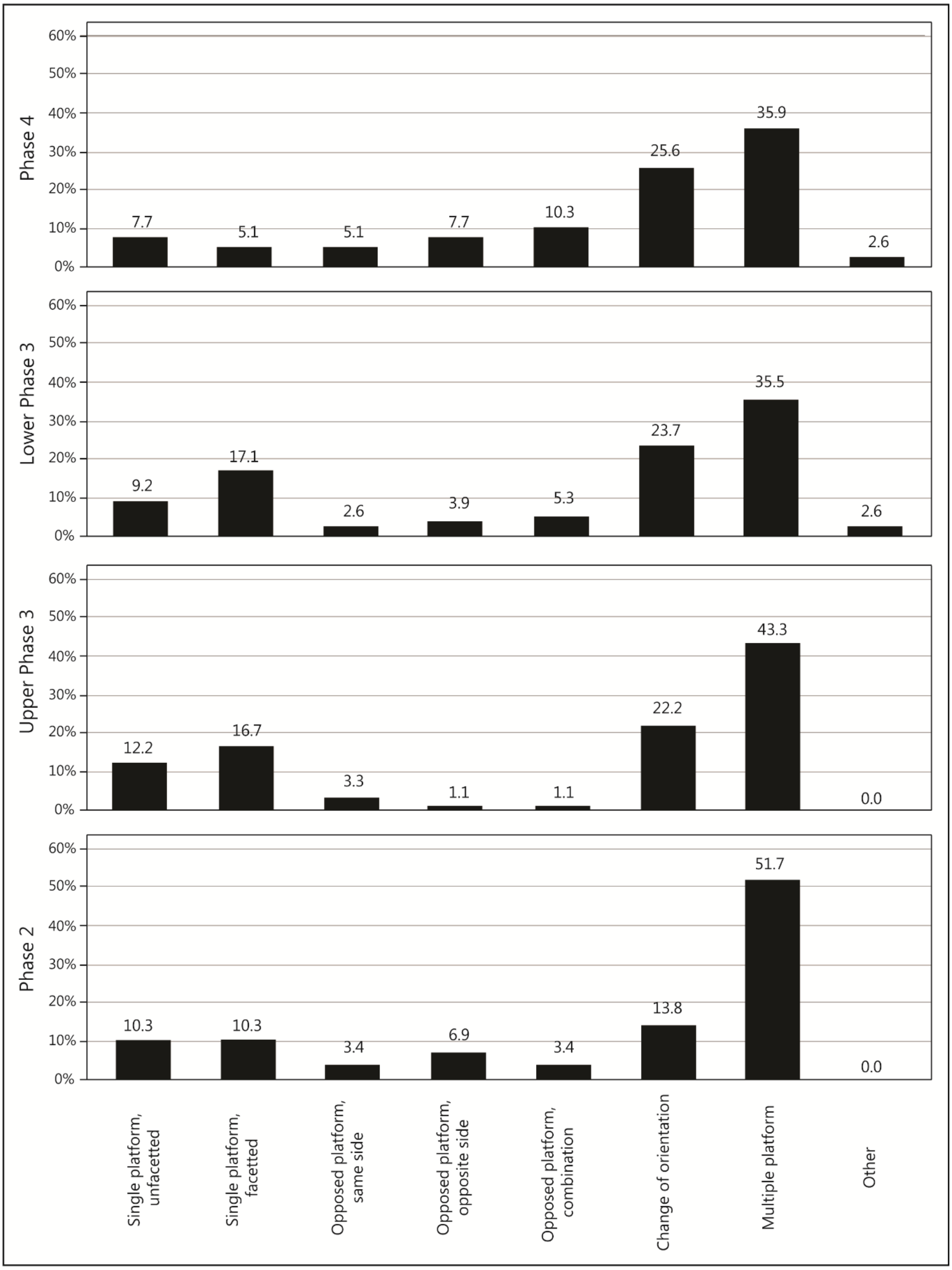


Figure 5.2: Flake core typological composition, by phase.

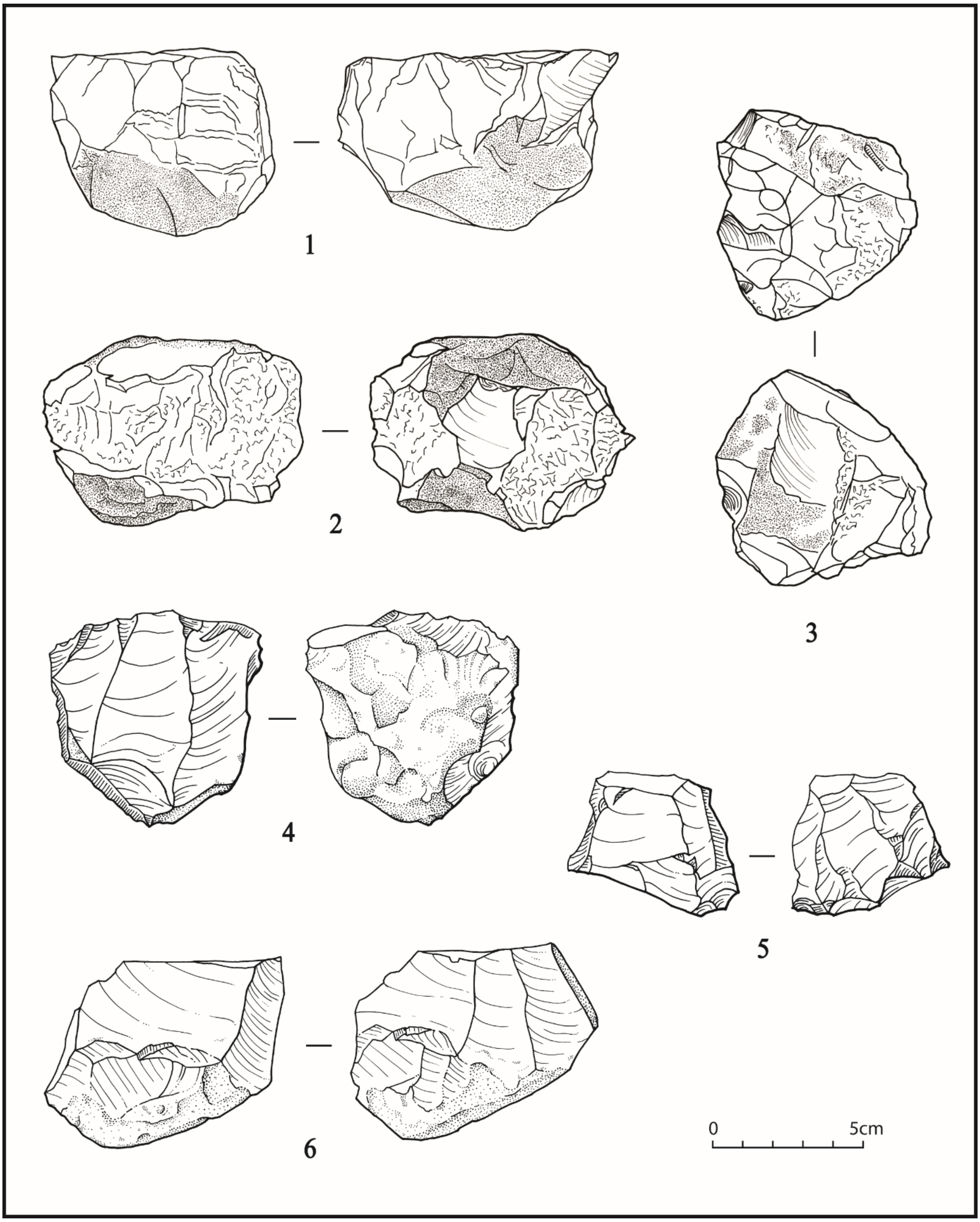


Figure 5.3: Large flake and blade cores from Wadi Hammeh 27, Area XX F.

1: Change of orientation flake core, Phase 2; **2:** Multiple platform flake core, Phase 2; **3:** Multiple platform flake core, Phase 2; **4**: Single platform blade core (facetted), Upper Phase 3; **5:** Opposed platform flake core (combination), Phase 2; **6:** Single platform flake core (facetted), Phase 4.

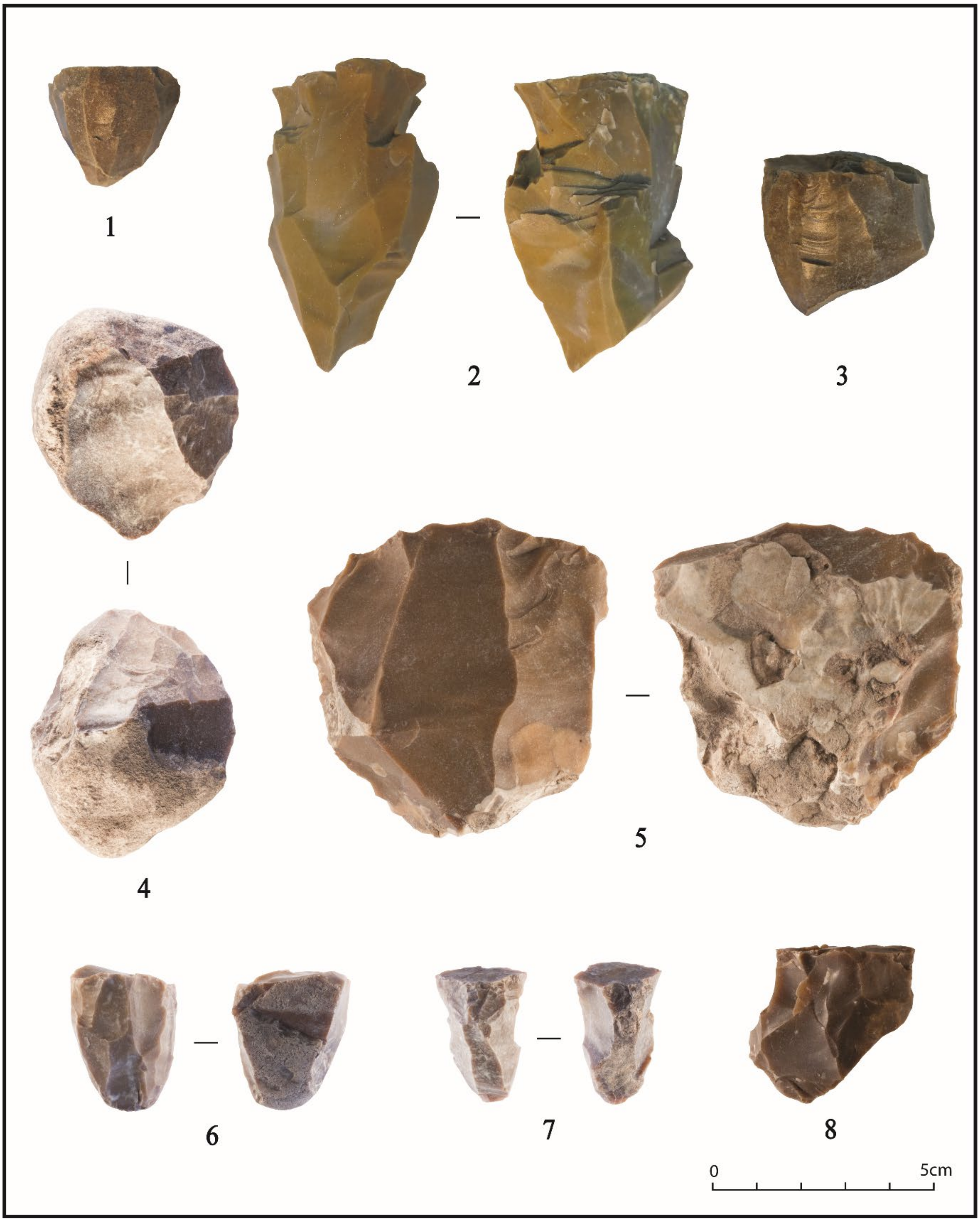


Figure 5.4: Cores from Phase 4 – Upper Phase 3.

1: Single platform bladelet core (facetted), Phase 4; **2:** Opposed platform blade core (combination), Lower Phase 3; **3:** Single platform bladelet core (facetted), Lower Phase 3; **4:** Change of orientation bladelet core, Upper Phase 3, **5:** Single platform blade core (facetted), Upper Phase 3, **6-8:** Single platform bladelet cores (unfacetted), Upper Phase 3.

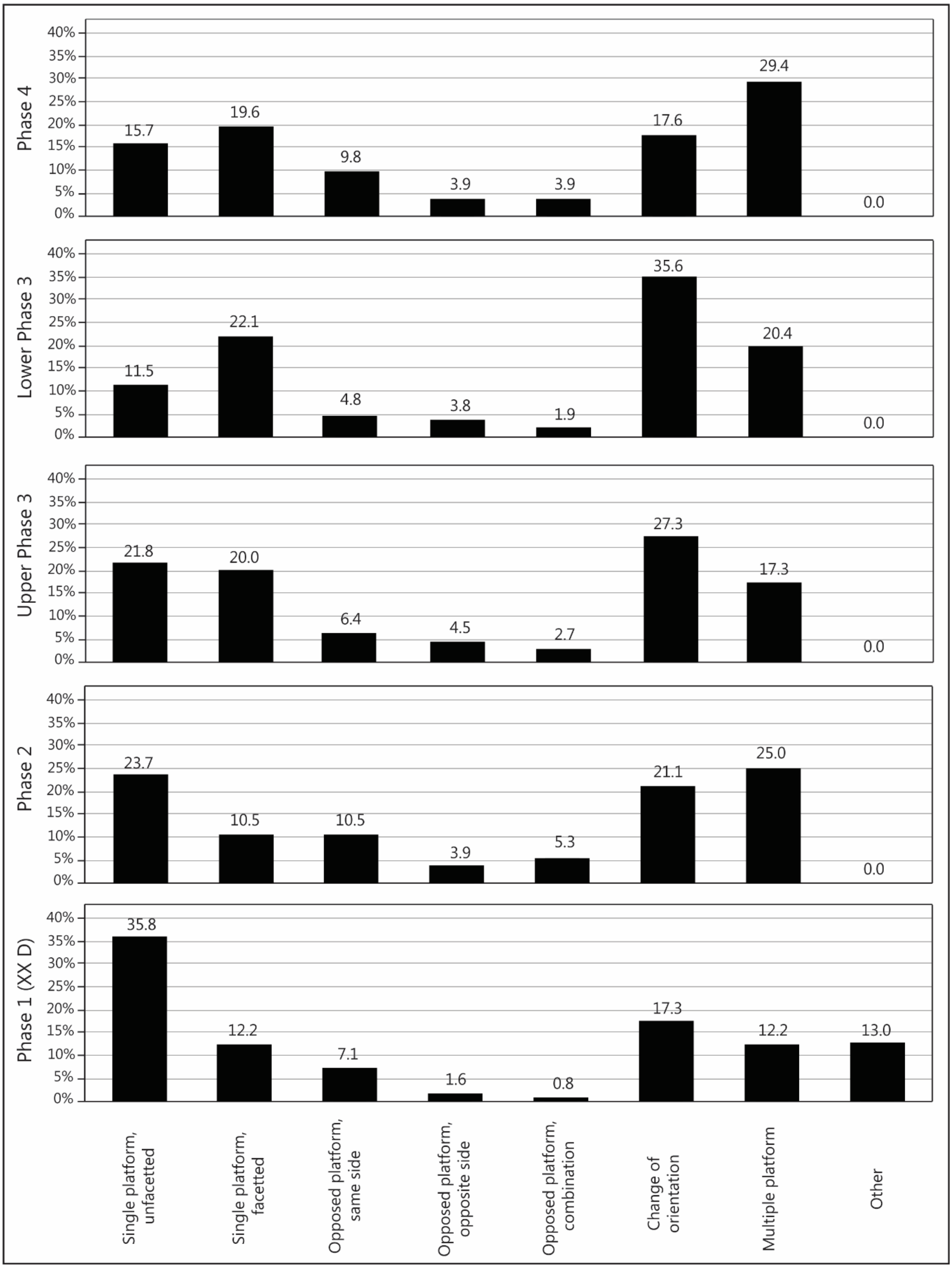


Figure 5.5: Bladelet core typological composition, by phase. Phase 1 data from Edwards 2013e: 128.

proportions of flake and bladelet cores remain consistent with the Phase 4 assemblage when the core fragments are excluded (**Table 5.2**), with bladelet cores again comprising an absolute majority (57.1%) over the flake cores (41.8%). Two blade cores were again recovered from the Lower Phase 3 deposits, comprising 0.7% of the core total.

5.3.2.1 Flake cores

Seventy-six flake cores were excavated from the Lower Phase 3 deposits. Multiple flake cores are again the most common type within this core group, comprising an almost identical share (35.5%) as in Phase 4 **(Fig. 5.2**; **Fig. 5.6**: 4). The Lower Phase 3 flake core assemblage nonetheless diverges from the previous assemblage in that it contains a higher proportion of single platform flake cores (26.3%). Of these objects, facetted single platform cores (17.1%) outnumber those with unfacetted platforms (9.2%). Change of orientation flake cores also occur in similar proportions (23.7%) as in Phase 4 - the rise in single platform flake cores instead corresponds with a marked decline in the proportion of opposed platform flake cores (11.8%).

5.3.2.2 Blade cores

The two Lower Phase 3 blade cores belong to the opposed platform (combination; **Fig. 5.4**: 2) and change of orientation types respectively.

5.3.2.3 Bladelet cores

A total of 104 bladelet cores were recovered from the Lower Phase 3 deposits. Change of orientation bladelet cores are the most numerous type in this assemblage (35.6%; **Fig. 5.6**: 5), narrowly outnumbering the two single platform bladelet core types (33.7%; **Fig. 5.5**). This shift represents a massive increase in both the number and proportion of change of orientation bladelet cores, with a relative representation twice that of the Phase 4 bladelet assemblage. This increase corresponds with a decline in share of both multiple platform (20.2%) and opposed platform (10.6%) bladelet cores. As with the Lower Phase 3 flake cores, single platform bladelet cores with facetted platforms (22.1%; **Fig. 5.4**: 3) outnumber the unfacetted type (11.5%).

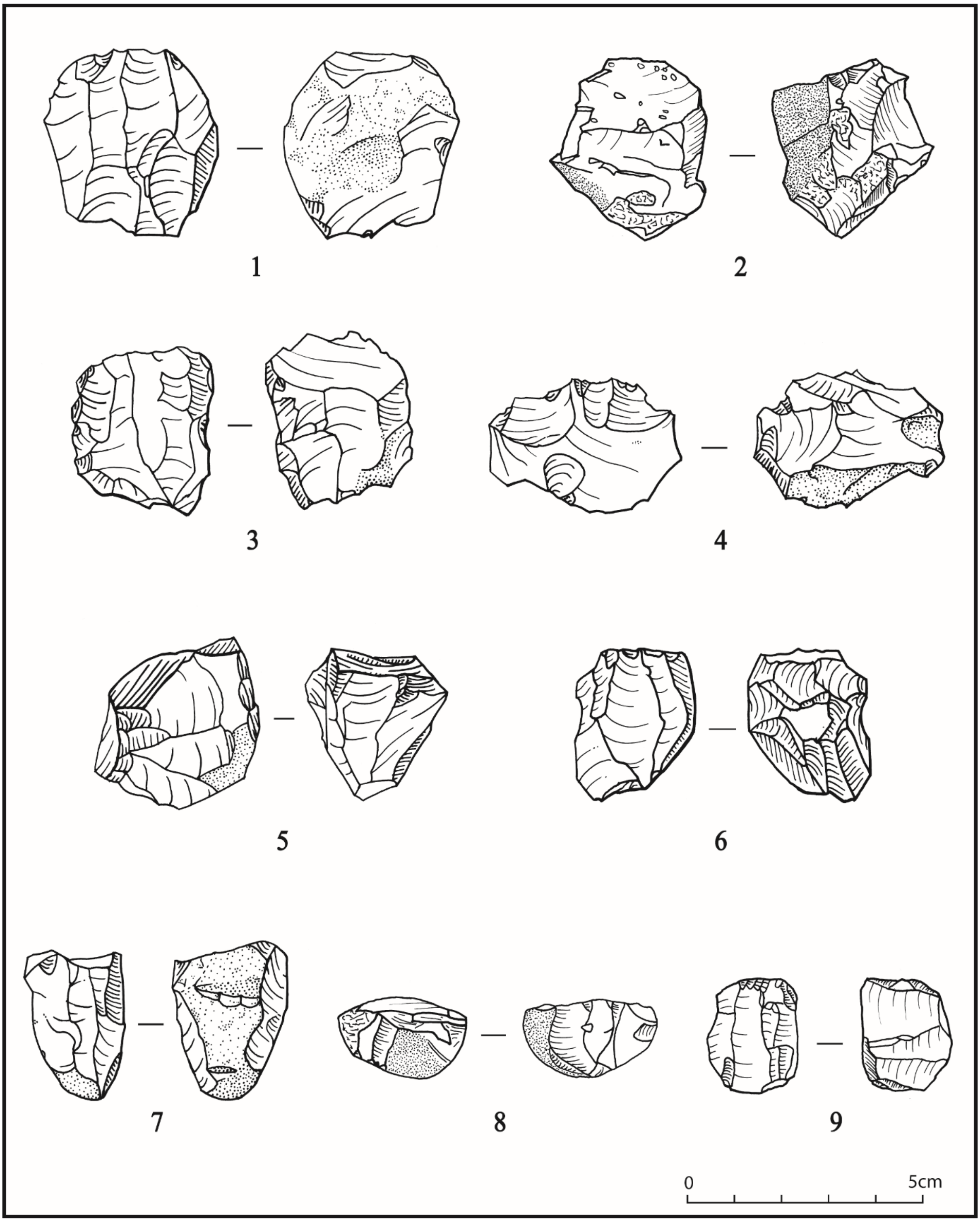


Figure 5.6: Small flake and bladelet cores from Wadi Hammeh 27, Area XX F.

1: Opposed platform bladelet core (same side), Phase 2; **2:** Multiple platform flake core, Phase 2; **3:** Opposed platform bladelet core (opposite side), Phase 2; **4:** Multiple platform flake core, Lower Phase 3; **5:** Change of orientation bladelet core, Lower Phase 3; **6:** Multiple platform bladelet core, Phase 2; **7:** Single platform bladelet core (unfaceted), Lower Phase 3; **8:** Single platform bladelet core (facetted), Phase 2; **9:** Change of orientation bladelet core, Phase 2.

5.3.3 Upper Phase 3

A total of 307 cores were identified from the Upper Phase 3 deposits, making this the largest core assemblage to be recovered during the renewed Wadi Hammeh excavations. Of these artefacts, a third (34.2%) were classified as core fragments – an almost identical share as in the Lower Phase 3 assemblage (**Table 5.1; Fig. 5.1**). The divide between flake and bladelet production also remains similar to that of the Lower Phase 3 assemblage, with bladelet cores (35.8%) narrowly outnumbering flake cores (29.3%). The divide between the two core groups likewise remains consistent with the preceding two assemblages when core fragments are excluded (**Table 5.2**). Blade cores are again rare, with the two examples constituting 0.7% (1.1% excluding core fragments) of the phase total.

5.3.3.1 Flake cores

Ninety flake cores were recovered from Upper Phase 3. Multiple platform flake cores are the most common type (**Fig. 5.7**: 1), with a greater share than seen in the previous assemblages (43.3%; **Fig. 5.2**). These cores are supplemented by similar proportions of single platform (28.9%) and change of orientation flake cores (22.2%) as in Lower Phase 3. Unlike in the preceding assemblage, however, the Upper Phase 3 single platform flake cores are characterised by near-equal proportions of facetted (16.7%) and unfacetted platforms (12.2%). The increase in multiple platform flake cores is at the expense of the opposed platform types, which together comprise a mere 5.6% of the total Upper Phase 3 flake cores.

5.3.3.2 Blade cores

Of the two blade cores, the more notable is a facetted single platform type - the only single platform blade core to be uncovered from the renewed excavations of Wadi Hammeh 27 (**Figs. 5.3**: 4; **5.4**: 5). The other specimen from this phase is a change of orientation blade core.

5.3.3.3 Bladelet cores

A total of 110 bladelet cores were uncovered from the Upper Phase 3 deposits. Unlike the Lower Phase 3 bladelet cores, these objects are dominated by the single platform types

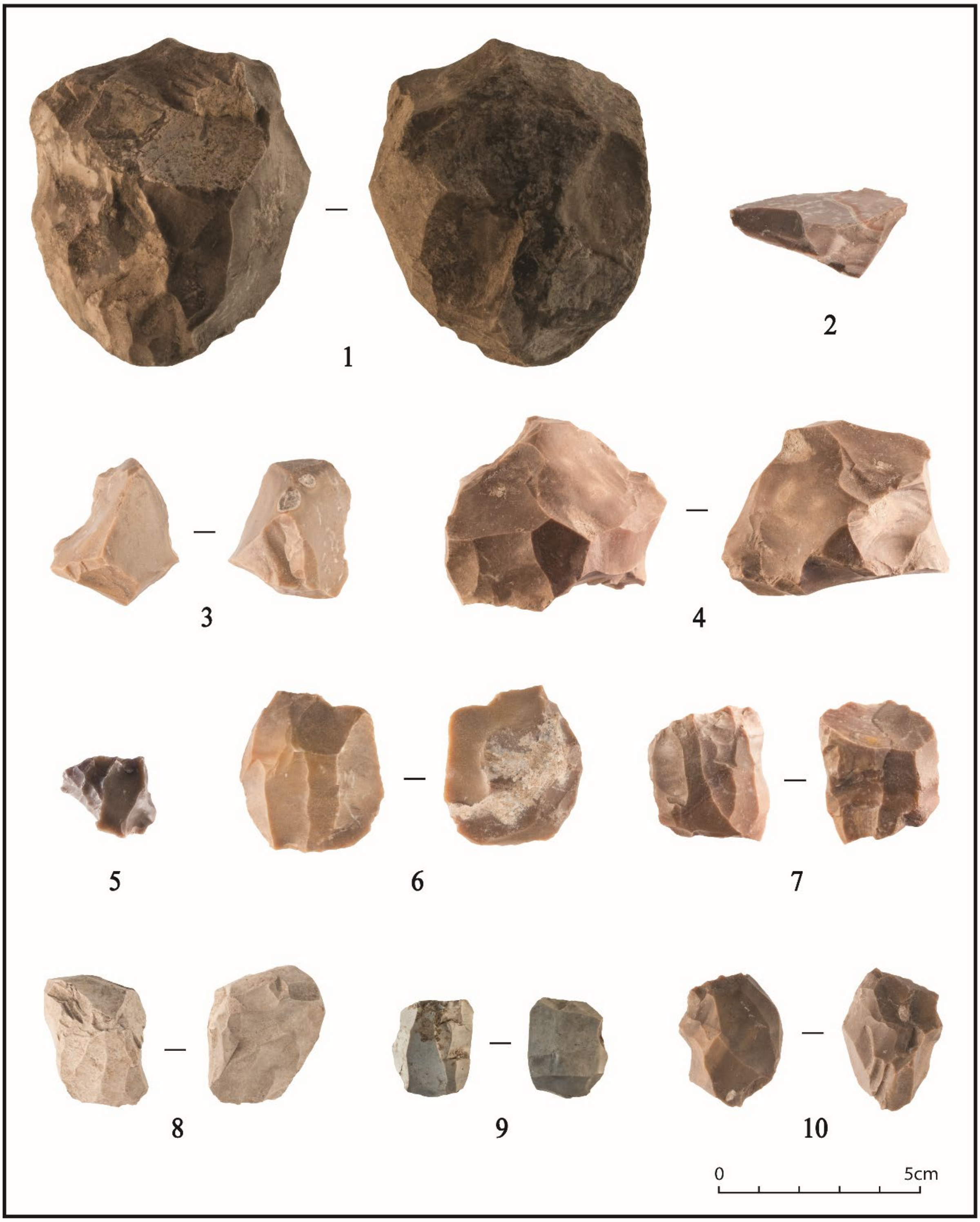


Figure 5.7: Cores from Upper Phase 3 and Phase 2.

1: Multiple platform flake core, Upper Phase 3; **2:** Single platform flake core (unfacetted), Phase 2; **3-4:** Multiple platform flake cores, Phase 2; **5-6:** Opposed platform bladelet cores (same side), Phase 2; **7:** Opposed platform bladelet core (opposite sides), Phase 2; **8:** Opposed platform bladelet core (combination), Phase 2; **9:** Change of orientation bladelet core, Phase 2; **10:** Multiple platform bladelet core, Phase 2.

(41.8%) - the greatest skew towards these types out of all four bladelet core assemblages (**Fig. 5.5**). Much like the flake cores, they are divided more-or-less evenly between unfacetted (21.8%; **Figs. 5.4**: 6-8**; 5.6**: 7) and facetted (20.0%) types. Single platform bladelet cores are supplemented mostly by change of orientation cores (27.3%; **Fig. 5.4**: 4), while the proportions of multiple platform (17.3%) and opposed platform (13.6%) types remain consistent with the Lower Phase 3 assemblage.

5.3.4 Phase 2

The Phase 2 assemblage features a total of 166 cores. These artefacts include a notably higher proportion of bladelet cores in comparison to the three preceding assemblages, with this group comprising almost half (45.8%) of the Phase 2 core assemblage (**Table 5.1; Fig. 5.1**). Flake cores, on the other hand, constitute under a fifth (17.5%) of the Phase 2 cores – a significantly reduced share compared to the earlier assemblages. Much as in the Upper and Lower Phase 3 assemblage, a high number of core fragments are also present in the Phase 2 assemblage, with these objects narrowly constituting their greatest proportion (35.5%) out of the four core assemblages. The divide between flake and bladelet cores becomes particularly pronounced when these core fragments are excluded, with bladelet cores comprising slightly under three quarters (71.0%) of the phase total (**Table 5.2**). Once again, only two blade cores were recovered from the Phase 2 deposits (1.2%).

5.3.4.1 Flake cores

A total of 29 flake cores are present within the Phase 2 core assemblage. A greater preponderance of multiple platform flake cores (**Figs. 5.3**: 2-3; **5.6**: 2; **5.7**: 3-4) is evident compared to the earlier assemblages, with this type representing slightly over half of the group total (51.7%; **Fig. 5.2**). The remaining flake cores are more or less evenly distributed between the other types, with a slight bias towards the single platform varieties (20.7%). As with the previous assemblage, an even split between unfaceted (**Fig. 5.7**: 2) and facetted single platform flake cores is present (each with 10.3%). Change of orientation (**Fig. 5.3**: 1, 5) and opposed platform flake cores are slightly less common, with each of these types comprising 13.8% of the flake cores from this phase.

5.3.4.2 Blade cores

The two Phase 2 blade cores belong to the opposed platform (same side) and change of orientation types.

5.3.4.3 Bladelet cores

Seventy-six bladelet cores were recovered from the Phase 2 strata. Single platform bladelet cores are again the most common orientation, with those of the unfacetted variety (23.7%; **Fig. 5.5**) outnumbering those with facetted platforms (10.5%; **Figs. 5.6**: 8). These pieces are trailed by a large proportion of multiple platform (25.0%; **Figs. 5.6**: 6; **5.7**: 10) and change of orientation bladelet cores (21.1%; **Figs. 5.6**: 9; **5.7**: 9). Opposed platform bladelet cores are slightly more common (19.7%) than in the preceding two assemblages, with a notable preference toward the 'same side' type (10.5%; **Figs 5.6**: 1; **5.7**: 5-6).

5.3.5 Comparison with Phase 1 cores

When the current assemblages are compared with the Area XX D Phase 1 data from Wadi Hammeh 27 (Edwards 2013e: 128), a clear shift towards bladelet cores over time is evident (**Fig. 5.1**). The Phase 1 core assemblage is overwhelmingly comprised of bladelet types, with these objects comprising 70% (N = 357) of the phase total when core fragments are included and an overwhelming 98.3% when they are discounted. In contrast, only five flake cores were recorded from the Phase 1 assemblage, with four of these objects being assigned to the 'other' type and the fifth as a multiple platform core. The proportion of core fragments in Phase 1 (28.4%) remains consistent with each of the lower XX F assemblages, if representing a slight decline from Phases 2 and 3.

The typological composition of the Phase 1 bladelet core assemblage resembles each of the newly analysed XX F assemblages aside from Lower Phase 3, in that single platform cores are the most common types (48.0%; **Figure 5.5**). This dominance, however, attains a far greater extent than seen in any of the lower XX F assemblages. The Phase 1 single platform bladelet cores also represent a significant break from the Upper Phase 3 and Phase 2 assemblages in that single platform cores with unfaceted platforms (35.8%) far outnumber those with facetted platforms (12.2%). The proportion of opposed platform bladelet cores declines considerably from Phase 2 (9.4%), although much like the preceding phase these are again characterised primarily by those knapped on a single surface (7.1%).

5.4 Core attribute data

5.4.1 Flake cores

Alongside their overall decrease in number, a unidirectional trend towards smaller, lighter flake cores is noted across the four assemblages (**Table 5.3; Fig. 5.8**). This trend is reflected archaeologically by gradually declining averages, standard deviation ranges and maximum ranges for both core dimensions and weight. This is not to say that the cores themselves decrease in size – the smaller end of the Phase 4 cores resemble those of Phase 2 in dimensions - but rather that the presence of exceptionally large, heavy outliers gradually fades over time. While the heaviest Phase 2 flake cores only narrowly exceed 100g in weight, the Phase 4 and Lower Phase 3 assemblage include numerous heavy outliers, the heaviest of which weighs 698g. Even when these large outliers are removed from the three earliest assemblages (in this case, pieces weighing more than 250 grams), unidirectional decreases in flake core length, width and weight remain (**Table 5.4; Fig. 5.9**), demonstrating that a marginal decline in flake occurs through time at Wadi Hammeh 27 unrelated to the disappearance of these large pieces in the later phases.

Flake core dimensions also vary on a typological basis, with single platform and opposed platform cores demonstrating smaller average lengths than the mean maximum dimensions of change of orientation and multiple platform types (**Table 5.5**; **Fig. 5.10**). Single platform flake cores are also noticeably lighter than the other types, with a mean weight half that of the change of orientation and multiple platform types.

The average platform area of the flake cores remains static over time, with the only observable trend being the disappearance of large outliers in the later assemblages (**Figs. 5.8 - 5.9**). Some decline in mean platform area is evident when the flake cores are segregated by type, however (**Table 5.6**). The mean platform areas for single platform, opposed platform and multiple platform flake cores are roughly twice as large in Phase 4 as they are in the

Table 5.3: Core dimensions, by phase.

	N	Length/Max dimension (mm)			Width (mm)			Thickness (mm)			Weight (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Flake Cores													
Phase 4	30	47.2	25.7	17.7-117.2	44.8	22.2	17.5-100.1	30.4	17.2	12.3-62.8	133.7	198.5	5.2-698.0
Lower Phase 3	37	36.1	17.1	11.3-74.6	34.6	14.2	16.5-81.7	24.2	12.1	9.3-62.3	54.3	89.0	2.5-467.0
Upper Phase 3	43	35.4	13.9	15.8-80.3	31.0	9.4	20.7-65.0	22.7	8.0	10.5-44.2	33.4	43.8	5.2-268.0
Phase 2	17	31.2	10.7	12.1-46.3	29.8	8.3	16.0-49.6	21.6	7.4	12.3-39.8	24.9	23.5	4.6-100.7
Bladelet cores													
Phase 4	35	35.2	9.5	16.5-54.9	28.2	7.5	13.6-50.0	20.7	7.4	10.1-47.6	28.4	27.1	4.9-148.0
Lower Phase 3	66	32.5	9.5	12.7-51.6	28.8	7.7	16.8-59.3	19.8	6.6	9.7-39.8	24.5	22.6	3.3-157.0
Upper Phase 3	62	33.1	10.0	16.3-68.6	29.9	9.4	15.8-63.7	21.6	7.6	2.0-46.3	29.6	28.7	3.6-162.0
Phase 2	33	31.5	7.7	19.5-47.2	27.5	5.9	16.0-41.3	18.4	5.3	3.8-28.7	19.9	10.9	1.1-43.3
Blade cores (all phases)	7	70.6	10.1	53.5-83.2	58.2	11.3	34.6-69.6	32.7	12.9	15.2-49.4	145.7	57.7	48.8-225.0

Table 5.4: Flake core dimensions, excluding large outliers (>250 grams).

	N	Length/Max dimension (mm)			Width (mm)			Thickness (mm)			Weight (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Flake Cores													
Phase 4	23	36.3	12.1	17.7-71.1	34.2	9.2	17.5-60.8	21.7	6.9	12.3-34.3	33.6	27.4	5.2-138.0
Lower Phase 3	35	34.2	15.4	11.3-73.8	32.3	10.6	16.5-68.9	22.3	9.4	9.3-46.8	36.8	43.8	2.5-202.0
Upper Phase 3	42	34.4	12.2	15.8-70.7	30.2	7.8	20.7-51.0	22.1	7.3	10.5-41.7	27.8	24.4	5.2-111.7
Phase 2	17	31.2	10.7	12.1-46.3	29.8	8.3	16.0-49.6	21.6	7.4	12.3-39.8	24.9	23.5	4.6-100.7

Table 5.5: Core dimensions, by type (abridged, Phases 2-4).

	N	Length/Max dimension (mm)			Width (mm)			Thickness (mm)			Weight (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Flake													
Single platform	30	25.6	10.0	11.3-54.6	33.5	13.0	17.4-85.4	23.2	8.8	10.2-53.8	34.5	60.8	2.5 - 342.0
Opposed platform	20	30.1	12.5	12.1-64.0	37.9	19.2	17.5-95.0	25.4	14.6	9.6-62.3	62.3	114.6	6.1-467.0
Change of orientation	22	45.9	17.9	30.8-103.3	37.3	18.4	23.2-100.1	24.6	11.7	10.9-60.2	70.3	127.8	6.9-597.0
Multiple platform	54	44.2	20.1	21.8-117.2	34.1	14.4	16.0-83.4	25.7	13.3	9.3-62.8	74.4	137.3	4.0-698.0
Bladelet													
Single platform	83	28.4	8.1	12.7-48.6	28.5	8.2	16.0-63.7	20.3	7.2	3.8-46.3	24.9	25.4	1.1-162.0
Opposed platform	25	33.5	9.2	19.9-57.5	26.4	7.8	16.0-50.0	19.0	8.5	6.3-47.6	25.4	28.3	3.6-148.0
Change of orientation	48	36.2	9.1	16.4-68.6	28.8	7.8	13.6-55.0	19.6	5.3	11.2-35.8	24.1	21.3	6.3-147.0
Multiple platform	40	38.5	7.9	23.6-55.6	31.0	7.6	13.7-48.7	21.9	6.9	2.0-39.7	31.2	22.5	4.9-104.6

Table 5.6: Average core platform area (cm^2), by phase and type (abridged). For cores with more than one platform, the area of the largest platform has been utilised.

	Flake				Bladelet			
	Single platform	Opposed platform	Change of orientation	Multiple platform	Single platform	Opposed platform	Change of orientation	Multiple platform
Phase 2	8.3	4.4	N/A	4.5	5.6	3.5	7.4	4.6
Upper Phase 3	6.7	5.8	8.5	9.0	6.1	3.8	7.1	9.7
Lower Phase 3	9.8	5.0	14.5	7.6	7.1	5.4	7.5	7.4
Phase 4	18.4	11.5	7.1	18.1	4.7	9.3	6.4	7.3

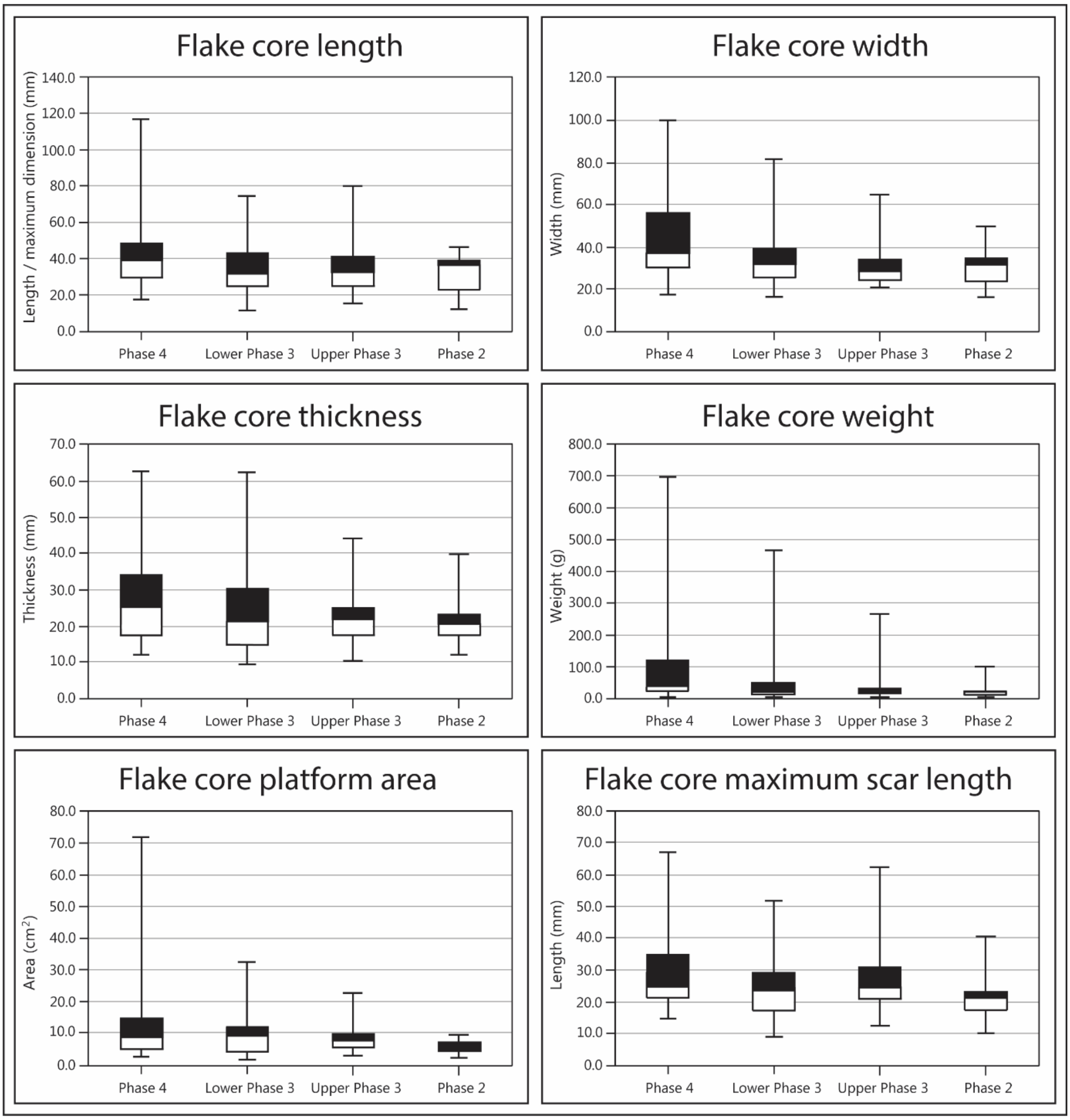


Figure 5.8: Flake core dimensions, by phase.

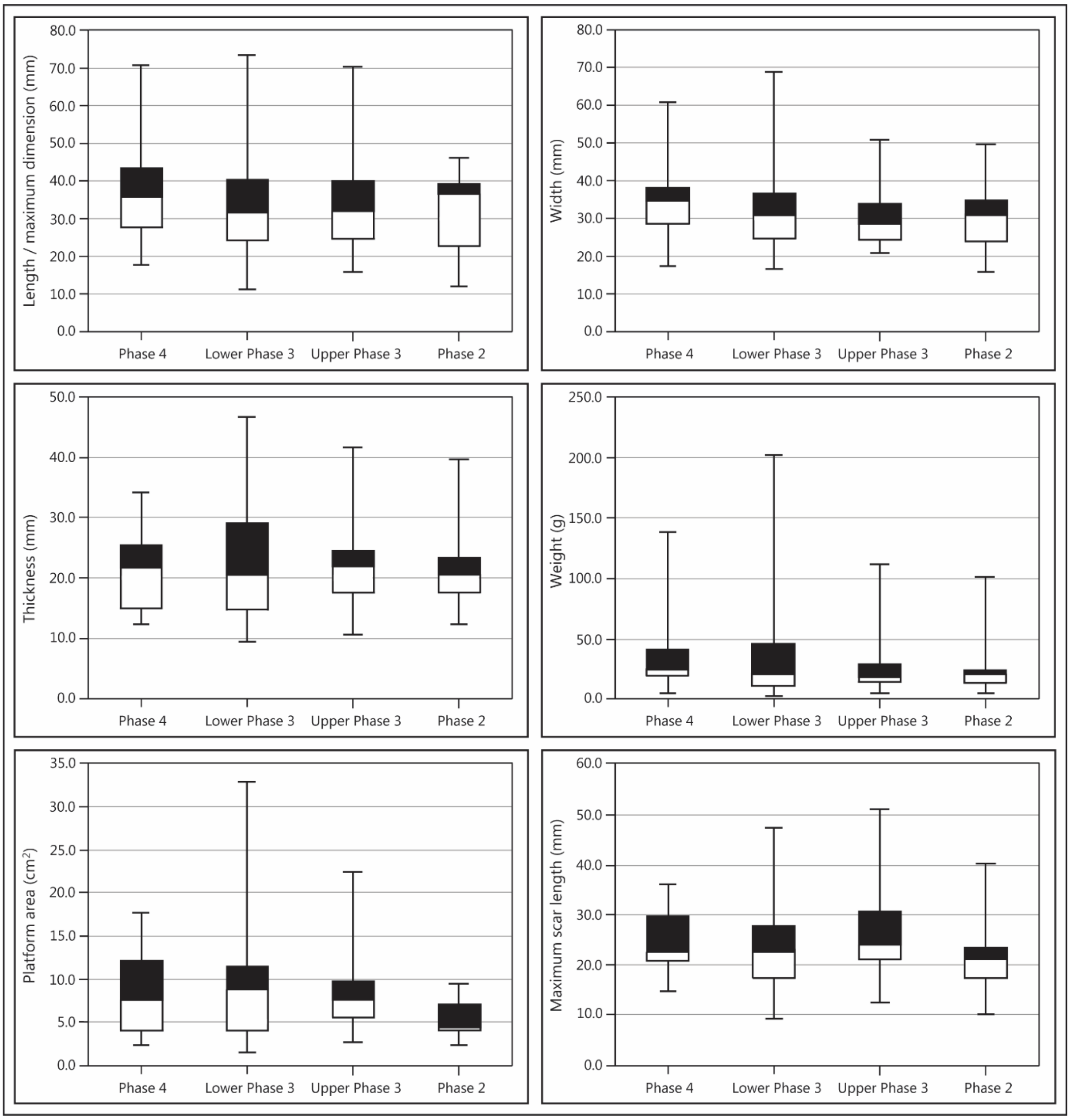


Figure 5.9: Flake core dimensions (excluding large outliers), by phase.

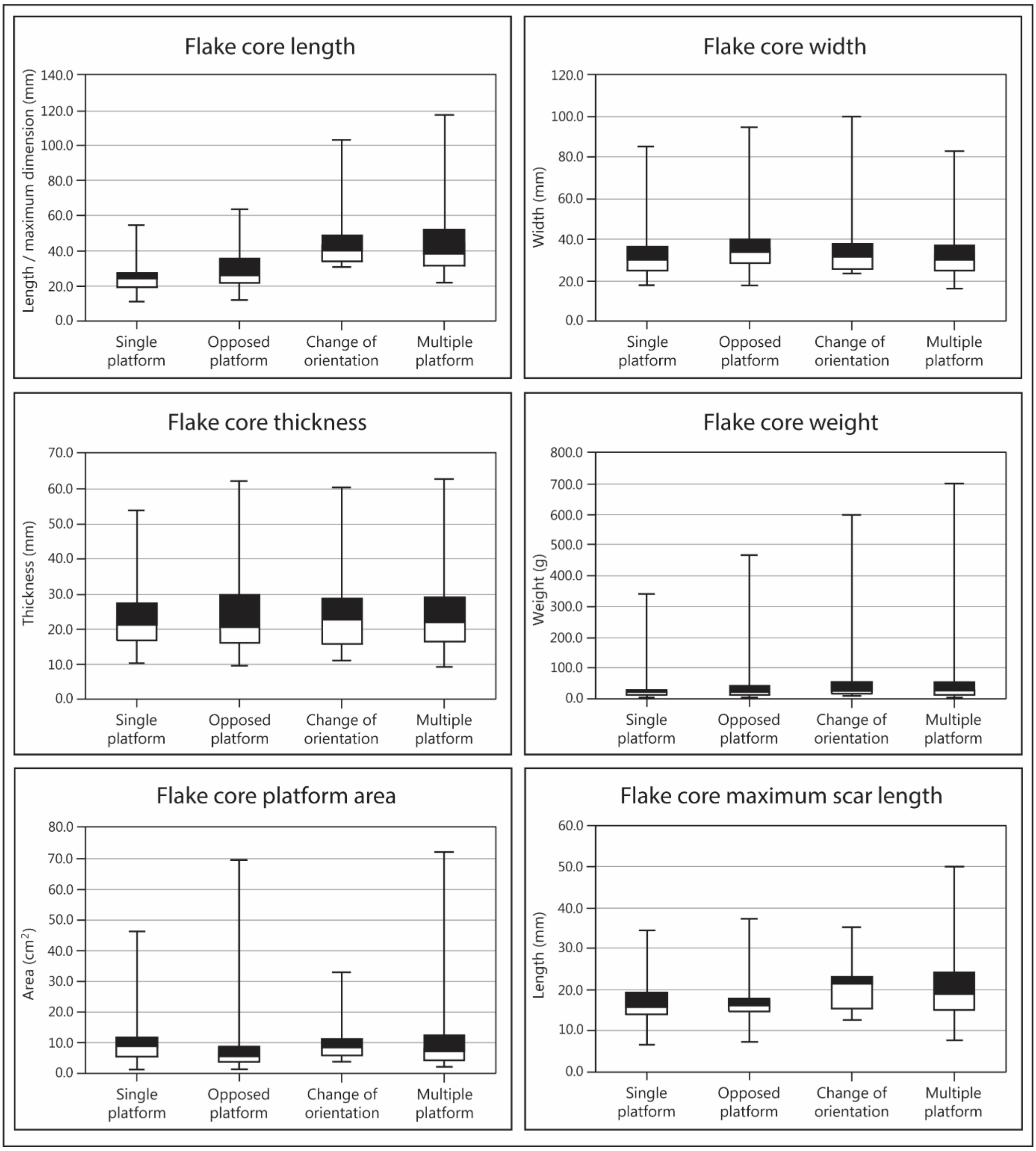


Figure 5.10: Flake core dimensions, by type (abridged, Phases 2-4).

Lower Phase 3 assemblage. After this phase, the platform area of single platform and opposed platform flake cores remain largely static in the Upper Phase 3 and Phase 2 assemblages, while the multiple platform flake cores exhibit a second drop between Upper Phase 3 and Phase 2. Conversely, the Lower Phase 3 change of orientation flake cores present significantly broader mean platforms areas than either the Phase 4 or Upper Phase 3 assemblages. Overall, opposed platform flake cores possess the smallest platform areas between Lower Phase 3 and Phase 2, although the reduction of multiple platform core size in this last assemblage means that the two types are roughly similar in size when it comes to platform area.

Platform combinations for flake cores with two platforms (opposed and change of orientation types) vary by phase (**Table 5.7; Fig. 5.11**). In Phase 4, these types are characterised by cores with a combination of plain and facetted platforms, while the Lower and Upper Phase 3 examples are represented more by pieces featuring only facetted platforms. Conversely, the small (N = 5) Phase 2 sample is distinguished mostly by pieces exclusively exhibiting either plain or facetted cores. Flake cores with three or more platforms are typified either by pieces exclusively displaying facetted platforms (in Phase 4 and Upper Phase 3), a combination of plain and facetted platforms (in Lower Phase 3), or a mixture of purely facetted cores and those with a combination of platform types (in Phase 2). Flake cores featuring extant cortical platforms are rare regardless of phase, and are usually present alongside plain or facetted platforms when they are encountered.

In conjunction with their smaller dimensions, the Phase 2 flake cores exhibit lower numbers of negative flake scars compared to the three earlier assemblages (**Fig. 5.12**). Scar counts also vary on a typological basis, with multiple platform flake cores in particular plummeting from an average of 17 scars in Phase 4 to nine in Phase 2 (**Table 5.8**). The mean maximum scar length of the Phase 2 flake cores are also lower than in any of the preceding assemblages (**Table 5.8**; **Figs. 5.8 – 5.9**).

Flake core scar patterning varies considerably by phase and type. Flake cores with divergent scar patterns are overall uncommon in the earliest three assemblages, being consistently outnumbered by cores with convergent or parallel patterns (**Table 5.9**). Conversely, the Phase 2 assemblage witnesses a dramatic rise in the proportion of flake cores featuring divergent scar patterns, to the point that they comprise a majority of analysed pieces from this phase (47.1%). This surge corresponds with a notably reduced amount of convergent flake cores in

Table 5.7: Core platform combinations, by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2	
	N	%	N	%	N	%	N	%
Flake cores								
One Platform								
Plain only	3	60.0	2	20.0	4	36.4	2	40.0
Facetted only	1	20.0	8	80.0	7	63.6	3	60.0
Cortical only	1	20.0	0	0.0	0	0.0	0	0.0
Total	**5**	**100.0**	**10**	**100.0**	**11**	**100.0**	**5**	**100.0**
Two Platforms								
Plain only	4	26.7	3	23.1	0	0.0	2	40.0
Facetted only	2	13.3	5	38.5	8	80.0	2	40.0
Cortical only	0	0.0	0	0.0	0	0.0	0	0.0
Plain & facetted	7	46.7	3	23.1	1	10.0	1	20.0
Plain & cortical	2	13.3	1	7.7	1	10.0	0	0.0
Facetted & cortical	0	0.0	1	7.7	0	0.0	0	0.0
Total	**15**	**100.0**	**13**	**100.1**	**10**	**100.0**	**5**	**100.0**
Three+ Platforms								
Plain only	0	0.0	1	7.1	3	13.6	1	14.3
Facetted only	6	60.0	5	35.7	10	45.5	3	42.9
Cortical only	0	0.0	0	0.0	1	4.5	0	0.0
Plain & facetted	3	30.0	7	50.0	3	13.6	3	42.9
Plain & cortical	0	0.0	0	0.0	3	13.6	0	0.0
Facetted & cortical	1	10.0	1	7.1	1	4.5	0	0.0
Plain, facetted & cortical	0	0.0	0	0.0	1	4.5	0	0.0
Total	**10**	**100.0**	**14**	**99.9**	**22**	**99.8**	**7**	**100.1**
Bladelet cores								
One Platform								
Plain only	6	54.5	9	33.3	20	58.8	11	84.6
Facetted only	5	45.5	17	63.0	13	38.2	1	7.7
Cortical only	0	0.0	1	3.7	1	2.9	1	7.7
Total	**11**	**100.0**	**27**	**100.0**	**34**	**99.9**	**13**	**100.0**
Two Platforms								
Plain only	3	27.3	9	33.3	3	17.6	9	64.3
Facetted only	2	18.2	11	40.7	8	47.1	2	14.3
Cortical only	1	9.1	0	0.0	0	0.0	0	0.0
Plain & facetted	4	36.4	6	22.2	6	35.3	3	21.4
Plain & cortical	0	0.0	1	3.7	0	0.0	0	0.0
Facetted & cortical	1	9.1	0	0.0	0	0.0	0	0.0
Total	**11**	**100.1**	**27**	**99.9**	**17**	**100.0**	**14**	**100.0**
Three+ Platforms								
Plain only	1	7.7	0	0.0	1	9.1	2	33.3
Facetted only	9	69.2	4	33.3	6	54.5	1	16.7
Cortical only	0	0.0	0	0.0	0	0.0	0	0.0
Plain & facetted	3	23.1	7	58.3	4	36.4	2	33.3
Plain & cortical	0	0.0	0	0.0	0	0.0	1	16.7
Facetted & cortical	0	0.0	0	0.0	0	0.0	0	0.0
Plain, facetted & cortical	0	0.0	1	8.3	0	0.0	0	0.0
Total	**13**	**100.0**	**12**	**99.9**	**11**	**100.0**	**6**	**100.0**

Table 5.8: Core flake scar number and maximum length, by phase and type (abridged).

	N	No. of flake scars			Maximum flake scar length (mm)		
		Mean	SD	Range	Mean	SD	Range
Flake cores							
Phase 4							
Single platform	4	8	4.9	4-14	33.7	9.2	24.5 – 46.4
Opposed platform	8	11	10.9	6-16	24.2	8.8	15.7 – 45.2
Change of orientation	7	10	4.3	3-17	28.1	9.0	19.0 – 44.6
Multiple platform	10	17	5.8	8-25	34.4	16.0	14.7 – 67.0
Lower Phase 3							
Single platform	10	7	3.7	2-15	20.8	9.3	9.2 – 40.6
Opposed platform	7	12	2.8	9-16	26.6	11.0	16.9 – 49.9
Change of orientation	6	14	7.5	10-29	28.3	11.1	17.3 – 47.4
Multiple platform	14	15	4.3	9-22	24.6	10.2	10.6 – 51.6
Upper Phase 3							
Single platform	11	8	2.0	4-10	23.0	3.8	19.2 – 30.6
Opposed platform	1	9	-	9	21.5	-	21.5
Change of orientation	9	13	3.2	6-18	27.3	6.6	19.0 – 36.5
Multiple platform	22	13	5.0	7-24	28.9	11.8	12.4 – 62.3
Phase 2							
Single platform	5	10	7.2	3-22	19.7	3.3	18.9 – 23.3
Opposed platform	4	8	2.9	6-12	21.2	13.2	10.2 – 40.3
Change of orientation	0	-	-	-	-	-	-
Multiple platform	8	9	4.7	4-18	22.9	7.2	12.2 – 36.9
Bladelet cores							
Phase 4							
Single platform	11	9	3.1	3-13	31.5	7.5	17.3 – 42.9
Opposed platform	5	14	6.6	8-24	34.4	9.6	21.3 – 43.9
Change of orientation	8	12	4.0	7-18	30.0	8.1	20.7 – 46.4
Multiple platform	17	17	2.9	11-22	28.5	10.4	12.6 – 48.6
Lower Phase 3							
Single platform	27	11	6.0	4-29	28.6	8.1	13.7 – 49.4
Opposed platform	5	11	2.9	9-16	28.1	6.9	19.5 – 37.7
Change of orientation	22	12	3.3	5-18	27.8	7.2	14.9 – 45.6
Multiple platform	12	14	4.9	5-25	29.3	6.8	18.9 – 38.1
Upper Phase 3							
Single platform	33	10	3.1	3-18	29.7	7.2	18.5 – 51.2
Opposed platform	5	10	2.1	7-12	27.1	6.5	18.7 – 35.0
Change of orientation	13	11	3.1	6-16	31.3	5.7	20.8 – 38.9
Multiple platform	11	15	3.4	11-22	31.4	6.5	22.5 – 42.2
Phase 2							
Single platform	12	8	3.1	4-13	25.1	6.0	16.2 – 36.2
Opposed platform	10	10	3.0	7-15	30.4	5.8	18.6 – 40.8
Change of orientation	5	10	5.8	4-18	26.6	6.2	17.8 – 33.1
Multiple platform	6	15	3.5	11-20	28.8	4.7	23.7 – 36.5
Blade cores	7	15	7	4-25	59.0	8.4	47.0 - 69.6

Table 5.9: Core scar patterning, by phase and type (abridged).

	N	Divergent		Parallel		Convergent	
		N	%	N	%	N	%
Flake cores							
Phase 4							
Single platform	4	1	25.0	0	0.0	3	75.0
Opposed platform	8	1	12.5	5	62.5	2	25.0
Change of orientation	7	2	28.6	3	42.9	2	28.6
Multiple platform	10	3	30.0	2	20.0	5	50.0
Total	**29**	**7**	**24.1**	**10**	**34.5**	**12**	**41.4**
Lower Phase 3							
Single platform	10	2	20.0	1	10.0	7	70.0
Opposed platform	7	0	0.0	4	57.1	3	42.9
Change of orientation	6	2	33.3	1	16.7	3	50.0
Multiple platform	14	2	14.3	5	35.7	7	50.0
Total	**37**	**6**	**16.2**	**11**	**29.7**	**20**	**54.1**
Upper Phase 3							
Single platform	11	1	9.1	5	45.5	5	45.5
Opposed platform	1	0	0.0	1	100.0	0	0.0
Change of orientation	9	0	0.0	2	22.2	7	77.8
Multiple platform	22	6	27.3	7	31.8	9	40.9
Total	**43**	**7**	**16.3**	**15**	**34.9**	**21**	**48.8**
Phase 2							
Single platform	5	2	40.0	3	60.0	0	0.0
Opposed platform	4	1	25.0	1	25.0	2	50.0
Change of orientation	0	-	-	-	-	-	-
Multiple platform	8	5	62.5	1	12.5	2	25.0
Total	**17**	**8**	**47.1**	**5**	**29.4**	**4**	**23.5**
Bladelet cores							
Phase 4							
Single platform	11	0	0.0	4	36.4	7	63.6
Opposed platform	5	0	0.0	1	20.0	4	80.0
Change of orientation	8	0	0.0	4	50.0	4	50.0
Multiple platform	11	0	0.0	6	54.5	5	45.5
Total	**35**	**0**	**0.0**	**15**	**42.9**	**20**	**57.1**
Lower Phase 3							
Single platform	27	0	0.0	12	44.4	15	55.6
Opposed platform	5	0	0.0	2	40.0	3	60.0
Change of orientation	22	0	0.0	10	45.5	12	54.5
Multiple platform	12	1	8.3	6	50.0	5	41.7
Total	**66**	**1**	**1.5**	**30**	**45.5**	**35**	**53.0**
Upper Phase 3							
Single platform	33	1	3.0	10	30.3	22	66.7
Opposed platform	5	0	0.0	2	40.0	3	60.0
Change of orientation	13	0	0.0	7	53.8	6	46.2
Multiple platform	11	0	0.0	5	45.5	6	54.5
Total	**62**	**1**	**1.6**	**24**	**38.7**	**37**	**59.7**
Phase 2							
Single platform	12	0	0.0	1	8.3	11	91.7
Opposed platform	10	0	0.0	3	30.0	7	70.0
Change of orientation	5	0	0.0	2	40.0	3	60.0
Multiple platform	6	0	0.0	2	33.3	4	66.7
Total	**33**	**0**	**0.0**	**8**	**24.2**	**25**	**75.8**
Blade cores	**7**	**0**	**0.0**	**4**	**57.1**	**3**	**42.9**

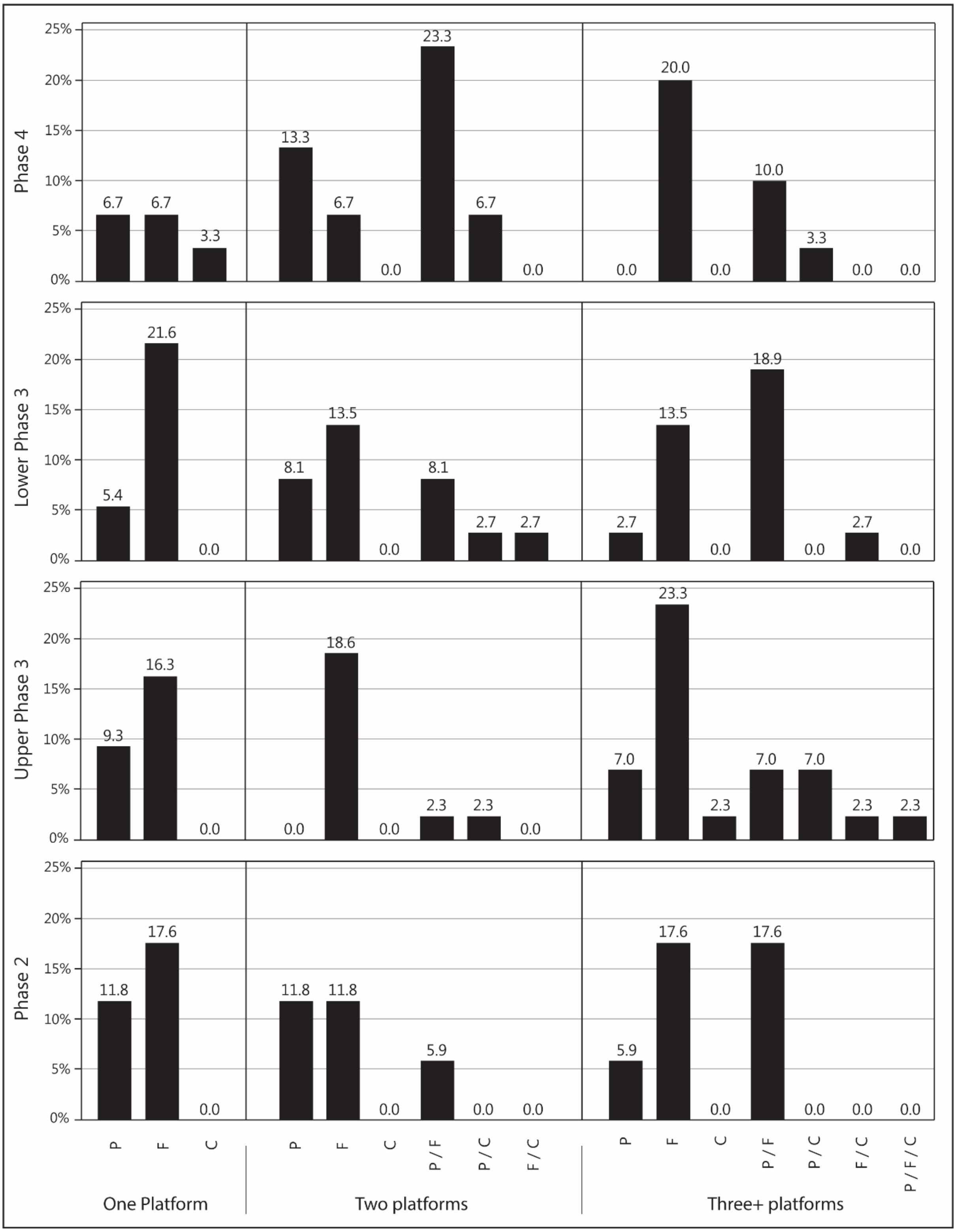


Figure 5.11: Flake core platform combinations, by phase. P = Plain, F = Facetted, C = Cortical.

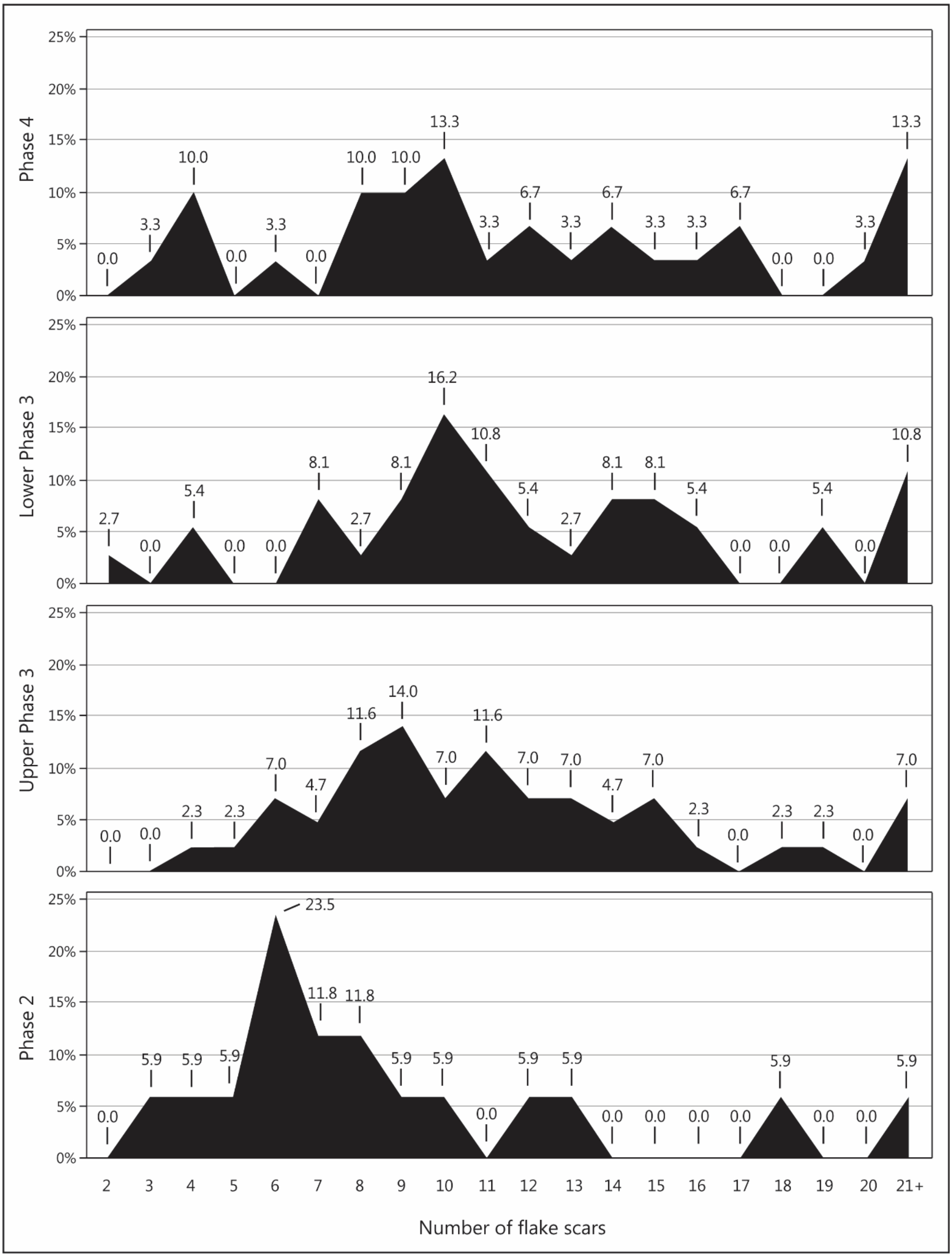


Figure 5.12: Number of negative flake scars on flake cores, by phase.

Phase 2. The proportions of flake cores with parallel flake scars remain static over time, comprising approximately one third of the pieces in each assemblage. By type, the single platform flake cores exhibit a bias towards pieces with convergent scar patterns in the Phase 4 and Lower Phase 3 assemblages, before being gradually supplanted by pieces with parallel scar patterns in Upper Phase 3 and Phase 2. The multiple platform flake cores are likewise primarily represented by pieces by convergent scar patterns between Phase 4 and Upper Phase 3, whereas the Phase 2 sample presents a higher proportion of pieces with divergent patterns.

The percentage of cortical surface coverage on the Wadi Hammeh 27 cores is affected to a certain degree by both occupational phase and type. The proportion of cortex-free flake cores remains relatively consistently low across the four assemblages, ranging from 19% in Lower Phase 3 to 24% in Upper Phase 3 (**Fig. 5.13**). Cortex averages vary by both phase and type (**Table 5.10**). The Phase 4 assemblage presents a particularly high proportion of cortex-rich outliers, many of which are also of a noticeably greater mass than the assemblage average (**Fig. 5.14**). These outliers include the only two cores with cortex covering 90% of their surface – these pieces being identified as change of orientation cores due to relationship between the flake scars present. A substantial divide is nonetheless present between these two objects in terms of mass, however, with one weighing 138 grams and the other 597 grams. Despite this disparity, the cortex standard deviation values remain relatively consistent across the four flake core assemblages, suggesting that the higher cortex coverage in Phase 4 was not simply due to the presence of a small number of cortex-rich outliers. In sharp contrast to the Phase 4 and Lower Phase 3 assemblages, the Upper Phase 3 and Phase 2 flake cores display a clear bias towards pieces with cortex covering between 1% and 10% of their total surface area. This bias towards cortex-scarce flake cores becomes particularly pronounced in Phase 2, where no examples of flake cores with cortex on more than twenty percent of their total surface area were analysed.

Change of orientation flake cores prove to be particularly rich in cortex compared with other flake core types in the Phase 4 and Lower Phase 3 assemblages (**Table 5.10**), with their averages featuring cortex on approximately a third of their total surface area. This outcome remains consistent even when the two aforementioned pseudo-change of orientation cores are excluded. In addition to containing these two cortex-heavy Phase 4 cores, this type presents only a single piece which is completely free of cortex (**Figs. 5.15 – 5.16**). This high occurrence of cortex coverage indicates that many of these pieces represent the initial core

Table 5.10: Core cortex coverage, by phase and type (abridged).

	N	Mean (%)	Standard Deviation	Range (%)
Flake cores				
Phase 4				
Single platform	4	38.8	20.2	15-60
Opposed platform	8	15.0	12.0	0-30
Change of orientation	7	38.6	36.9	5-90
Multiple platform	10	22.0	23.7	0-65
Lower Phase 3				
Single platform	10	31.0	18.2	0-50
Opposed platform	7	25.7	21.5	0-60
Change of orientation	6	30.0	7.1	20-40
Multiple platform	14	11.1	13.3	0-40
Upper Phase 3				
Single platform	11	23.2	17.5	0-60
Opposed platform	1	0.0	-	0
Change of orientation	8	18.8	18.9	0-60
Multiple platform	22	17.5	19.4	0-70
Phase 2				
Single platform	5	12.0	12.5	0-30
Opposed platform	4	8.8	4.8	5-15
Change of orientation	0	-	-	-
Multiple platform	8	13.1	18.5	0-55
Bladelet cores				
Phase 4				
Single platform	11	26.4	16.6	0-45
Opposed platform	5	19.0	16.4	0-35
Change of orientation	8	14.4	20.9	0-60
Multiple platform	11	10.5	8.2	0-30
Lower Phase 3				
Single platform	20	20.0	17.2	0-65
Opposed platform	5	8.0	9.1	0-20
Change of orientation	22	13.0	11.5	0-40
Multiple platform	12	7.1	6.6	0-20
Upper Phase 3				
Single platform	33	21.8	15.5	0-60
Opposed platform	5	13.0	18.6	0-45
Change of orientation	13	5.8	8.1	0-20
Multiple platform	11	11.4	11.0	0-35
Phase 2				
Single platform	12	9.2	13.8	0-30
Opposed platform	10	16.5	16.0	0-40
Change of orientation	5	10.0	12.7	0-30
Multiple platform	6	10.0	10.5	0-30
Blade cores	7	11.4	14.9	0-40

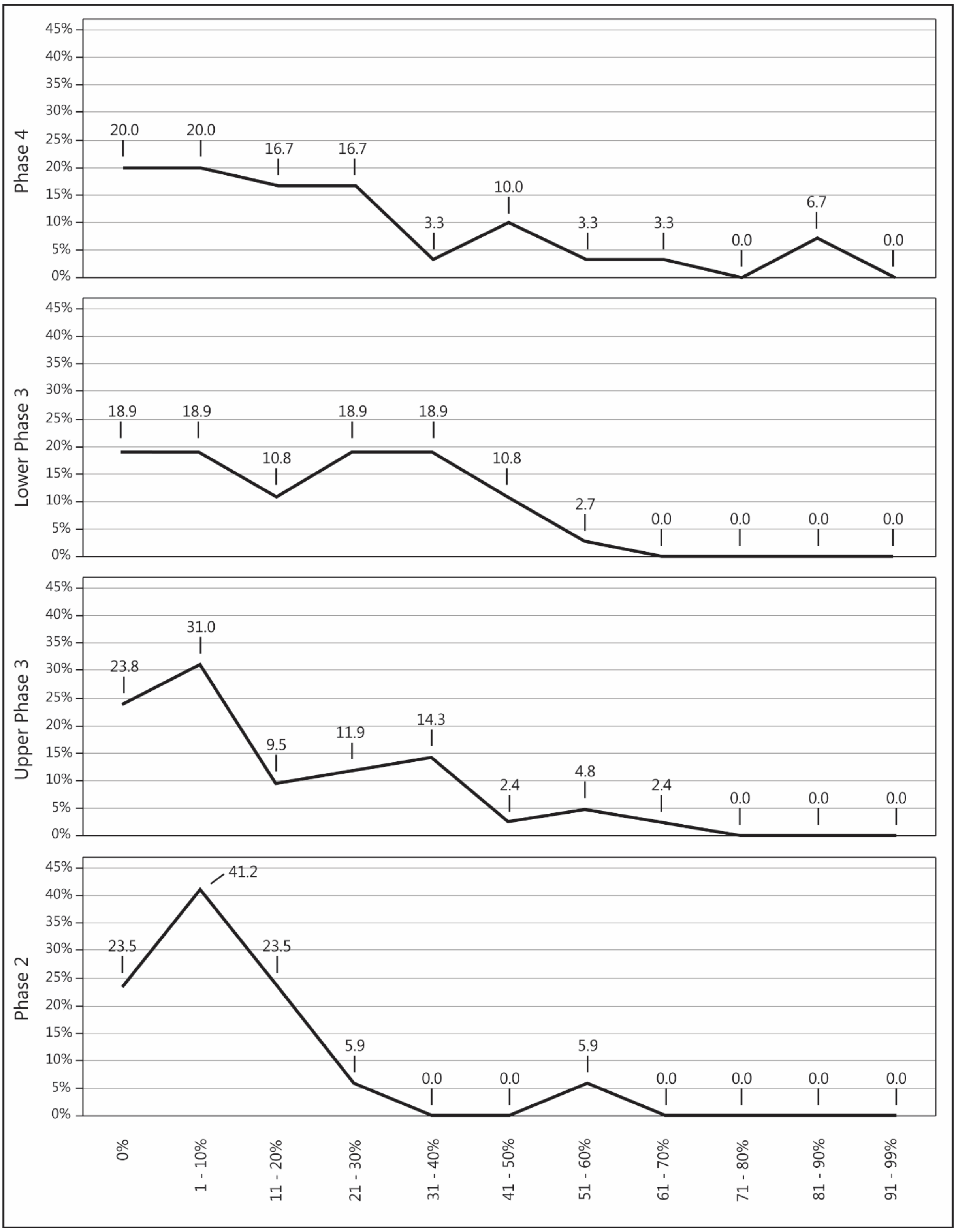


Figure 5.13: Flake core cortex coverage, by phase.

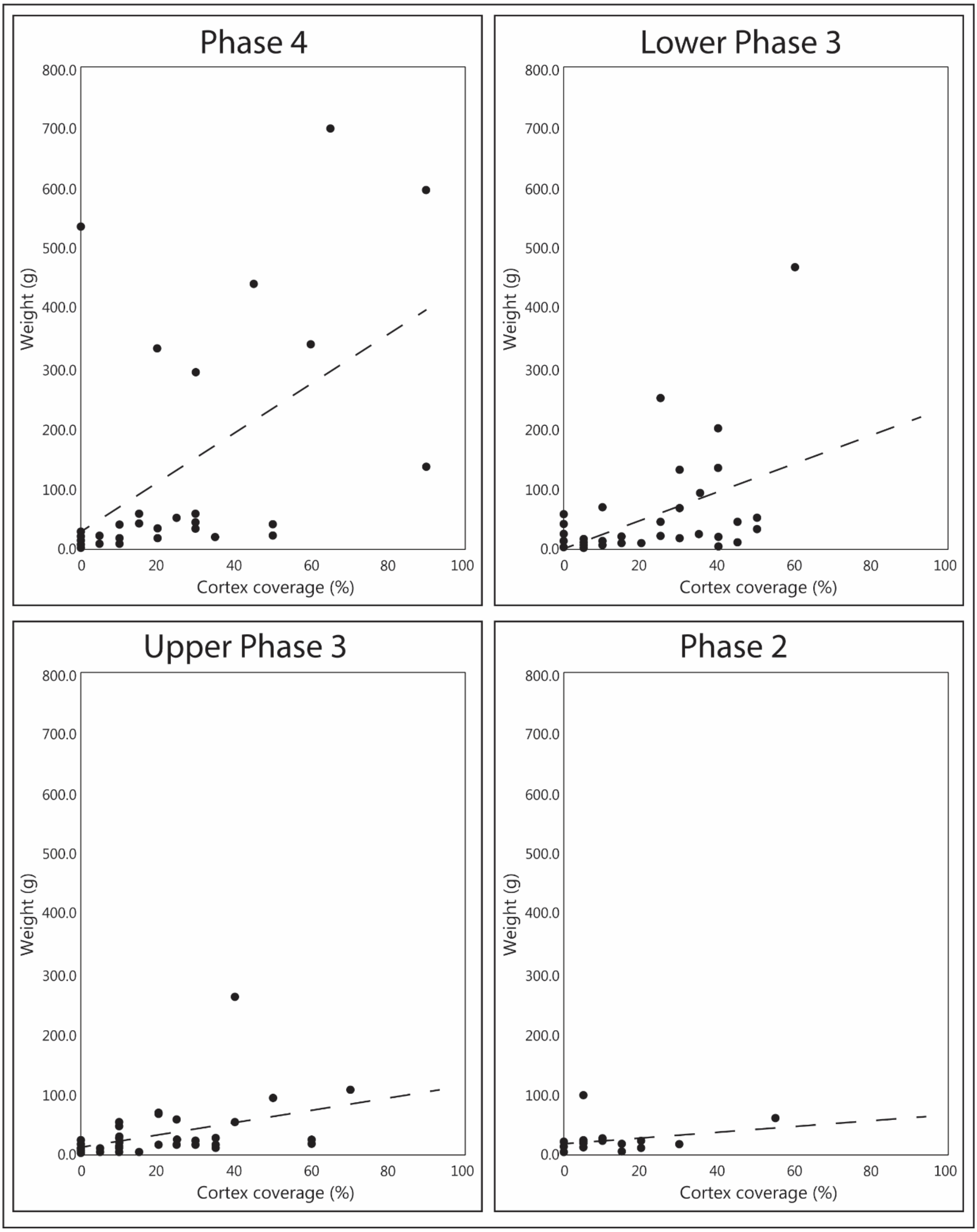


Figure 5.14: Flake core cortex coverage versus weight, by phase.

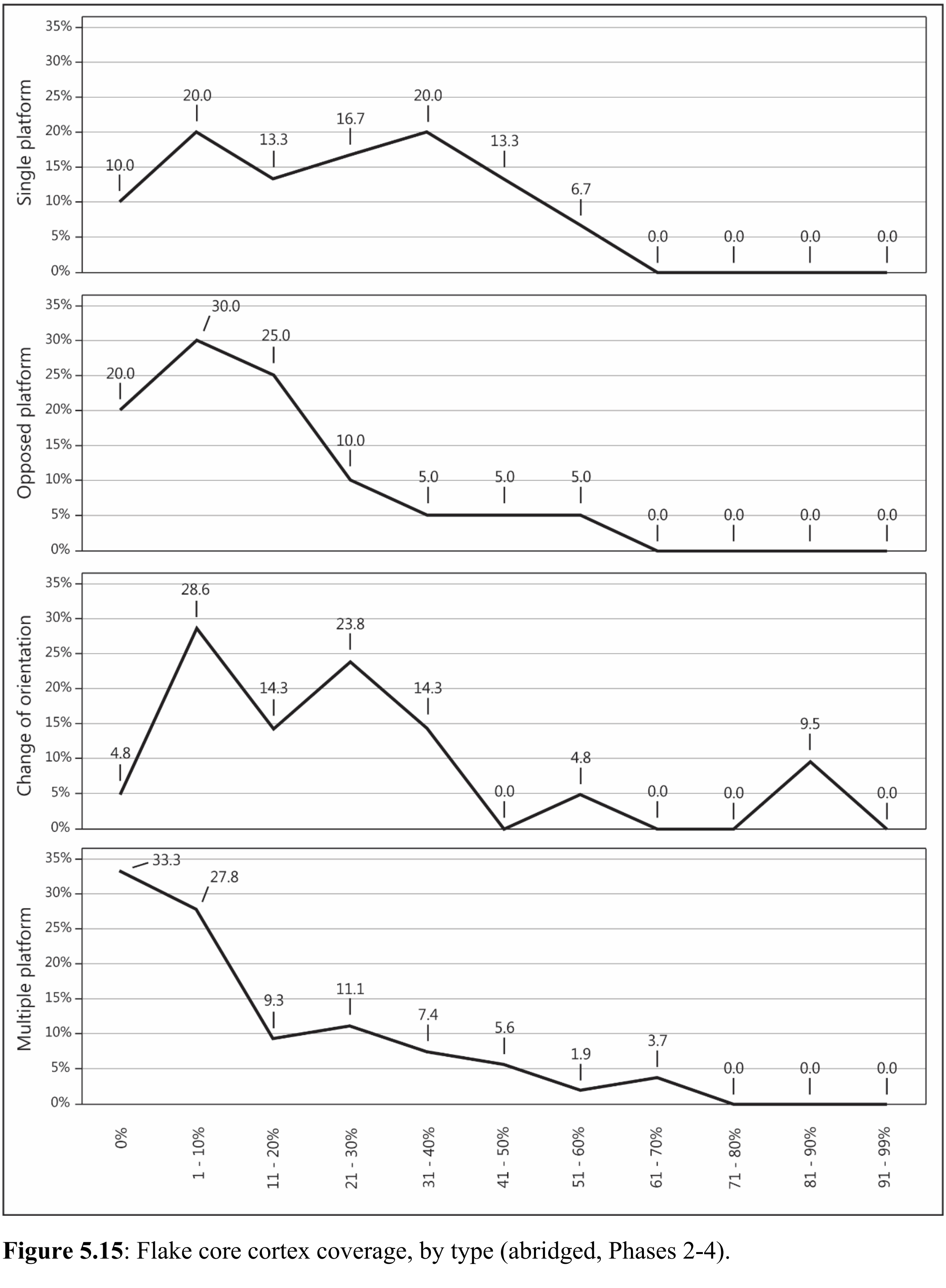


Figure 5.15: Flake core cortex coverage, by type (abridged, Phases 2-4).

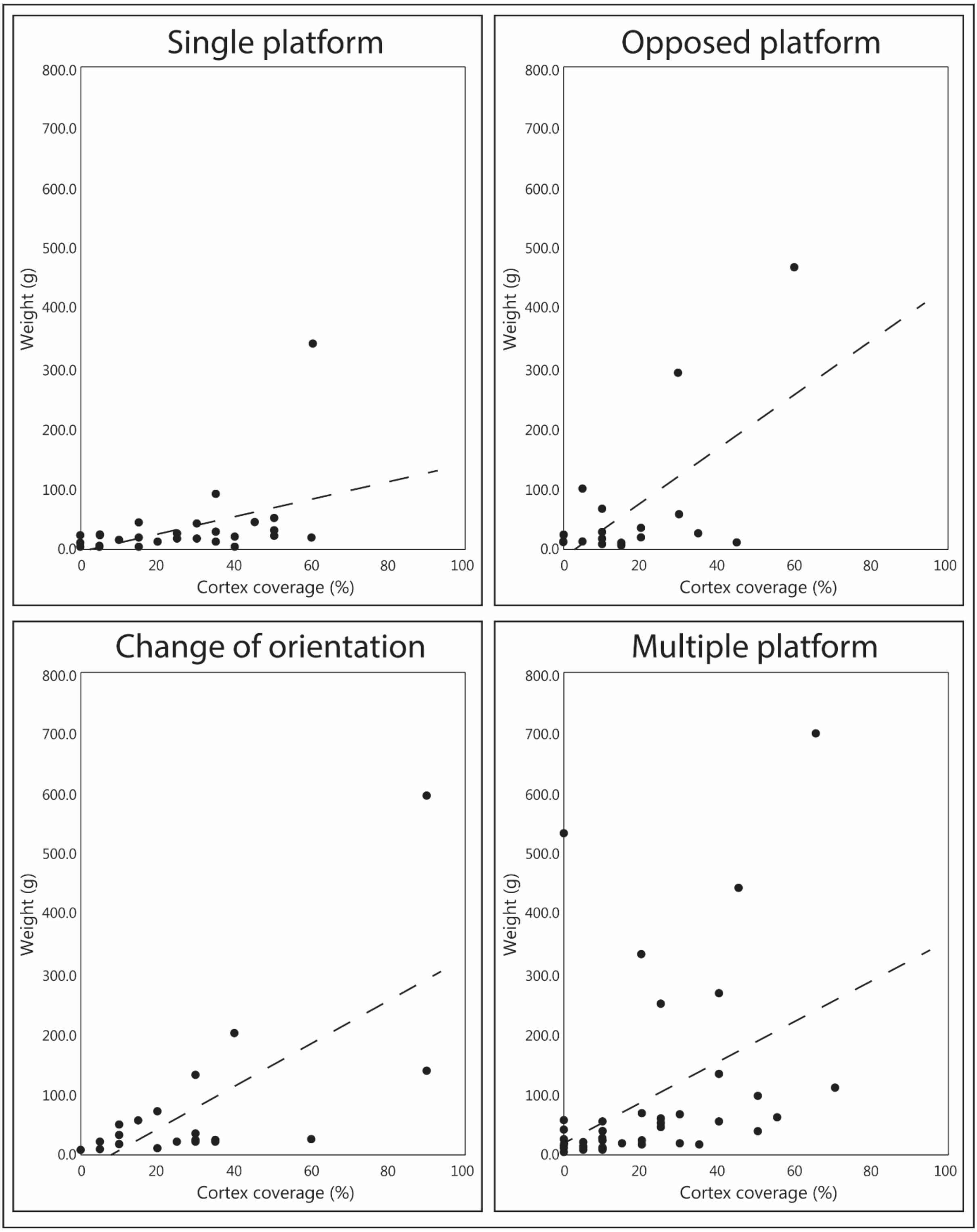


Figure 5.16: Flake core cortex coverage versus weight, by type (abridged, Phases 2-4).

preparation state, with primary flakes being removed at perpendicular angles to one another. The deposition of these cores in such a state indicates that little attention was paid to raw material conservation at Wadi Hammeh 27 (see Chapter 8).

The mean cortex coverage on the single platform flake cores is similarly high in the earlier assemblages, with only 10% (N = 3) being completely free of cortex. They nonetheless remain small, with only one heavy outlier present in the analytical sample (**Fig. 5.16**). The combination of cortex-rich and cortex-free pieces with similar dimensions suggests that the single platform flake cores deposited at Wadi Hammeh 27 originated from a myriad of different sized chert cobbles, with some of those in the lower ranges of cortex coverage likely representing more heavily reduced pieces in a tertiary stage of reduction, possibly having originated as one of the aforementioned expediently knapped cobbles. On the other hand, smaller, cortex-rich pieces most likely represent the relatively expedient production of flakes through a basic two-stage process encompassing the creation of a platform on a small cobble, from which a restricted number of small flakes were removed.

The multiple platform flake cores exhibit the greatest range of heavy outliers, with varying ranges of cortical coverage (**Fig. 5.16**). Nevertheless, the vast majority of pieces belonging to this type are small cores lacking cortex on most on their surface, and their mean cortical coverage thus remains low (**Table 5.10**). At the same time, numerous small, yet cortex-rich, multiple platform flake cores comparable to the aforementioned single platform cores are also present within the analytical sample. As such, it is clear that the multiple platform flake cores deposited at Wadi Hammeh 27 represent a combination of extensively rotated and worked blocks of chert, alongside a proportion of expediently knapped smaller cobbles.

5.4.2 Blade cores

Given the scarcity of extant blade cores in the Wadi Hammeh 27 assemblages, these artefacts are better analysed as a collective whole rather than on an inter-phase or typological basis. Unsurprisingly, the combined blade cores demonstrated higher average dimensions and weight than the flake or bladelet cores from any of the four assemblages. The maximum ranges exhibited by these pieces are relatively low, however, being outsized by the largest Phase 4 flake cores in every field (**Table 5.3**).

The seven blade cores analysed feature a notably greater mean flake scar count and maximum length than the other core groups. These cores nonetheless remain relatively small, with the longest flake scar measuring only 70mm, while the average maximum length is a mere 59mm (**Table 5.8**). These dimensions are much lower than those of many of the retouched tools manufactured from blade blanks, indicating that the residual blade cores present in the archaeological record at Wadi Hammeh 27 provide only a narrow snapshot of the overall sequence of blade production. The blade core assemblage differs from the bladelet cores in that it is characterised by a higher proportion of parallel (57.1%) above convergent scar patterning (42.9%). None of the seven analysed blade cores possesses a divergent layout.

Cortex coverage on the blade cores is low, with an average coverage of eleven percent (**Table 5.10**). Just under half (42.9%) are completely absent of cortex, while the blade core with the highest amount of cortex (covering forty percent of its surface) was a facetted single platform core from the Upper Phase 3 assemblage.

5.4.3 Bladelet cores

Bladelet core dimensions remain largely static across the four assemblages, with the only notable variation being that the Phase 2 bladelet cores are slightly smaller and lighter on average than the preceding assemblages (**Table 5.3**; **Fig. 5.17**). They are consistently smaller than the flake cores in every assemblage aside from Phase 2, where the two core groups possess similar dimensions to one another. As with the flake cores, bladelet core dimensions vary by type, albeit to a slightly reduced extent (**Table 5.5**; **Fig. 5.18**). The average single platform bladelet core is noticeably shorter than the other types, although their mean width and thickness remain similar. Conversely, the multiple platform bladelet cores are slightly larger and heavier than the other bladelet core types.

The mean platform area exhibited by the bladelet cores remains steady over time, with the only discernible variation being a greater maximum range of the Phase 4 sample (**Fig. 5.17**). This consistency is particularly evident in the case of the change of orientation bladelet cores, whereby the largest platform area remains remarkably invariant across all four assemblages (**Table 5.6**). Subsequently, the platform areas of opposed platform cores decline over time, falling from 9.3cm^2 in Phase 4 to 3.8cm^2 in Upper Phase 3, which subsequently remains consistent through to Phase 2. The mean areas of single platform bladelet cores display a

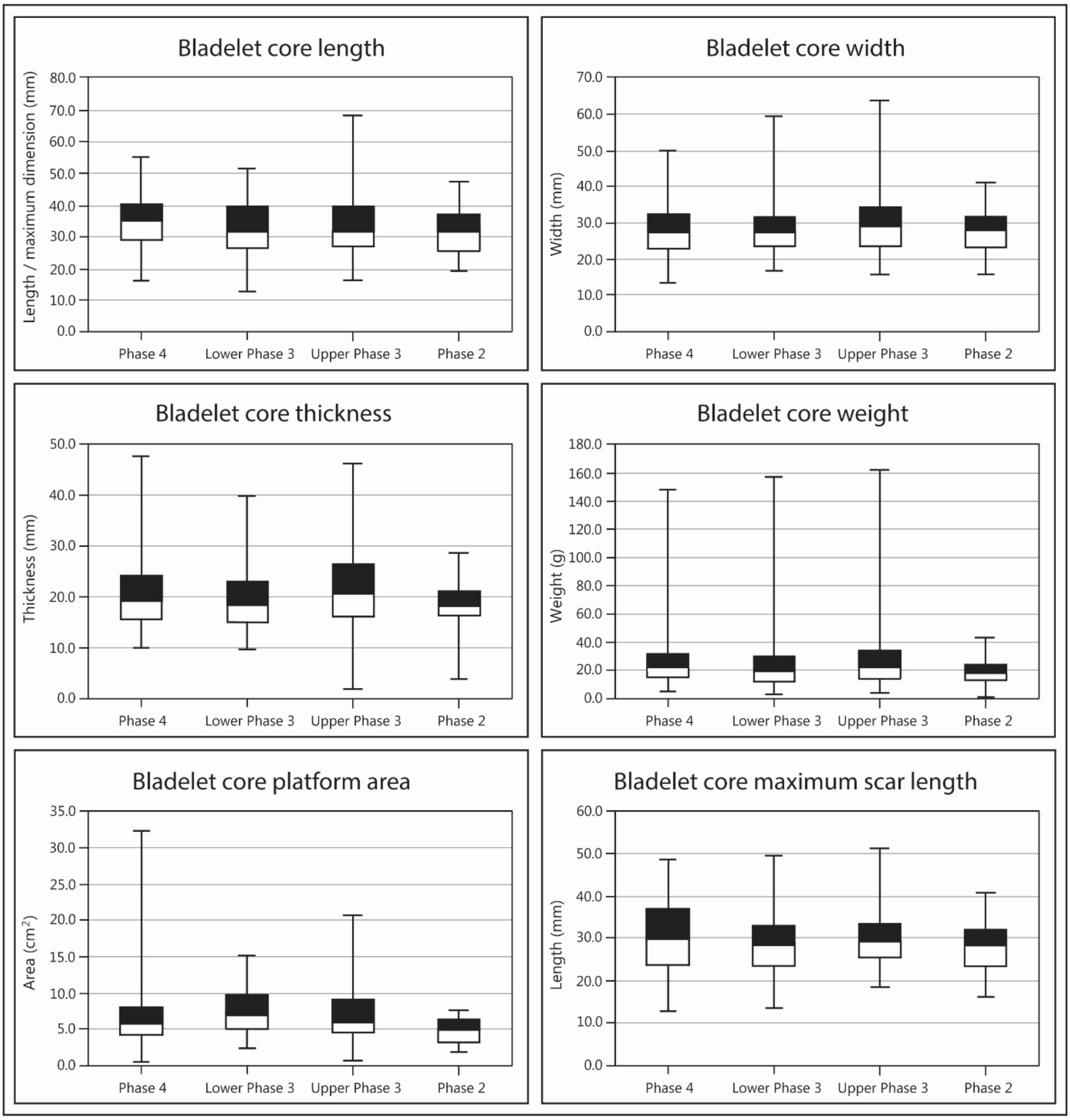


Figure 5.17: Bladelet core dimensions, by phase.

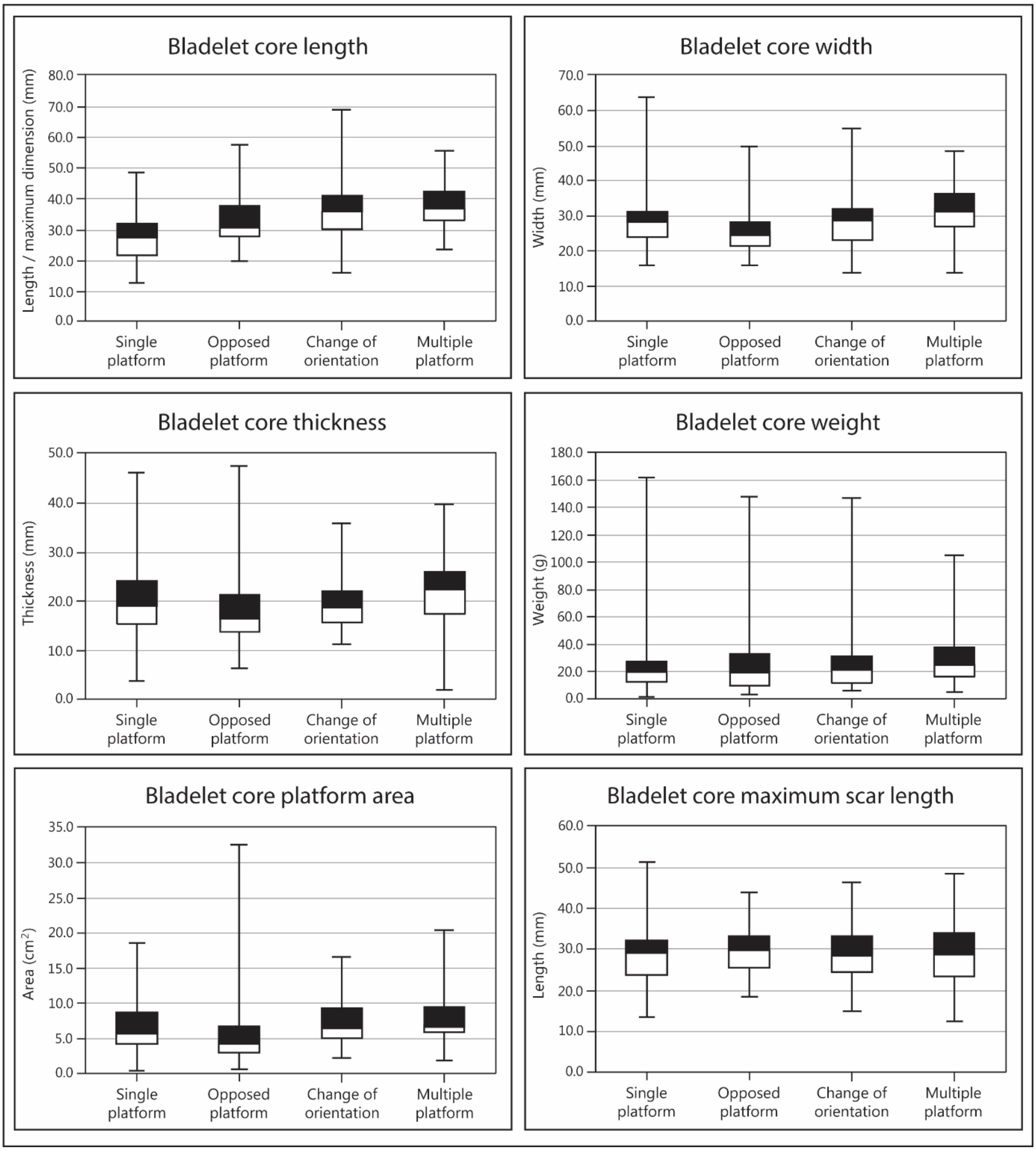


Figure 5.18: Bladelet core dimensions, by type (abridged; Phases 4-2).

greater degree of fluctuation over time, with the Phase 4 collection featuring the smallest platform area (4.7cm^2), which are then followed the greatest platform areas reached by this core type (7.1cm^2) in Lower Phase 3. The maximum area of multiple platform bladelet cores, conversely, remain static across the earliest two assemblages (7.3cm^2 and 7.4cm^2 respectively), after which they rose to 9.7cm^2 in Upper Phase 3 before abruptly falling to their lowest area (4.6cm^2) in Phase 2.

Bladelet cores with two platforms demonstrate similar platform combinations as the flake cores, with the assemblages between Phase 4 and Upper Phase 3 being typified by a combination of specimens featuring either plain or facetted cores, or a combination of the two types (**Table 5.7; Fig. 5.19**). Contrarily, the bladelet cores with two platforms from Phase 2 are dominated by pieces with exclusively plain platforms. The platform combinations on the multiple platform cores fluctuate on an inter-phase basis to a greater degree, with the Phase 4 and Upper Phase 3 assemblages exhibiting a bias towards pieces with only facetted platforms, while the Lower Phase 3 assemblage leans towards pieces with both plain and facetted platforms. The sample taken for the Phase 2 multiple platform bladelet cores is too small for any trends to be evident.

Similar to the flake cores, the mean number of negative scars on the bladelet cores decline over time **(Fig. 5.20**). Mean scar counts also vary considerably by phase and type, with the opposed platform and change of orientation bladelet cores exhibiting slight, unidirectional declines in their mean scar counts over time, whereas the single platform and multiple platform bladelet cores remain relatively static (**Table 5.8**). Multiple platform bladelet cores likewise possess the greatest average scar counts in each assemblage. Given that the overall decrease in scar count over time does not correspond with a reduction in bladelet core dimensions, the rise in single platform bladelet core proportions at Wadi Hammeh 27 can thus serve as an explanation for this phenomenon. The maximum scar lengths reflect the overall bladelet core dimensions, with the Phase 2 single platform core means declining slightly over time from 31.5mm to 25.1mm (**Table 5.8**). The highest range of bladelet core scar lengths straddle the boundary between bladelet and blade dimensions, further reflecting the fact that the division between blade and bladelet cores is ultimately an arbitrary, etic one.

While bladelet cores with convergent scar patterning consistently outnumber cores with parallel flake scars in each assemblage, this tendency becomes particularly pronounced in Phase 2, where three quarters of the bladelet cores feature this pattern (**Table 5.9**).

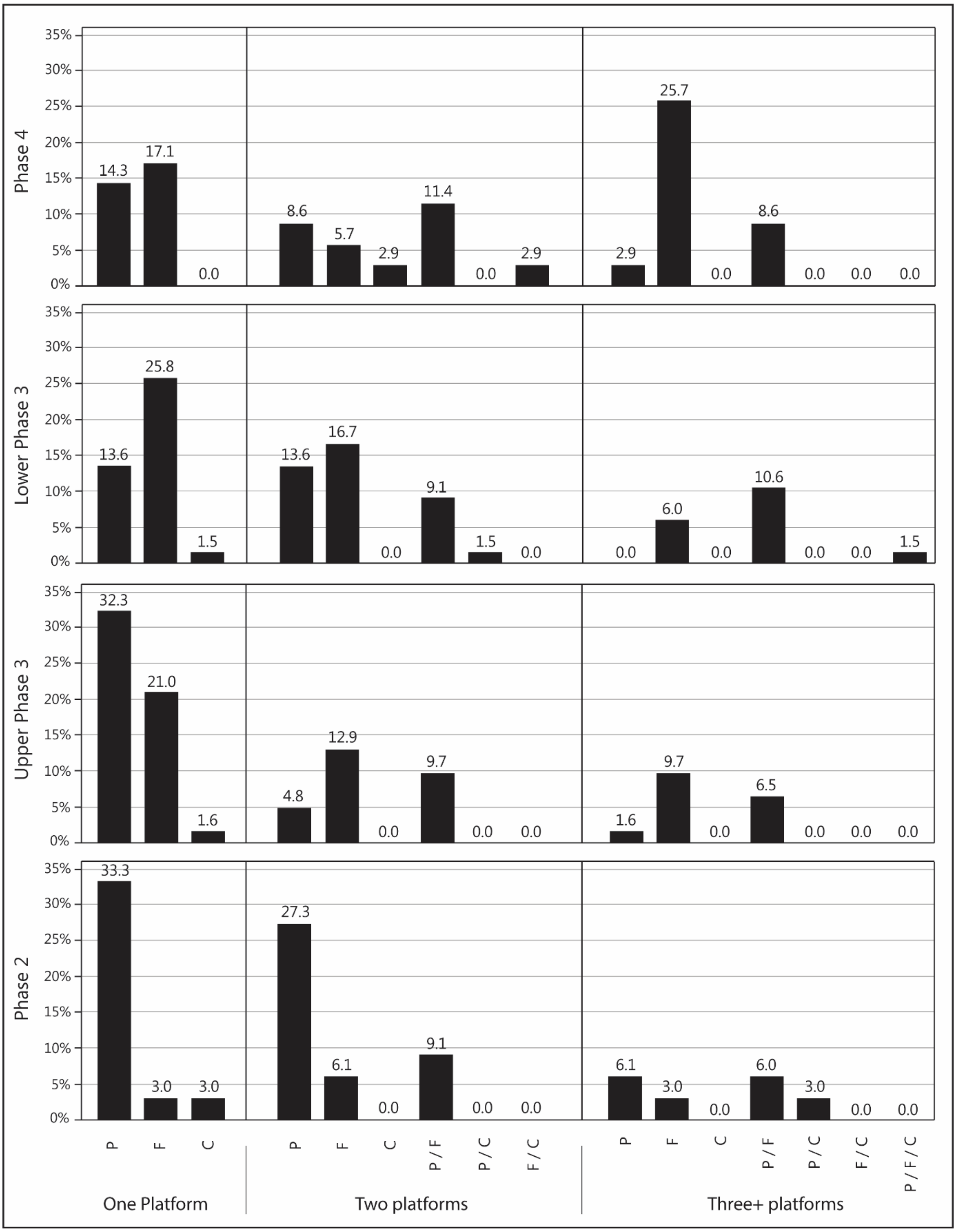


Figure 5.19: Bladelet core platform combinations, by phase. P = Plain, F = Facetted, C = Cortical.

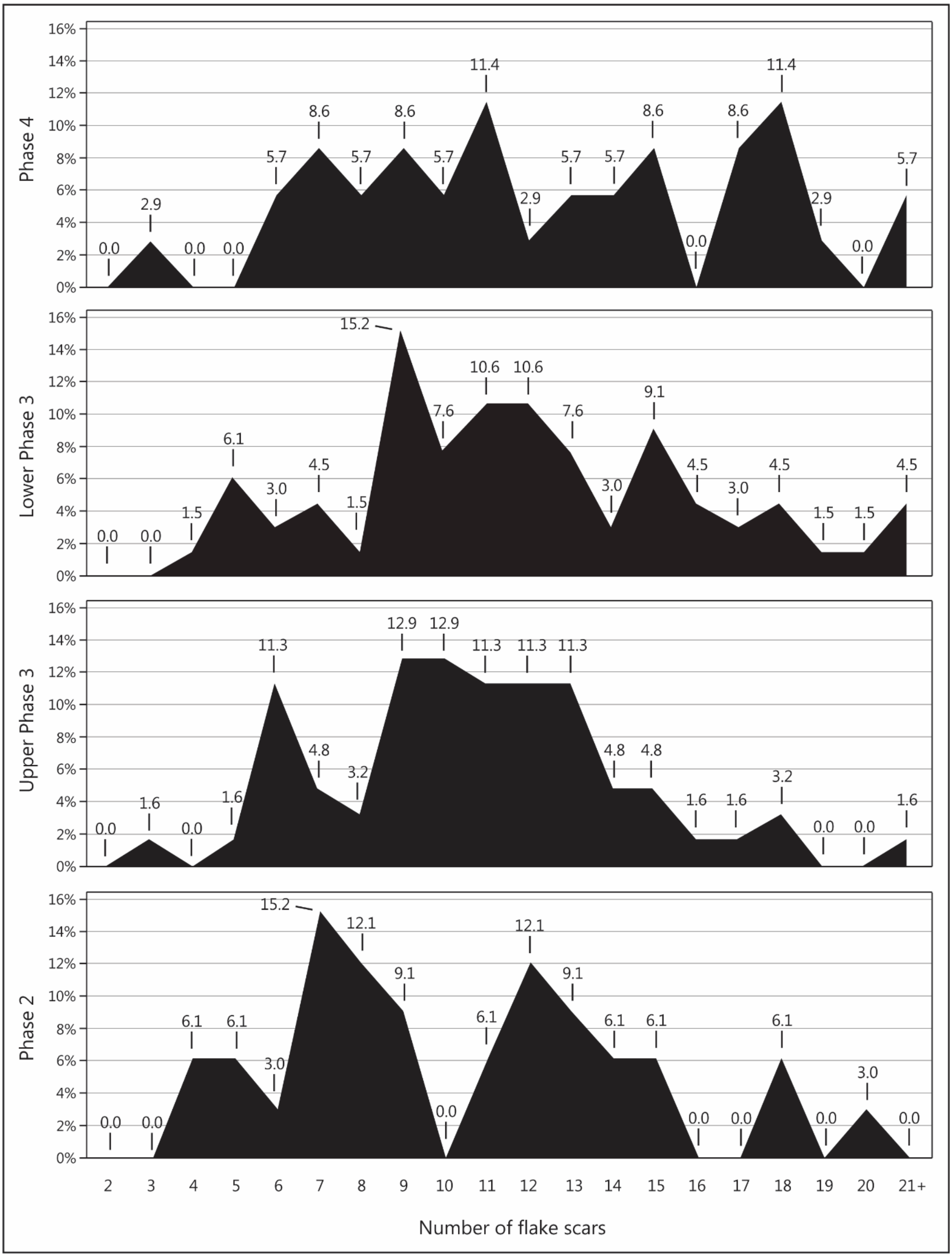


Figure 5.20: Number of negative flake scars on bladelet cores, by phase.

Convergent scar patterns likewise dominate each bladelet core type to their greatest extent in Phase 2, with 11 out of the 12 single platform cores analysed from this assemblage exhibiting this pattern.

Much like the flake cores, the bladelet cores demonstrate a decrease in cortical coverage over time, albeit with some differences (**Table 5.10**). The proportions of Phase 4 and 3 bladelet cores without cortex fluctuate between 20% and 26% percent, whereas a dramatic shift is evident for the Phase 2 bladelet core assemblage, where slightly under half (42.4%) of the analysed pieces are devoid of cortex (**Figs. 5.21**). This rise corresponds with a significant decline in the mean cortical coverage on the single platform cores, which exhibit average levels of cortical coverage between Phase 4 and Upper Phase 3 which encompass between a quarter and one fifth of their surface. In contrast, the average Phase 2 single platform bladelet core features cortex on less than a tenth of its surface area – a lower value than any of the other bladelet core types in this assemblage. This rise in cortex-free bladelet cores may relate to an increased implementation of the two-step reduction system described by Edwards (2013e: 145) from the Phase 1 data, where large flake and blade cores were recycled into bladelet cores once they were reduced to a smaller size. These small, recycled cores would be far less likely to retain their original cortex than a small cobble imported to the site for the express purpose of microlith production, as reflected by consistent presence of small bladelet cores retaining up to half of their original cortical surface (**Fig. 5.22**).

Conversely, the change of orientation and multiple platform bladelet cores tend to lean towards the lower range of cortical coverage in each assemblage (**Table 5.10; Fig. 5.23**). This bias is particularly pronounced with the multiple platform cores, where the maximum range of cortex coverage is only 35%. Nonetheless, multiple platform bladelets cores that completely lack cortex are also relatively uncommon (22.5%), with pieces in the '1-10%' cortex coverage bracket instead dominating this type (52.5%). Change of orientation bladelet cores demonstrate a similar trend, albeit with a greater emphasis on cortex-free pieces (35.4%). The opposed platform bladelet cores are unique in that they exhibit a negative correlation between size and cortex coverage, with the larger cores belonging to these types tending to possess less cortex coverage (**Fig. 5.24**).

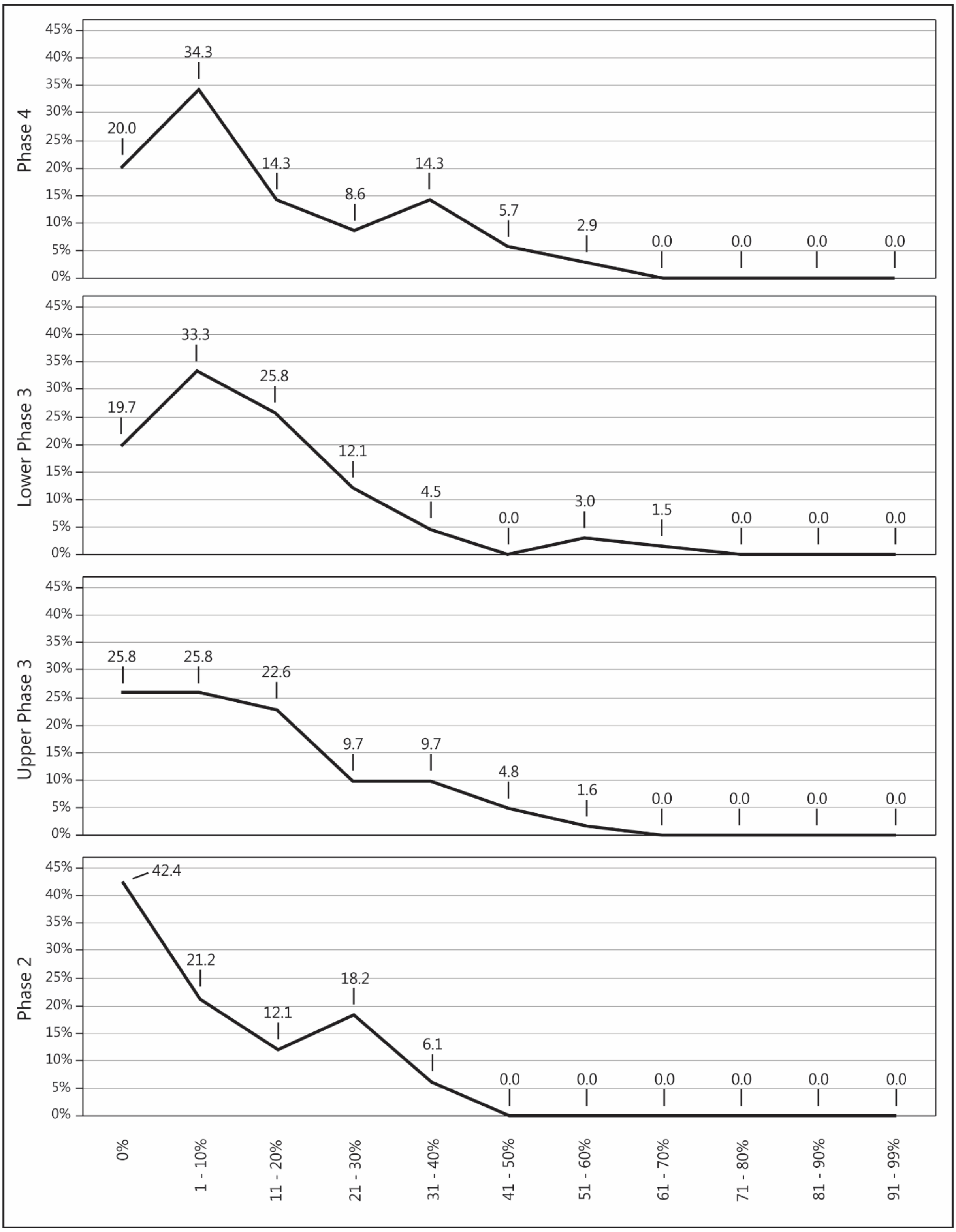


Figure 5.21: Bladelet core cortex coverage, by phase.

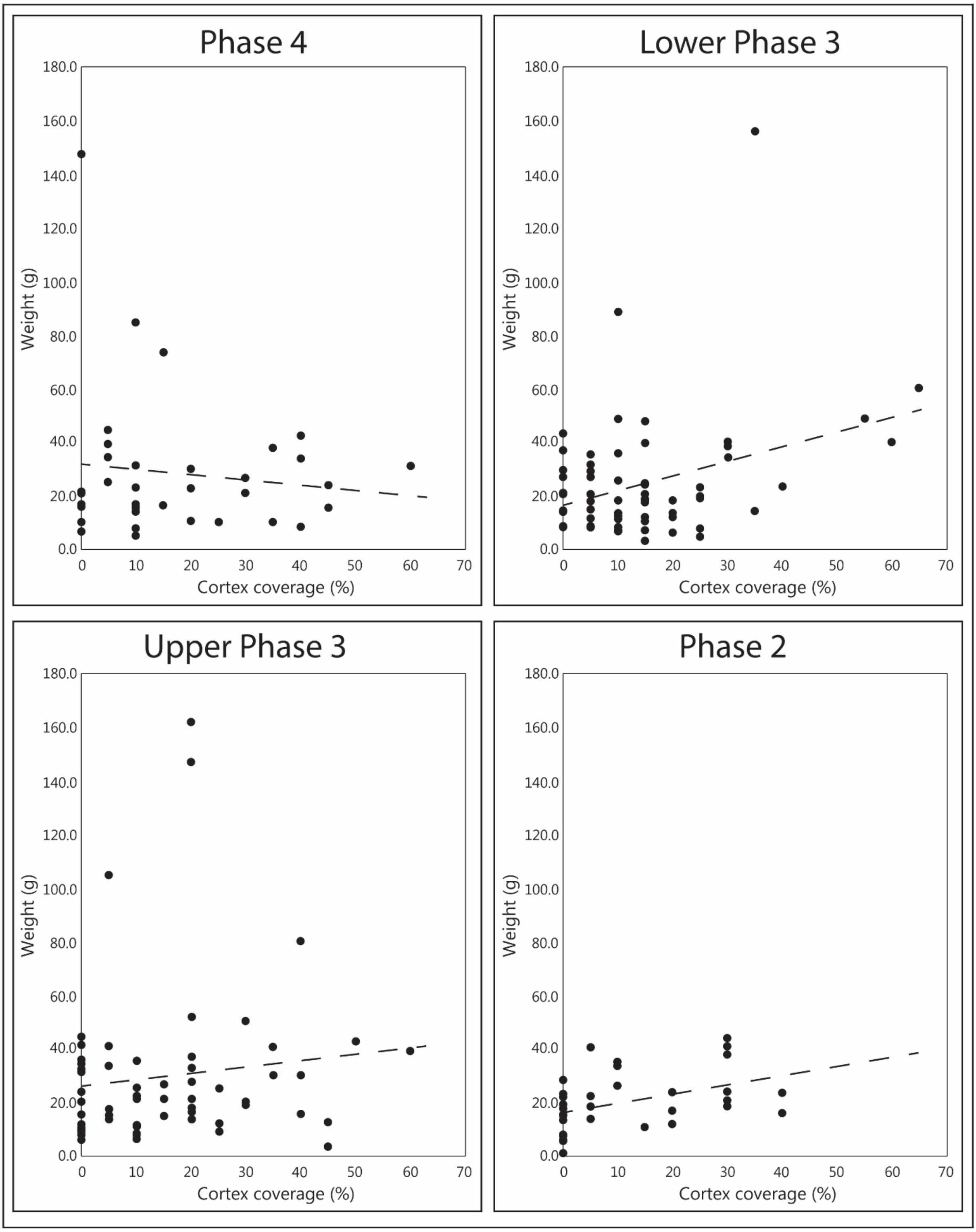


Figure 5.22: Bladelet core cortex coverage versus weight, by phase.

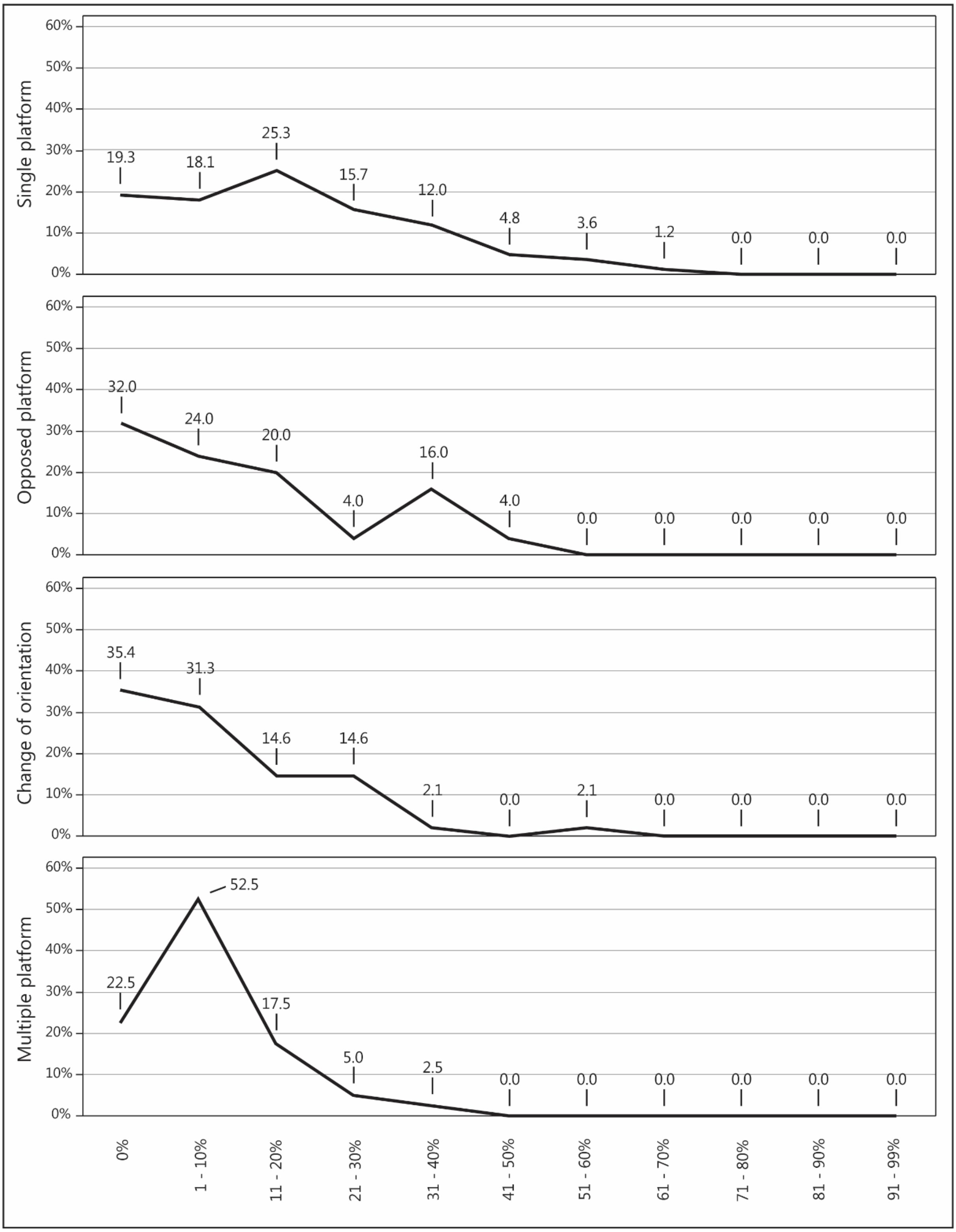


Figure 5.23: Bladelet core cortex coverage, by type (abridged, Phases 2-4).

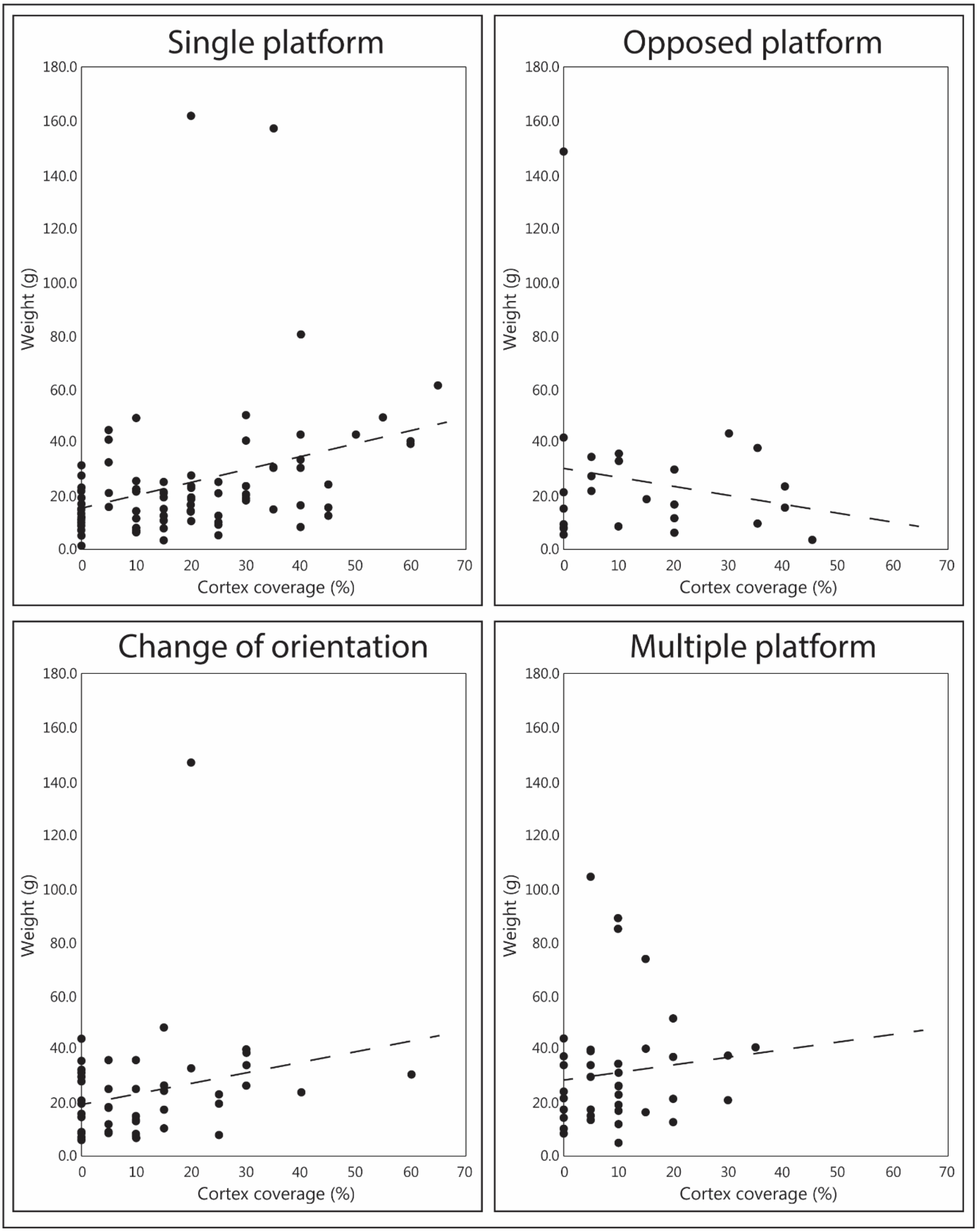


Figure 5.24: Bladelet core cortex coverage versus weight, by type (abridged, Phases 2-4).

5.5 Summary

Much like the debris and debitage, many attributes of the Wadi Hammeh 27 core assemblage remain static over time, yet some others change significantly. Unlike the debris and debitage, however, where most of the significant changes appear abruptly with the final Phase 1 assemblage, the most important shift discussed in this chapter is represented by the significant increase in bladelet core proportions between the occupation of Structure 3 in Upper Phase 3 and the foundation of Structure 1 in Phase 2.

This chapter has focussed primarily on presenting detailed typological and technological overviews of each core assemblage on an interphase basis. A more comprehensive reconstruction of the overall core reduction pathways employed onsite, along with theoretical discussions regarding the relationship between core provisioning and mobility, raw material access and land-use patterns by the inhabitants of Wadi Hammeh 27, may be found in Chapter 9. Before these aspects can be elucidated, however, the rich assemblages of retouched end-products must first be discussed in the following chapter.

Chapter 6: The Wadi Hammeh 27 retouched stone artefact assemblages

6.1 Introduction

In addition to its large variety of debitage and cores, the various occupational deposits of Wadi Hammeh 27 present arrays of retouched artefacts. As part of the cataloguing process, all 6,002 retouched artefacts to be uncovered during the renewed excavations of Wadi Hammeh 27 were classified according to the typological system described in this chapter, providing the largest Early Natufian retouched artefact assemblage to be catalogued at the time of writing (see Chapter 11).

As with the preceding two chapters, this examination can roughly be divided into two halves – the first detailing the entirety of each assemblage on a typological basis, and the second describing the attributes of a sample of artefacts from each assemblage. An exception has been made to this format in the case of the bifacial tools, which are instead described in detail on a phase-by-phase basis. The decision to present these artefacts as such was made based on the high degree of morphological and technological variety exhibited by these pieces despite their low numbers (N = 10).

6.2 Typological overview

The definitions used in the identification of the retouched artefacts remain mostly consistent with those utilised by Edwards (2013e). This system itself is largely a modified version of Bar-Yosef (1970)'s type-list, with further definitions lifted from Henry (1973), Marks (1976) and Holdaway and Stern (2004). Following Edwards (2013e), most types are defined by the mode and location of retouch applied to a blank rather than the attributes of the original debitage blank utilised. Some exceptions to this rule still exist in Edwards (2013e)'s type-list, and have subsequently been retained in the current study. For example, the 'nucleiform scraper' and 'nucleiform burin' types are both defined by their usage of a core or core fragment as a prerequisite blank, regardless of their final form. A number of deviations from Edwards' typology have nonetheless been made in this study, as listed below.

The scrapers have been sorted into 16 types, with these being unchanged from Edwards (2013e). This continuation includes a retention of the division between carinated and nucleiform cores based on blank selection, with carinated scraper types comprising thick, non-nucleiform pieces which retain an identifiable ventral surface, whereas the nucleiform scraper type only incorporates pieces manufactured from recycled cores and core fragments. This distinction varies from Bar-Yosef's type-list (1970: 205-6), which included some scrapers made from cores into his 'carinated narrow scraper' type.

The 'multiple tools' group encompasses three types, which remain unchanged from Edwards (2013e). All three represent burins featuring additional retouch disassociated from the primary burin facet. Consistent with Edwards' type-list, this additional retouch occurs in three modes: scraper retouch, truncations and retouched notches.

The 17 burin types utilised in the present study are for the most part similar to those employed by Edwards (2013e). The only variation from this type-list is the incorporation of Edwards' 'transversal burin' type into the 'burins on natural surface'. This decision was made due to these objects being almost indistinguishable in terms of manufacture, with the only variation being the direction the spall was removed relative to the orientation of the debitage blank. The removed 'transversal burin' type is not to be confused with either the 'transversal burin on lateral retouch' or 'transversal burin on retouched notch' types, however, as both of these latter types represent unique, two-stage retouch processes, and have subsequently been retained. Furthermore, only a single example of a 'transversal burin' was recorded from the entirety of the 1980s excavations (Edwards 2013e: 143), meaning that its reassignment has marginal effect when comparing the old and new assemblages.

Twelve types are utilised in the 'retouched blade' tool group, with two notable variations from Edwards' type-list. The first of these is these alterations is the relocation of the 'broken backed blade' and 'broken retouched blade' types into the new 'retouched fragments' tool group, the rationale for which is discussed further below. The other modification is the addition of the 'blade with silica sheen, unretouched' type, which as the name suggests incorporates any blades which feature the characteristic sheen produced during the harvesting of grasses and other silica-rich plants (Fullagar 1991), but is otherwise unretouched.

Objects classified as truncated pieces fall under two types ('truncated piece' and 'bi-truncated piece'), with the number of truncated ends being the sole means of differentiation. As Bar-Yosef (1970: 211) defined a truncated piece as being a "flake or blade truncated and retouched at one end”, many of the truncated bladelets at Wadi Hammeh 27 would have fallen into this tool group, had the myriad unretouched truncated bladelet types not already been assigned to the ‘non-geometric microliths’ tool group. Likewise, any truncated blade which does not fit into the pre-existing types was assigned to the ‘various’ type in that group, rather than being categorised as a truncated piece. Truncation are instead restricted to flakes, core rotation elements and other miscellaneous debitage types featuring one or two truncated ends. A significant degree of overlap thus exists between objects assigned to this tool group and the retouched flake artefacts.

The non-geometric microliths are divided into 25 types in the current study. Similar typological modifications have been made to this tool group as with the retouched blades, namely through the relocation of the ‘broken retouched bladelet’ and broken backed bladelet’ types to the ‘retouched fragments’ tool group, and the addition of the ‘bladelet with silica sheen, unretouched’ type. Microliths types are primarily defined according to dominant retouch mode. For example, a bladelet with Helwan retouch covering three quarters of one edge would be classified as a ‘Helwan Bladelet’, even if the remaining quarter of that edge only features inverse retouch. Similarly, a bladelet with inverse, alternating or Helwan retouch that covers only two thirds of its worked edge would be assigned to the corresponding type rather than the vaguer ‘partially retouched bladelet’ type. As a result, this latter type only incorporates pieces with marginal, disjointed retouch. Following Edwards (2013e), no points named after specific sites have been incorporated into the current typology. Potential points are largely absent from Wadi Hammeh 27 regardless, with only a single non-geometric microlith from the Phase 2 assemblage designated to the ‘narrow, curved, pointed backed bladelet’ type taking on such a form (**Fig. 6.12**: 9).

The geometric microlith group comprises 12 types. Edwards’ (2013e) ‘inverse lunate’ and ‘Helwan lunate’ types are supplemented by a further three lunate variations based on the primary mode of retouch applied. These are the ‘semi-steep lunate’, ‘alternating lunate’ and ‘abrupt lunate’ types. The addition of these types renders Edwards’ generic ‘Lunate’ type redundant, and this has subsequently been removed. The retouch on a small number of lunates is neatly segregated between abrupt retouch towards one end, and either Helwan or semi-steep retouch on the other. These objects - tentatively named ‘mixed lunates’ - exhibit noticeable variation in form based on the mode of retouch applied, with the abrupt-retouched end generally being noticeably more oblique than the opposing termination. Such pieces are nonetheless classified as lunates rather than irregular microliths, so long as they maintain an overall curved retouched edge. Typologically, these objects have been assigned to the 'various' type. The boundary between geometric and non-geometric microliths is occasionally blurred in some cases, given that many of the sickle elements at Wadi Hammeh 27 also featured curved, retouched edges.

The four types included in the 'notched and denticulated pieces' tool group remain unchanged from those utilised by Edwards (2013e). The present study followed Akerman and Bindon (1995: 89)'s definition of denticulated retouch only including edges with regularly spaced teeth that are narrower in length than the notches dividing them. In contrast, any piece with 'teeth' wider than its interspacing notches (dentate retouch; Holdaway and Stern 2004: 165) was instead placed into the pre-existing 'piece with notches' type.

The 'alternately-retouched awl' and bilaterally-backed borer' types introduced by Bar-Yosef (1970) and retained by Edwards (2013e) are also utilised in the current study. Despite assigning these pieces as two discrete classes of tool, Bar-Yosef himself noted (1970: 168; 222) that there is little differentiation between the two types aside from the mode of retouch utilised. As such, the decision was made to supplement these two types with a number of new awl types in order to illustrate the variety of retouch modes applied in the manufacture of these artefacts. These new types include the 'semi-steep awl' and 'inverse awl', which are defined by bilaterally-retouched edges exhibiting the corresponding retouch mode, whereas the 'Helwan awl' type features at least one edge covered by Helwan retouch.

In addition to the 'pick' and 'bifacial/tranchet axe' types which encompassed the 'bifacial tools' tool group in Edwards (2013e), a third, 'various' type has been added to the current typology in order to accommodate three small, irregular bifaces recovered from the lower phases.

The 'retouched flake' tool group encompasses any flake featuring edge retouch that did not fall into any of the formal tool groups. The three types utilised remain identical to those in Edwards (2013e). While nominally referred to as retouched flakes, these artefacts also incorporate other irregularly retouched blanks that possess flake rather than bladelet dimensions, such as core tablets or certain core rotation elements.

The most significant divergence from Edwards' type-list is the addition of the 'retouched fragments' tool group, with this approach taking after Byrd and Garrard's (2013: 141) analysis of Epipalaeolithic assemblages from the Azraq basin. Rather than representing a formal group of tools, these artefacts represent broken pieces which are too fragmentary to be safely assigned into a type. The first four types in this group – the ‘broken retouched blade’, ‘broken retouched blade’, ‘broken retouched bladelet’ and ‘broken backed bladelet’ were relocated from the ‘retouched blade’ and ‘microlith’ tool groups in Edwards (2013e). Conversely, the new ‘miscellaneous retouched fragment’ represents pieces which are too fragmentary to even be determined as having originated from a blade or bladelet blank.

This is not to say that every broken retouched blade or bladelet was relegated to this tool group. For example, if a broken bladelet featuring Helwan retouch was intact enough in order to safely differentiate it from a Helwan lunate or awl, it was assigned to the ‘Helwan bladelet’ type rather than being classified as a ‘broken retouched bladelet’. Conversely, a distal fragment of a retouched bladelet too fragmentary for its overall form to be inferred was allocated to this tool group, as there is no means of determining whether this piece originates from a geometric or non-geometric microlith short of a refitting study – something that is beyond the scope of this study given the size, density and complexity of the assemblages under investigation.

The three ‘informal tool’ types remain identical to those employed by Edwards (2013e). The ‘scaled piece’ type encompasses any piece typified by the presence of scaling use-wear, indicative of its expedient usage as a scraper without the application of specialised retouch. The ‘battered piece’ type incorporates any piece featuring battering damage along part of one its edge. Nucleiform pieces with battering damage have not been included in the current study, as these pieces would technically be designated as hammerstones (or ‘pounders’) - and thus as ground stone artefacts - under Wright’s (1992) classification system.

6.3 Retouched artefact assemblages, by phase

As every retouched artefact to be recovered from all three seasons was catalogued, the typological figures given in this chapter again represent the complete population of each assemblage. This fact, combined with the rich assemblages provided by each phase, allowed for reliable, in-depth, inter-assemblage typological comparisons to be undertaken.

6.3.1 Phase 4

A total of 927 retouched artefacts were retrieved from the Phase 4 deposits, a quarter of which (27.0%) are otherwise unidentifiable fragments of broken tools (**Table 6.1; Fig. 6.1**). The geometric microliths are the most numerous formal tool group, comprising 15.9% of the phase total. These artefacts are supplemented by large quantities of burins (13.6%), notched and denticulated pieces (12.6%) and non-geometric microliths (11.2%). The remaining eight tool groups each encompass less than 5% of the total Phase 4 retouched artefact assemblage.

6.3.1.1 Scrapers

A total of 38 scrapers were uncovered from the Phase 4 deposits, constituting 4.1% of this tool assemblage. While relatively low, this percentage nonetheless represents the highest range reached by the group until Phase 1. Twelve out of 16 scraper types are present, with the endscraper with notch, circular/oval scraper, multiple scraper and micro-carinated scraper types all being absent (**Fig. 6.2**). Basic endscrapers and sidescrapers (**Fig. 6.3:** 1, 7) are the two most common types, both of which comprise 18.4% of the Phase 4 scraper assemblage. These objects are narrowly followed by the rounded scrapers (**Fig. 6.3:** 2-3, 6) and broad carinated scrapers, each of which amount to 15.8% of the Phase 4 scraper collection. The high frequency of rounded scrapers in Phase 4 is notable, with this percentage doubling that the Phase 3 and 2 scraper assemblages. Narrow carinated scrapers (**Fig. 6.3:** 4) are similarly more common in Phase 4 (7.9%) than in any of the subsequent phases. The remaining seven scraper types are represented by only one or two artefacts each.

6.3.1.2 Multiple tools

Forty-three objects were assigned as multiple tools from the Phase 4 deposits, representing 4.6% of the phase total – narrowly the highest share taken by this group out of all four assemblages. Burin/scraper combinations (**Fig. 6.4:** 1, 3-5, 7) dominate the assemblage (72.1%), with burin/truncation (18.6%) and burin/notched piece (9.3%; **Fig. 6.4:** 2, 6) combinations occurring in far lower proportions (**Fig. 6.5**).

Table 6.1: Wadi Hammeh 27 total retouched artefact assemblages, by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
Scrapers										
Endscraper	7	0.8	3	0.2	9	0.4	6	0.6	25	0.4
Endscraper on Retouched Piece	2	0.2	4	0.2	3	0.1	4	0.4	13	0.2
Double Endscraper	1	0.1	0	0.0	4	0.2	1	0.1	6	0.1
Thumbnail Scraper	1	0.1	3	0.2	1	0.0	2	0.2	7	0.1
Transversal Endscraper	1	0.1	2	0.1	1	0.0	2	0.2	6	0.1
Endscraper with Notch	0	0.0	2	0.1	1	0.0	0	0.0	3	0.0
Rounded Scraper	6	0.6	3	0.2	4	0.2	2	0.2	15	0.2
Circular/Oval Scraper	0	0.0	2	0.1	2	0.1	0	0.0	4	0.1
Sidescraper	7	0.8	6	0.3	15	0.7	5	0.5	33	0.5
Multiple Scraper	0	0.0	1	0.1	4	0.2	1	0.1	6	0.1
Nosed Scraper	2	0.2	2	0.1	6	0.3	4	0.4	14	0.2
Broad Carinated Scraper	6	0.6	15	0.8	9	0.4	2	0.2	32	0.5
Narrow Carinated Scraper	3	0.3	1	0.1	4	0.2	0	0.0	8	0.1
Micro-Carinated Scraper	0	0.0	0	0.0	2	0.1	0	0.0	2	0.0
Nucleiform Scraper	1	0.1	1	0.1	4	0.2	2	0.2	8	0.1
Other	1	0.1	0	0.0	0	0.0	0	0.0	1	0.0
Sub-total	**38**	**4.1**	**45**	**2.3**	**69**	**3.2**	**31**	**3.3**	**183**	**3.0**
Multiple Tools										
Burin/Scraper	31	3.3	52	2.7	34	1.6	14	1.5	131	2.2
Burin/Truncation	8	0.9	13	0.7	20	0.9	3	0.3	44	0.7
Burin/Notched Piece	4	0.4	18	0.9	19	0.9	4	0.4	45	0.7
Sub-total	**43**	**4.6**	**83**	**4.3**	**73**	**3.3**	**21**	**2.2**	**220**	**3.7**
Burins										
Dihedral Burin	3	0.3	11	0.6	19	0.9	7	0.7	40	0.7
Offset Dihedral Burin	4	0.4	18	0.9	28	1.3	11	1.2	61	1.0
Dihedral Angled Burin	5	0.5	24	1.2	46	2.1	19	2.0	94	1.6
Double Dihedral Burin	3	0.3	4	0.2	5	0.2	3	0.3	15	0.2
Burin on Natural Surface	25	2.7	49	2.5	97	4.4	34	3.6	205	3.4
Double Burin on Natural Surface	2	0.2	7	0.4	10	0.5	6	0.6	25	0.4
Burin on Straight Truncation	11	1.2	17	0.9	14	0.6	4	0.4	46	0.8
Burin on Oblique Truncation	22	2.4	32	1.6	53	2.4	22	2.3	129	2.1
Burin on Concave Truncation	5	0.5	14	0.7	13	0.6	5	0.5	37	0.6
Burin on Convex Truncation	10	1.1	30	1.5	20	0.9	9	0.9	69	1.1
Double Burin on Truncation	9	1.0	12	0.6	22	1.0	1	0.1	44	0.7
Transverse Burin on Lateral Retouch	5	0.5	21	1.1	18	0.8	9	0.9	53	0.9
Nucleiform Burin	1	0.1	0	0.0	0	0.0	0	0.0	1	0.0
Ventral Burin	4	0.4	5	0.3	9	0.4	5	0.5	23	0.4
Beaked Burin	0.0	0.0	0	0.0	0.0	0.0	0	0.9	0	0.0
Transverse Burin on Retouched Notch	1	0.1	4	0.2	3	0.1	2	0.2	10	0.2
Double Mixed Burin	15	1.7	34	1.8	49	2.2	20	2.1	120	2.0
Sub-Total	**126**	**13.6**	**283**	**14.6**	**406**	**18.6**	**157**	**16.5**	**972**	**16.2**
Retouched Blades										
Partly Retouched on One Edge	0	0.0	12	0.6	7	0.3	2	0.2	21	0.3
Completely Retouched on One Edge	1	0.1	0	0.0	1	0.0	2	0.2	4	0.1
Retouched on Both Edges	3	0.3	4	0.2	1	0.0	1	0.1	9	0.1
Inverse Retouched	0	0.0	2	0.1	2	0.1	1	0.1	5	0.1
Alternately Retouched	2	0.2	1	0.1	0	0.0	0	0.0	3	0.0
With Alternating Retouch	2	0.2	3	0.2	3	0.1	2	0.2	10	0.2
Backed Blade	1	0.1	0	0.0	0	0.0	1	0.1	2	0.0

Curved Backed Blade	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Helwan Blade	3	0.3	3	0.2	2	0.1	2	0.2	10	0.2
Obliquely-Truncated Backed Blade	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Straight Bi-Truncated Blade	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Blade with Silica Sheen, Unretouched	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Various	2	0.2	2	0.1	2	0.1	2	0.2	8	0.1
Sub-Total	**14**	**1.5**	**27**	**1.4**	**18**	**0.8**	**13**	**1.4**	**72**	**1.2**
Truncations										
Truncated Piece	17	1.8	75	3.9	75	3.4	11	1.2	178	3.0
Bi-Truncated Piece	4	0.4	16	0.8	13	0.6	3	0.3	36	0.6
Sub-Total	**21**	**2.3**	**91**	**4.7**	**88**	**4.0**	**14**	**1.5**	**214**	**3.6**
Non-geometric microliths										
Partially Retouched Bladelet	20	2.2	52	2.7	66	3.0	25	2.6	163	2.7
Bladelet Completely Retouched on One Edge	5	0.5	0	0.0	4	0.2	2	0.2	11	0.2
Pointed Retouched Bladelet	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Bladelet Retouched on Both Edges	4	0.4	10	0.5	8	0.4	1	0.1	23	0.4
Alternately Retouched Bladelet	0	0.0	2	0.1	5	0.2	2	0.2	9	0.1
Bladelet with Alternating Retouch	6	0.6	7	0.4	10	0.5	9	0.9	32	0.5
Inverse Bladelet	13	1.4	26	1.3	22	1.0	14	1.5	75	1.2
Helwan Bladelet	31	3.3	45	2.3	64	2.9	42	4.4	182	3.0
Helwan-Truncated Bladelet	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Bladelet Completely Backed on One Edge	0	0.0	6	0.3	4	0.2	0	0.0	10	0.2
Curved Backed Bladelet	1	0.1	2	0.1	5	0.2	1	0.1	9	0.1
Narrow, Curved, Pointed Backed Bladelet	0	0.0	0	0.0	0	0.0	1	0.1	1	0.0
Obliquely-Truncated Bladelet	6	0.6	11	0.6	12	0.6	2	0.2	31	0.5
Obliquely-Truncated Retouched Bladelet	2	0.2	2	0.1	5	0.2	1	0.1	10	0.2
Obliquely-Truncated Backed Bladelet	1	0.1	3	0.2	2	0.1	1	0.1	7	0.1
Straight-Truncated Bladelet	3	0.3	6	0.3	4	0.2	1	0.1	14	0.2
Straight-Truncated Retouched Bladelet	3	0.3	1	0.1	6	0.3	0	0.0	10	0.2
Straight-Truncated Backed Bladelet	1	0.1	0	0.0	1	0.0	0	0.0	2	0.0
Straight Bi-Truncated Backed Bladelet	1	0.1	0	0.0	1	0.0	1	0.1	3	0.0
Convex-Truncated Bladelet	3	0.3	4	0.2	8	0.4	2	0.2	17	0.3
Convex-Truncated Backed Bladelet	0	0.0	1	0.1	1	0.0	0	0.0	2	0.0
Convex Bi-Truncated Bladelet	0	0.0	1	0.1	1	0.0	0	0.0	2	0.0
Convex Bi-Truncated Backed Bladelet	0	0.0	0	0.0	1	0.0	1	0.1	2	0.0
Bladelet with Silica Sheen, Unretouched	1	0.1	0	0.0	2	0.1	0	0.0	3	0.0
Various	3	0.3	5	0.3	7	0.3	2	0.2	17	0.3
Sub-Total	**104**	**11.2**	**184**	**9.5**	**239**	**11.0**	**108**	**11.4**	**635**	**10.6**
Geometric Microliths										
Irregular Microlith	6	0.6	7	0.4	13	0.6	9	0.9	35	0.6
Scalene Triangle	0	0.0	0	0.0	2	0.1	0	0.0	2	0.0
Isosceles Triangle	1	0.1	1	0.1	1	0.0	2	0.2	5	0.1
Rectangle	0	0.0	0	0.0	1	0.0	0	0.0	1	0.0
Helwan Rectangle	1	0.1	1	0.1	0	0.0	0	0.0	2	0.0
Trapeze	0	0.0	1	0.1	3	0.1	0	0.0	4	0.1

Inverse Lunate	10	1.1	27	1.4	33	1.5	6	0.6	76	1.3
Semi-Steep Lunate	7	0.8	19	1.0	26	1.2	13	1.4	65	1.1
Abrupt Lunate	9	1.0	14	0.7	19	0.9	11	1.2	53	0.9
Alternating Lunate	20	2.2	44	2.3	29	1.3	12	1.3	105	1.7
Helwan Lunate	88	9.5	193	9.9	208	9.5	147	15.5	636	10.6
Various	5	0.5	4	0.2	1	0.0	1	0.1	11	0.2
Sub-total	**147**	**15.9**	**311**	**16.0**	**336**	**15.4**	**201**	**21.2**	**995**	**16.6**
Notches & Denticulates										
Piece with Small Notch	47	5.1	79	4.1	89	4.1	37	3.9	252	4.2
Piece with Large Notch	24	2.6	52	2.7	65	3.0	28	2.9	169	2.8
Piece with Notches	14	1.5	22	1.1	39	1.8	30	3.2	105	1.7
Denticulated Piece	32	3.5	70	3.6	86	3.9	53	5.6	241	4.0
Sub-total	**117**	**12.6**	**223**	**11.5**	**279**	**12.8**	**148**	**15.6**	**767**	**12.8**
Awls and Borers										
Alternately-Retouched Awl	7	0.8	5	0.3	8	0.4	8	0.8	28	0.5
Inverse Awl	1	0.1	0	0.0	1	0.0	2	0.2	4	0.1
Semi-Steep Awl	0	0.0	1	0.1	1	0.0	2	0.2	4	0.1
Helwan awl	0	0.0	0	0.0	1	0.0	1	0.1	2	0.0
Bilaterally-Backed Borer	4	0.4	8	0.4	3	0.1	6	0.6	21	0.3
Sub-total	**12**	**1.3**	**14**	**0.7**	**14**	**0.6**	**19**	**2.0**	**59**	**1.0**
Bifacial Tools										
Pick	1	0.1	2	0.1	3	0.1	0	0.0	6	0.1
Bifacial/Tranchet Axe	0	0.0	0	0.0	1	0.0	0	0.0	1	0.0
Various	1	0.1	1	0.1	1	0.0	0	0.0	3	0.0
Sub-Total	**2**	**0.2**	**3**	**0.2**	**5**	**0.2**	**0**	**0.0**	**10**	**0.2**
Retouched Flakes										
Retouched Flake	36	3.9	65	3.3	87	4.0	21	2.2	209	3.5
Helwan-Retouched Flake	0	0.0	3	0.2	0	0.0	1	0.1	4	0.1
Backed Flake	6	0.6	17	0.9	10	0.5	11	1.2	44	0.7
Sub-total	**42**	**4.5**	**85**	**4.4**	**97**	**4.4**	**33**	**3.5**	**257**	**4.3**
Fragments										
Broken Retouched Blade	10	1.1	30	1.5	19	0.9	5	0.5	64	1.1
Broken Backed Blade	1	0.1	2	0.1	2	0.1	0	0.0	5	0.1
Broken Retouched Bladelet	144	15.5	358	18.4	335	15.4	157	16.5	994	16.6
Broken Backed Bladelet	44	4.7	80	4.1	57	2.6	19	2.0	200	3.3
Misc. Retouched Fragment	51	5.5	119	6.1	137	6.3	23	2.4	330	5.5
Sub-total	**250**	**27.0**	**589**	**30.3**	**550**	**25.2**	**204**	**21.5**	**1,593**	**26.5**
Informal Tools										
Battered Piece	2	0.2	2	0.1	0	0.0	0	0.0	4	0.1
Scaled Piece	9	1.0	4	0.2	6	0.3	1	0.1	20	0.3
Other	0	0.0	1	0.1	0	0.0	0	0.0	1	0.1
Sub-total	**11**	**1.2**	**7**	**0.4**	**6**	**0.3**	**1**	**0.1**	**25**	**0.4**
Total Retouched Tools	**927**	**100.0**	**1,945**	**100.3**	**2,180**	**99.8**	**950**	**100.2**	**6,002**	**100.1**

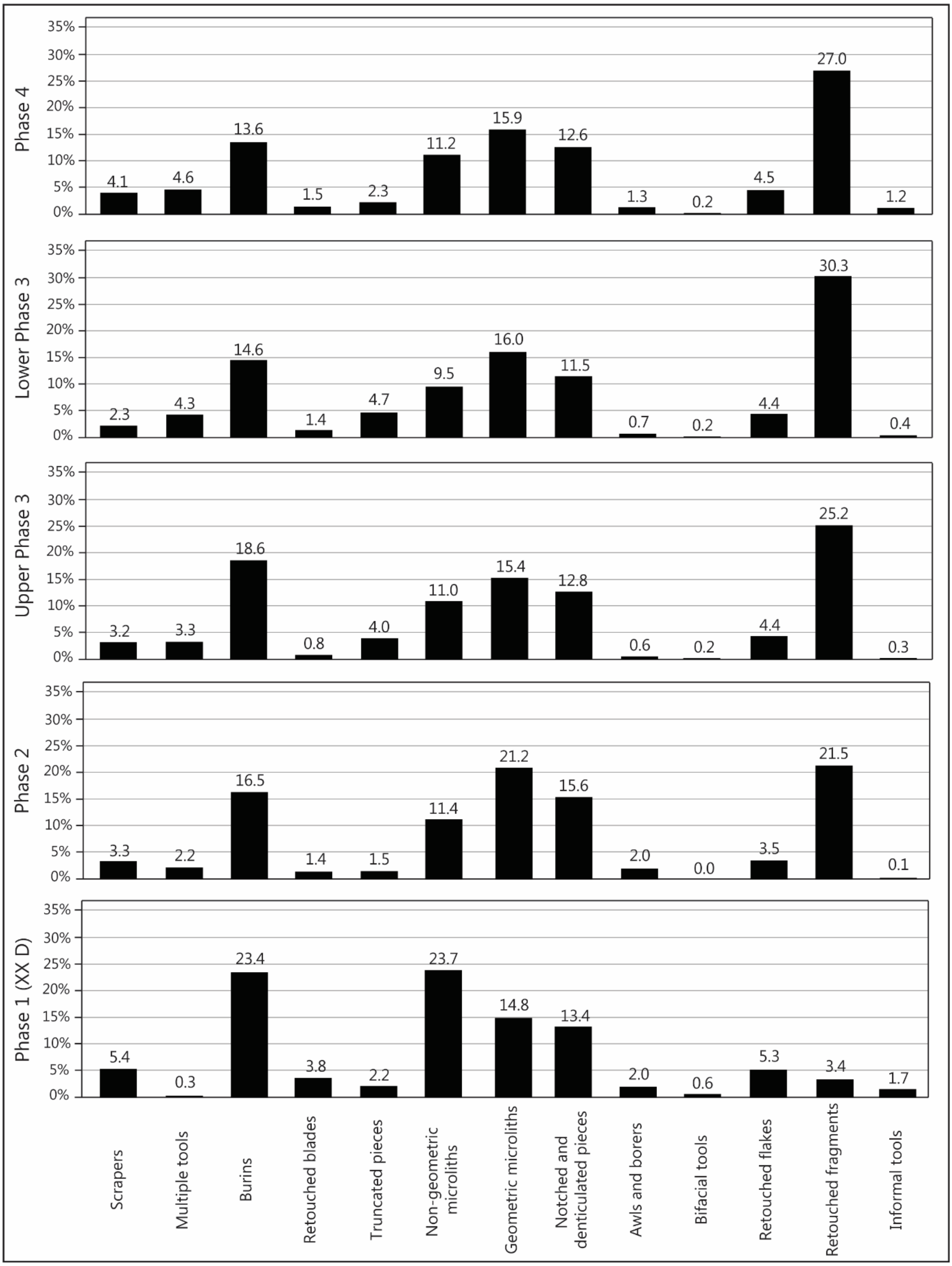


Figure 6.1: Wadi Hammeh 27 retouched artefact assemblage composition, by phase. Phase 1 data from Edwards 2013e: 148-151.

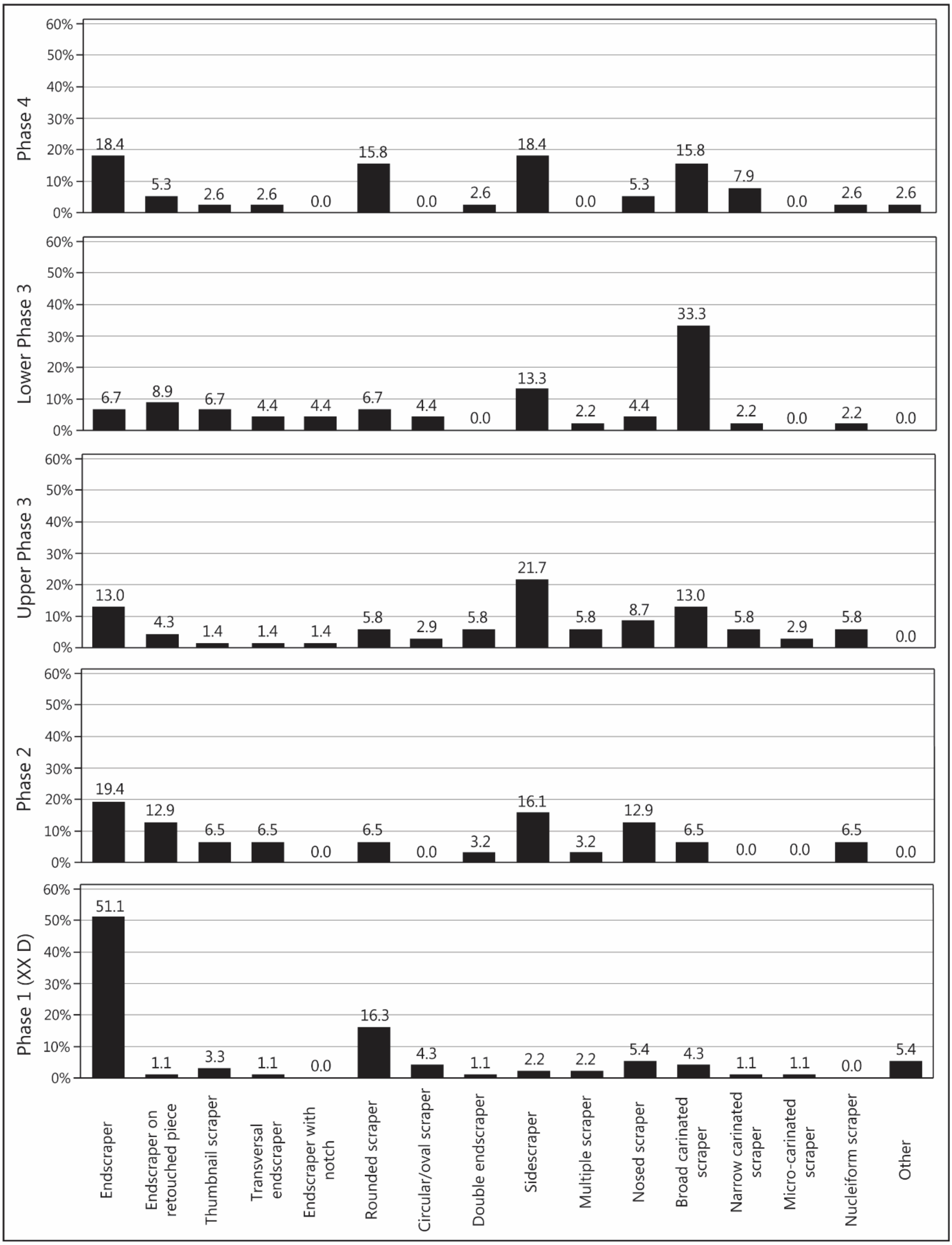


Figure 6.2: Scraper types, by phase. Phase 1 data from Edwards 2013e: 148.

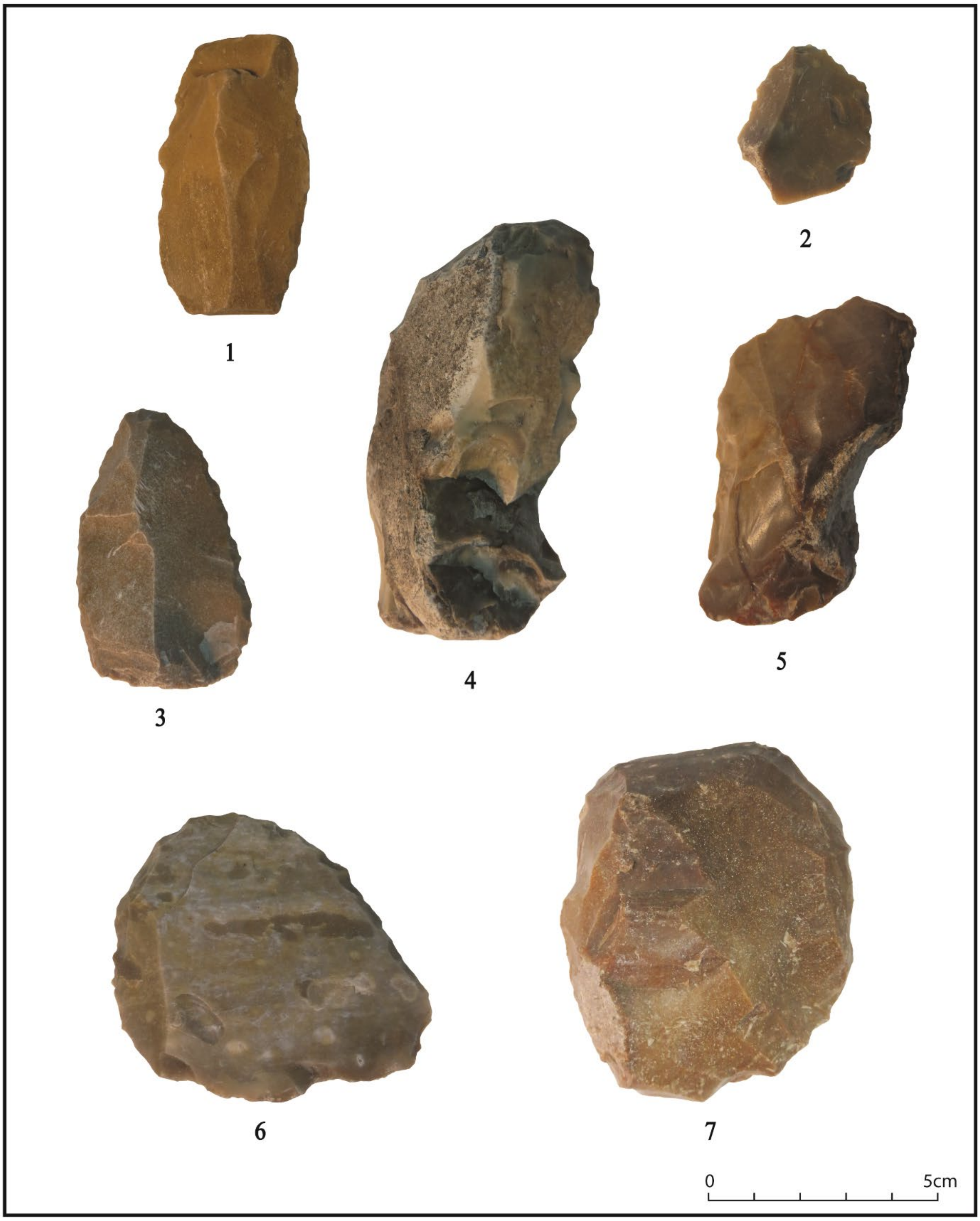


Figure 6.3: Scrapers from Phase 4.

1: Sidescraper (Locus 8.3); **2-3**: Rounded scrapers (Locus 8.3); **4**: Narrow carinated scraper (Locus 8.5); **5**: Nosed scraper (Locus 8.9); **6**: Rounded scraper (Locus 8.9); **7**: Sidescraper (Locus 9.4).

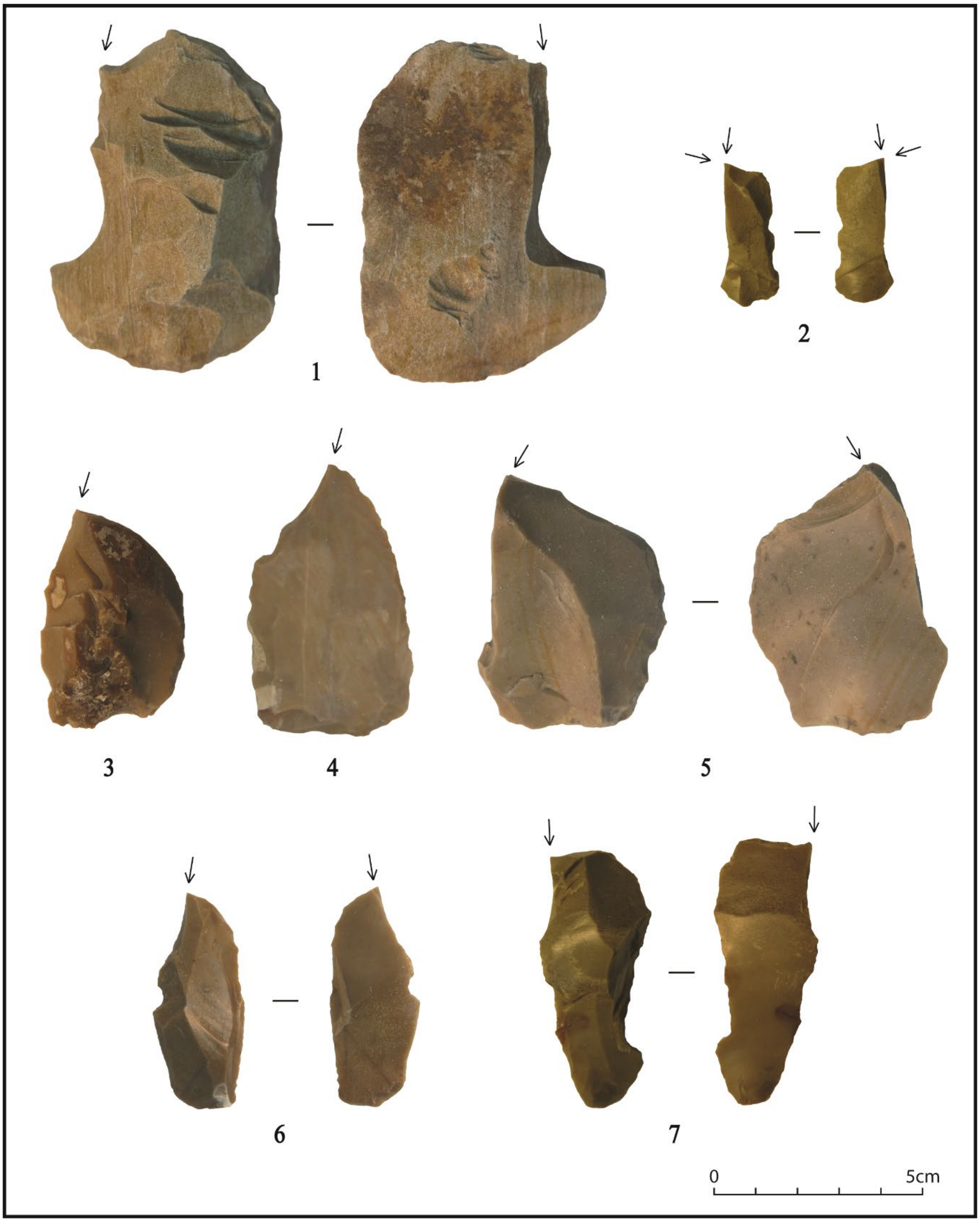


Figure 6.4: Multiple tools from Phase 4.

1: Burin on convex truncation/Double endscraper (Locus 8.3); **2**: Dihedral angled burin/ Denticulated piece (Locus 8.3); **3**: Burin on oblique truncation/Sidescraper (Locus 8.5); **4**: Burin on convex truncation/Sidescraper (Locus 8.5); **5**: Burin on oblique truncation/ Sidescraper (Locus 8.6); **6**: Burin on convex truncation/Piece with large notch (Locus 8.9); **7**: Burin on concave truncation/Endscraper (Locus 9.4).

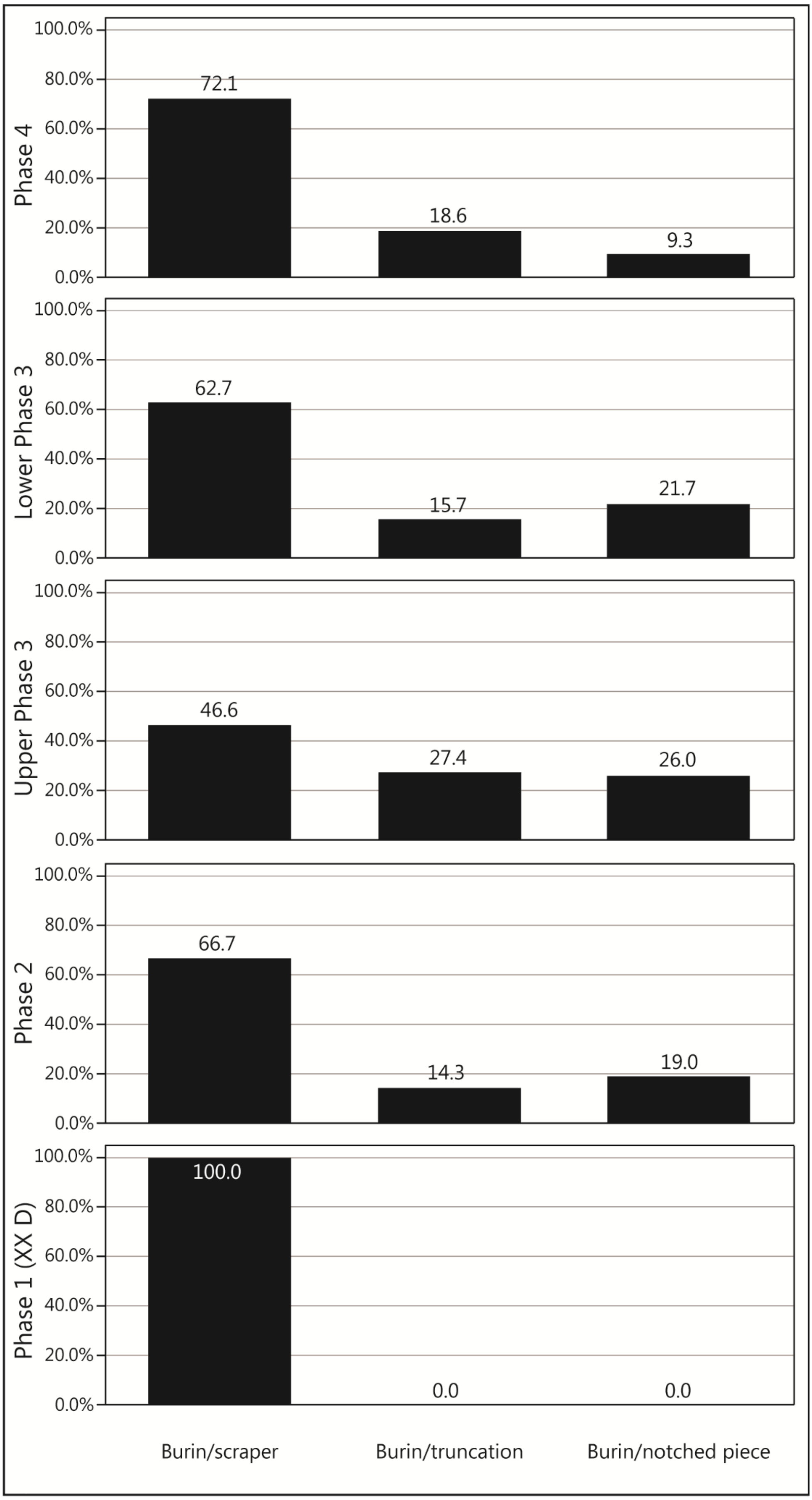


Figure 6.5: Multiple tool types, by phase. Phase 1 data from Edwards 2013e: 148.

6.3.1.3 Burins

A total of 126 burins were recovered from the Phase 4 deposits, comprising 13.6% of the retouched tool assemblage – the lowest share reached by this tool group throughout the various Wadi Hammeh 27 assemblages. The Phase 4 burins nonetheless present the greatest amount of typological diversity out of all four burin assemblages analysed. Seventeen out of 18 types are represented, with the only absent type being the beaked burin (**Fig. 6.6**). Burins on natural surfaces are the most common type (19.8%; **Fig. 6.7**: 6), followed closely by burins on oblique truncations (17.5%; **Fig. 6.7:** 2-3, 7-9, 12) and double mixed burins (11.9%). When the burin type list viewed more broadly, however, an emphasis towards burins struck from truncations becomes evident, with these five types together encompassing just under half (45.2%) of the Phase 4 assemblage (**Fig. 6.8**). This combined share overshadows that of the four dihedral burin types, which together comprise a mere 11.9% of the tool group.

6.3.1.4 Retouched blades

Fourteen retouched blades were retrieved from the Phase 4 deposits, comprising 1.5% of the phase total. Seven out of 13 types are represented, with the blades retouched on both edges (**Fig. 6.9:** 1) and Helwan blades (**Fig. 6.9:** 3) occurring in the highest numbers, with three specimens each (21.4%; **Fig. 6.10**). While Helwan blades continue to occur in similar numbers throughout the subsequent assemblages, this is not the case for the blades retouched on both edges. These artefacts instead constitute their greatest share in Phase 4, with their proportions gradually diminishing across time at Wadi Hammeh 27.

6.3.1.5 Truncated pieces

Twenty-one truncated pieces were recovered, comprising 2.3% of the Phase 4 retouched artefact assemblage. Pieces with a single truncated end easily outnumber those with opposed truncations, with the former type making up 81.0% of this group.

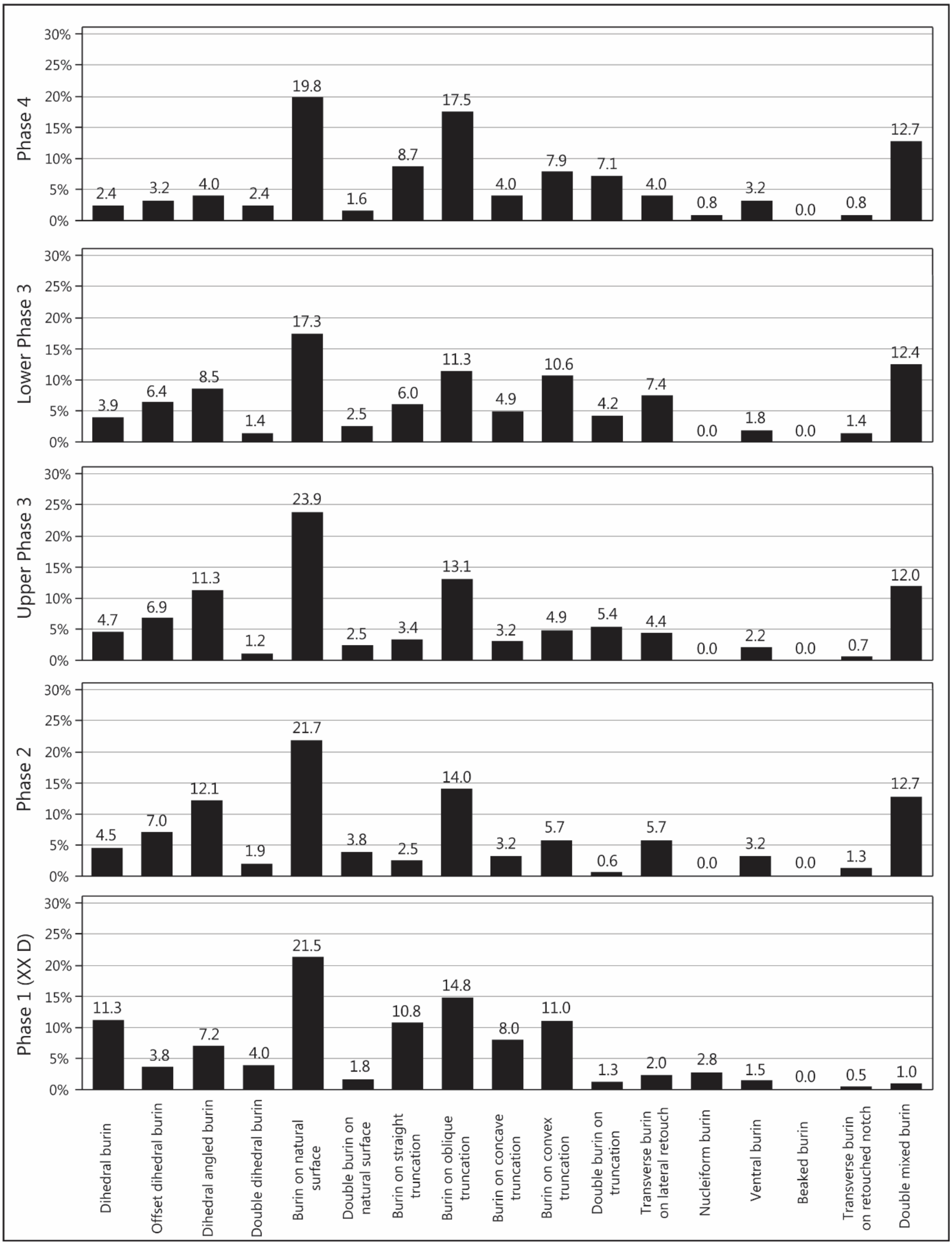


Figure 6.6: Burin types, by phase. Phase 1 data from Edwards 2013e: 148-9.

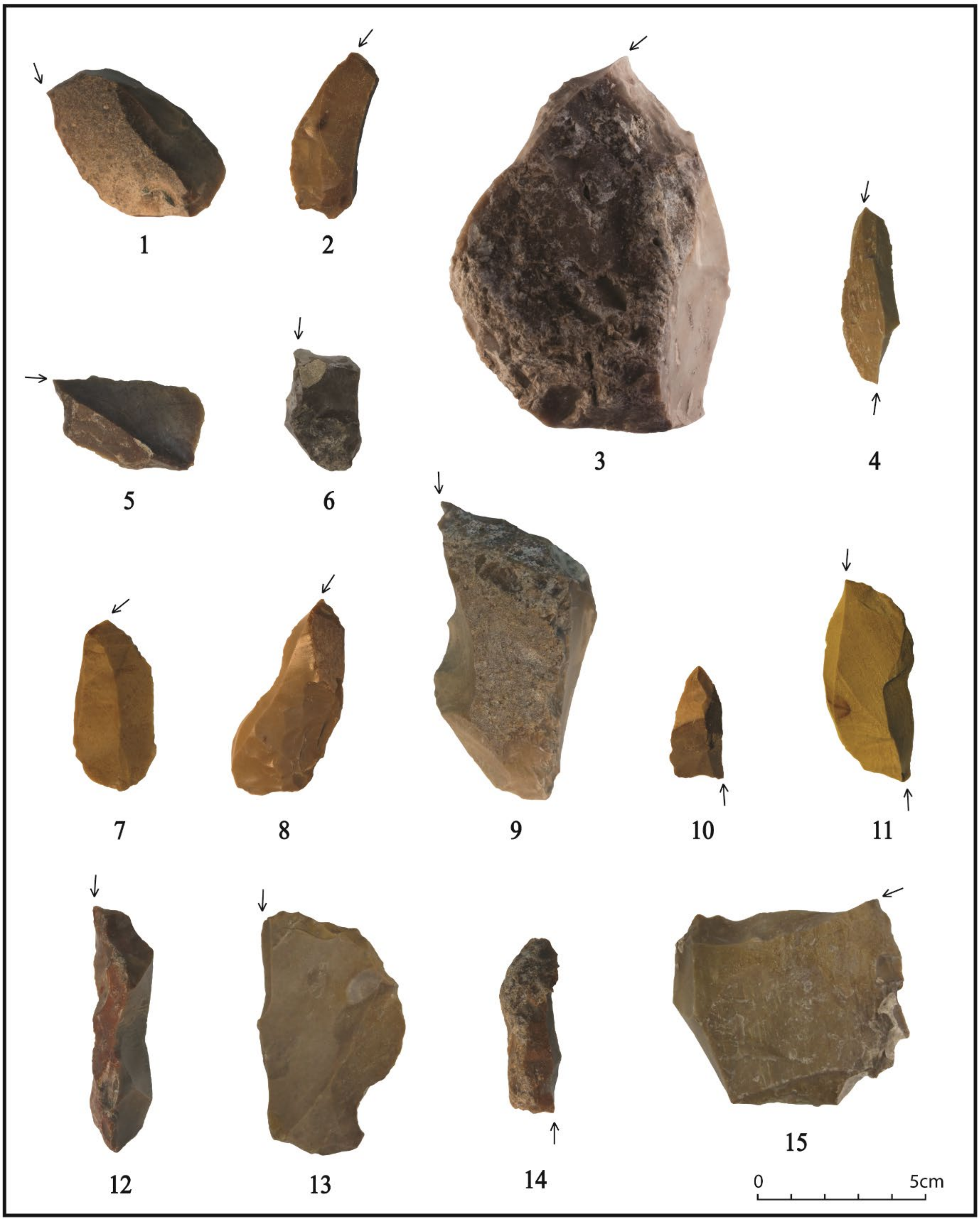


Figure 6.7: Burins from Phase 4.

1: Burin on convex truncation (Locus 8.3); **2-3**: Burins on oblique truncation (Locus 8.3); **4**: Double burin on truncation (Locus 8.3); **5**: Transverse burin on retouched notch (Locus 8.3); **6**: Burin on natural surface (Locus 8.5); **7-9**: Burins on oblique truncation (Locus 8.5); **10**: Burin on straight truncation (Locus 8.5); **11**: Double burin on truncation (Locus 8.5); **12**: Burin on oblique truncation (Locus 8.6); **13**: Burin on convex truncation (Locus 8.9); **14**: Burin on straight truncation (Locus 8.9); **15**: Transverse burin on lateral retouch (Locus 8.9).

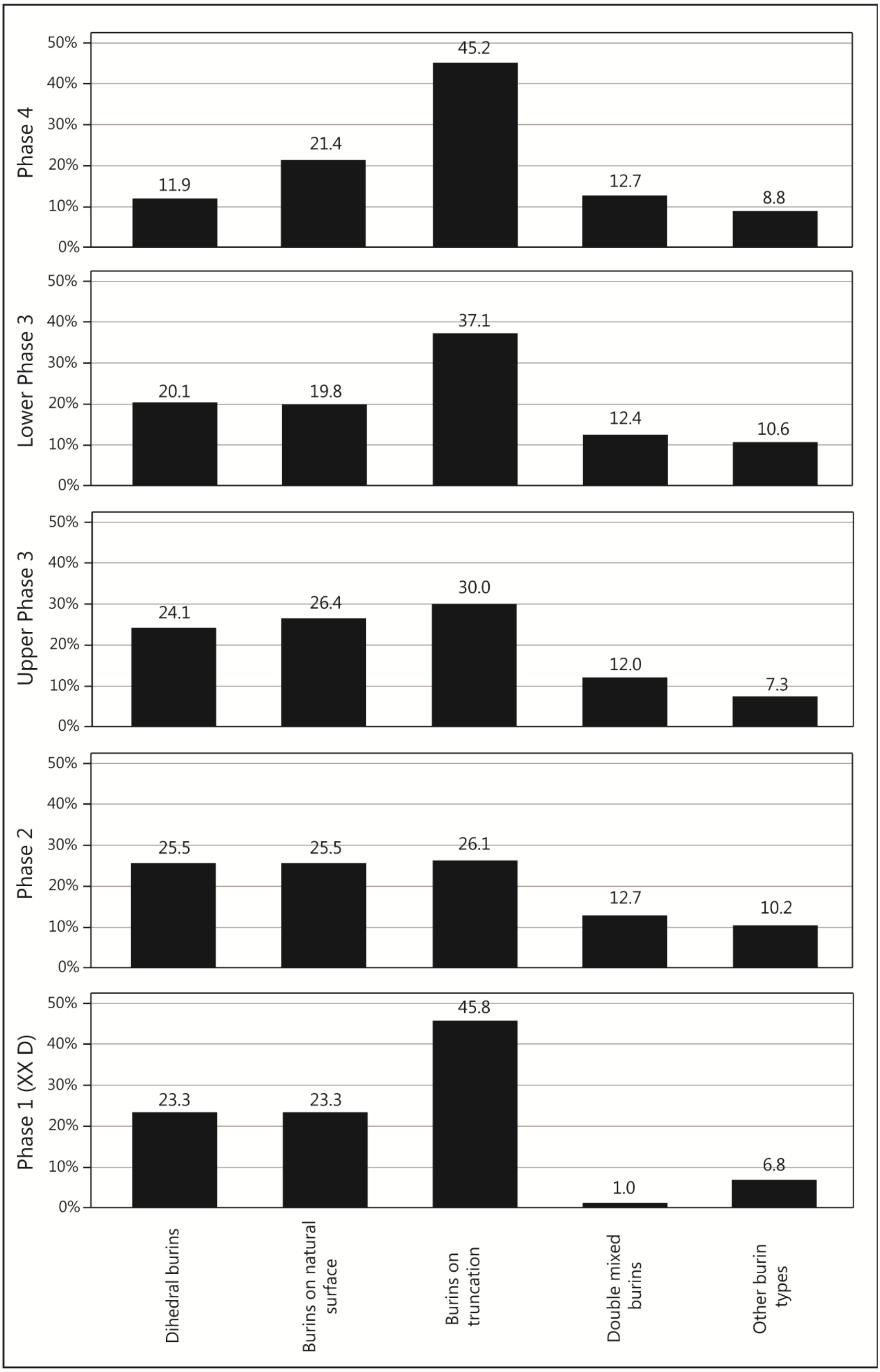


Figure 6.8: Burin types (abridged), by phase. Phase 1 data from Edwards 2013e: 148-9.

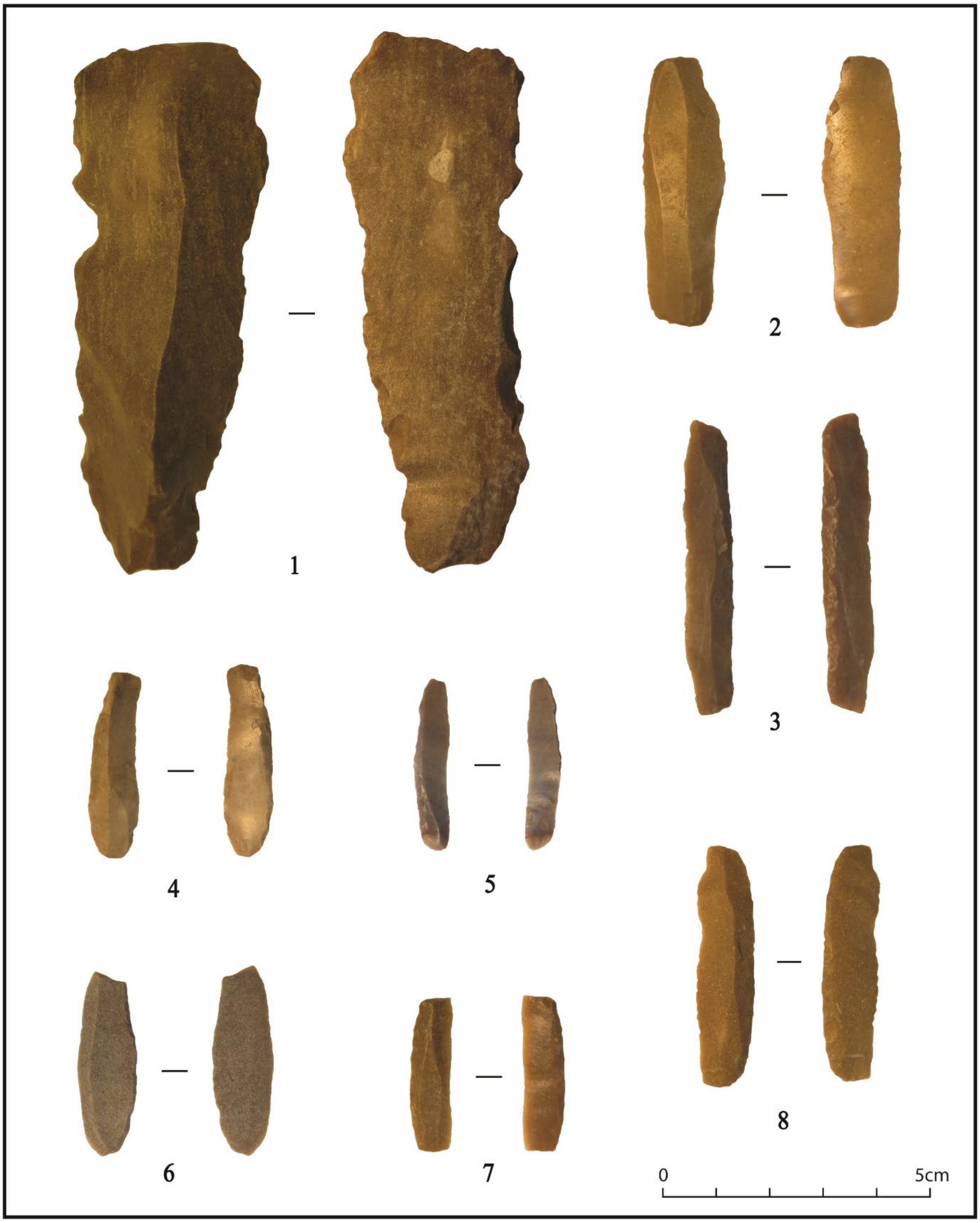


Figure 6.9: Retouched blades and non-geometric microliths from Phase 4.

1: Blade retouched on both edges (Locus 8.3); **2**: Straight bi-truncated backed blade (Locus 8.3); **3**: Helwan blade (Locus 8.9); **4-5**: Bladelets with alternating retouch (Locus 8.3); **6**: Obliquely-truncated backed bladelet (Locus 8.3); **7-8**: Helwan bladelets (Locus 9.4).

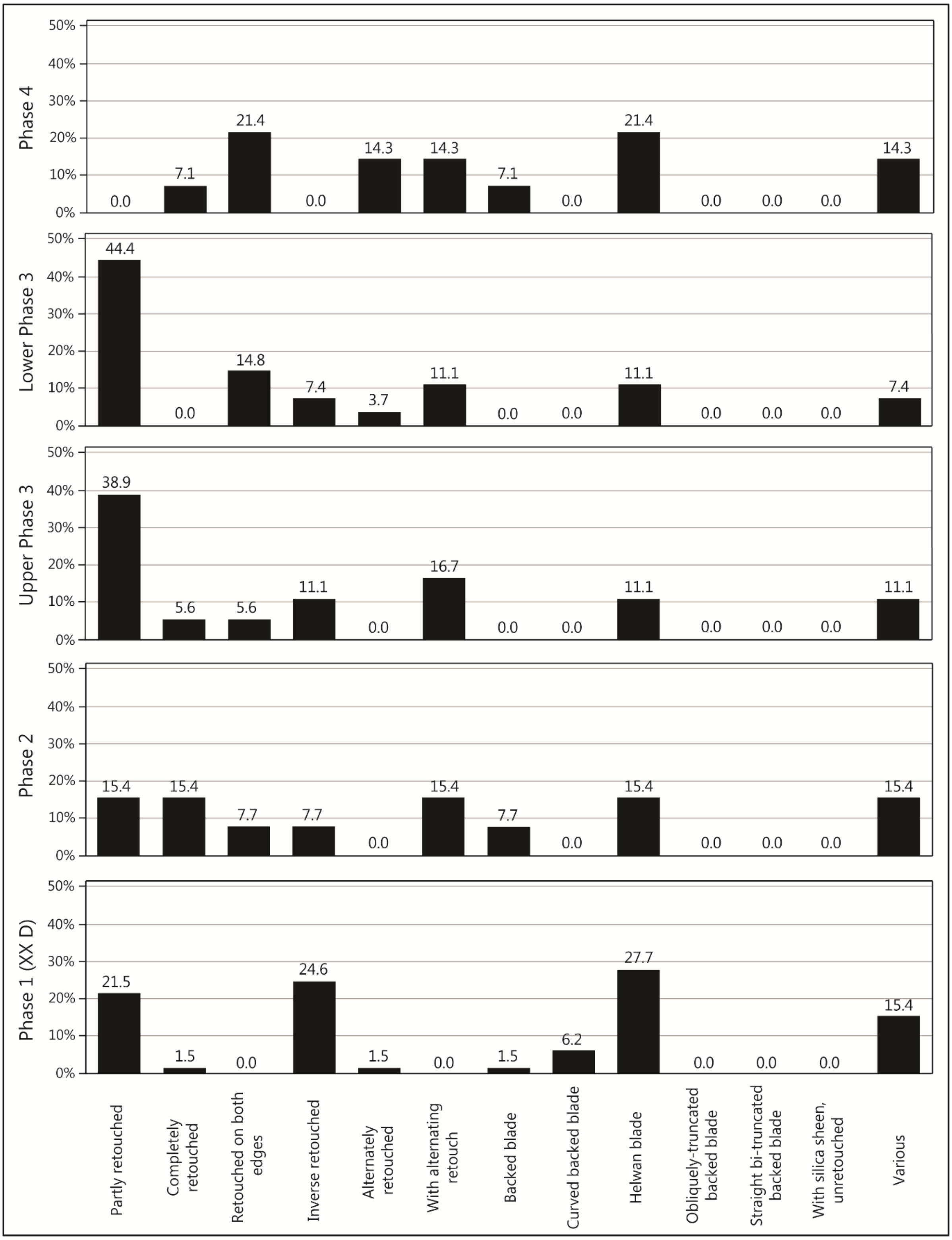


Figure 6.10: Retouched blade types, by phase. Phase 1 data from Edwards 2013e: 149.

6.3.1.6 *Non-geometric microliths*

Non-geometric microliths are common in Phase 4, with 104 artefacts assigned to this tool group across 17 out of 25 available types (**Fig. 6.11**). Helwan bladelets (**Fig. 6.9:** 7-8) are the most common type, amounting to just under a third (29.8%) of the tool group. These pieces are complemented primarily by partially retouched bladelets (19.2%) and inverse bladelets (12.5%). While comprising a relatively minor proportion of the total microliths in this phase, bladelets completely retouched on one edge represent a greater percentage (4.8%) of this tool group than seen in any of the later phases.

6.3.1.7 *Geometric Microliths*

A total of 147 geometric microliths were identified from the Phase 4 strata, with nine out of 12 types represented. Helwan lunates (**Fig. 6.12:** 6-10, 12-16, 18) are easily the most frequently occurring type (59.9%), although not to as great an extent as seen in subsequent phases (**Fig. 6.13**). The Helwan lunates are predominantly supplemented by significant numbers of alternating lunates (13.6%; **Fig. 6.12:** 1-3) with smaller numbers of inverse lunates (6.8%; **Fig. 6.12:** 5), abrupt lunates (6.1%; **Fig. 6.12:** 11, 17) and semi-steep lunates (4.8%; **Fig. 6.12:** 4) also present. A relatively high proportion (3.4%) of 'various' geometric microliths – primarily lunates featuring a combination of abrupt and non-abrupt retouch – were also retrieved from this phase. The dominance of Helwan retouch for the manufacture of lunates becomes especially pronounced when the lunates are segregated from other forms of geometric microliths (**Fig. 6.14**) The isosceles triangle and Helwan rectangle types are each represented by a single specimen (0.7%), while scalene triangles, rectangles and trapezes are entirely absent.

6.3.1.8 *Notched and denticulated pieces*

A total 117 pieces bearing notched or denticulated retouch were recovered from the Phase 4 loci, with all four types represented (**Fig. 6.15**). Pieces featuring a single small notch dominate this tool group (40.2%), followed by objects bearing denticulated retouch (27.4%; **Fig. 6.16:** 1-3) and pieces with a large notch (20.5%). Pieces with multiple, non-denticulated notches are less common (12.0%).

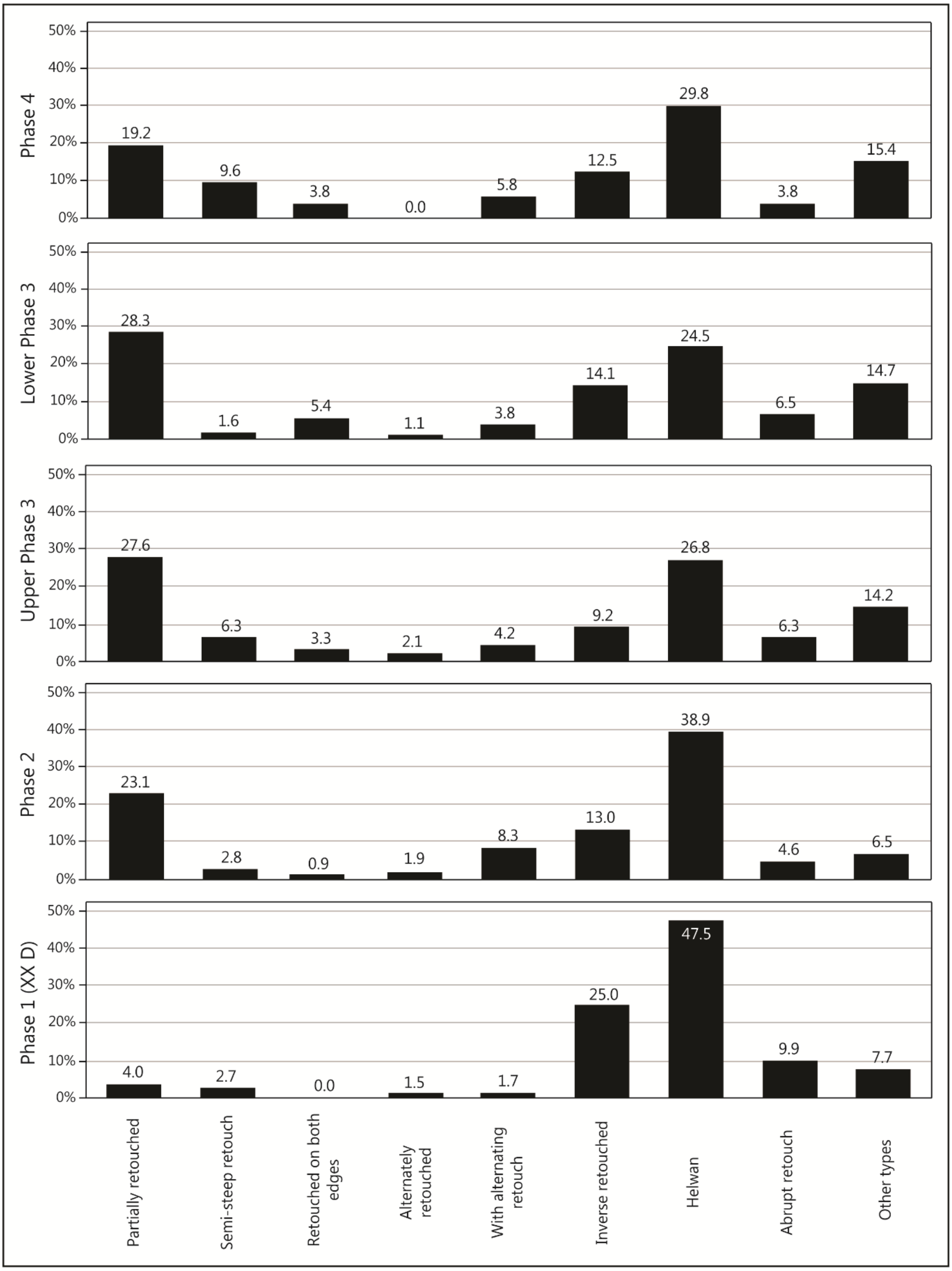


Figure 6.11: Non-geometric microlith types (abridged), by phase. Phase 1 data from Edwards 2013e: 149-150.

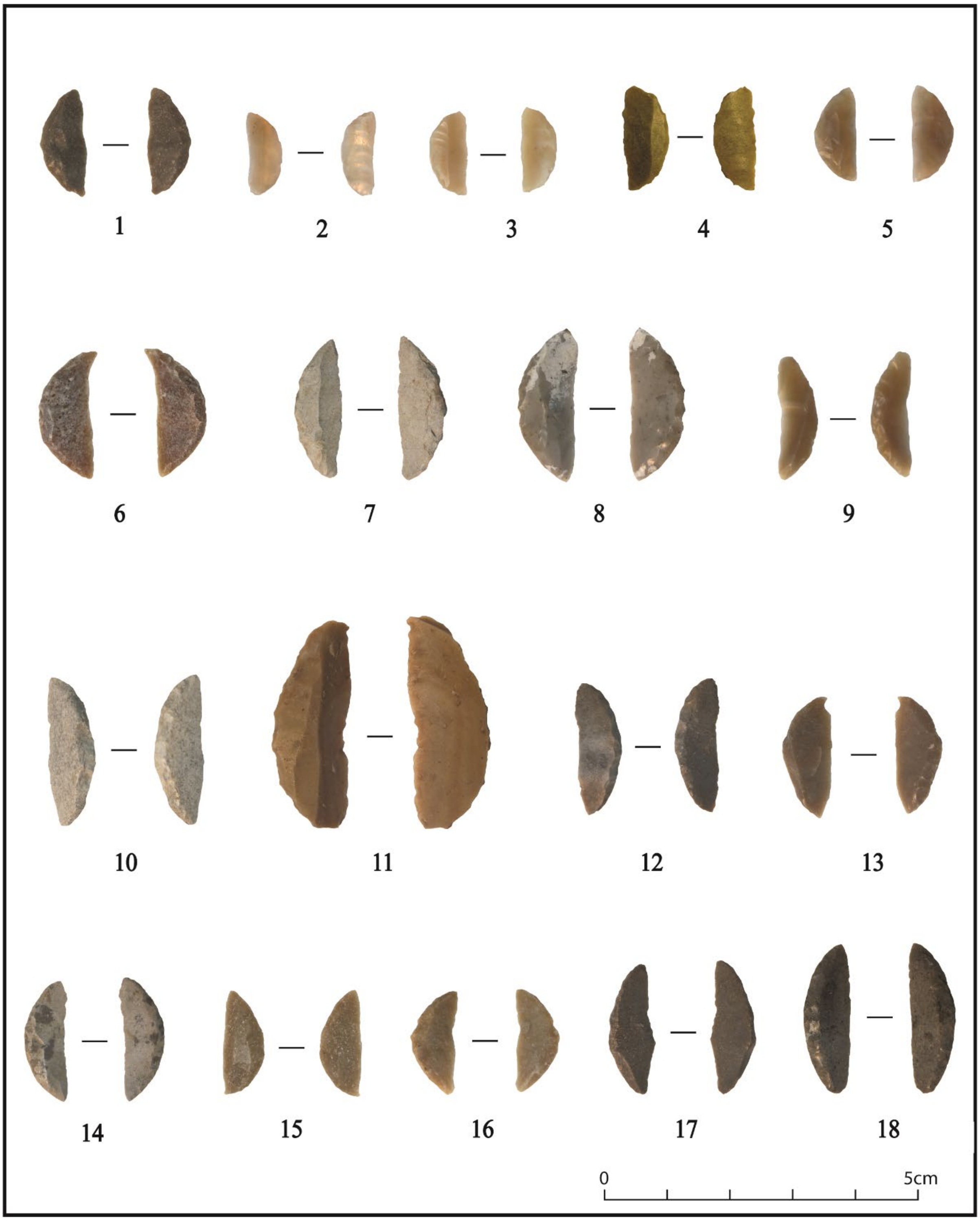


Figure 6.12: Geometric microliths from Phase 4.

1-3: Alternating lunates (Locus 8.3); **4**: Semi-steep lunate (Locus 8.3); **5**: Inverse lunate (Locus 8.3); **6-10**: Helwan lunates (Locus 8.3); **11**: Abrupt lunate (Locus 8.5); **12-14**: Helwan lunates (Locus 8.5); **15-16**: Helwan lunates (Locus 8.6); **17**: Abrupt lunate (Locus 8.9); **18**: Helwan lunate (Locus 8.9).

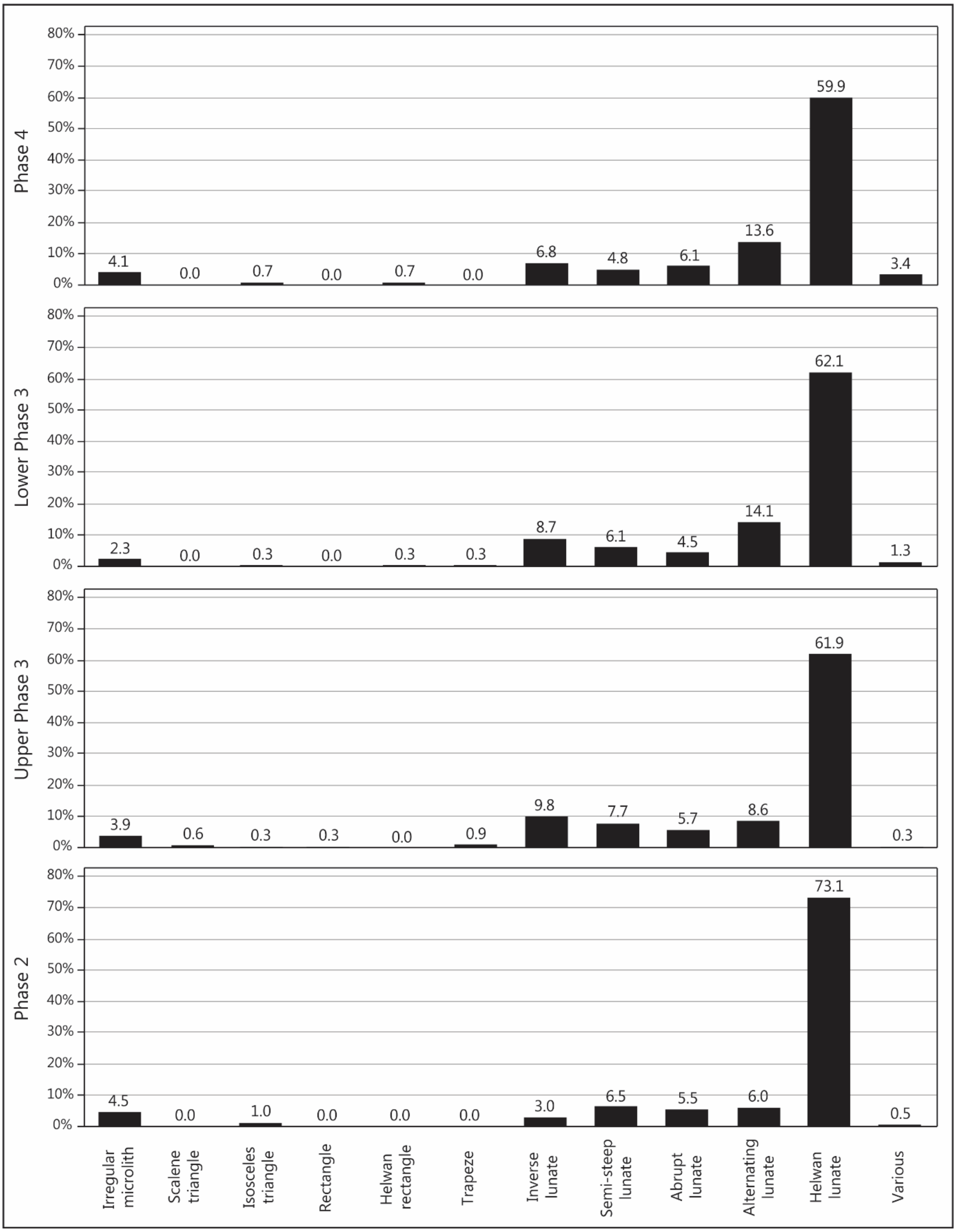


Figure 6.13: Geometric microlith types, by phase.

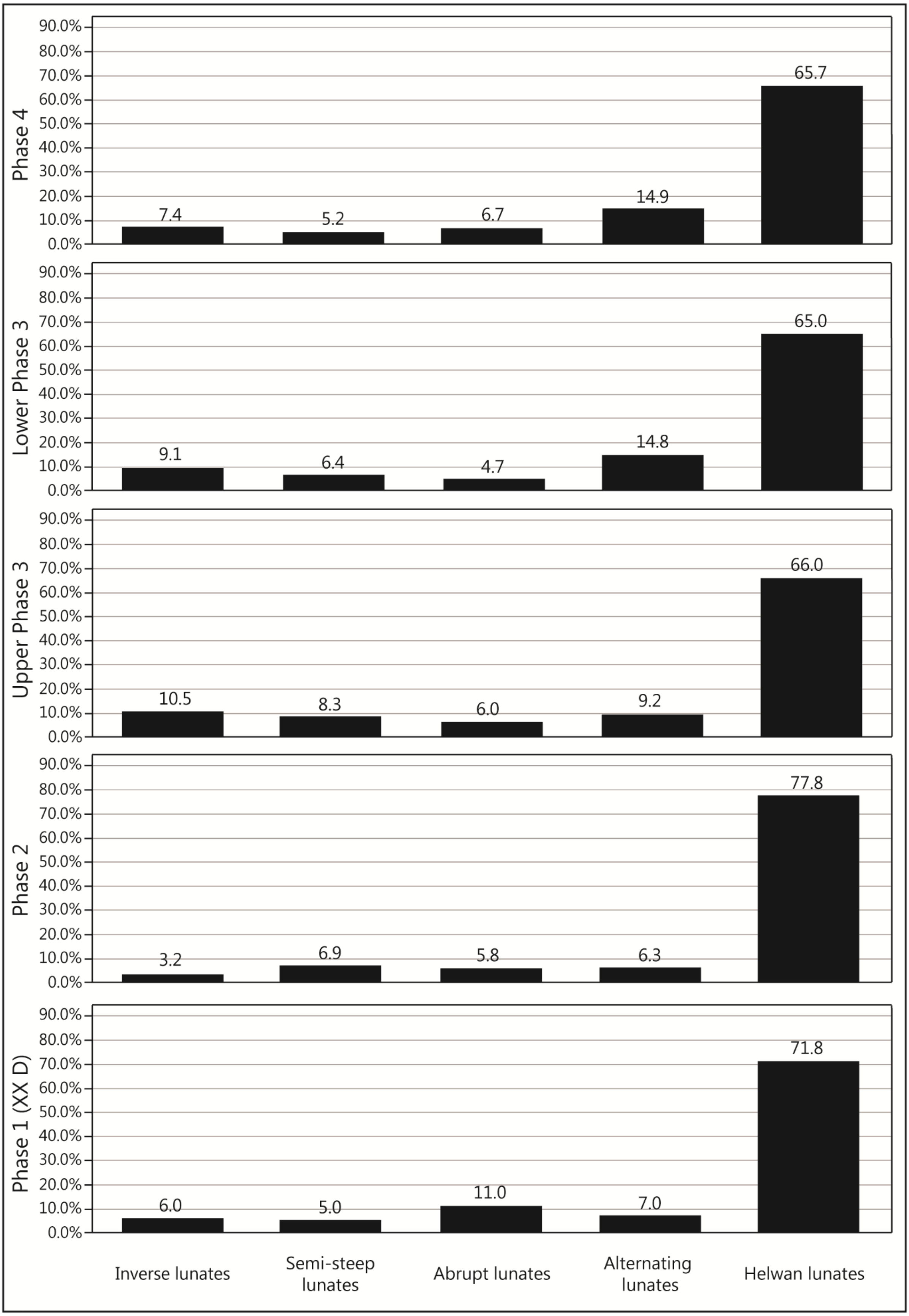


Figure 6.14: Lunate retouch modes, by phase.

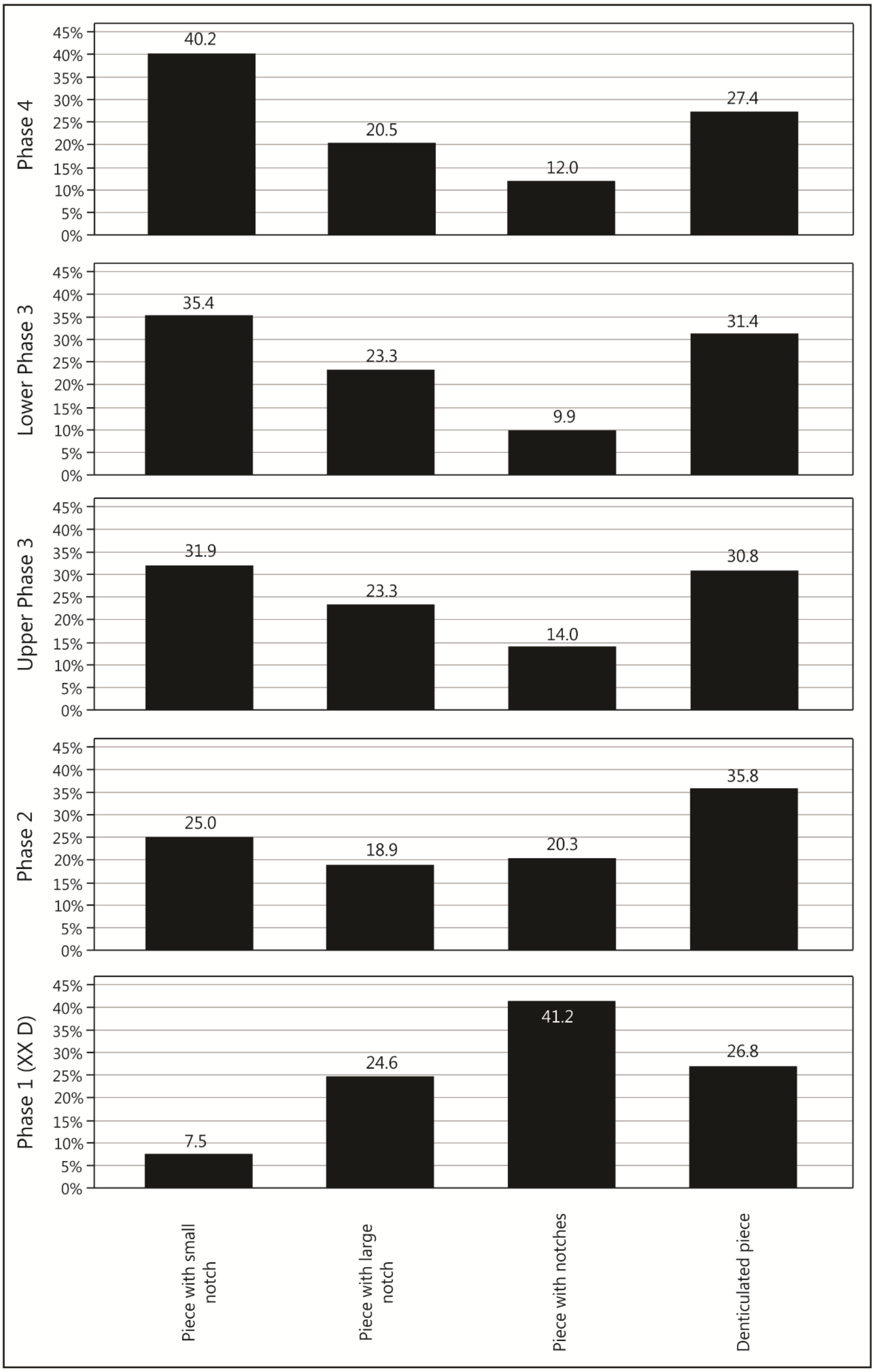


Figure 6.15: Notched and denticulated piece types, by phase. Phase 1 data from Edwards 2013e: 151.

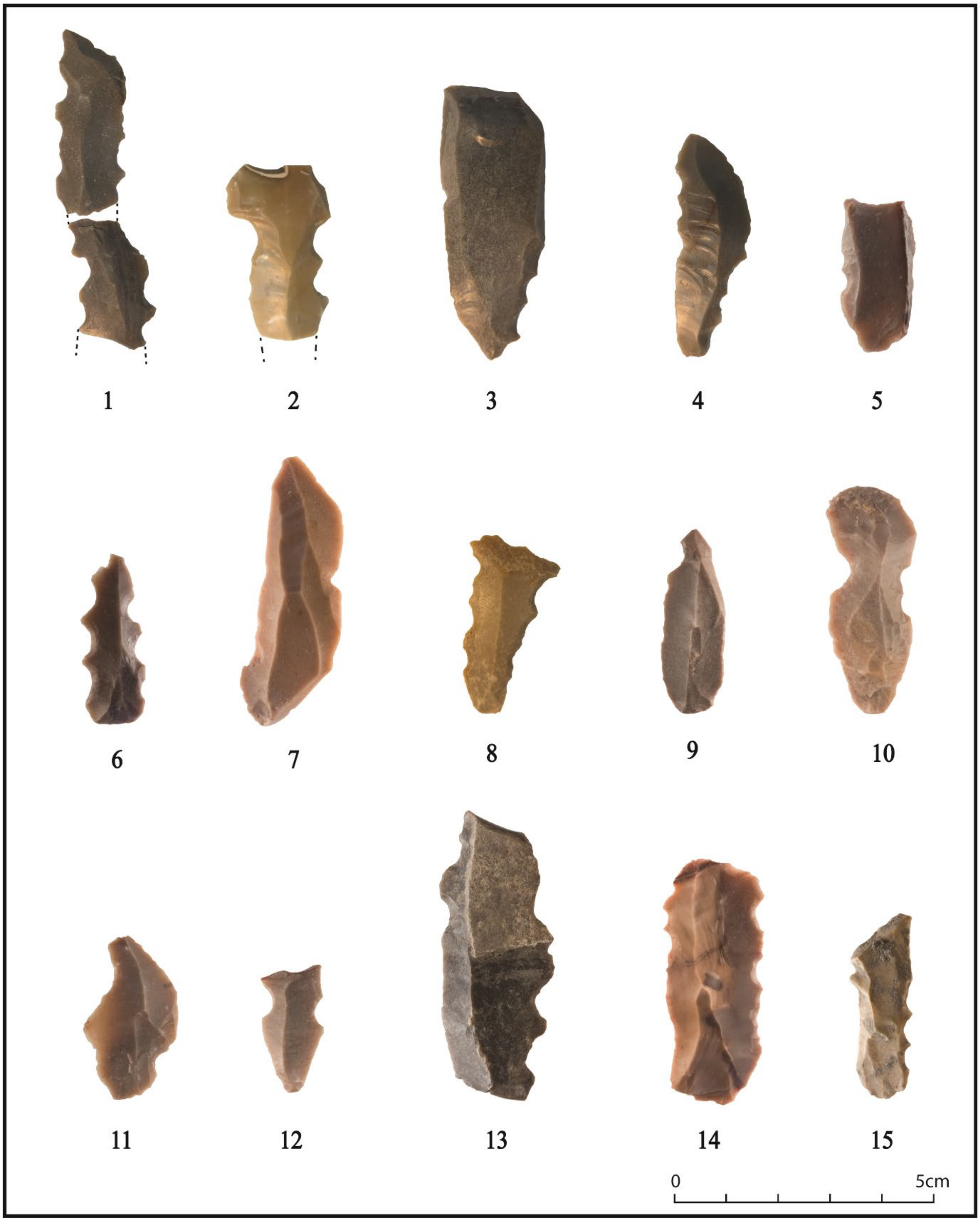


Figure 6.16: Notched and denticulated pieces from Wadi Hammeh 27, Phases 2-4.

Phase 4: 1-2: Denticulated pieces (Locus 8.3); **3**: Denticulated piece (Locus 8.5); **Lower Phase 3: 4**: Denticulated piece (Locus 8.1); **5**: Denticulated piece/Bladelet with concave truncation (Locus 8.1); **6**: Denticulated piece (Locus 9.1); **Upper Phase 3: 7**: Piece with small notch (Locus 6.1); **8**: Denticulated piece (Locus 7.1); **Phase 2: 9**: Piece with large notch (Locus 2.5); **10-12**: Pieces with notches (Locus 2.5); **13-15**: Denticulated pieces (Locus 2.5).

6.3.1.9 Awls and borers

Twelve objects belonging to this tool group were retrieved from the Phase 4 deposits, representing 1.3% of the retouched tool assemblage. Only three out of the five types are present, with the alternately-retouched awls being the dominant type (58.3%; **Fig. 6.17:** 2, 4), followed by bilaterally-backed borers (33.3%; **Fig. 6.17:** 3, 5). Awls with semi-steep or Helwan retouch are absent. (**Table 6.1**).

6.3.1.10 Bifacial tools

Two bifacial tools were uncovered from the Phase 4 loci, representing 0.2% of the total retouched artefact assemblage. The first of these objects is a trihedral pick discovered in the uppermost spit of Locus 8.5, directly overlaying the Feature 29 double burial (**Fig. 6.18:** 2). Its elongated, slightly tapered form measures 81mm in length. Retouch is limited to the removal of flakes along its lateral margins, with a clear preference towards the removal of flakes from one side. No cortex remains, negating any assessments of the original size of the chert nodule from which it originated. Prominent impact fractures also present at either end of the pick, indicating that this piece was heavily utilised prior to its disposal, possibly in association with the burial pit in which it was discovered.

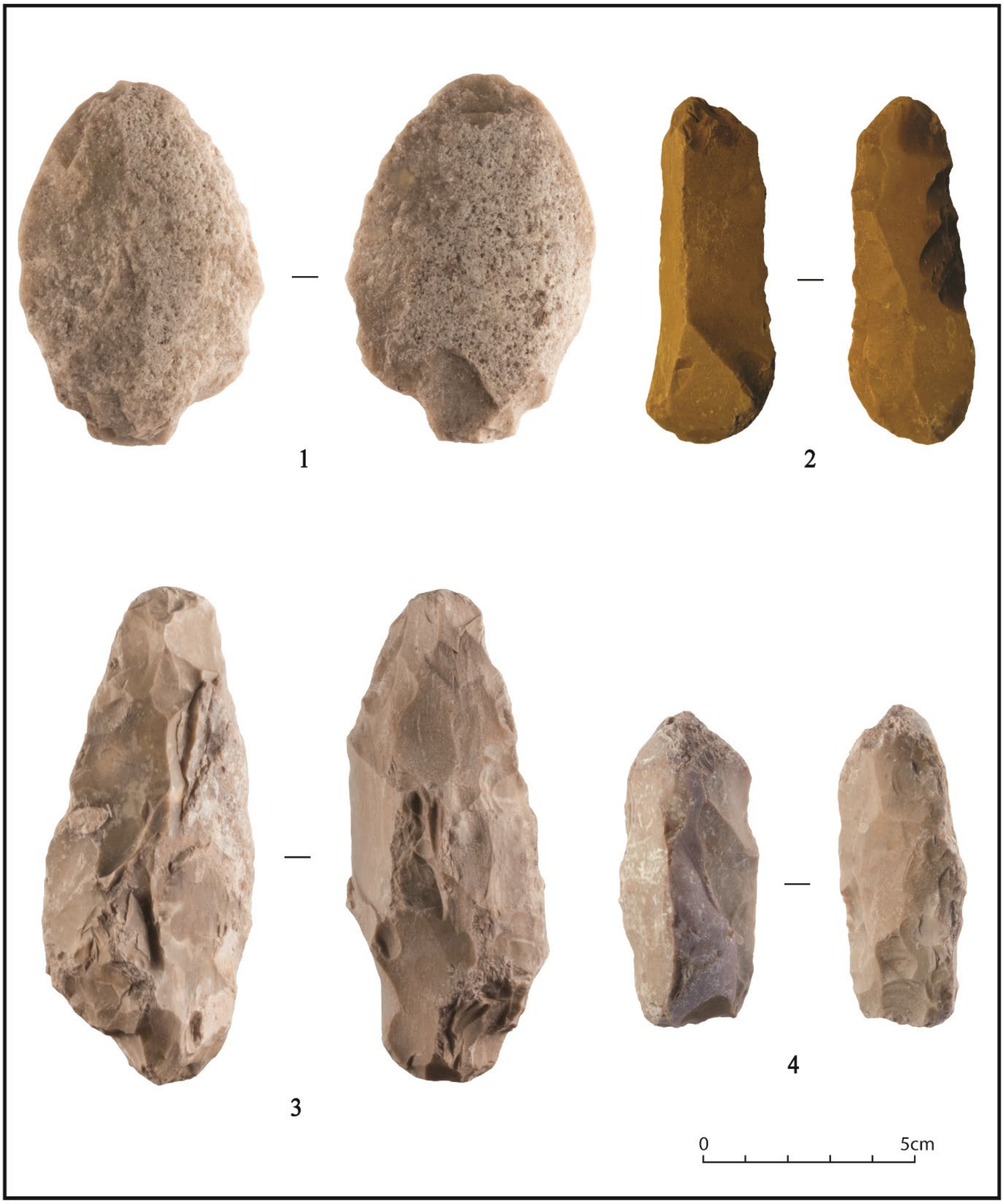
The other Phase 4 biface is an irregular, quartzite biface uncovered at the base of the excavated Locus 8.9 deposits in the Feature 35 pit (Figs. **6.18:** 1; **6.19:** 5). Unlike the pick, this artefact features an ovoid plan and a comparatively thin, lenticular cross-section. Its retouch takes the form of a combination of bifacial and unifacial flaking along its entire margin. This retouch is relatively non-invasive, resulting in the retention of large amounts of cortex on either face. This evidence suggests that the final form of this biface varies only slightly in size from the original quartzite cobble utilised.

6.3.1.11 Retouched flakes

Forty-two retouched flakes were recovered from the Phase 4 deposits, constituting 4.5% of the Phase 4 tool assemblage. The overwhelming majority of these pieces belong to the 'retouched flake' type (85.7%), with fewer numbers of backed flakes (14.3%). No examples of Helwan-retouched flakes are present in the Phase 4 deposits.

Figure 6.17: Awls and borers from Wadi Hammeh 27, Phases 2-4.

Phase 4: **1**: Inverse awl (Locus 8.3); **2**: Alternately-retouched awl (Locus 8.5); **3**: Bilaterally-backed borer (Locus 8.5); **4**: Alternately-retouched awl (Locus 8.6); **5**: Bilaterally-backed borer (Locus 8.6); **Lower Phase 3:** **6**: Bilaterally-backed borer (Locus 8.1); **7-8**: Bilaterally-backed borers (Locus 9.1); **Upper Phase 3:** **9**: Helwan-retouched awl (Locus 7.1); **Phase 2:** **10-11**: Bilaterally-backed borers (Locus 2.5).



Figures 6.18: Bifacial tools from Phase 4 and Lower Phase 3.

Phase 4: **1**: Irregular biface (Locus 8.9); **2**: Pick (Locus 8.5); **Lower Phase 3:** **3-4**: Picks (Locus 9.1).

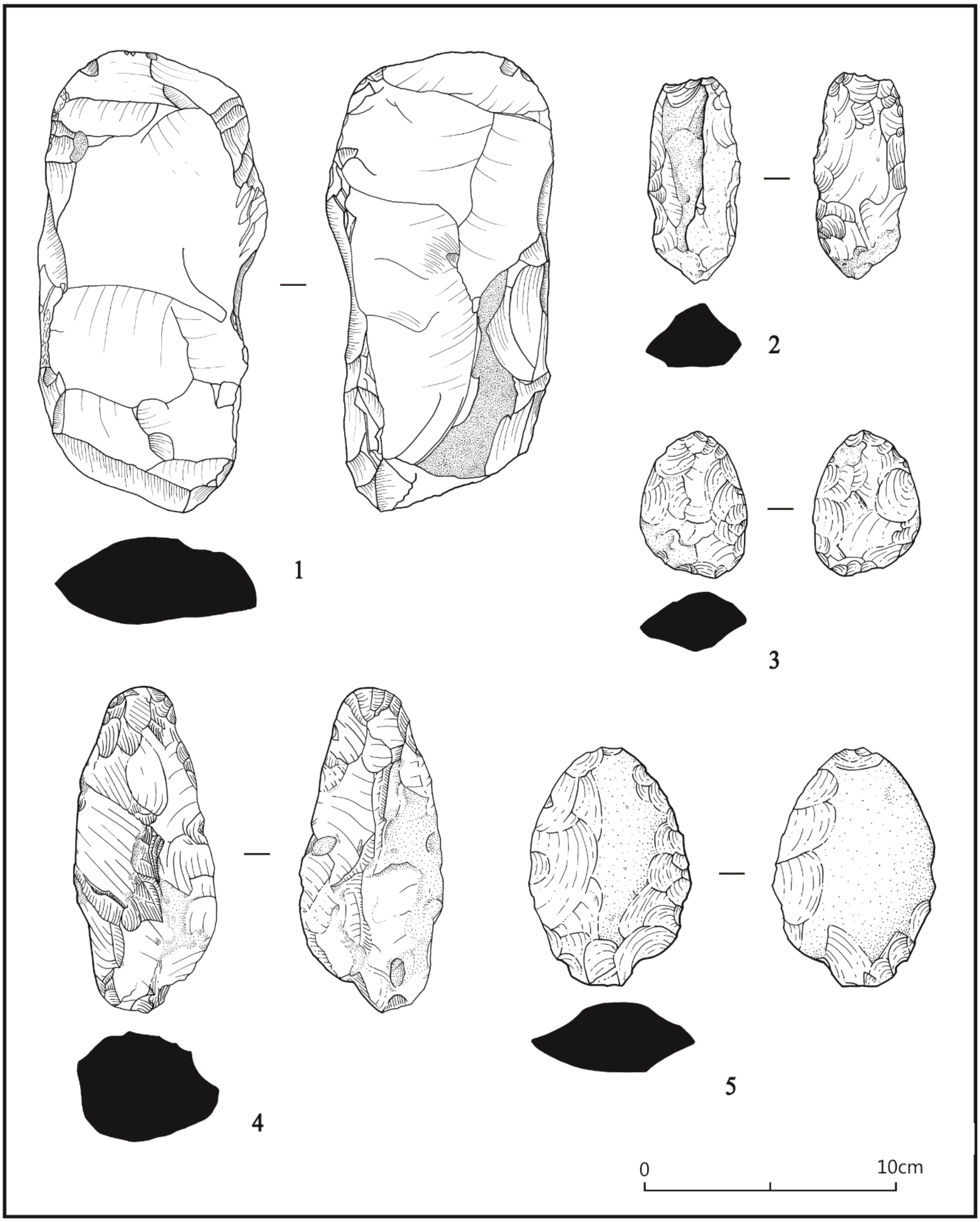


Figure 6.19: Bifacial tools from Wadi Hammeh 27, Area XX F.

1: Tranchet axe (Upper Phase 3); **2**: Pick (Lower Phase 3); **3**: Irregular biface (Lower Phase 3); **4**: Pick (Lower Phase 3); **5**: Irregular biface (Phase 4).

6.3.1.12 Retouched fragments

A total of 250 fragments featuring retouch were retrieved from the Phase 4 deposits which could not be properly typologically defined. Of these pieces, broken retouched bladelets comprise the greatest share (57.6%), followed by miscellaneous retouched fragments (20.4%) and broken backed bladelets (17.6%). Lower quantities of broken retouched blades (4.0%) and broken backed blades (0.4%) were recovered.

6.3.1.13 Informal tools

Eleven artefacts classified as 'informal tools' were recovered from the Phase 4 strata, constituting 1.2% of the total retouched artefact assemblage. Most of these pieces exhibit scaled use-wear (81.8%), with the other two objects (18.2%) featuring extensive battering damage.

<u>6.3.2 Lower Phase 3 retouched artefacts</u>

The Lower Phase 3 assemblage yielded the second greatest quantity of retouched artefacts from the analysed assemblages, numbering 1,945 tools. All 13 tool groups are represented. Almost a third of the Lower Phase 3 retouched pieces (30.3%) have been assigned as retouched fragments - the largest share that this group attains at Wadi Hammeh 27 (**Table 6.1; Fig. 6.1**). Geometric microliths are again the most common formal group of tools, with almost identical proportions (16.0%) as in Phase 4. These artefacts are primarily supplemented by a slightly greater presence of burins (14.6%) compared to Phase 4. These groups are followed by the notched and denticulated pieces (11.5%) and non-geometric microliths (9.5%), although both of these tool groups present their lowest representation out of all four lower assemblages. None of the other eight tool groups attain a frequency greater than 5% of the phase total.

6.3.2.1 Scrapers

Forty-five scrapers were recovered, representing 2.3% of the Lower Phase 3 tool assemblage – the lowest proportion reached by this tool group out of the four assemblages. Thirteen out of 16 scraper types are represented, with the double endscraper, micro-carinated scraper and ‘other’ types absent. This scraper assemblage is unique at Wadi Hammeh 27 in that broad carinated scrapers **(Fig. 6.20:** 1, 3-5) are the most commonly occurring type, comprising a third (33.3%) of the phase total (**Fig. 6.2**). These artefacts are supplemented by sidescrapers (13.3%) and endscrapers on retouched pieces (8.9%; **Fig. 6.21**: 10). Endscrapers (**Fig. 6.20:** 6) and rounded scrapers (**Fig. 6.20:** 2, 7) are notably less prevalent that in the previous assemblage, with each of these types making up 6.7% of the Lower Phase 3 scrapers. While this reduced share is an anomaly for the endscraper type, the percentages of rounded scrapers continue to decline over time across subsequent phases at Wadi Hammeh 27.

6.3.2.2 Multiple tools

Eighty-three multiple tools were uncovered, representing 4.3% of the retouched artefacts from Lower Phase 3. While burin/scraper combinations remain the most numerous type (62.7%; **Fig 6.22:** 1-2, 4-10), this is a noticeably reduced share than in the previous assemblage (**Fig. 6.5**). In turn, the percentage of burin/notched piece combinations (21.7%; **Fig. 6.22:** 5) rises dramatically. Burin/truncation combinations occur in similar, albeit slightly reduced proportions (15.7%; **Fig. 6.22:** 3) as in Phase 4.

6.3.2.3 Burins

A total of 283 burins were excavated from the Lower Phase 3 deposits, with all types aside from the beaked burins and nucleiform burins present. The burin on natural surface (**Fig. 6.23**: 1) is once again the most plentiful type, albeit with its lowest share (17.3%) out of the newly catalogued assemblages (**Fig. 6.6**). This type predominates over the double mixed burins (12.4%), burins on oblique truncations (11.3%) and burins on convex truncations (10.6%; **Fig. 6.24:** 4, 8).

When the burin list is viewed from an abridged perspective, a diminution of burins on truncations occurs compared to Phase 4, with the five truncation types amounting to 37.1% of the Lower Phase 3 burins (**Fig. 6.8**). While this decrease may appear superficial when comparing only the lowest two assemblages, this decline also continues across the subsequent two assemblages, before rising again in Phase 1. The share of burins on oblique truncations (11.3%) and double burins on truncations (4.2%; **Fig. 6.24:** 5-6) decline markedly from Phase 4, whereas the burins on convex truncations slightly increase. In contrast with this

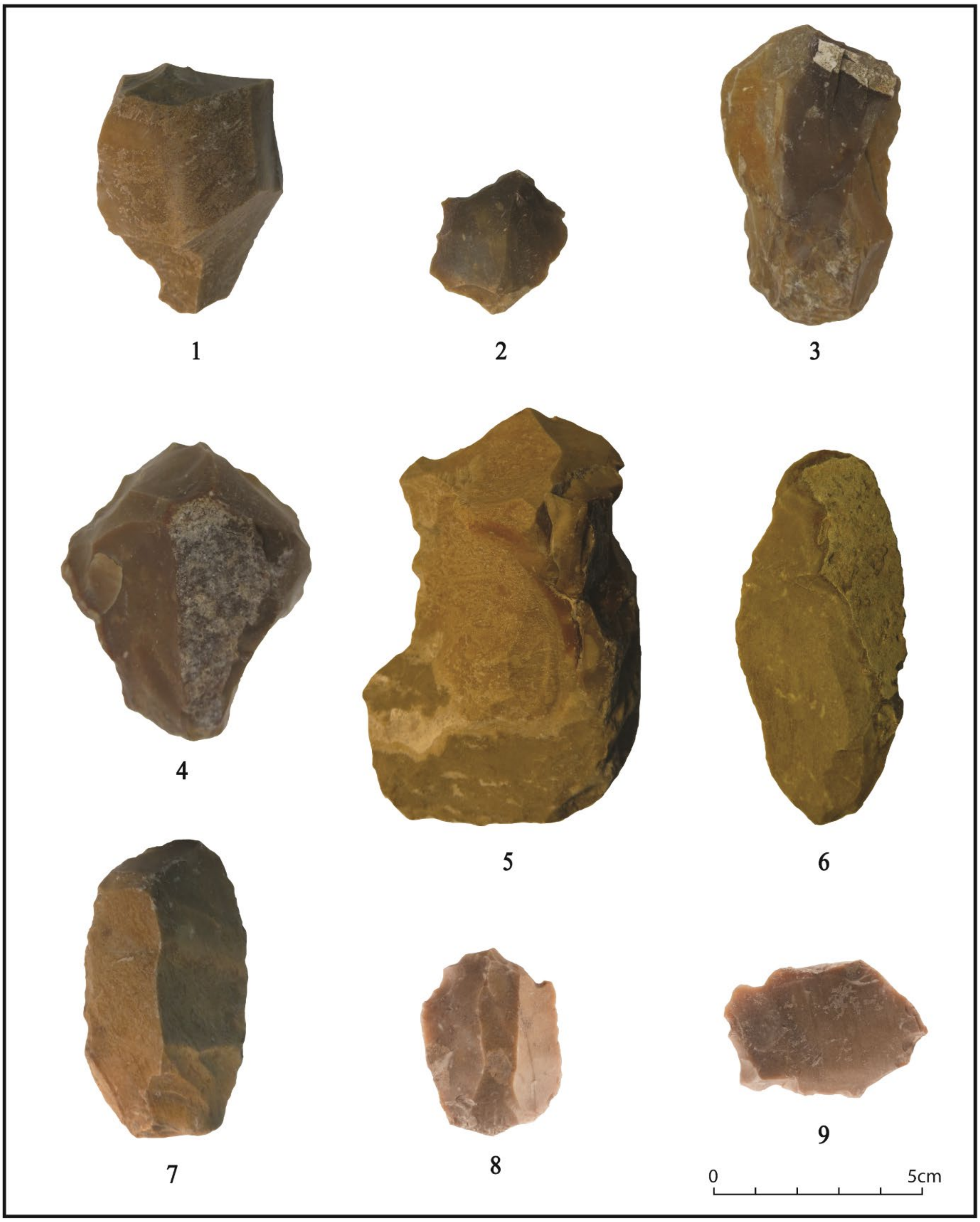


Figure 6.20: Scrapers from Lower and Upper Phase 3.

Lower Phase 3: 1: Broad carinated scraper (Locus 8.1); **2**: Rounded scraper (Locus 8.1); **3-5**: Broad carinated scrapers (Locus 9.1); **6**: Endscraper (Locus 9.1); **7**: Rounded scraper (Locus 9.1); **Upper Phase 3: 8**: Endscraper (Locus 7.1); **9**: Nosed scraper (Locus 7.1).

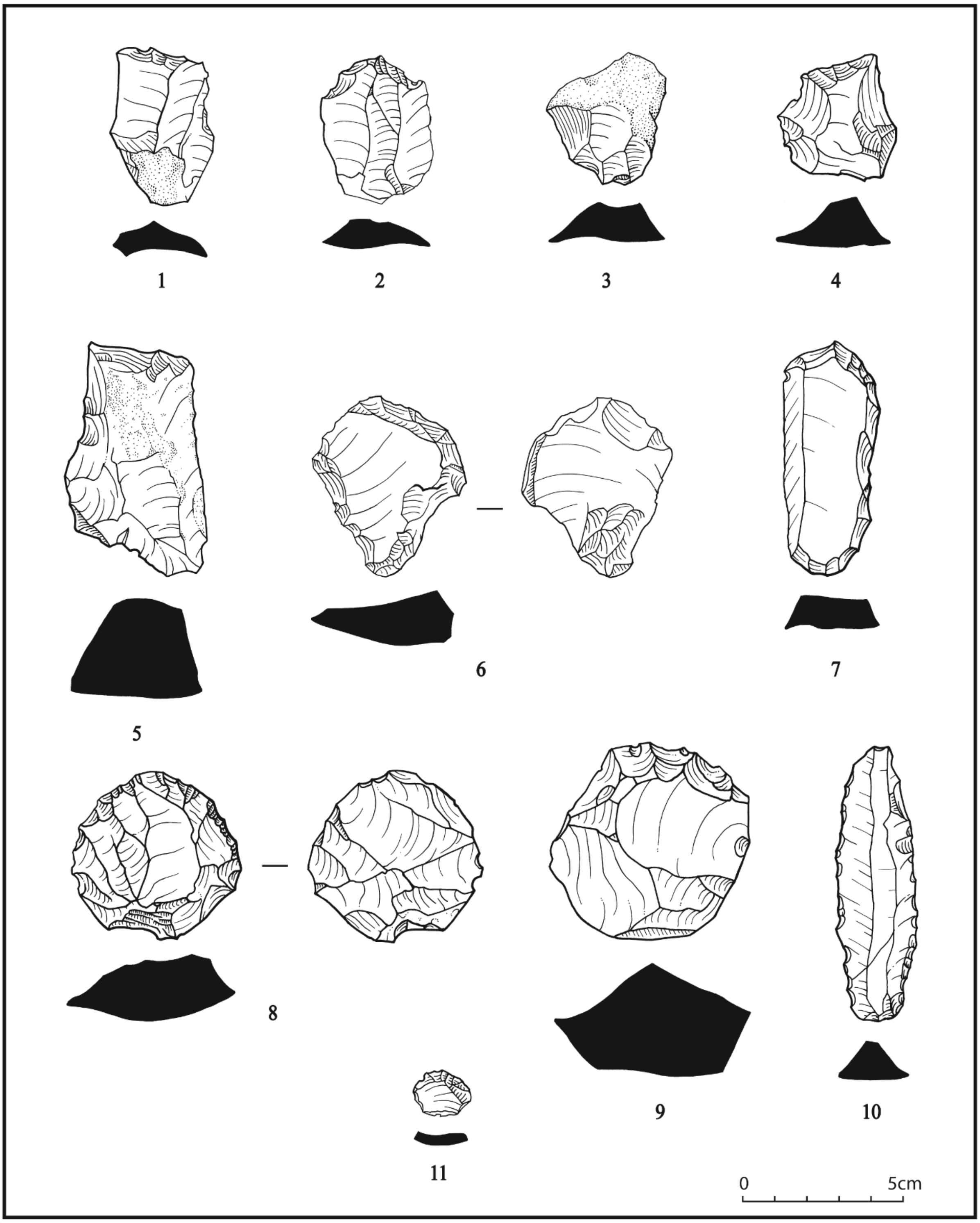


Figure 6.21: Scrapers from Wadi Hammeh 27, Plot XX F.

1: Endscraper (Phase 2); **2**: Endscraper (Upper Phase 3); **3**: Transversal endscraper (Phase 2); **4**: Rounded scraper (Phase 2); **5**: Narrow carinated scraper (Upper Phase 3); **6**: Double mixed scraper (Phase 2); **7**: Sidescraper (Phase 2); **8**: Nuceiform scraper (Upper Phase 3); **9**: Nucleiform scraper (Phase 2); **10**: Endscraper on retouched blade (Lower Phase 3); **11**: Thumbnail scraper (Phase 2).

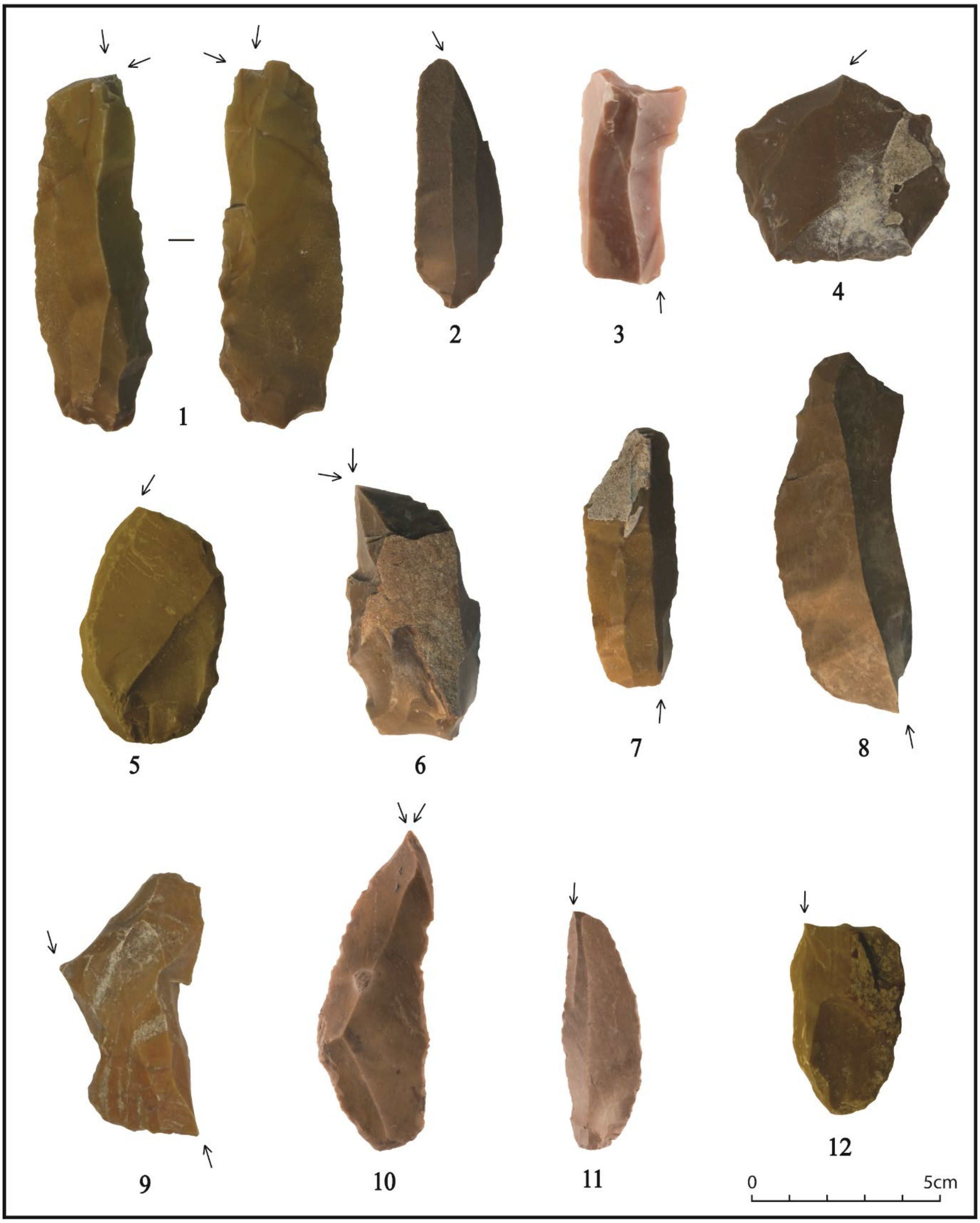


Figure 6.22: Multiple tools from Lower and Upper Phase 3.

Lower Phase 3: **1**: Dihedral angled burin/Endscraper on retouched blade (Locus 8.1); **2**: Burin on oblique truncation/Endscraper (Locus 8.1); **3**: Burin on oblique truncation/Blade with concave truncation (Locus 8.1); **4**: Burin on convex truncation/Rounded scraper (Locus 8.1); **5**: Burin on oblique truncation/Sidescraper (Locus 9.1); **6**: Dihedral angled burin/ Narrow carinated scraper (Locus 9.1); **7**: Burin on convex truncation/ Endscraper on retouched blade (Locus 9.1); **8**: Burin on oblique truncation/Endscraper on retouched blade (Locus 9.1); **9**: Double burin on truncation/Multiple scraper (Locus 9.1); **10**: Dihedral burin/Endscraper on retouched blade (Locus 9.1); **Upper Phase 3:** **11**: Burin on oblique truncation/Endscraper on retouched blade (Locus 7.1); **12**: Burin on straight truncation/Sidescraper.

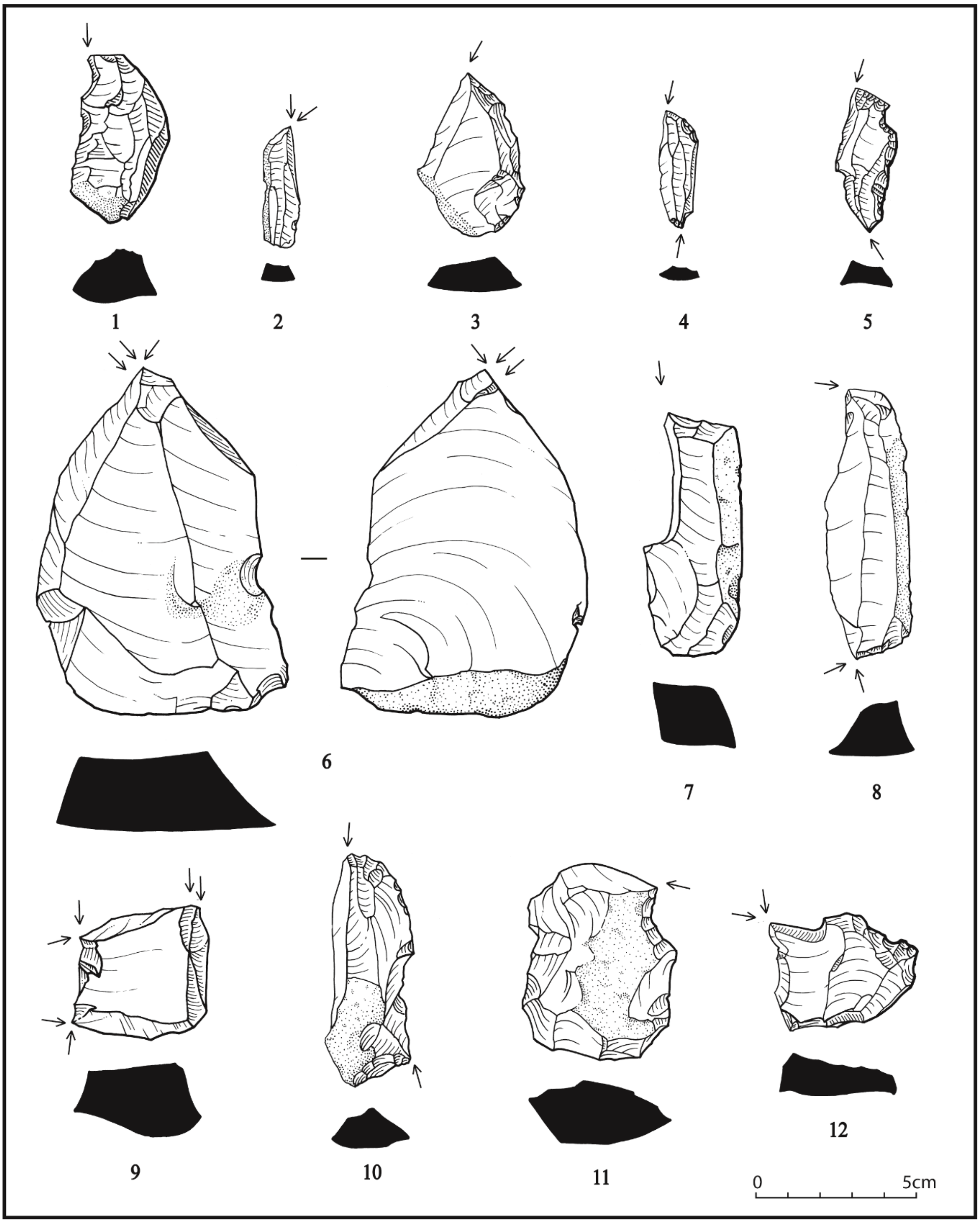


Figure 6.23: Burins and multiple tools from Wadi Hammeh 27, Plot XX F.

1: Burin on natural surface (Lower Phase 3); **2**: Offset dihedral burin (Upper Phase 3); **3**: Burin on convex truncation (Phase 2); **4**: Double burin on truncation (Upper Phase 3); **5**: Double mixed burin/Piece with large notch (Lower Phase 3); **6**: Dihedral burin (Lower Phase 3); **7**: Burin on oblique truncation (Phase 2); **8**: Double mixed burin (Upper Phase 3); **9**: Double mixed burin (Phase 2); **10**: Double burin on truncation (Upper Phase 3); **11**: Transverse burin on retouched notch/Endscraper (Phase 2); **12**: Offset dihedral burin/Transversal endscraper (Phase 2).

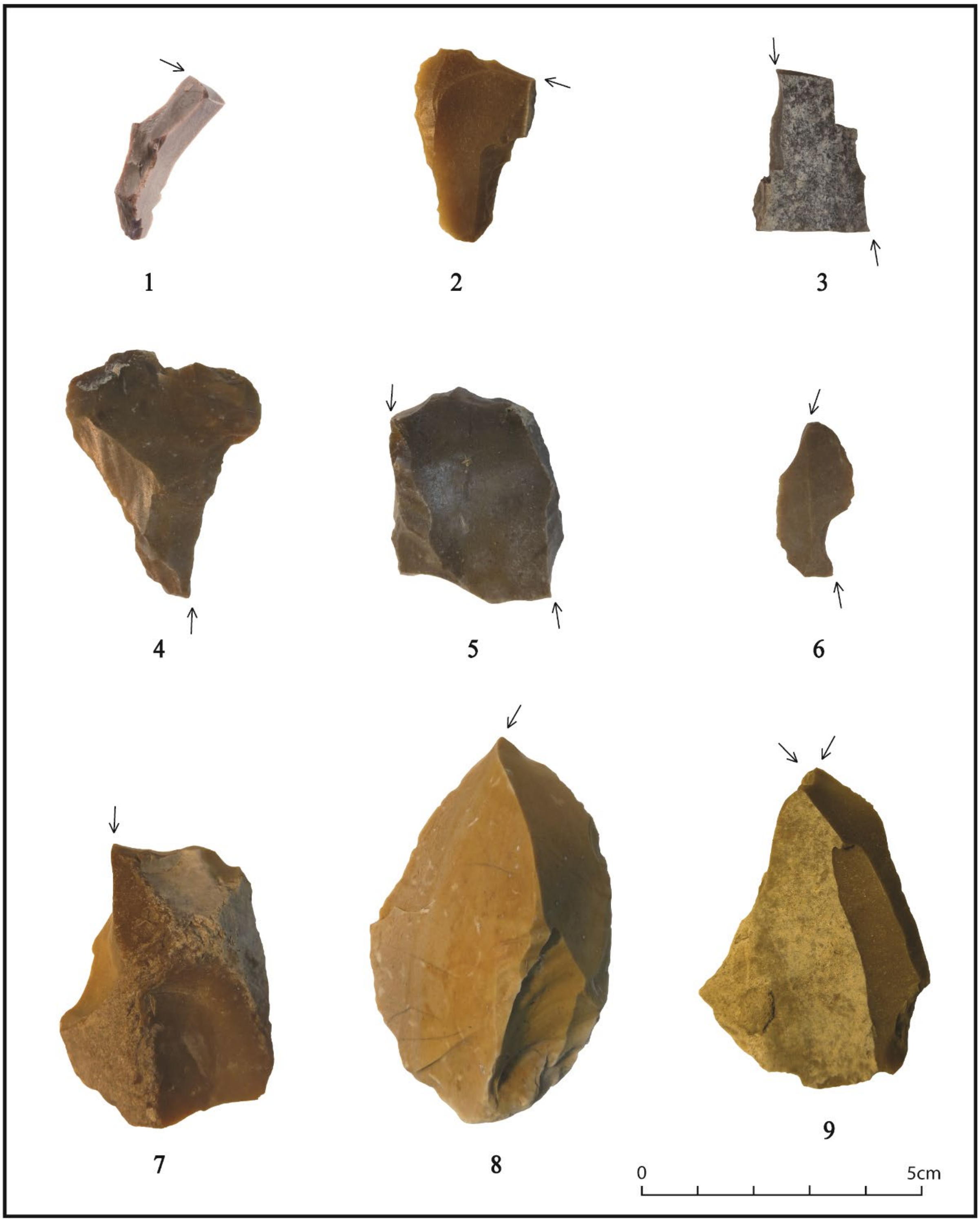


Figure 6.24: Burins from Lower Phase 3.

1-2: Transverse burins on lateral retouch (Locus 8.1); **3**: Double burin on natural surface (Locus 8.1); **4**: Burin on convex truncation (Locus 8.1); **5-6**: Double burins on truncation (Locus 8.1); **7**: Burin on concave truncation (Locus 9.1); **8**: Burin on convex truncation (Locus 9.1); **9**: Dihedral burin (Locus 9.1).

decline, a higher proportion of dihedral burins is evident in the Lower Phase 3 deposits, with these types together comprising a share (20.1%) almost twice as high as that of the previous assemblage. A larger amount of burins struck from lateral retouch (**Fig. 6.24:** 1-2) is also notable, this type reaching its greatest share (7.4%) at the site.

6.3.2.4 Retouched blades

Twenty-seven retouched blades were recovered, representing 1.4% of the Lower Phase 3 retouched artefact assemblage. Seven out of 13 types are present. Almost half of these artefacts (44.4%) belong to the blade partially retouched along one edge type – a comparatively large increase considering that this type is entirely absent in the previous assemblage (**Fig. 6.10**). These pieces are supplemented by blades retouched on both edges (14.8%; **Fig. 6.25:** 1), running at similar numbers to the Phase 4 assemblage, yet which comprise a lower proportion of the overall tool group. The same can be said for the Helwan blades (**Fig. 6.25:** 4, 6) and blades with alternating retouch (**Fig. 6.25:** 2-3), both of which encompass 11.1% of the group total for this phase. Two inverse-retouched blades (**Fig. 6.25:** 5) were also discovered (7.4%), another type which is absent from the prior assemblage.

6.3.2.5 Truncations

A total of 91 truncations were recovered from the Lower Phase 3 deposits, comprising 4.7% of the assemblage total – the greatest share reached by this tool group at Wadi Hammeh 27. Pieces with a single truncation are again the more common type (82.4%), outnumbering the bi-truncated pieces to a similar extent as in the preceding assemblage.

6.3.2.6 Non-geometric microliths

A total of 184 non-geometric microliths were retrieved from the Lower Phase 3 deposits. A similar degree of typological diversity to the prior assemblage is present, with 17 out of 25 types present. The types represented diverge from Phase 4, however, with the first appearance of alternately retouched bladelets, bladelets completely backed on one edge, convex-truncated backed bladelets and convex bi-truncated backed bladelets. The appearance of

Figure 6.25: Retouched blades and non-geometric microliths from Lower Phase 3.

1: Blade retouched on both edges (Locus 9.1); **2-3**: Blades with alternating retouch (Locus 9.1); **4**: Helwan blade (Locus 9.1); **5**: Inverse-retouched blade (Locus 8.1); **6**: Helwan blade (Locus 8.1); **7**: Bladelet retouched on both edged (Locus 8.1); **8**: Bladelet with alternating retouch (Locus 9.1); **9**: Obliquely bi-truncated bladelet (Locus 9.1).

these types are offset by the absence of the straight-truncated backed bladelet, straight bi-truncated backed bladelet and unretouched bladelet with silica sheen types.

This assemblage also differs from the previous one in that partially retouched bladelets are the most numerous type (28.3%), outnumbering Helwan bladelets (24.5%; **Fig. 6.11**). Inverse bladelets again appear in substantial numbers (14.1%). The remaining types are less common, with only the obliquely-truncated bladelets (6.0%; **Fig. 6.25:** 9) and bladelets retouched on both edges (5.4%) breaching 5% of the tool group.

6.3.2.7 Geometric microliths

A total of 311 geometric microliths were recovered from the Lower Phase 3 deposits encompassing ten out of 12 types, with only scalene triangles and non-Helwan rectangles absent. Helwan lunates are again the dominant type (**Figs. 6.26:** 6; **6.27:** 6-7), with a slightly increased share (62.1%) from the preceding phase (**Fig. 6.13**), although the proportions of lunate types remain largely unchanged from Phase 4 when the other geometric microlith types are excluded (**Fig. 6.14**). Alternating lunates (14.1%; **Fig. 6.27:** 4-5), inverse lunates (8.7%) and semi-steep lunates (6.1%) also occur in narrowly greater proportions than in Phase 4, while abrupt lunates (4.5%), irregular microliths (2.3%; **Fig. 6.27:** 1-2) and 'various' microliths (1.3%) all decline in representation.

6.3.2.8 Notched and denticulated pieces

A total of 223 pieces featuring notching or denticulated retouch were excavated from the Lower Phase 3 deposits, with all four types represented. While the gap between the number of pieces with a small notch (35.4%) and denticulated pieces (31.4%; **Figs. 6.16:** 4-6; **6.28:** 6) is narrowed, pieces with multiple notches comprise an even lower share of this assemblage (9.9%), than in the previous one (**Fig. 6.15**).

6.3.2.9 Awls and borers

Fourteen awls and borers were excavated from the Lower Phase 3 deposits. While this number is similar to that of Phase 4, their proportion amongst the entire tool assemblage is significantly lower at a mere 0.7%. Three out of five types are again represented, with the

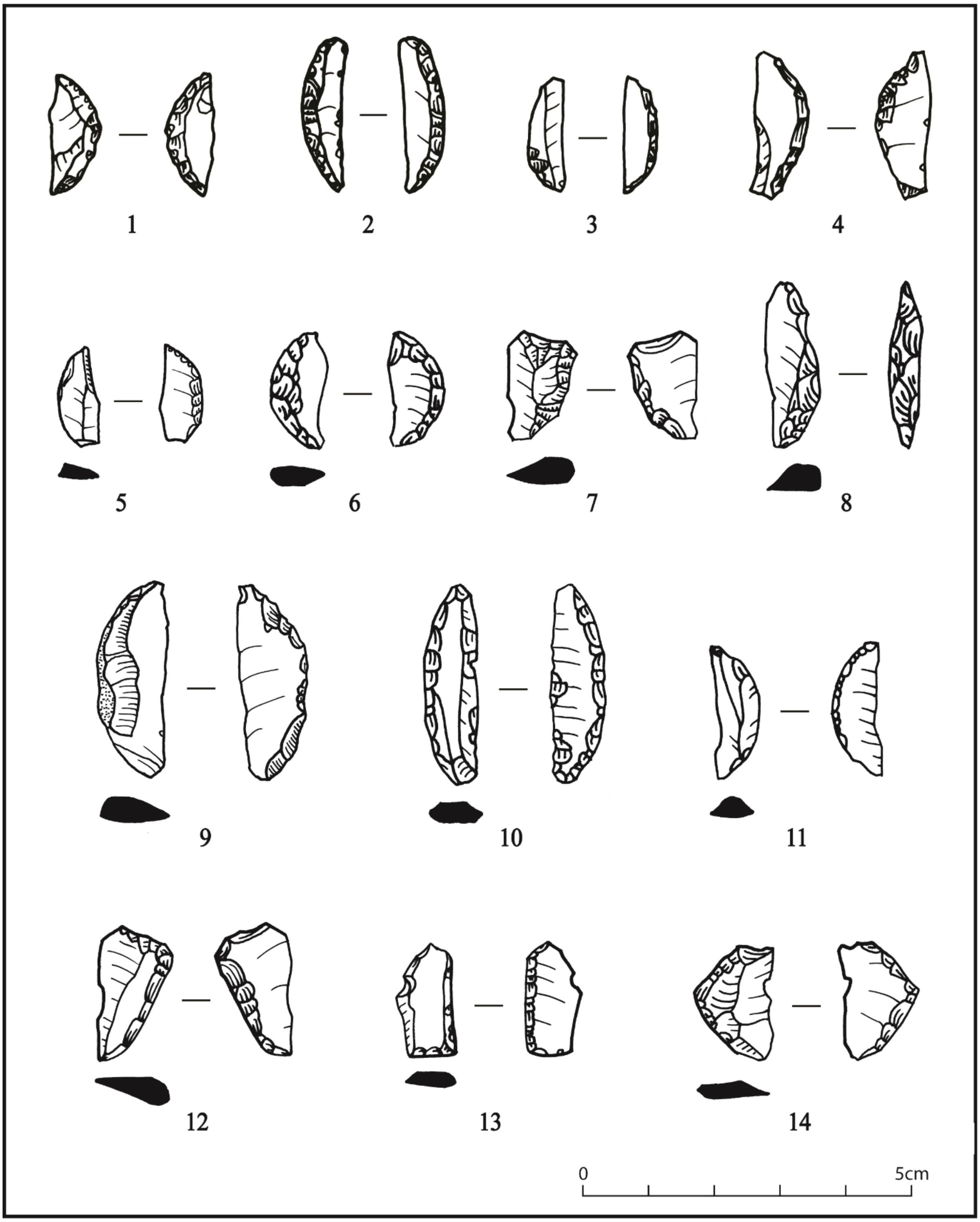


Figure 6.26: Geometric microliths from Wadi Hammeh 27, Plot XX F.

1: Helwan lunate (Phase 2); **2**: Helwan lunate (Phase 2); **3**: Abrupt lunate (Phase 2); **4**: Abrupt lunate (Phase 2); **5**: Inverse lunate (Phase 2); **6**: Helwan lunate (Lower Phase 3); **7**: Scalene triangle (Upper Phase 3); **8**: Mixed lunate (Phase 2); **9**: Inverse lunate (Phase 2); **10**: Helwan lunate (Phase 2); **11**: Alternating lunate (Phase 2); **12**: Scalene triangle (Upper Phase 3); **13**: Irregular microlith (Phase 2); **14**: Isosceles triangle (Phase 2).

Figure 6.27: Geometric microliths from Lower and Upper Phase 3.

Lower Phase 3: 1-2: Irregular microliths (Locus 8.1); **3**: Isosceles triangle (Locus 8.1); **4-5**: Alternating lunates (Locus 8.1); **6-7**: Helwan lunates (Locus 9.1); **8**: Helwan rectangle (Locus 9.1); **Upper Phase 3: 9**: Semi-steep lunate (Locus 6.1); **10**: Abrupt lunate (Locus 6.1); **11**: Mixed lunate (Locus 6.1); **12**: Trapeze (Locus 7.1); **13**: Rectangle (Locus 7.1); **14**: Abrupt lunate (Locus 2.6).

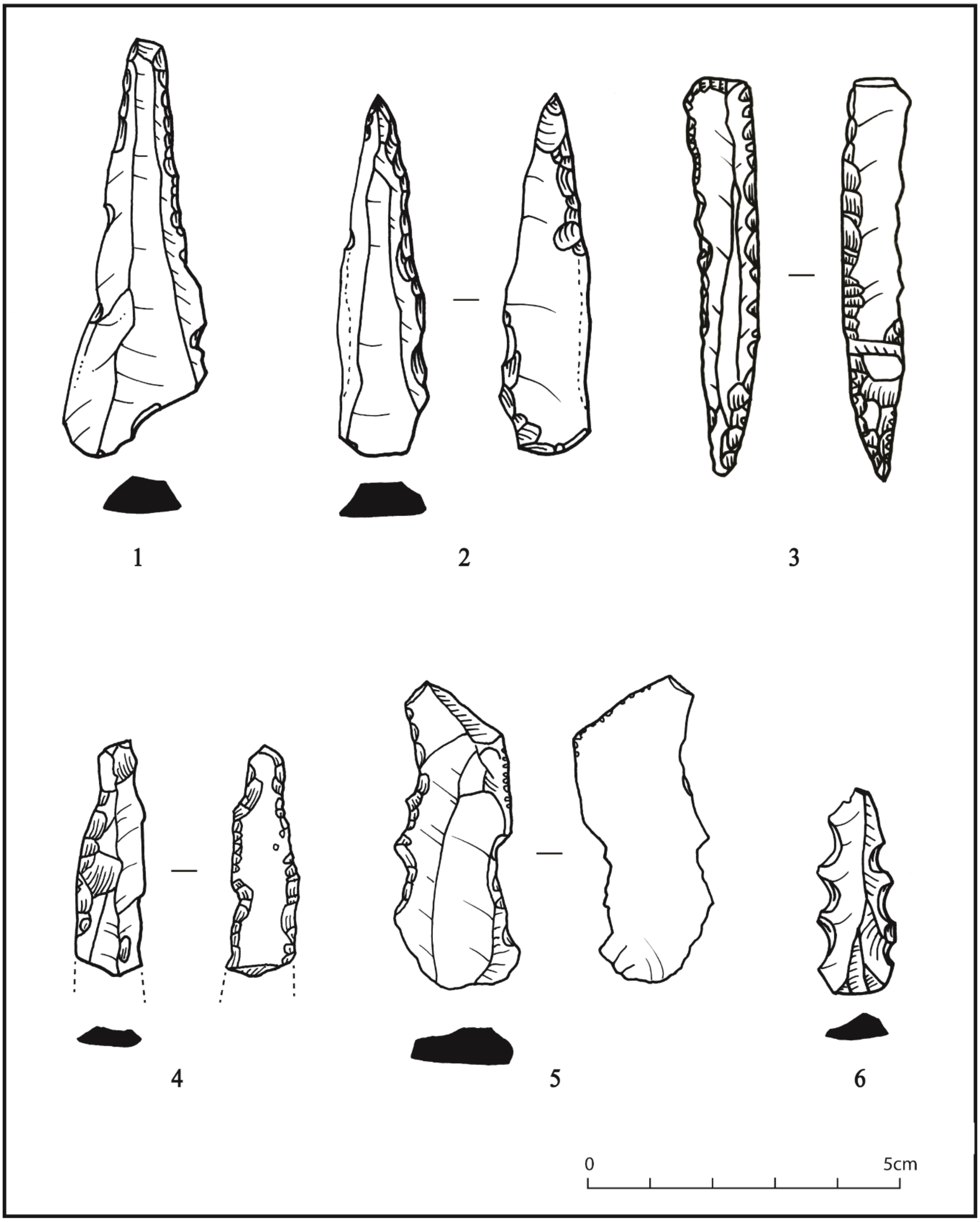


Figure 6.28: Awls and borers and notched and denticulated pieces from Wadi Hammeh 27, Area XX F. Note the retention of sickle sheen along the left lateral margin of artefact 2.

1: Semi-steep awl (Phase 2); **2**: Alternately-retouched awl (Phase 2); **3**: Helwan-retouched awl (Phase 2); **4**: Inverse awl (Phase 2); **5**: Denticulated piece (Phase 2); **6**: Denticulated piece (Lower Phase 3).

inverse and Helwan awl types being absent. The typological distribution is essentially the inverse of that seen in the preceding assemblage, with bilaterally backed borers (57.1%; **Fig. 6.17:** 6-8) outnumbering the alternately-retouched awls (35.7%), with a single example of an awl retouched with obverse semi-steep retouch also present.

6.3.2.10 Bifacial tools

Three bifacial tools were uncovered in the Lower Phase 3 deposits of Wadi Hammeh 27. Two of these pieces are trihedral picks sourced from the base of Locus 9.1 in adjacent squares. The first of these, found in Square B2, measures 126mm in length, making this object the largest pick and second largest biface overall to be recovered from the lower deposits of Wadi Hammeh 27 (**Figs. 6.18:** 3; **6.19:** 4). 20% of its surface retains cortex, suggesting little deviation in size from the original raw material nodule. A two-stage reduction strategy is clearly visible on its surface, with its overall elongated form manufactured through the radial removal of large flakes. A thinner use-edge was then formed on one termination through the bifacial flaking of smaller, more gracile flakes, resulting in an overall tapered form.

The second pick was recovered from Square B3, and exhibits a squatter, rectilinear form (**Figs**. **6.18:** 4; **6.19:** 2). It similarly features a combination of large flake scars and more gracile retouch scars, and features a large amount of cortex on one face. One end is covered in impact fractures, indicating that this artefact was extensively utilised during its use-life.

The third Lower Phase 3 biface is a small, quartzite biface uncovered from the interior Locus 8.1 fill in Square E3 (**Figs. 6.19:** 3; **6.29:** 3). At 42mm in length, this is the smallest biface to the retrieved from the renewed Wadi Hammeh 27 excavations. Like its Phase 4 predecessor, this piece features an ovoid form, although its cross-section is notably more curved. This artefact deviates further in that its entire surface is covered in bifacial flake scars, with no cortex remaining on either face.

6.3.2.11 Retouched flakes

Eighty-five retouched flakes were recovered from the Lower Phase 3 deposits, comprising 4.4% of the total retouched artefacts from this phase. The 'retouched flake' type again covers over three quarters (76.5%) of this tool group, although this dominance is slightly less

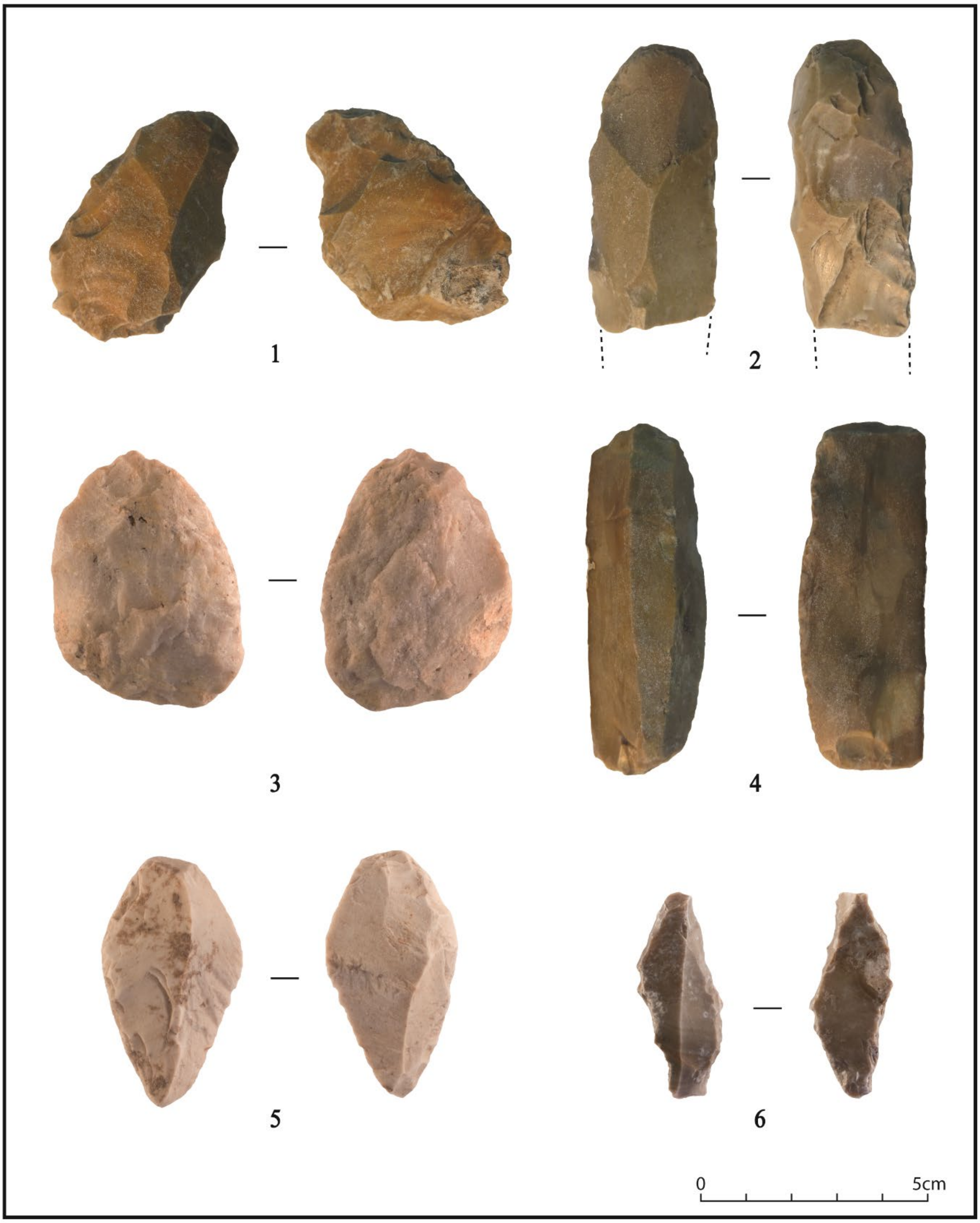


Figure 6.29: Bifacial and informal tools from Wadi Hammeh 27.

1: Irregular biface, Upper Phase 3 (Locus 7.1); **2**: Pick, Upper Phase 3 (Locus 7.1); **3**: Irregular biface, Lower Phase 3 (Locus 8.1); **4**: Battered piece/chisel, Lower Phase 3 (Locus 9.1); **5**: Scaled piece, Upper Phase 3 (Locus 6.1); **6**: Flaked piece/failed burin, Lower Phase 3 (Locus 8.1).

pronounced than in the previous assemblage. In return, a higher proportion of backed flakes (20%) are present, as are a small number of Helwan-retouched flakes (3.5%).

6.3.2.12 Retouched fragments

A total of 589 small fragments of retouched tools were retrieved from the Lower Phase 3 deposits. The typological distribution remains similar to that of the prior assemblage, albeit with a slight shift towards bladelet fragments with non-abrupt retouch (60.8%) at the expense of bladelet fragments featuring abrupt backing (13.6%).

6.3.2.13 Informal tools

Seven informal tools were uncovered, comprising 0.4% of the Lower Phase 3 total. Scaled pieces are again the most common type (57.1%), followed by battered pieces (28.6%). Most notable amongst these objects is a blade featuring a thick, steep, trapezoidal cross-section which exhibits extensive battering damage at its proximal and distal terminations, suggest that it was utilised as a chisel or bipolar pestle (**Fig. 6.29:** 4). Also notable is the presence of an extensively flaked piece which appears to have been an unsuccessful attempt at manufacturing a burin (**Fig. 6.29**: 6).

6.3.3 Upper Phase 3 retouched artefacts

A total of 2,180 retouched artefacts were excavated from the Upper Phase 3 strata, a quarter of which (25.2%) are otherwise unclassifiable fragments (**Table 6.1; Fig. 6.1**). Unlike the preceding two assemblages, burins are the predominant tool group in this phase, comprising 18.6% of the total retouched artefacts. This percentage also represents the greatest share reached by this tool group out of all four assemblages. This increased proportion of burins corresponds with a slightly reduced representation of geometric microliths (15.4%). Notched and denticulated pieces (12.8%) and non-geometric microliths (11%) also appear in marginally greater proportions compared to the previous assemblage. The remaining eight tool groups are all represented within this assemblage, albeit once again with less than 5% of the total share each.

6.3.3.1 Scrapers

Sixty-nine scrapers were recovered, making up 3.2% of the Upper Phase 3 assemblage – a slight increase from the Lower Phase 3 assemblage. This is the most typologically diverse of the four earlier scraper assemblages, with 15 out of 16 types represented. Only the 'various' type is absent from this phase. In terms of typological frequency, this scraper assemblage is closer to the Phase 4 assemblage rather than the previous Lower Phase 3 assemblage (**Fig. 6.2**). Sidescrapers are the most numerous type, at 21.7% of the phase total. They are primarily supplemented by increased numbers of endscrapers (**Figs. 6.20:** 8; **6.21:** 2) and a reduced proportion of broad carinated scrapers, with each of these types comprising 13% of the phase total. Unlike the Phase 4 assemblage, however, rounded scrapers remain relatively scarce in the Upper Phase 3 deposits, with a percentage (5.8%) more in line with the preceding Lower Phase 3 assemblage.

The typological diversity of the scrapers in this phase is further reflected by the relatively increased proportions of a number of scraper types uncommon in the site as a whole. For example, two thirds of the total number of double endscrapers and multiple scrapers were retrieved from the Lower Phase 3 deposits, as were half of the circular/oval scrapers, narrow carinated scrapers (**Fig. 6.21**: 5) and nucleiform scrapers (**Fig. 6.21**: 8). Furthermore, the only two micro-carinated scrapers to be recovered from the lower Wadi Hammeh 27 deposits are from this assemblage.

6.3.3.2 Multiple tools

Seventy-three multiple tools are present within the Upper Phase 3 deposits, amounting to 3.3% of the Upper Phase 3 tool assemblage. Burin/scraper combinations are again the most commonly occurring type (46.6%; **Fig. 6.22:** 11-12), although this dominance is even less pronounced than in the previous phase (**Fig. 6.5**). The remaining artefacts in this group are almost neatly divided between burin/truncation (27.4%) and burin/notched piece (26%) combinations.

6.3.3.3 Burins

A total of 406 burins were recovered from the Upper Phase 3 deposits. The types represented are identical to that of Lower Phase 3 assemblage, with only nucleiform burins and beaked burins being absent. Burin on natural surface (**Fig. 6.30:** 4) are once again the most plentiful type (23.9%), marking the greatest proportion reached by this type out of the four lower assemblages (**Fig. 6.6**). They are supplemented primarily by burins on oblique truncations (13.1%; **Fig. 6.30**: 8, 10), double mixed burins (11.8%; **Figs. 6.23:** 8; **6.30:** 5) and dihedral angled burins (11.3%). The abridged burin list reveals that the decline of truncation burins evident in the prior phases continues into this one, with these five types together comprising less than a third (30.0%) of the total (**Fig. 6.8**). In return, the share of dihedral burin types continues to rise to a just under a quarter (24.1%) of the tool group.

6.3.3.4 Retouched blades

Eighteen retouched blades, representing 0.8% of the Upper Phase 3 retouched artefacts, were catalogued – the lowest share for this tool group out of all four lower assemblages. As with the previous two assemblages, these artefacts span seven out of the 13 types in this group, although these vary slightly from the preceding assemblages. Alternately retouched blades are completely absent in this assemblage, while blades completely retouched on one edge return, having been absent in the Lower Phase 3 assemblage. The Upper Phase 3 retouched blade assemblage is quite similar to its predecessor, however, in that blades partly retouched on one edge are again the most common type (38.9%; **Fig. 6.10**). The only other blade type to be found to any extent in Upper Phase 3 are the blades with alternating retouch (16.7%), with the remaining five types being represented by only one or two artefacts each (**Figs. 6.31**: 1-2; **6.32**: 1-2).

6.3.3.5 Truncations

Eighty-eight truncations were excavated (4.0% of the phase total), a proportion similar to that of the Lower Phase 3 assemblage. As with the preceding two assemblages, pieces with a single truncated edge dominate (85.2%) this tool group.

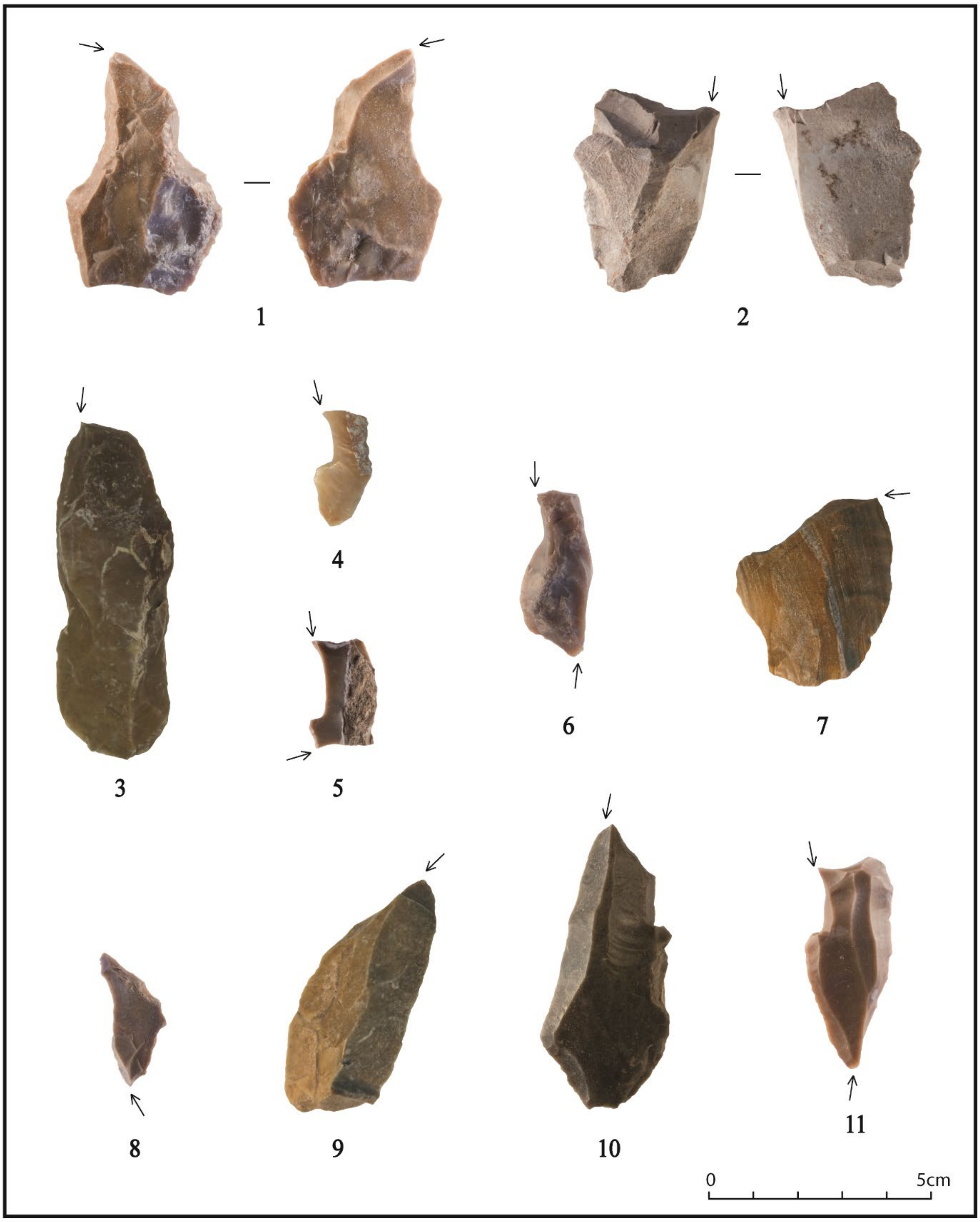


Figure 6.30: Burins from Upper Phase 3.

1: Transverse burin on retouched notch (Locus 6.1); **2**: Ventral burin on concave truncation (Locus 6.1); **3**: Burin on convex truncation (Locus 6.1); **4**: Burin on natural surface (Locus 6.1); **5**: Double mixed burin (Locus 6.1); **6**: Double burin on truncation (Locus 6.1); **7**: Transverse burin on lateral retouch (Locus 6.1); **8**: Burin on oblique truncation (Locus 6.1); **9**: Burin on convex truncation (Locus 7.1); **10**: Burin on oblique truncation (Locus 7.1); **11**: Double burin on truncation (Locus 7.1).

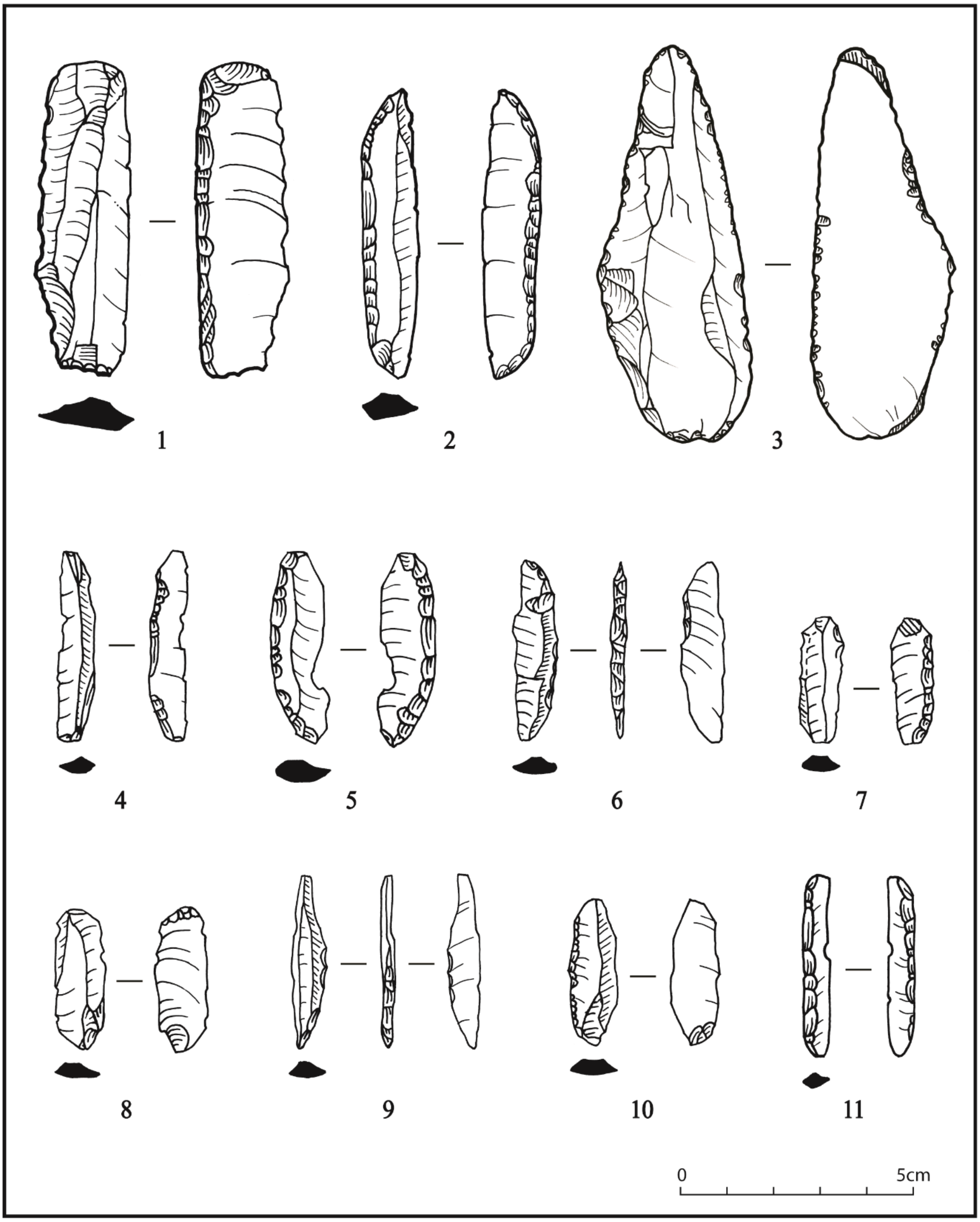


Figure 6.31: Retouched blades and non-geometric microliths from Wadi Hammeh 27, Area XX F.

1: Inverse retouched blade (Upper Phase 3); **2**: Helwan blade (Upper Phase 3); **3**: Blade retouched on both edges (Phase 2); **4**: Inverse bladelet (Upper Phase 3); **5**: Helwan bladelet (Phase 2); **6**: Curved backed bladelet (Phase 2); **7**: Inverse bladelet (Phase 2); **8**: Convex-truncated bladelet (Phase 2); **9**: Narrow, curved, pointed backed bladelet (Phase 2);
10: Obliquely-truncated retouched bladelet (Upper Phase 3); **11**: Helwan bladelet (Phase 2).

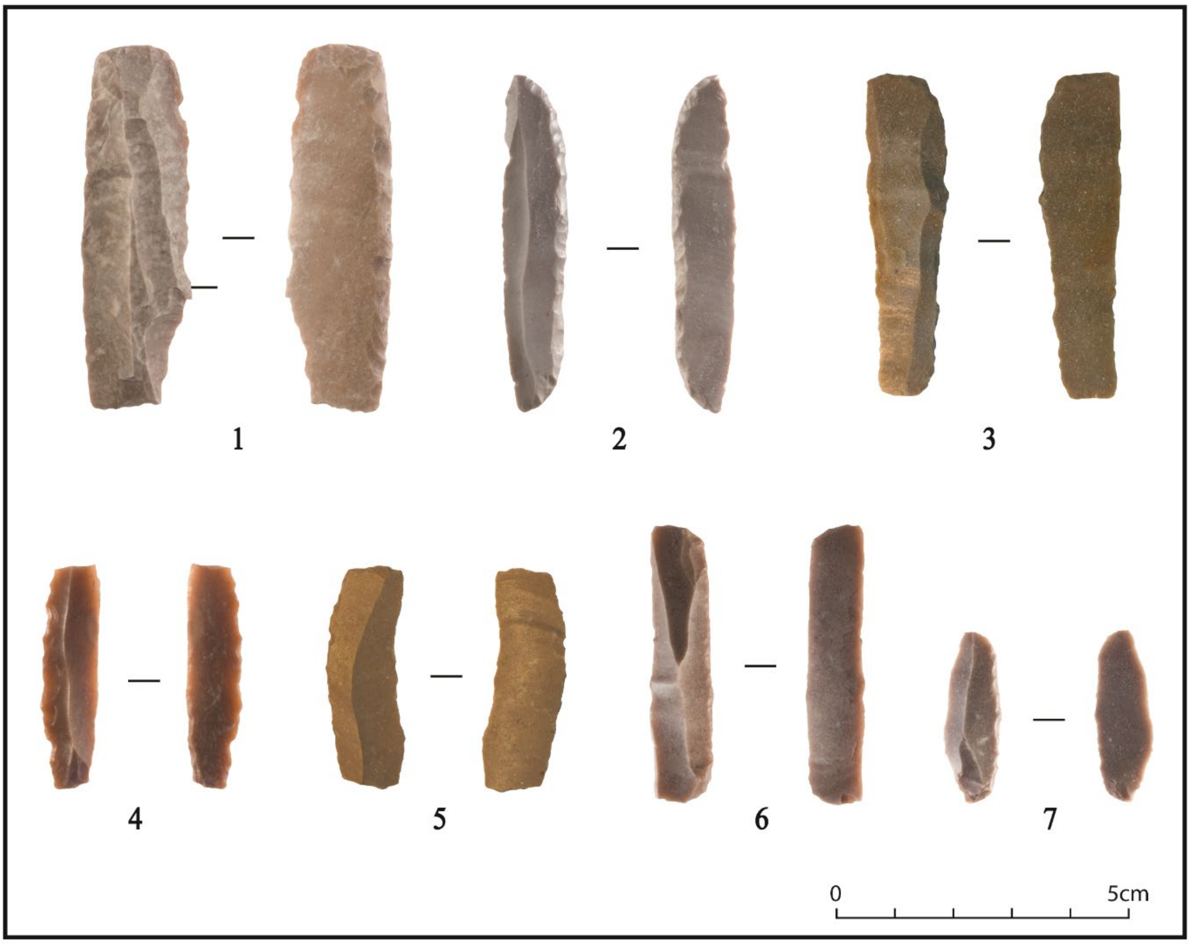


Figure 6.32: Retouched blades and non-geometric microliths from Upper Phase 3.

1: Inverse-retouched blade (Locus 2.6); **2**: Helwan blade (Locus 7.1); **3**: Straight bi-truncated backed blade (Locus 6.1); **4**: Bladelet retouched on both edges (Locus 7.1); **5**: Straight bi-truncated backed bladelet; **6**: Oblique-truncated retouched bladelet (Locus 7.1); **7**: Obliquely-truncated backed bladelet (Locus 7.1).

6.3.3.6 Non-geometric microliths

The Upper Phase 3 non-geometric microliths demonstrate the highest degree of typological diversity out of the four assemblages, with the 239 artefacts comprising 22 out of the 25 types. Only the pointed retouched bladelet, Helwan-truncated bladelet and narrow, curved, pointed backed bladelet types are absent. As with the previous assemblage, partially retouched bladelets are the most commonly occurring type (27.6%), narrowly outnumbering the Helwan bladelets (26.8%; **Fig. 6.11**). Inverse bladelets (**Fig. 6.31**: 4) are distantly the third most numerous type (9.2%), with no other types comprising more than 5% of the tool group.

6.3.3.7 Geometric microliths

The Upper Phase 3 geometric microliths also present the greatest degree of typological diversity for their tool group, with only Helwan rectangles being absent amongst the 336 artefacts in this phase. Helwan lunates again easily dominate this group, with a near identical share (61.9%) as in the Lower Phase 3 assemblage (**Figs. 6.13-14**). Unlike the previous two assemblages, however, alternating lunates are not the second most common type (8.6%), being outnumbered by inverse lunates (9.8%). The proportions of lunates shaped through semi-steep (7.7%; **Fig. 6.27:** 9) and abrupt retouch (5.7%; **Fig. 6.27:** 10, 14) also rise slightly from the preceding phase.

6.3.3.8 Notched and denticulated pieces

A total of 279 pieces bearing notches or denticulated retouch were uncovered from the Upper Phase 3 deposits. The artefacts in this assemblage are even more typologically balanced than in the previous phase (**Fig. 6.15**), with pieces with a single small notch (31.9%; **Fig. 6.16:** 7) only narrowly outnumbering those featuring denticulated retouch (30.8%; **Fig. 6.16:** 8). Meanwhile, the proportion of pieces with a large notch remains identical (23.3%) to that of the Lower Phase 3 assemblage, while the percentage of the ‘piece with notches’ type rises marginally (14.0%).

6.3.3.9 Awls and borers

Fourteen awls or borers were recovered from the Upper Phase 3 deposits. These pieces comprise 0.6% of the phase total, a similarly low share as in Lower Phase 3. All five types are nonetheless represented, making the awls and borers from this phase the most typologically diverse. Alternately-retouched awls are the most common type (57.1%), with these pieces complemented chiefly by bilaterally-backed borers (21.4%), while the other three types are represented by one artefact each.

6.3.3.10 Bifacial tools

Five bifacial tools were uncovered from Upper Phase 3 deposits – half of the total number of bifaces to be uncovered throughout the renewed excavations at Wadi Hammeh 27 – with this group once again representing 0.2% of the phase tool assemblage. This assemblage also represents the only one where all three biface types are present.

Most notable among these objects is the only tranchet axe to be uncovered from the lower deposits of Wadi Hammeh 27 (**Figs. 6.19**: 1; **6.33**). Measuring slightly under 19cm in length and weighing over a kilogram (1,169 grams), this is the single largest flaked stone artefact to be recovered during the renewed excavations of Wadi Hammeh 27, and once again serves as a testament to the variety of different sized raw chert nodules that were being exploited onsite. The artefact was shaped through the bifacial removal of large flakes along the length of the artefact on both faces. The working edge was then manufactured through the removal of a tranchet spall struck perpendicularly from each surface. This artefact was discovered in association with the lower course of Feature 6, providing some of the only evidence of flaked stone artefacts being recycled as architectural elements at Wadi Hammeh 27.

Also unique to Upper Phase 3 is a small chert biface similar in size to the quartzite bifaces found in the previous assemblages (**Fig 6.29:** 1). This piece is unique, however, in that it represents the only non-nucleiform biface to be identified during the renewed excavations of Wadi Hammeh 27. This artefact was instead shaped from a moderate-sized flake, with bifacial flaking applied in order to create a relatively narrow working edge on its distal end. The proximal end was conversely unretouched, leaving the platform intact. The remaining three bifacial tools from the Upper Phase 3 assemblage are all fragments of picks similar in

Figure 6.33: Tranchet axe from Upper Phase 3 (Locus 6.1).

appearance to the complete pieces seen in the underlying assemblages. One of these fragments exhibits battering damage on its snapped end, however, indicating the continued utilisation of broken picks in some cases, so long as the fragment remained large enough to be hafted effectively (**Fig. 6.29:** 2).

6.3.3.11 Retouched flakes

Ninety-seven retouched flakes were recovered from the Upper Phase 3 strata, comprising 4.4% of the total retouched artefacts. The overwhelming majority fall into the retouched flake type (89.7%), with this assemblage containing the lowest percentage of backed flakes (10.3%). No examples of ‘Helwan-retouched flakes’ are present in this phase.

6.3.3.12 Retouched fragments

A total 550 fragmentary artefacts bearing retouch were assigned to this tool group from the Upper Phase 3 strata, the majority of which are bladelet fragments featuring non-abrupt retouch (60.9%). Broken backed bladelets once again decline in representation (10.4%) from the prior two assemblages.

6.3.3.13 Informal tools

Six artefacts were allocated to this tool group, comprising 0.3% of the retouched artefacts from Upper Phase 3. All are classified as scaled pieces (**Fig. 6.29:** 5).

6.3.4 Phase 2 retouched artefacts

A total of 950 retouched artefacts were excavated from the Phase 2 deposits. The Phase 2 assemblage largely accords with the proportions present in the Phase 4 and Lower Phase 3 assemblages, with geometric microliths once again constituting the greatest share of the retouched artefacts, aside from the unretouched fragments (**Table 6.1; Fig. 6.1**). At 21.2%, this is also the greatest share taken by this tool group throughout the lower Wadi Hammeh 27 deposits. The Phase 2 geometric microliths are trailed by the burins (16.5%), notched and denticulated pieces (15.6%) and non-geometric microliths (11.4%). The remaining tool groups each constitute relatively low shares, with none reaching 5% of the Phase 2 tool assemblage. The Phase 2 assemblage is unique at Wadi Hammeh 27 in that in contains no examples of bifacial tools.

6.3.4.1 Scrapers

A total of thirty-one scrapers were excavated from the Phase 2 deposits, comprising 3.3% of the total Phase 2 tool assemblage – an almost identical proportion as in Upper Phase 3. Compared to the preceding assemblage, however, the Phase 2 scrapers exhibit a considerably reduced degree of typological diversity. Only 11 out of 16 types are present in Phase 2, with the endscraper with notch, circular/oval scraper, narrow carinated scraper, micro-carinated scraper and 'various' types all absent. The endscraper (**Fig. 6.21**: 1) and sidescraper (**Fig. 6.21**: 7) types are the most numerous, constituting 19.4% and 16.1% of the Phase 2 scrapers respectively (**Fig. 6.2**). These artefacts are followed by the endscrapers on retouched piece (**Fig. 6.34:** 1-2) and nosed scrapers (**Fig. 6.34:** 3) with these two types each representing 12.9% of the Phase 2 scraper. These shares represent the maximum reached by either type, although their actual numbers (N = 4) remain similar to the previous assemblage. The remaining types are represented by only one or two specimens each.

6.3.4.2 Multiple tools

Twenty-one examples of multiple tools were recovered from the Phase 2 strata, comprising 2.2% of the total retouched artefact assemblage. This assemblage sees a return to the dominance of burin/scraper combinations (**Figs. 6.23:** 11-12; **6.34:** 5-7), with these artefacts encompassing two thirds (66.7%) of this group (**Fig. 6.5**), dwarfing the proportions of burin/notched pieces (19%; **Fig. 6.34:** 9) and burin/truncations (14.3%; **Fig. 6.34:** 10).

6.3.4.3 Burins

Much like the other assemblages, the Phase 2 burins demonstrate a high degree of typological variety, with 16 out of 18 types represented. The most commonly occurring individual type is again the burin on a natural surface (**Fig. 6.35:** 1), which constitutes 21.7% of the Phase 2

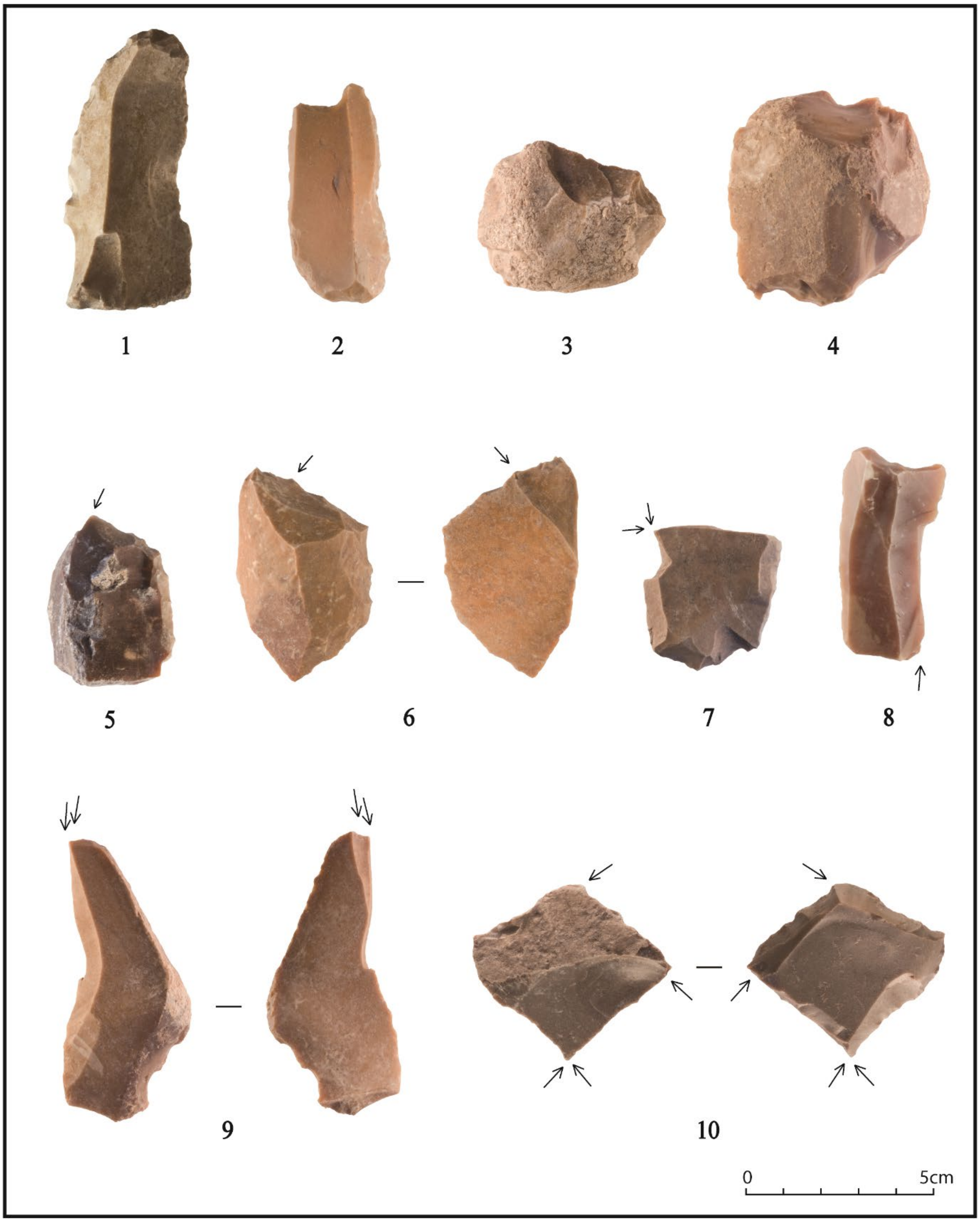


Figure 6.34: Scrapers and multiple tools from Phase 2. All pieces are from Locus 2.5.

1-2: Endscrapers on retouched blade; **3**: Nosed scraper; **4**: Broad carinated scraper; **5**: Burin on oblique truncation/Sidescraper; **6**: Ventral burin on oblique truncation/Sidescraper; **7**: Dihedral angled burin/Endscraper; **8**: Burin on straight truncation/Piece with concave truncation; **9**: Ventral burin/Piece with large notch; **10**: Double mixed burin/Truncated piece.

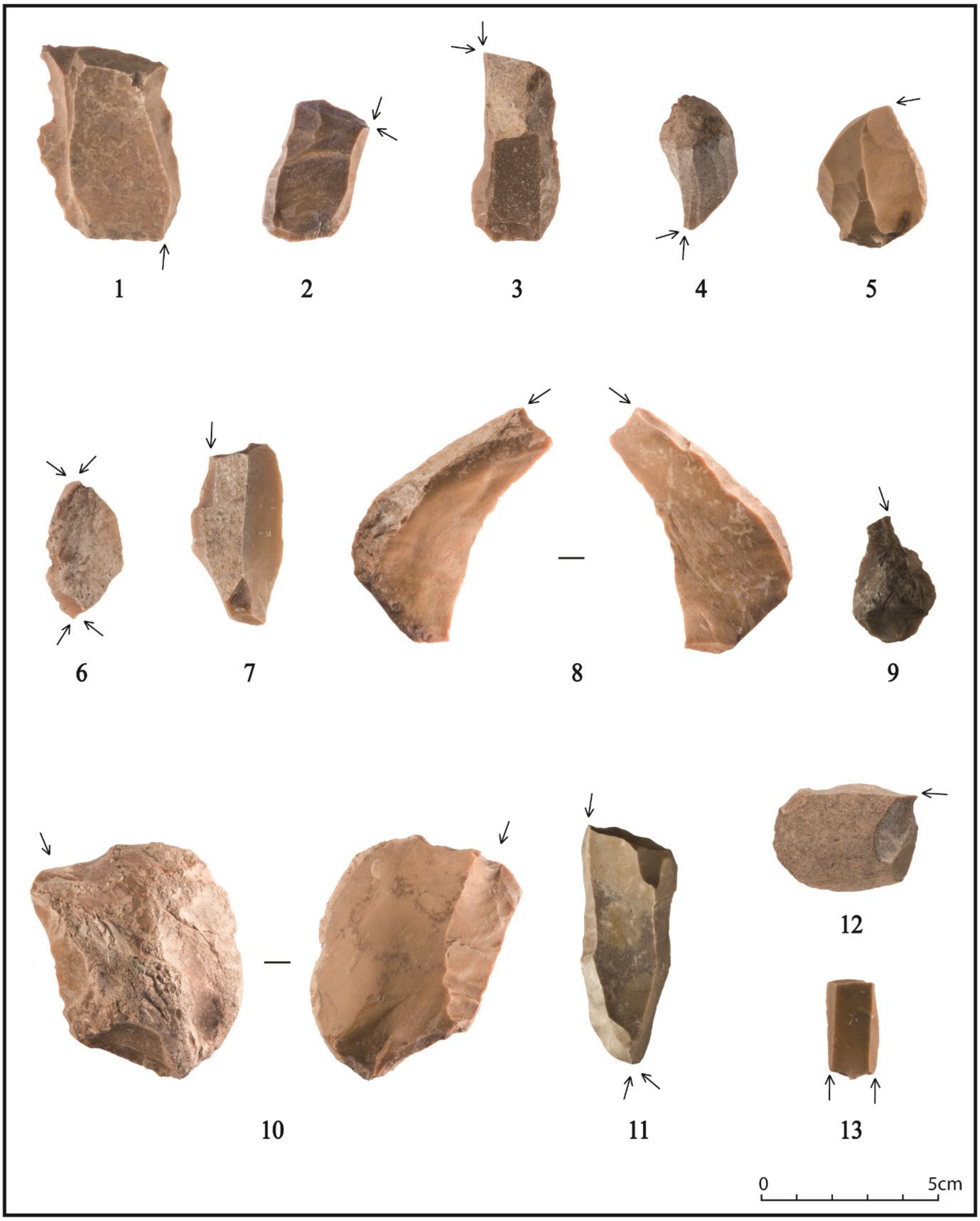


Figure 6.35: Burins from Phase 2. All pieces are from Locus 2.5.

1: Burin on natural surface; **2-4**: Dihedral angled burins; **5**: Transverse burin on lateral retouch; **6**: Double dihedral burin; **7**: Burin on concave truncation; **8-9**: Burins on oblique truncation; **10**: Ventral burin on oblique truncation; **11**: Double mixed burin; **12**: Transverse burin on retouched notch; **13**: Double burin on truncation.

total (**Fig. 6.6**). These pieces are supplemented principally by burins on oblique truncations (14.0%; **Figs. 6.23:** 7; **6.35:** 8-10), dihedral angled burins (12.1%; **Fig. 6.35:** 2-4) and double mixed burins (12.1%; **Figs. 6.23:** 9; **6.35:** 11). The remaining artefacts are spread relatively evenly between the remaining types, with the exception of the nucleiform burin and beaked burin types, neither of which is present in the Phase 2 deposits.

The abridged burin list demonstrates that burins struck from truncations continue to decline in importance from Phase 3 (**Fig. 6.8**). Together, the five truncation burin types comprise 26.1% of the Phase 2 collection, only narrowly outnumbering the dihedral burin and burin on natural surfaces sub-groups (each with 25.5%). The Phase 2 are thus present in even proportions, with no clear preference towards a single manufacturing strategy.

6.3.4.4 Retouched blades

Retouched blades are again uncommon in Phase 2, with only 13 of these objects recovered from the Phase 2 strata, making up 1.4% of the retouched assemblage. This share nonetheless represents a rise from Upper Phase 3, conforming more closely to the numbers from Phase 4 and Lower Phase 3. Of the 13 types in this group, eight are represented in the Phase 2 assemblage, narrowly making this collection the most typologically diverse. No type is clearly favoured, with each being represented by only one or two artefacts each (**Fig. 6.10**).

6.3.4.5 Truncated pieces

Truncations are a relatively infrequently occurring group of tools in the Phase 2 deposits compared to the Phase 3 assemblages, comprising only 1.5%. Pieces with a single truncation again heavily outnumber the bi-truncated pieces, with the former type constituting 78.6% of this tool group.

6.3.4.6 Non-geometric microliths

A total of 108 non-geometric microliths were excavated from the Phase 2 deposits, with 19 out of 25 types represented. Helwan bladelets compose over a third of this tool group (38.9%; **Figs. 6.31**: 5, 11; **6.36:** 4-7) – a greater share for this type than is seen in any of the preceding

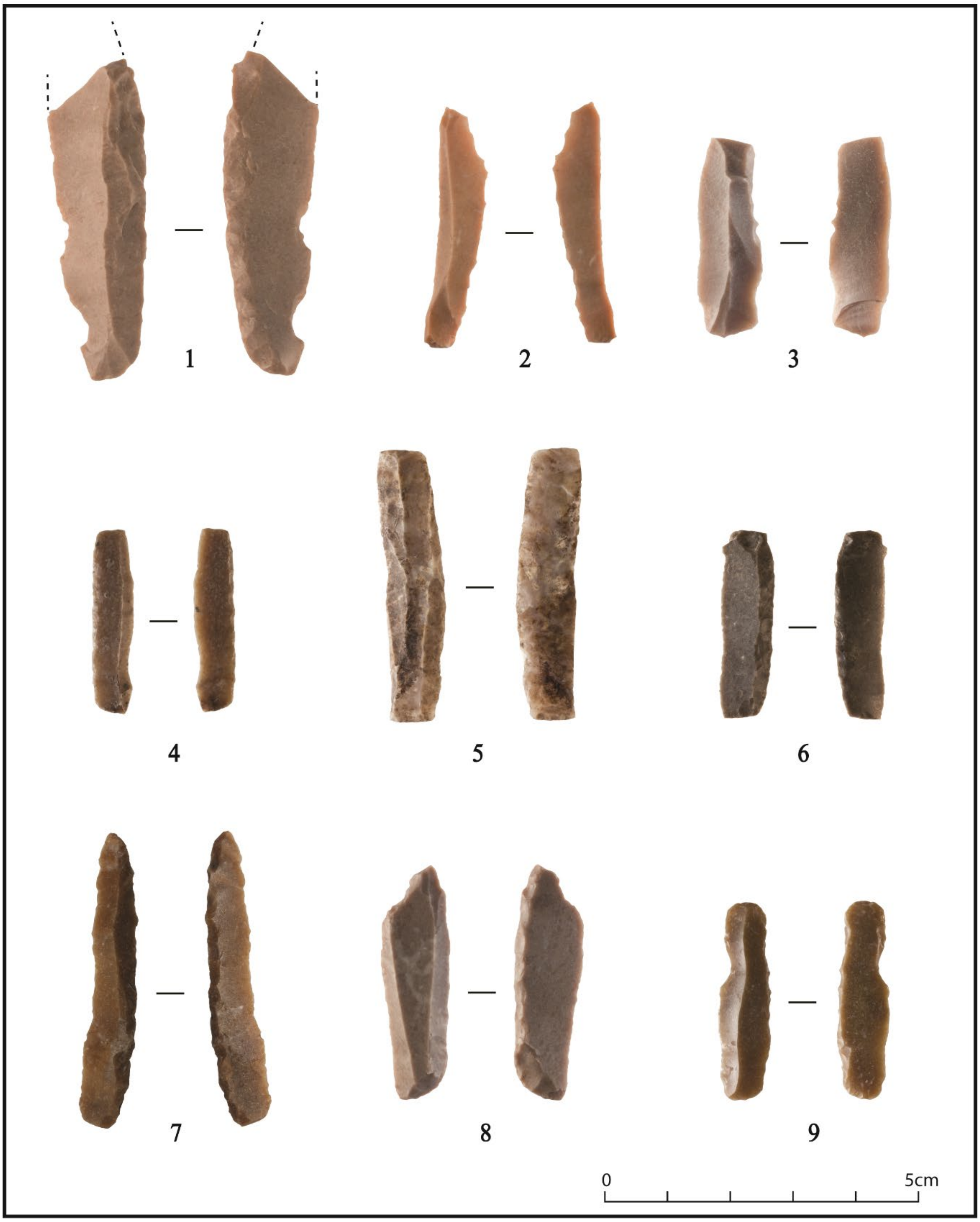


Figure 6.36: Retouched blades and non-geometric microliths from Phase 2. All pieces are from Locus 2.5.

1: Inverse-retouched blade; **2-3**: Partially retouched bladelets; **4-7**: Helwan bladelets; **8**: Obliquely bi-truncated backed bladelet; **9**: Convex bi-truncated backed bladelet.

assemblages (**Fig. 6.11**). These pieces are principally supplemented by partially retouched bladelets (23.1%; **Fig. 6.36:** 2-3), inverse bladelets (13%; **Fig. 6.31**: 7) and bladelets with alternating retouch (8.3%). The remaining artefacts are spread across the other 15 types, with none featuring more than two specimens.

6.3.4.7 Geometric microliths

A total of 201 geometric microliths were recovered from the Phase 2 strata. This is the least typologically diverse geometric microlith assemblage from the lower Wadi Hammeh 27 deposits, with only with only eight out of 12 types represented. Much like their non-geometric counterpart, Helwan lunates (**Figs. 6.26:** 1-2, 10; **6.37:** 9-12) dominate this tool group to a greater extent than seen in any of the previous assemblages, with this type comprising almost three quarters (73.1%) of the Phase 2 geometric microliths (**Figs. 6.13-14**) and 77.8% of the lunate types. These artefacts are complemented by small numbers of semi-steep lunates (6.5%; **Fig. 6.37:** 3), alternating lunates (6%; **Fig. 6.26**: 11), abrupt lunates (5.5%; **Figs. 6.26:** 3-4; **6.37:** 4-8) and irregular microliths (4.5%; **Figs. 6.26:** 13; **6.37:** 1). No scalene triangles, rectangles, Helwan rectangles or trapezes are present.

6.3.4.8 Notched and denticulated pieces

A total of 148 notched and denticulated pieces were retrieved from Phase 2 strata, with all four types once again being represented. Unlike the preceding three assemblages, denticulated pieces (**Figs. 6.16:** 13-15) are most common type in Phase 2 (35.8%), followed by pieces featuring a single small notch (25.0%; **Fig. 6.15**). These types are followed by larger proportions of pieces with multiple notches (20.3%; **Fig. 6.16:** 10-12), which outnumber pieces with a single large notch (18.9%; **Fig. 6.16:** 9).

6.3.4.9 Awls and borers

Nineteen objects allocated to the awls and borers group were recovered, comprising 2% of the Phase 2 total – a significantly greater proportion than seen in any of the earlier assemblages. As in the Upper Phase 3 assemblage, all five types are present. Alternately-retouched awls (**Fig. 6.28**: 2) are again the most numerous type (42.1%), followed by

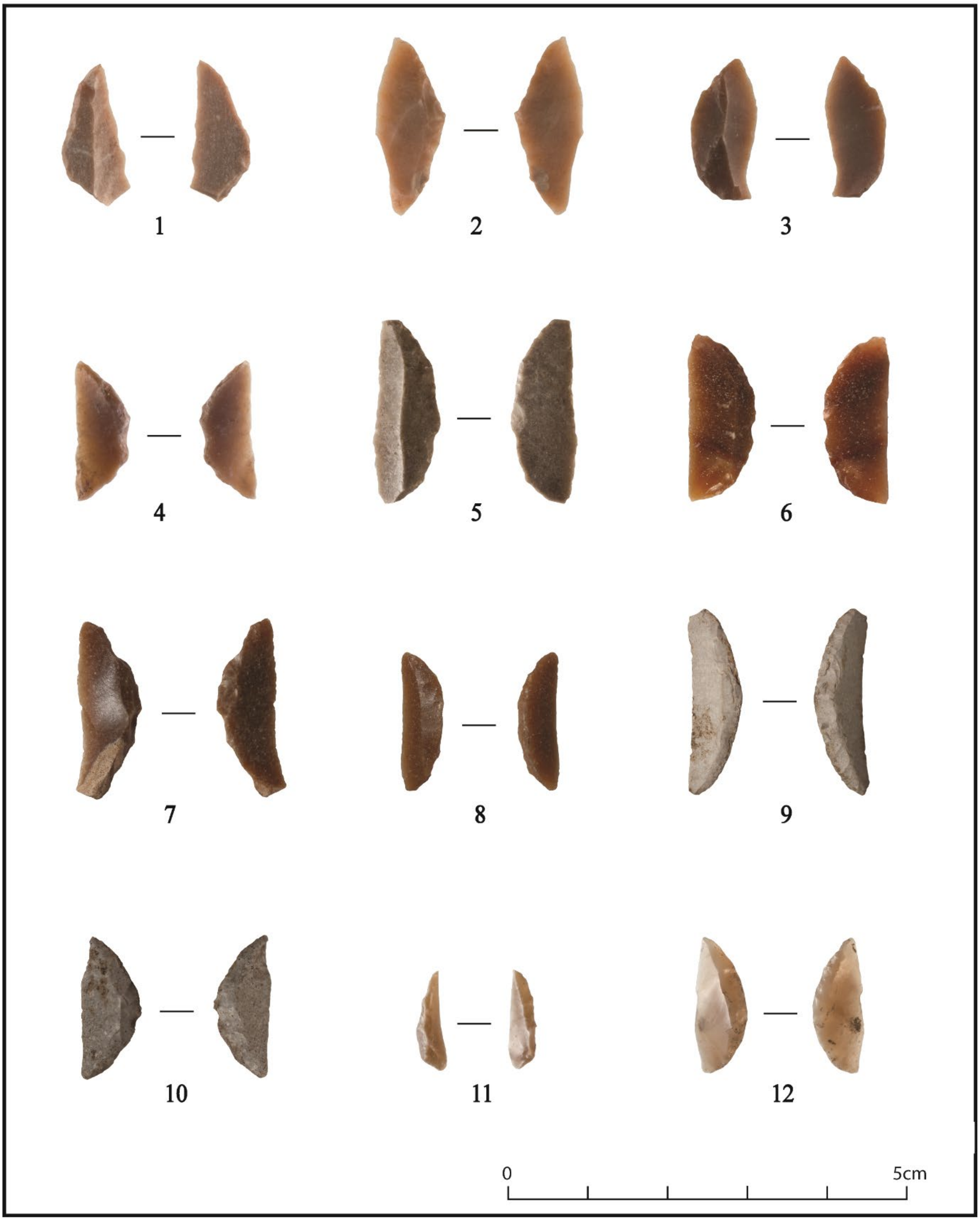


Figure 6.37: Geometric microliths from Phase 2. All pieces are from Locus 2.5.

1: Irregular microlith; **2**: Isosceles triangle; **3**: Semi-steep lunate; **4-8**: Abrupt lunates; **9-12**: Helwan lunates.

bilaterally-backed borers (31.6%; **Fig. 6.17:** 10-11). Awls retouched using inverse (**Fig. 6.28:** 4) or semi-steep retouch (**Fig. 6.28:** 1) are less common, with each type amounting to 10.2% of the overall tool group, while only a single Helwan awl is present in this phase (**Fig. 6.28:** 3).

6.3.4.10 Retouched flakes

Thirty-three retouched flakes were sourced from the Phase 2 strata (3.5%), with all three types represented. The basic retouched flakes are again most the most plentiful type, albeit to a lesser extent (63.6%) than in the preceding assemblages. In return, a relatively large proportion of backed flakes (33.3%) were recovered from this phase. Only a single Helwan-retouched flake is present.

6.3.4.11 Retouched fragments

A total of 204 retouched fragments were retrieved from the Phase 2 deposits. Of these pieces, fragments of broken retouched bladelets are the most common type (77%) – the greatest share reached by this 'type' out of the four lower assemblages. This is offset by reduced percentages of miscellaneous retouched fragments (11.3%) and broken backed bladelets (9.3%). Broken retouched blades also comprise a reduced proportion (2.5%) compared to the preceding assemblages, while broken backed blades are absent entirely.

6.3.4.12 Informal tools

Only a single artefact - identified as a scaled piece - was assigned to this tool group from the Phase 2 assemblage.

6.3.5 Comparison with the Phase 1 assemblage

The Plot XX D assemblage is once again utilised here as a Phase 1 comparative sample in order to evaluate the full sequence of lithic assemblages from Wadi Hammeh 27. In a drastic break from the underlying deposits, non-geometric microliths represent the most numerous Phase 1 tool group (23.7%), narrowly outnumbering the burins (23.4%; **Fig. 6.1**)

6.3.5.1 Scrapers

Scrapers comprise a slightly greater proportion of the Phase 1 retouched artefacts (5.4%) than in any of the preceding assemblages (Edwards 2013e: 148). The scrapers from this final assemblage also display a far greater degree of typological homogeneity, with basic endscrapers constituting an absolute majority (51.1%; **Fig. 6.2**). Rounded scrapers are also far more common in Phase 1 than in Phases 2 and 3, being more like the Phase 4 scraper assemblage in this regard. In contrast, the sidescraper (2.2%) and endscraper on retouched piece (1.1%) types both exhibit notably reduced shares in Phase 1 compared to the underlying scraper assemblages. The Phase 1 proportion of broad carinated scrapers (4.3%) is far lower than the Phase 3 or 4 assemblages, being more in line with the Phase 2 data. A sudden drop in the frequency of this type is thus observable between the Upper Phase 3 and Phase 2 occupations, with the fall-off continuing in the Phase 1 deposits. The Phase 1 assemblage also differs from the four earlier assemblages in that nucleiform scrapers are entirely absent, although pieces belonging to this type are present in the Phase 1 assemblage from Plot XX E (Edwards 2013e: 148)

6.3.5.2 Multiple tools

Completing the decline exhibited by the preceding assemblages, the Phase 1 retouched artefact assemblage presents the lowest percentage of multiple tools (0.2%) at Wadi Hammeh 27. Only five artefacts belonging to this tool group were identified from the Phase 1 assemblage, all of which are burin/scraper combinations (**Fig. 6.5**).

6.3.5.3 Burins

Burins make up a greater proportion of the Phase 1 assemblage (23.4%) than any of the earlier assemblages. The collective portion of dihedral burin types remains consistent with the Upper Phase 3 and Phase 2 assemblage, with these types constituting just under a quarter (23.3%) of the Phase 1 burin assemblage (**Fig. 6.8**). The proportions of individual dihedral burins types shift considerably, however, with the regular dihedral burin type comprising a greater percentage of the Phase 1 burin assemblage (11.3%), than in any of the earlier assemblages (**Fig. 6.6**). This shift is counteracted by reduced amounts of offset dihedral burins (3.8%) and dihedral angled burins (7.2%). The combined share of burins on natural surface types (23.3%) also remains steady with the Phase 2 assemblage

Despite the clear decline over time in the amount of burins struck from truncated ends between Phase 4 and Phase 2, the percentage of these objects surges again in Phase 1, composing slightly under half of the total burin assemblage (45.8%). This rise consists of substantial increases in the proportions of burins on straight truncations (10.8%), burins on concave truncations (8.0%), and burins on convex truncations (11.0%) compared to the preceding assemblage. The percentage of burins on oblique truncations remains consistent with the Phase 2 assemblage (14.8%), as well as remaining as the most common type in this sub-group. Conversely, the proportions of double burins on truncations remain low in Phase 1, suggesting that the decline of this type in Upper Phase 3 and Phase 2 continues into the final assemblage.

The overall rise in truncation burins between Phases 2 and 1 largely corresponds with a massive decline in the percentage of double mixed burins (1.0%). Transverse burins on lateral retouch are also relatively infrequent in Phase 1 (2.0%). Conversely, the Phase 1 assemblage exhibits a comparatively large amount of nucleiform burins (2.8%), with this type being almost non-existent in the lower deposits.

6.3.5.4 Retouched blades

Retouched blade types are noticeably more numerous in Phase 1 than any of the underlying assemblages, being over twice as common (3.8%) as in Phase 4. This is manifested primarily through the far larger percentage of inverse-retouched blades (24.6%) than is seen in any of the preceding assemblages (**Fig. 6.10**). Helwan blades are similarly more abundant than in the Phase 3 or 2 assemblages (27.7%), although a similarly high proportion of these artefacts is also present in Phase 4. Despite consistently comprising large portions of the earlier retouched blade assemblages, blades retouched on both edges and those with alternating retouch are completely absent from the Phase 1 assemblage.

6.3.5.5 Truncated pieces

Truncated pieces occur in a similar proportion (2.0%) to Phase 4, being more plentiful than in Phase 2, yet smaller in comparison to the Upper and Lower Phase 3 assemblages. Unlike the earlier collections, the entirety of the Phase 1 sample is encompassed by pieces with a single truncated end, with no 'bi-truncated pieces' recovered from Plot XX D.

6.3.5.6 Non-geometric microliths

The percentage of non-geometric microliths in Phase 1 (23.7%) is twice that of each of the underlying assemblages. The proportional increase of Helwan bladelets which begins in Phase 2 continues into Phase 1, with this type comprising just under half of the tool group (47.5%; **Fig. 6.11**). 'Inverse bladelets' are similarly far more abundant in Phase 1 (25.0%) than any of the earlier phases. No other types reach 5% of this tool group. The emphasis on Helwan- and inverse-retouched bladelets corresponds with a marked decline in the share of partially retouched bladelets (4.0%). Bladelets with alternating retouch are also relatively uncommon in Phase 1 (1.7%).

6.3.5.7 Geometric microliths

Compared to the numerical dominance of the geometric microliths in the Phase 2 retouched artefact assemblage, the Phase 1 assemblage displays a marked decline in representation (14.8%). This is narrowly the lowest share reached by this tool group at Wadi Hammeh 27, being slightly exceeded by the Phase 4 and 3 proportions. The increase of Helwan lunates in Phase 2 continues into Phase 1, however, with this type comprising just under three quarters (74.3%) of the tool group (**Figs. 6.13-14**). Similarly, the decline in the amounts of inverse-retouched lunates continues from Phase 2 in the Phase 1 sample (2.4%). The 'irregular microlith' type is likewise rare in Phase 1 (0.8%) compared with the previous geometric microlith assemblages.

6.3.5.8 Notched and denticulated pieces

Notched and denticulated pieces reach similar proportions in Phase 1 (13.4%) as in in the preceding assemblages. The Phase 1 typological composition differs considerably however, with the piece with notches type covering a far greater share (41.2%) of this tool group in Phase 1 than in any of the previous collections (**Fig. 6.15**). In contrast, the piece with small notch type is much rarer (7.5%), while denticulated pieces narrowly comprise their lowest portion (26.8%) out of all five assemblages.

6.3.5.9 Awls and borers

Awls and borers cover an identical share of the retouched tools in Phases 1 (2.0%) as in the Phase 2 assemblage, demonstrating a quantifiable rise in the proportion of these tools in the latest two occupational phases. Unlike in Phase 2, however, bilaterally-backed borers are the most commonly occurring type (70.6%) in Phase 1, sharing this aspect with the Lower Phase 3 assemblage.

6.3.5.10 Bifacial tools

Ten bifacial tools were uncovered from the Plot XX D Phase 1 deposits – this number equalling all specimens of this tool group recovered during the renewed excavations of Wadi Hammeh 27. The proportion of the total XX D retouched artefacts taken by this tool group (0.6%) is consequently three times that of the Phase 4 and 3 assemblages. The substantial share of bifacial tools in Phase 1 is significant when compared to their complete absence in the Phase 2 assemblage in terms of the potential curative value of these pieces (see Chapter 10). As with the lower assemblages, picks are the most numerous type (70.0%), with the remaining three artefacts being large axes. No examples of the small, irregular bifaces of the Phase 4 and 3 assemblages were uncovered from the Phase 1 deposits.

6.3.5.11 Retouched flakes

Retouched flakes comprise just over five percent (5.3%) of the Phase 1 retouched artefacts, narrowly making this the largest share taken by this tool group out of all five assemblages. The Phase 1 typological distribution of this tool group remains essentially identical with the Phase 4 and 3 assemblages, with the retouched flake type again remaining dominant (86.8%).

6.3.5.12 Retouched fragments

Given that the ‘retouched fragments’ did not exist as a separate tool group in Edwards’ typology, the Phase 1 sample has been reconstructed by compiling the ‘broken backed blade’, ‘broken retouched blade’, ‘broken retouched bladelet’ and ‘broken backed bladelet’ types. These pieces are much rarer in the Phase 1 assemblage, comprising only a sixth (3.4%) of the preceding Phase 2 assemblage and being nine times rarer than in Lower Phase 3. Fragments of retouched and backed blades (as opposed to bladelets) are also represented to a greater extent (8.5% each) in the Phase 1 assemblage than in any of the preceding assemblages.

6.3.5.13 Informal tools

Informal tools are relatively common in Phase 1 (1.7%), being more reminiscent of the similar proportion of this tool group in Phase 4 rather than their scarcity in the Phase 3 and 2 assemblages. Battered pieces (37.9%) and the ‘other’ type (31.0%) are also better represented in this assemblage compared to the earlier ones.

6.4 Retouched artefact attribute data

Qualitative and quantitative attributes were recorded from a sample of 1,383 individual retouched artefacts - slightly under a third of the total tool assemblage (31.4%) when the retouched fragments are excluded. Only intact artefacts were selected for this stage of analysis. In total, 340 artefacts were sampled from Phase 4, 419 from Lower Phase 3, 390 from Upper Phase 3 and 234 from Phase 2.

A combination of metric data, attributes relating to the original debitage blank and those regarding the distribution and nature of retouch were recorded for each artefact. The type of the original debitage blank was recorded wherever viable, although often the intensiveness of the retouch applied to the artefact made such an identification impossible, in which case the blank was recorded as ‘indeterminate’. As with the distribution of cortex on debitage artefacts, the location of marginal retouch was recorded using a system of quadrats. This process involved dividing the perimeter of each artefact into four even sectors, proceeding in a clockwise orientation, with Quadrat 1 encompassing the proximal end of the artefact (Holdaway & Stern 2004: 157).

6.4.1 Scrapers

6.4.1.1 Dimensions

No significant shift in mean scraper dimensions are evident across time at Wadi Hammeh 27 (**Table 6.2; Fig. 6.38**). The Lower Phase 3 assemblage does present a wider range of larger, heavier scrapers, although this configuration can be easily explained by the higher proportion of broad carinated scrapers in this assemblage. While a slightly greater degree of size variability is evident when segregating the scrapers by type (**Fig. 6.39**; **Table 6.3**), these differences are more indicative of variation in blank selection for certain types rather than a reflection of preconceived designs. For example, while the average endscraper on retouched piece is significantly longer than most other scraper types, this result merely reflects the predominance of blade blanks for this type. Given their typological parameters, the thumbnail scrapers unsurprisingly exhibit the smallest dimensions for this tool group.

6.4.1.2 Blank Attributes

The scrapers of Wadi Hammeh 27 are consistently dominated by pieces manufactured from flake blanks, with just under three quarters of each scraper assemblage made from this debitage type (**Table 6.4**; **Fig. 6.40**). The second most common blank varies between assemblages, with blades used more often in the Lower Phase 3 (11.1%) and Phase 2 samples (15.8%), while slightly more scrapers created from core trimming elements are present in Phase 4 (11.1%) and Upper Phase 3 (14.8%). None of the analysed scrapers are bladelet products; an unsurprising result given the inherently low tensile strength of these artefacts.

A steady trend towards flake blanks is also observable when the scrapers are divided by type, with the only departures being a preference for blade blanks for the endscraper on retouched piece type (**Table 6.5**) and the fact that nucleiform scrapers were manufactured from cores as a typological prerequisite. Exceptionally small, thin, micro-flake blanks bearing a minimal amount of cortex were utilised in the production of thumbnail scrapers, making them easily distinguishable from the larger flake-scrapers dominating each assemblage.

Large, rounded, relatively thin cores with at least one flat face appear to have been intentionally selected for recycling into nucleiform scrapers, with the edges of the cores providing an easily reworkable, acute angle which could be retouched in the same manner as one would work a large, carinated flake. No discrimination appears to have been made on the

Table 6.2: Scraper dimensions, by phase.

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	18	46.2	16.8	14.4-79.3	39.7	16.8	11.4-70.3	15.3	6.0	4.1-32.0	38.3	36.8	0.5-126.0
Lower Phase 3	28	50.0	20.0	14.9-88.8	41.8	19.2	14.8-106.8	15.8	10.3	3.6-50.4	50.0	80.9	1.4-412.0
Upper Phase 3	27	46.1	13.9	22.0-72.8	38.9	10.4	15.7-63.5	15.1	5.9	5.4-24.7	31.9	22.8	1.9-89.8
Phase 2	19	45.6	15.7	13.6-75.0	36.9	12.8	16.2-63.5	14.4	6.8	3.8-32.7	31.7	30.5	0.9-133.0

Table 6.3: Scraper dimensions, by type (Phases 2-4).

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Endscraper	7	45.2	19.8	28.5-88.8	29.2	6.2	19.6-40.2	11.3	2.9	8.3-16.8	14.9	9.3	4.7-31.9
Endscraper on retouched piece	6	65.5	12.7	48.6-84.6	28.1	3.9	23.4-33.0	12.5	4.1	8.8-20.0	24.0	9.0	15.7-40.5
Thumbnail scraper	6	17.6	5.2	13.6-24.8	15.7	2.5	11.4-18.7	4.4	0.7	3.6-5.4	1.2	0.5	0.5-1.9
Transversal endcraper	6	37.9	8.9	31.2-55.1	47.3	15.0	38.3-77.6	13.0	1.5	11.5-15.6	23.4	13.9	16.7-51.7
Rounded scraper	6	44.0	14.2	26.0-64.7	39.2	12.8	28.0-64.0	13.7	4.7	6.8-19.2	30.4	23.8	7.1-63.4
Sidecraper	17	50.4	12.7	34.2-72.8	38.3	11.8	19.6-70.3	13.1	3.7	7.8-19.7	31.1	30.1	8.0-126.0
Nosed scraper	7	48.2	10.3	33.4-64.2	47.2	5.4	37.2-54.4	14.2	5.1	7.7-19.6	31.8	15.5	12.9-50.0
Broad carinated scraper	20	47.2	14.5	24.4-79.7	46.3	18.4	28.1-106.8	22.3	9.7	11.8-50.4	66.6	91.3	10.0-412.0
Narrow carinated scraper	4	62.7	19.6	34.2-79.3	43.6	14.7	30.4-64.6	21.2	3.8	15.7-24.7	64.3	34.6	15.9-89.8
Nucleiform scraper	5	44.8	17.7	24.6-61.3	40.8	14.7	23.6-54.1	19.4	8.9	8.4-32.7	54.2	51.8	5.6-133.0

Table 6.4: Tool blank selection, by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2	
	N	%	N	%	N	%	N	%
Scrapers								
Flake	13	72.2	20	74.1	19	70.4	14	73.7
Blade	0	0.0	3	11.1	0	0.0	3	15.8
Bladelet	0	0.0	0	0.0	0	0.0	0	0.0
Core trimming element	2	11.1	2	7.4	4	14.8	1	5.3
Other	1	5.6	0	0.0	3	11.1	1	5.3
Indeterminate	2	11.1	2	7.4	1	3.7	0	0.0
Total	**18**	**100.0**	**27**	**100.0**	**27**	**100.0**	**19**	**100.1**
Multiple tools								
Flake	17	60.7	21	50.0	16	57.1	11	73.3
Blade	1	3.6	8	19.0	3	10.7	0	0.0
Bladelet	1	3.6	2	4.8	1	3.6	1	6.7
Core trimming element	1	3.6	2	4.8	2	7.1	1	6.7
Other	1	3.6	0	0.0	0	0.0	0	0.0
Indeterminate	7	25.0	9	21.4	6	21.4	2	13.3
Total	**28**	**100.1**	**42**	**100.0**	**28**	**99.9**	**15**	**100.0**
Burins								
Flake	45	47.4	45	43.7	64	56.6	21	39.6
Blade	11	11.6	5	4.9	9	8.0	7	13.2
Bladelet	3	3.2	3	2.9	9	8.0	8	15.1
Core trimming element	10	10.5	9	8.7	10	8.8	3	5.7
Other	1	1.1	1	1.0	0	0.0	0	0.0
Indeterminate	25	26.3	40	38.8	21	18.6	14	26.4
Total	**95**	**100.1**	**103**	**100.0**	**113**	**100.0**	**53**	**100.0**
Geometric microliths								
Flake	0	0.0	0	0.0	1	1.0	1	1.6
Blade	0	0.0	0	0.0	0	0.0	0	0.0
Bladelet	54	52.9	62	60.2	64	61.0	39	62.9
Core trimming element	0	0.0	0	0.0	0	0.0	0	0.0
Other	0	0.0	0	0.0	0	0.0	0	0.0
Indeterminate	48	47.1	41	39.8	40	38.1	22	35.5
Total	**102**	**100.0**	**103**	**100.0**	**105**	**100.1**	**62**	**100.0**
Notches and denticulates								
Flake	18	54.5	21	53.8	19	55.9	9	37.5
Blade	1	3.0	0	0.0	2	5.9	3	12.5
Bladelet	12	36.4	17	43.6	11	32.4	12	50.0
Core trimming element	2	6.1	1	2.6	2	5.9	0	0.0
Other	0	0.0	0	0.0	0	0.0	0	0.0
Indeterminate	0	0.0	0	0.0	0	0.0	0	0.0
Total	**33**	**100.0**	**39**	**100.0**	**34**	**100.1**	**24**	**100.0**

Table 6.5: Blanks used to manufacture scrapers, by type (Phases 2-4).

	N	Flake		Blade		Bladelet		CTE		Indetermi-nate		Other	
		N	%	N	%	N	%	N	%	N.	%	N	%
Endscraper	7	5	71.4	1	14.3	0	-	1	14.3	0	-	0	-
Endscraper on retouched piece	6	1	16.7	4	66.7	0	-	1	16.7	0	-	0	-
Thumbnail scraper	6	4	66.7	0	-	0	-	0	-	2	33.3	0	-
Transversal endscraper	6	5	83.3	0	-	0	-	1	16.7	0	-	0	-
Rounded scraper	6	4	66.7	0	-	0	-	0	-	2	33.3	0	-
Sidescraper	17	11	64.7	1	5.9	0	-	5	29.4	0	-	0	-
Nosed scraper	7	7	100.0	0	-	0	-	0	-	0	-	0	-
Broad carinated scraper	20	19	95.0	0	-	0	-	1	5.0	0	-	0	-
Narrow carinated scraper	4	3	75.0	0	-	0	-	0	-	1	25.0	0	-

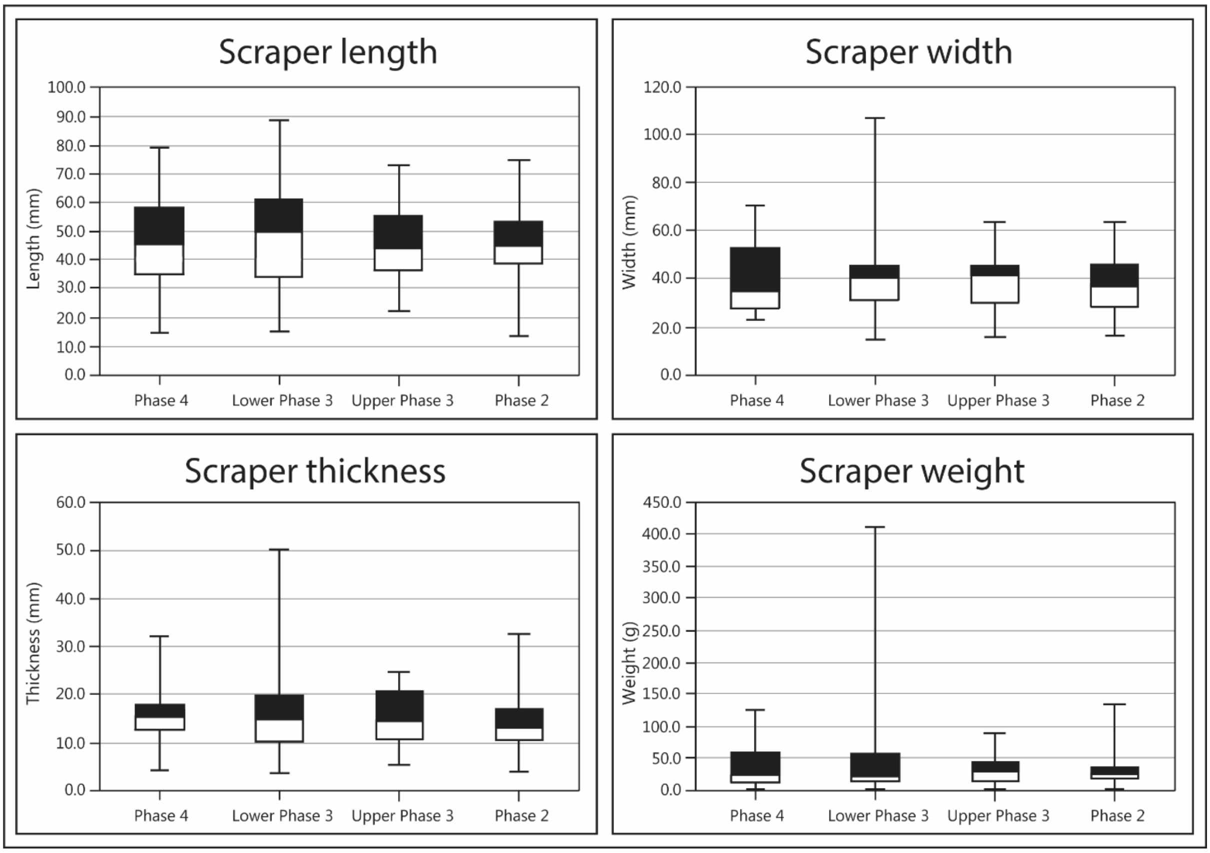


Figure 6.38: Scraper dimensions, by phase.

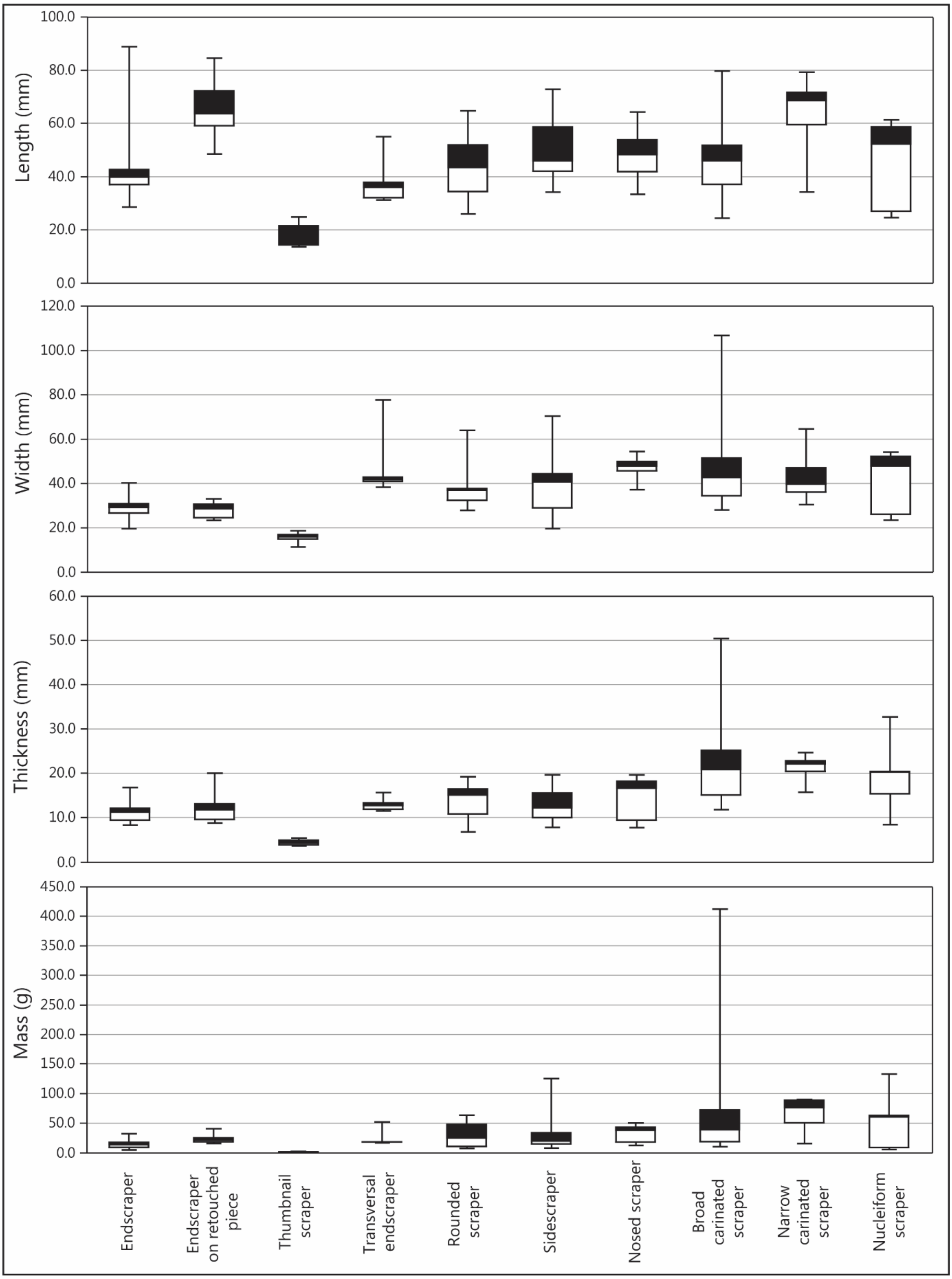


Figure 6.39: Scraper dimensions, by type (Phases 2-4).

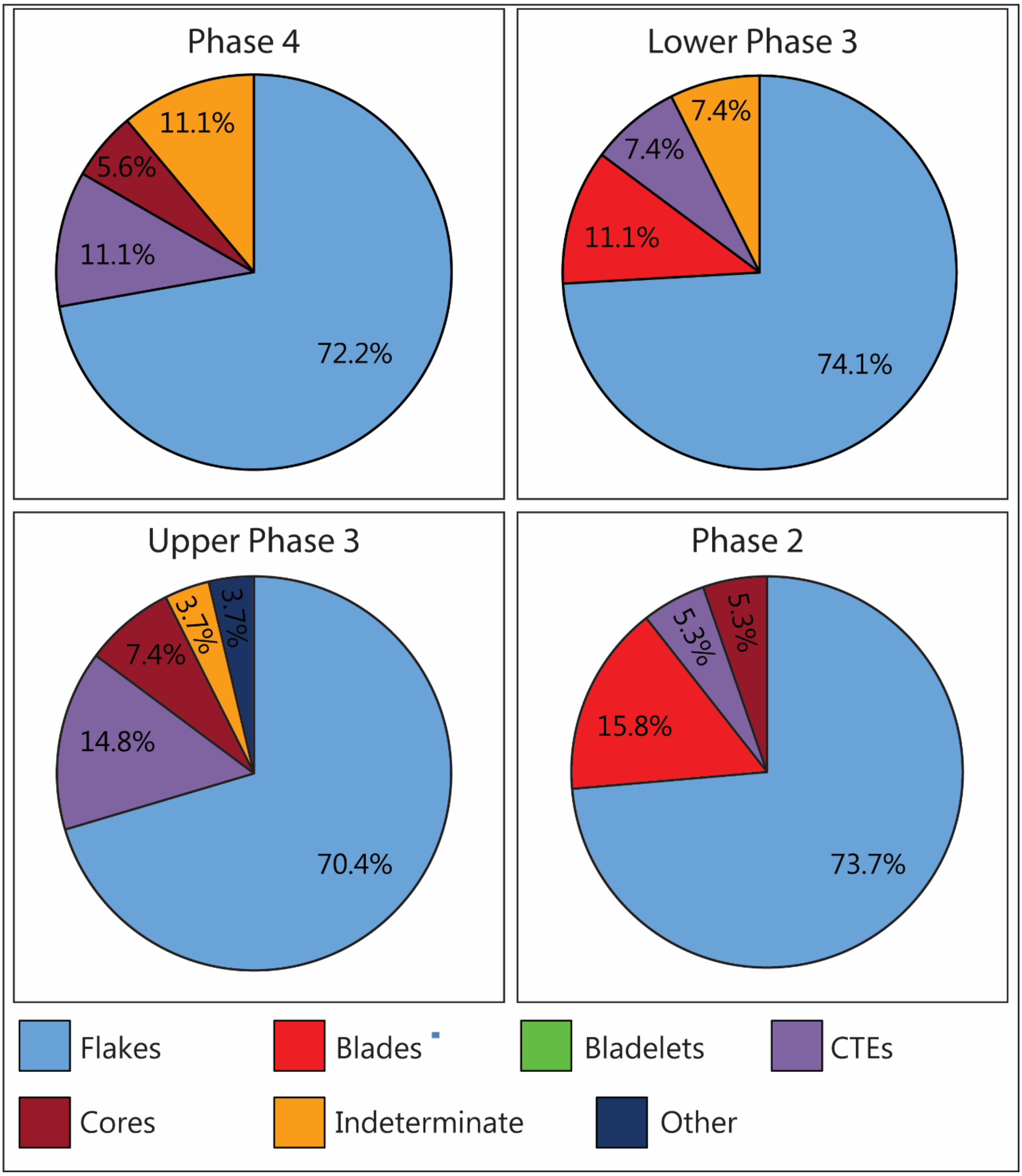


Figure 6.40: Scraper blank selection, by phase.

basis of the blanks produced prior to the core's repurposing, with nucleiform scrapers created from both flake (**Fig. 6.20:** 9) and bladelet cores (**Fig. 6.20:** 8).

While blank selection thus remains consistent from a typological standpoint, several unidirectional attribute shifts can be noted. The proportions of scrapers manufactured from blanks with a unidirectional scar orientation increase dramatically through time, from 0% of the Phase 4 scrapers to over a third (36.8%) of the Phase 2 sample (**Fig. 6.41**). This increase corresponds with a decline in pieces with a 'change of orientation' pattern between Phase 4 (50.0%) to Phase 2 (21.1%). Scrapers with radial scar patterns are similarly common in the first three assemblages (ranging from 30.8% in Upper Phase 3 to 38.5% in Lower Phase 3), before substantially dropping in Phase 2 (15.8%). The Phase 2 scraper assemblage likewise displays an increase in the 'bi-directional crossed' orientation (26.3%) compared to the three underlying assemblages. The scrapers in each assemblage maintain a mean number of dorsal flake scars, ranging between five and six scars (**Table 6.6**), although the distribution by actual scar count varies by phase (**Fig. 6.42**). For example, the Phase 2 scraper assemblage presents an abnormally large number of pieces with three flake scars (consistent with the increased unidirectional flake usage in this phase), although this result is balanced by the co-occurrence of relatively high proportions of scrapers with five to seven flake scars.

Cortical coverage on the scrapers remains persistently low over time, with the average scraper in each assemblage bearing cortex on slightly under a fifth of its dorsal surface (**Table 6.6**). At the same time, the proportion of cortex-free scrapers increases over time, with a particularly notable jump between Phase 4 (22.2%) and Lower Phase 3 (40.7%), before incrementally rising to narrowly over half of the Phase 2 assemblage (52.6%; **Fig 6.43**).

6.4.1.3 Retouch attributes

The scrapers in each assemblage comprise a combination of expediently and intensively retouched pieces in terms of percentage of total edge modification (**Fig. 6.44**). This arrangement results in the average scraper possessing retouch on slightly under half of its total edge, ranging from 43.3% in Upper Phase 3 to 48.5% in Lower Phase 3 (**Table 6.6**).

Table 6.6: Scraper attributes, by phase.

	N	Flake scars			Percentage of cortex coverage			Percentage of edge retouched		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	17	6	4.7	0 - 18	17.9	18.5	0 - 65	43.8	27.2	15 - 90
Lower Phase 3	27	5	2.1	0 - 9	19.3	23.7	0 - 80	48.5	27.9	10 - 100
Upper Phase 3	26	6	4.0	1 - 17	16.2	22.2	0 - 70	43.3	17.9	20 - 85
Phase 2	19	5	3.7	1 - 18	16.3	26.9	0 - 80	44.7	25.7	10 - 100

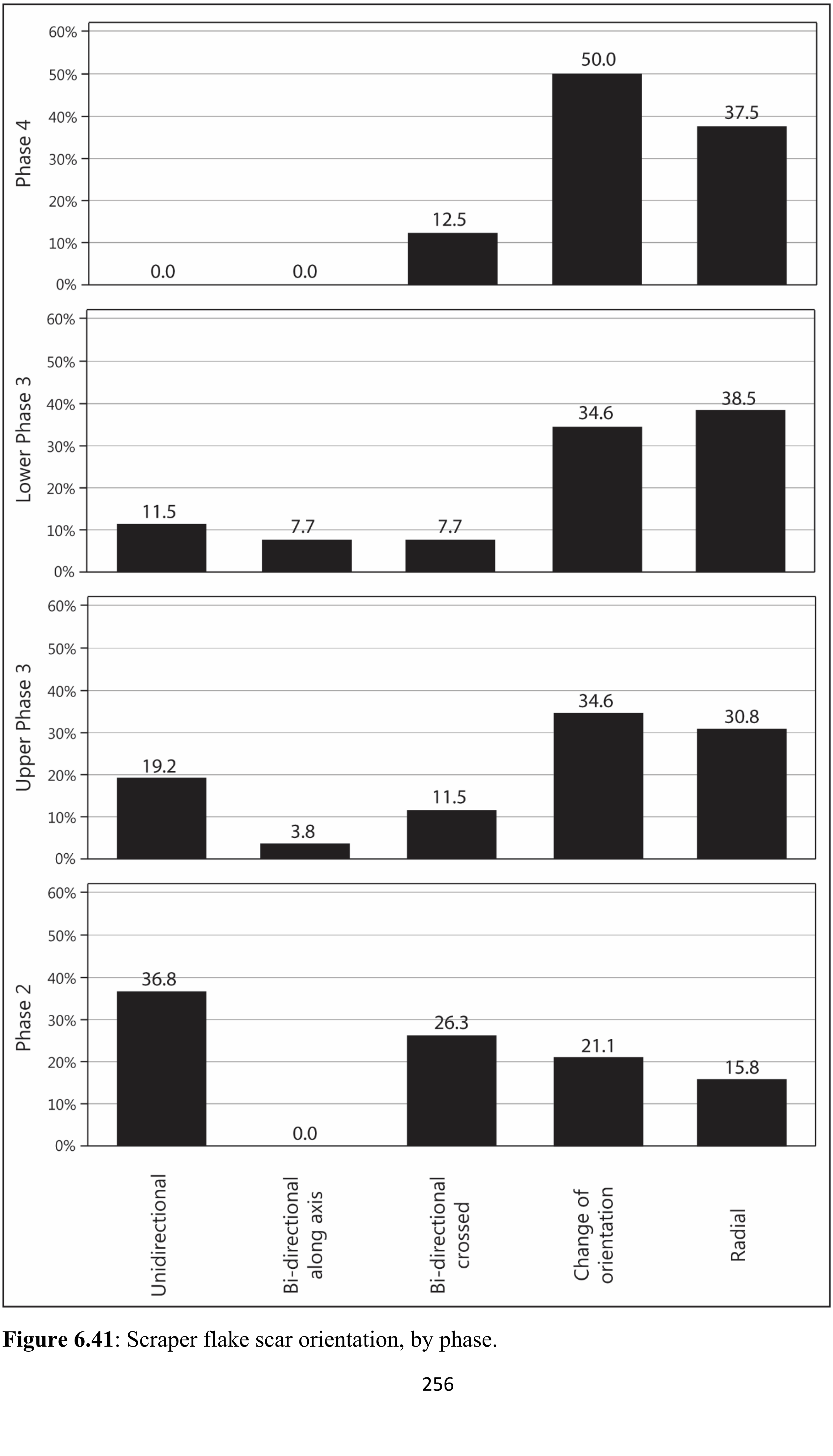


Figure 6.41: Scraper flake scar orientation, by phase.

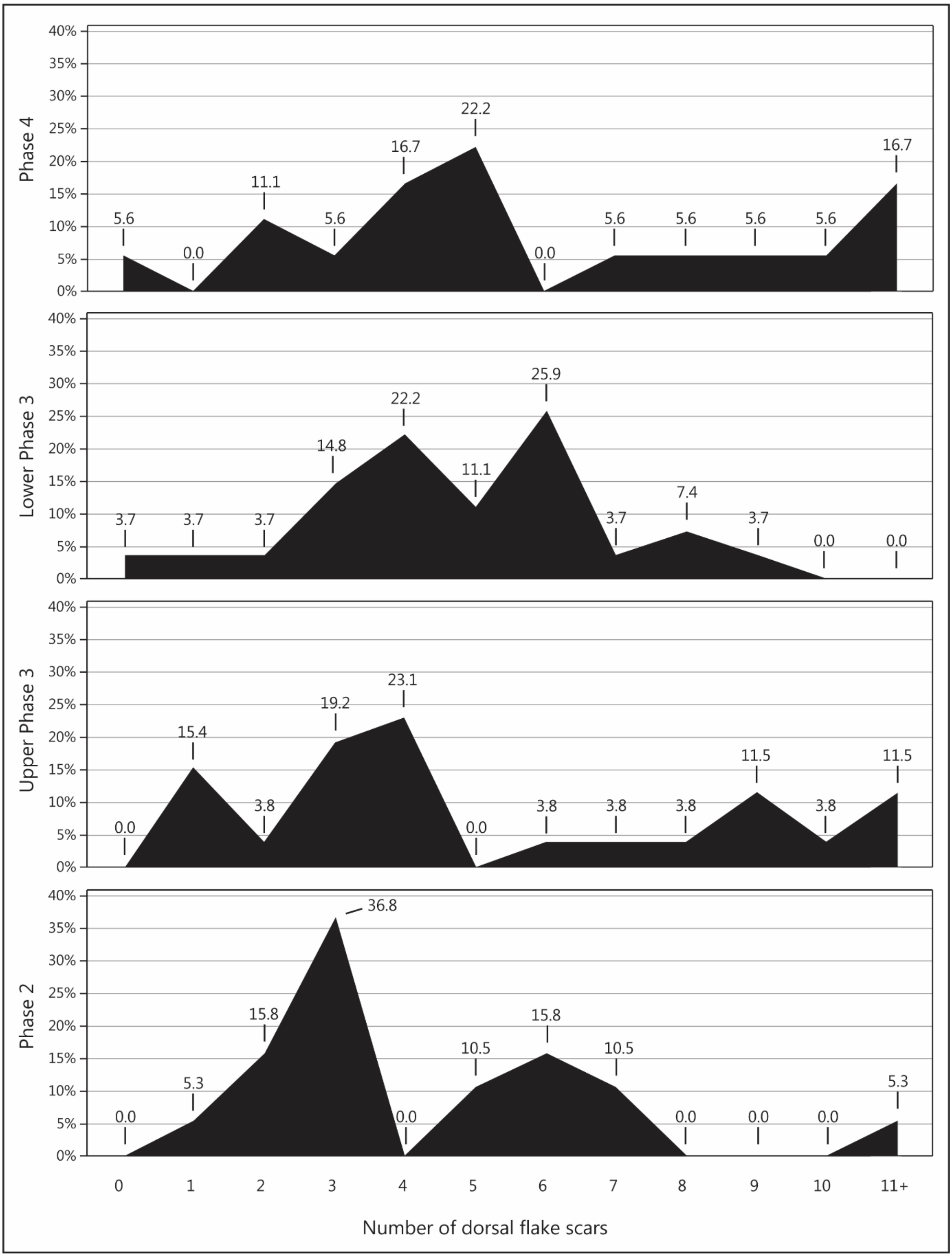


Figure 6.42: Number of negative flake scars on scrapers, by phase.

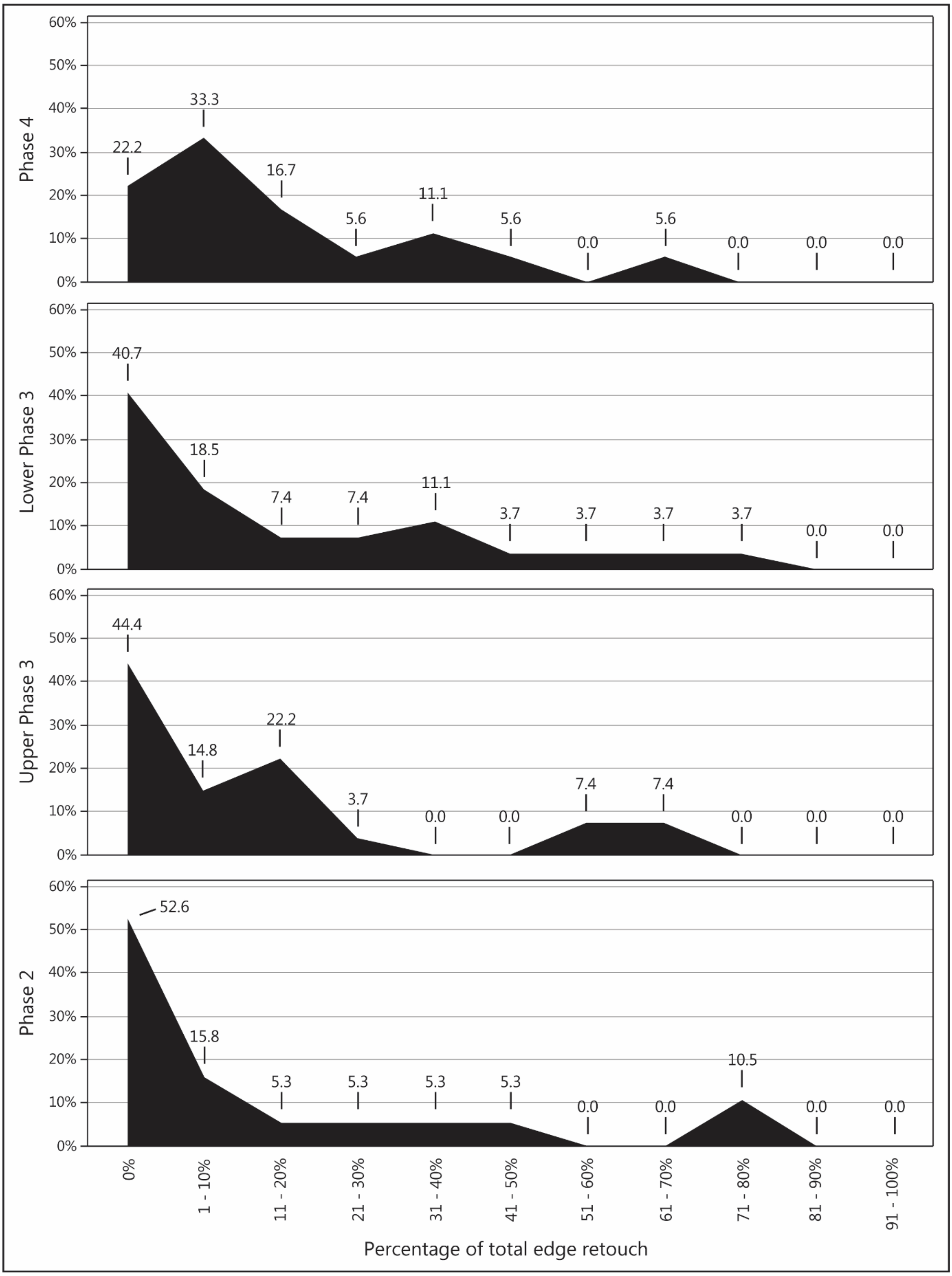


Figure 6.43: Scraper dorsal surface cortex coverage, by phase

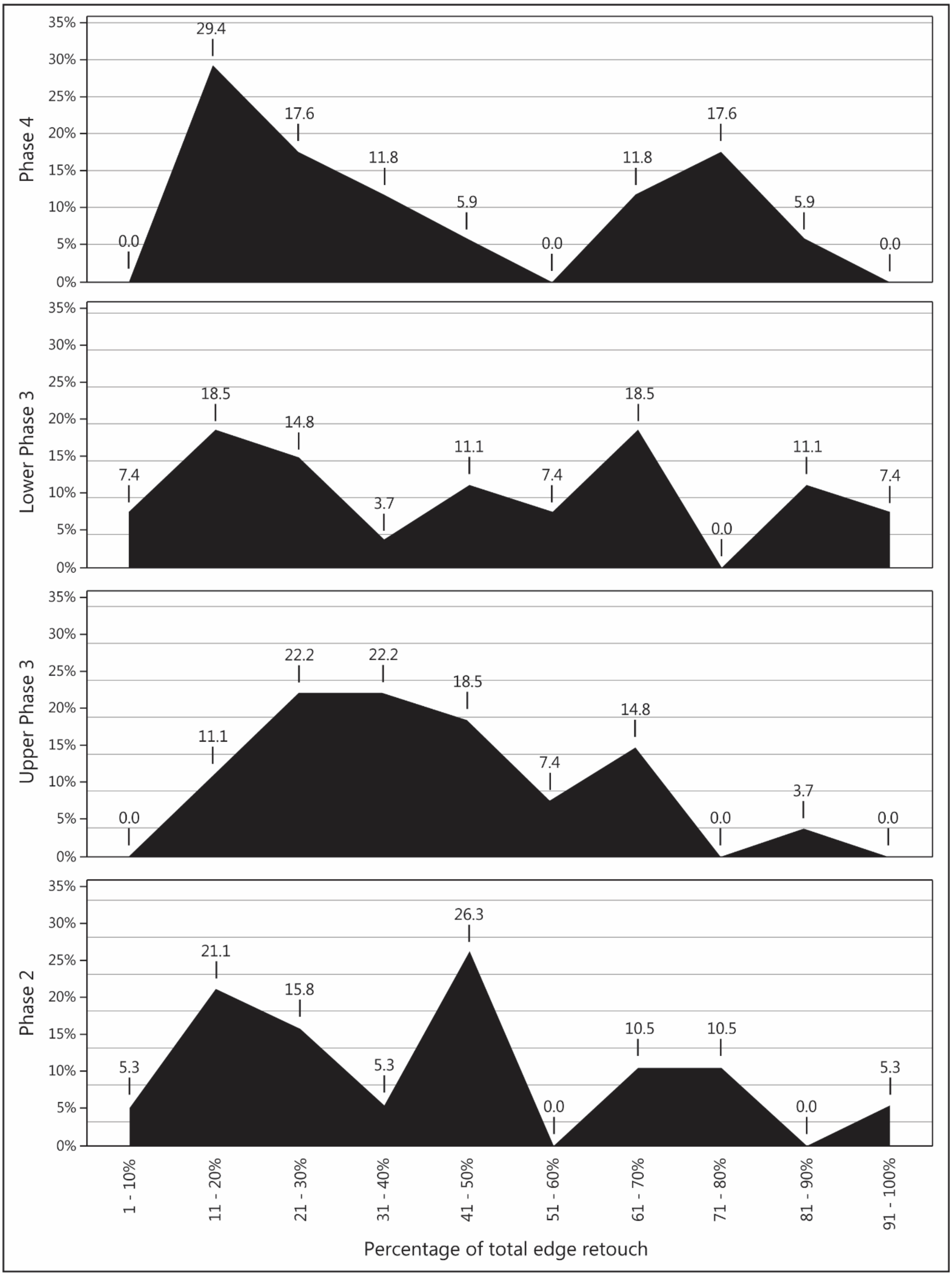


Figure 6.44: Percentage of total edge retouch on scrapers, by phase.

While the distribution of retouch is diverse in terms of quadrat combinations, an overall preference towards the distal end of the blank (Quadrat 3) is evident in every assemblage (**Table 6.7**; **Fig. 6.45**). Scrapers with retouch localised exclusively within Quadrat 3 are fairly common in every assemblage aside from Phase 4, from which only a single example was recorded. This assemblage nonetheless yields high proportions of scrapers with retouch combinations in Quadrats 3/4 and 2/3/4, demonstrating that the distal end of the blank was still being targeted for retouch. Conversely, endscrapers with retouch focussed around the proximal end (Quadrat 1) are rare in every assemblage aside from Upper Phase 3, where no preference towards either the proximal or distal end is evident. Similarly, the Upper Phase 3 scraper assemblage features a greater proportion of pieces with retouch in all four quadrats than the other assemblages.

6.4.2 Multiple tools

6.4.2.1 Dimensions

A vectored decline in the length of multiple tools over time is evident, with their average length falling from 50mm in Phase 4 to 40mm in Phase 2 (**Table 6.8**; **Fig. 6.46**). Burin/scraper combinations are noticeably larger and heavier than the other two types in this group, exhibiting similar dimensions to the regular scrapers (**Table 6.9**; **Fig. 6.47**). In contrast, the burin/truncation and burin/notched piece combinations are closer in size to the regular burins.

6.4.2.2 Blank attributes

Like scrapers, multiple tools are mainly produced using flake blanks, although this varies considerably by phase, ranging from half of the Lower Phase 3 assemblage to just under three quarters (73.3%) of the Phase 2 multiple tools (**Table 6.4**; **Fig. 6.48**). Multiple tools manufactured from indeterminate blanks are also fairly common in Phase 4 (25.0%), with the proportions of these artefacts steadily declining to their lowest representation in Phase 2 (13.3%). The numbers of multiple tools on blade blanks fluctuate over time, being rare in Phase 4 (3.6%), relatively common in the Lower and Upper Phase 3 assemblages (19.0% and 10.7% respectively), before disappearing entirely from the Phase 2 sample. Multiple tools made from bladelets and core trimming elements also occur in low numbers in each

Table 6.7: Distribution of retouch on scrapers (in quadrats), by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
One quadrat										
1	1	5.9	1	3.7	1	4.0	0	0.0	3	3.4
2	0	0.0	1	3.7	1	4.0	0	0.0	2	2.3
3	1	5.9	6	22.2	3	16.0	4	22.2	14	16.1
4	1	5.9	0	0.0	1	4.0	1	5.6	3	3.4
Sub-total	**3**	**17.6**	**8**	**28.6**	**6**	**25.0**	**5**	**27.8**	**22**	**25.3**
Two quadrats										
1,2	1	5.9	0	0.0	2	8.0	1	5.6	4	4.6
1,3	0	0.0	0	0.0	1	4.0	0	0.0	1	1.1
1,4	0	0.0	0	0.0	1	4.0	2	11.1	3	3.4
2,3	1	5.9	2	7.4	3	12.0	0	0.0	6	6.9
2,4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3,4	5	29.4	4	14.8	0	0.0	1	5.6	10	11.5
Sub-total	**7**	**41.2**	**6**	**21.4**	**7**	**29.2**	**4**	**22.2**	**24**	**27.6**
Three quadrats										
1,2,3	0	0.0	0	0.0	3	12.0	1	5.6	4	4.6
1,2,4	0	0.0	1	3.7	0	0.0	0	0.0	1	1.1
1,3,4	0	0.0	2	7.4	3	12.0	2	11.1	7	8.0
2,3,4	4	23.5	4	14.8	3	12.0	2	11.1	13	14.9
Sub-total	**4**	**23.5**	**7**	**25.0**	**9**	**37.5**	**5**	**27.8**	**25**	**28.7**
Four quadrats										
Sub-total	**3**	**17.6**	**7**	**25.0**	**2**	**8.0**	**4**	**22.2**	**16**	**18.4**
Total	**17**	**99.9**	**28**	**100.0**	**24**	**99.7**	**18**	**100.0**	**87**	**100.0**

Table 6.8: Multiple tool dimensions, by phase.

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	28	50.6	15.3	20.7-95.3	35.7	14.9	13.9-84.4	14.3	7.7	4.2-33.3	40.0	58.1	2.5-250.0
Lower Phase 3	42	49.7	16.5	24.4-92.4	32.2	11.9	14.0-68.3	10.4	5.2	3.4-26.7	21.0	19.1	2.2-85.8
Upper Phase 3	28	45.6	11.2	20.0-65.7	35.6	14.7	13.4-66.2	12.7	6.3	3.3-27.4	25.3	22.3	1.2-77.5
Phase 2	15	40.4	10.8	19.8-59.4	36.0	15.2	9.8-74.6	11.9	5.9	2.6-20.4	20.9	15.9	0.4-61.8

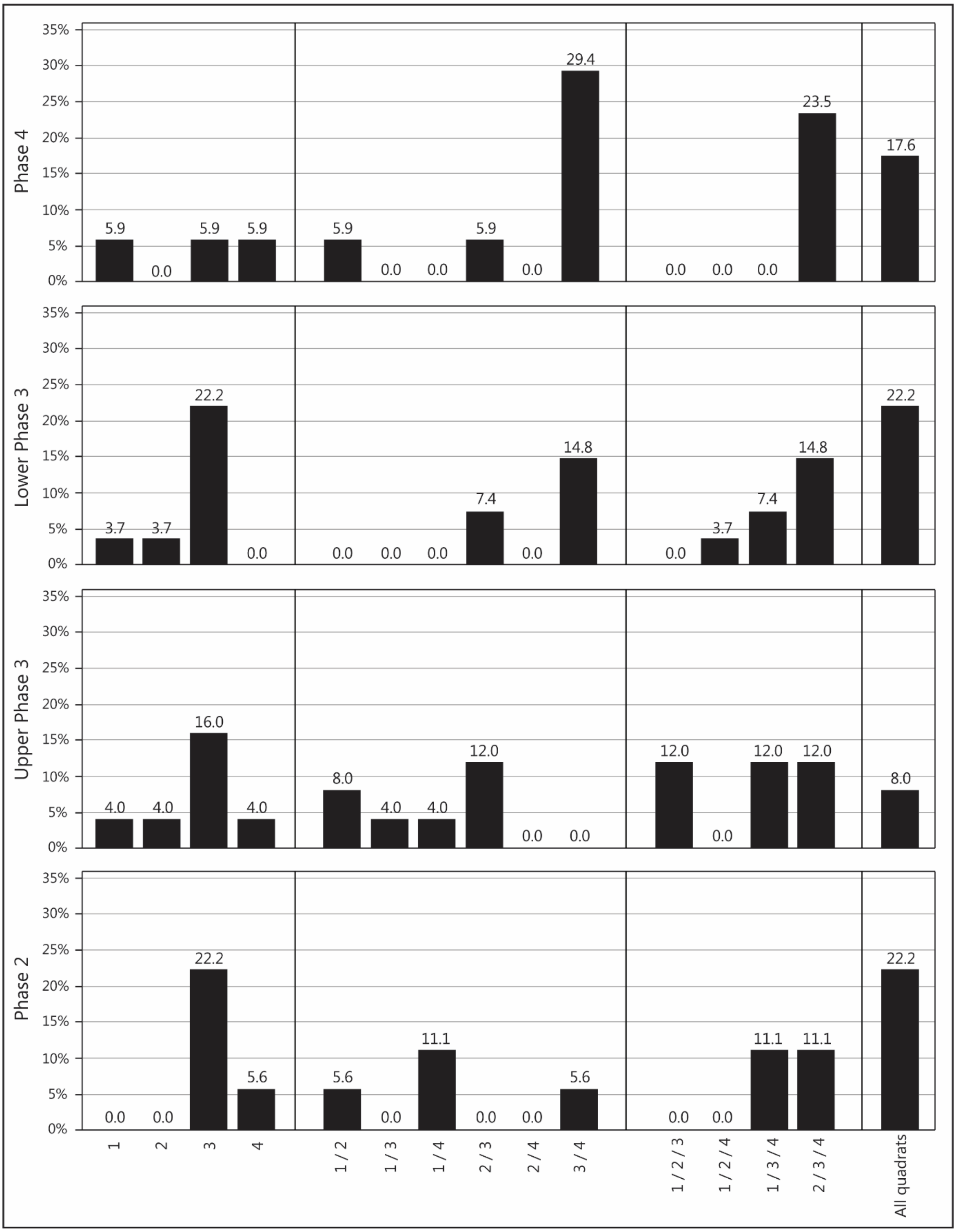


Figure 6.45: Retouch quadrat combinations on scrapers, by phase.

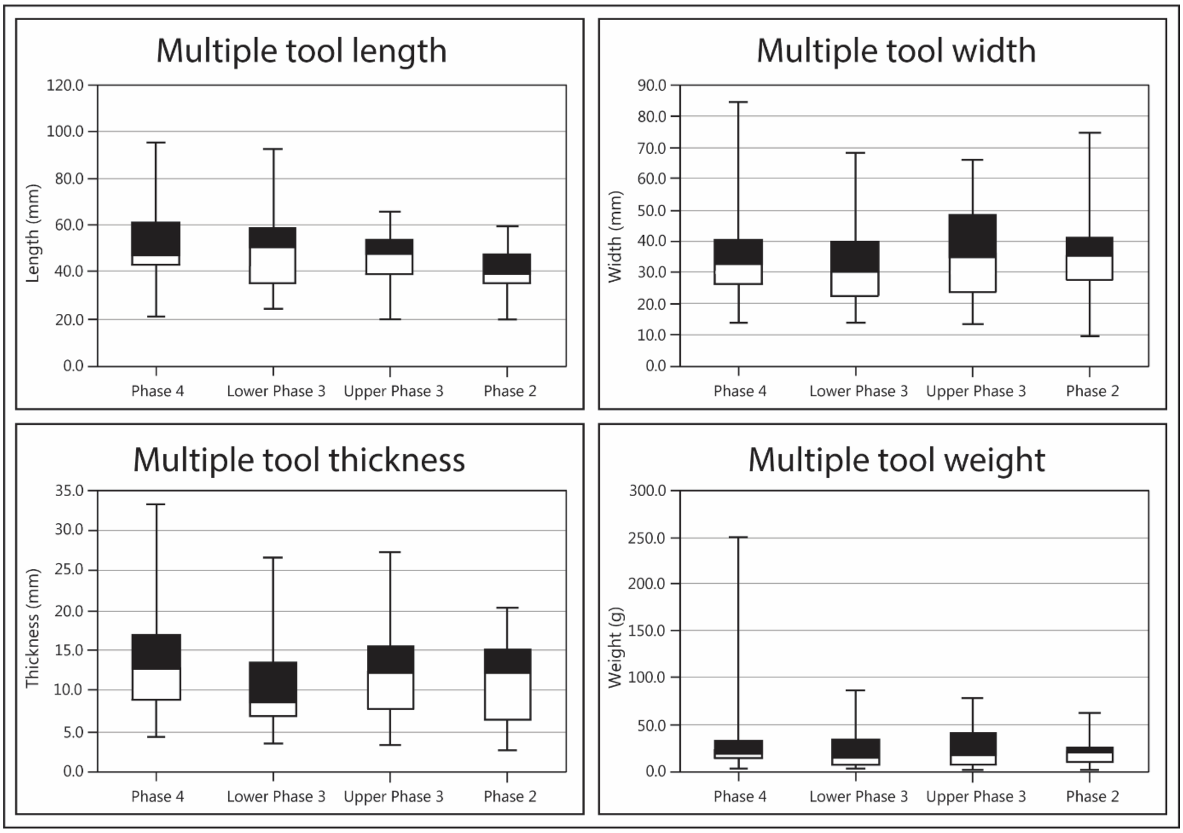


Figure 6.46: Multiple tool dimensions, by phase.

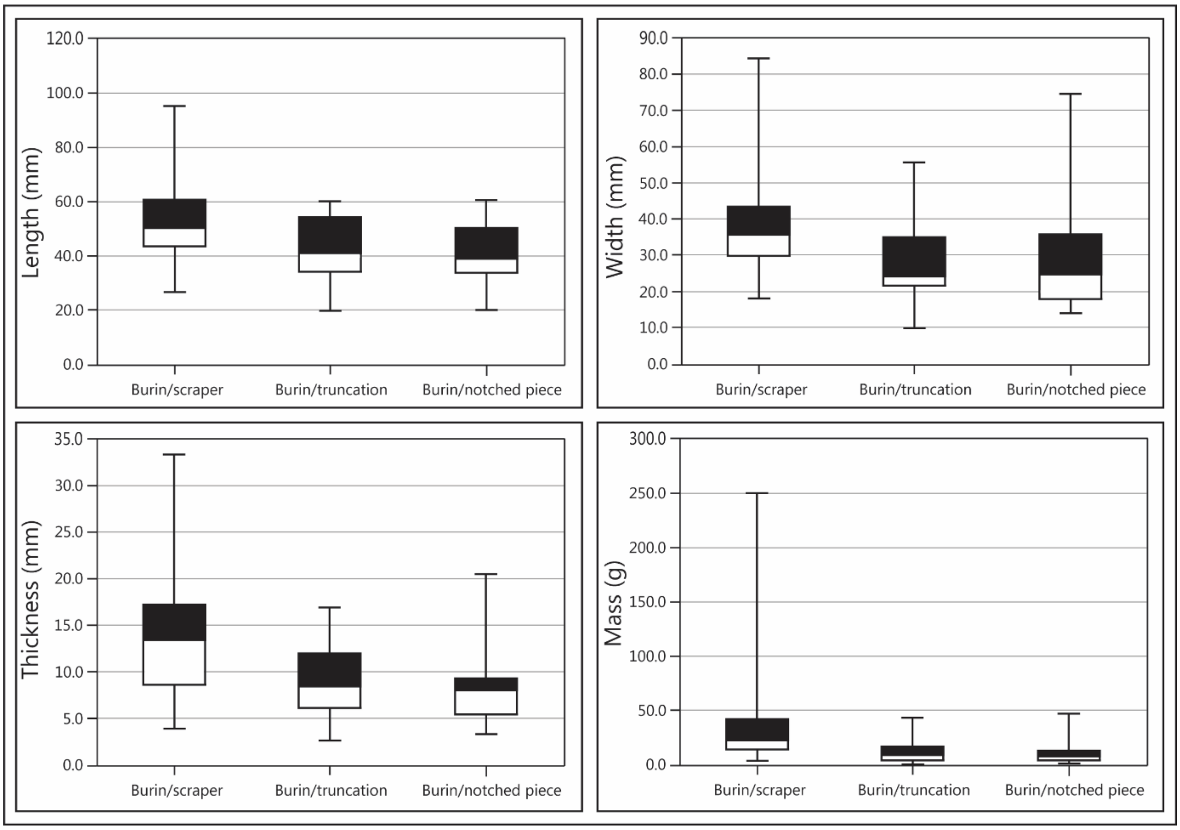


Figure 6.47: Multiple tool dimensions, by type (Phases 2-4).

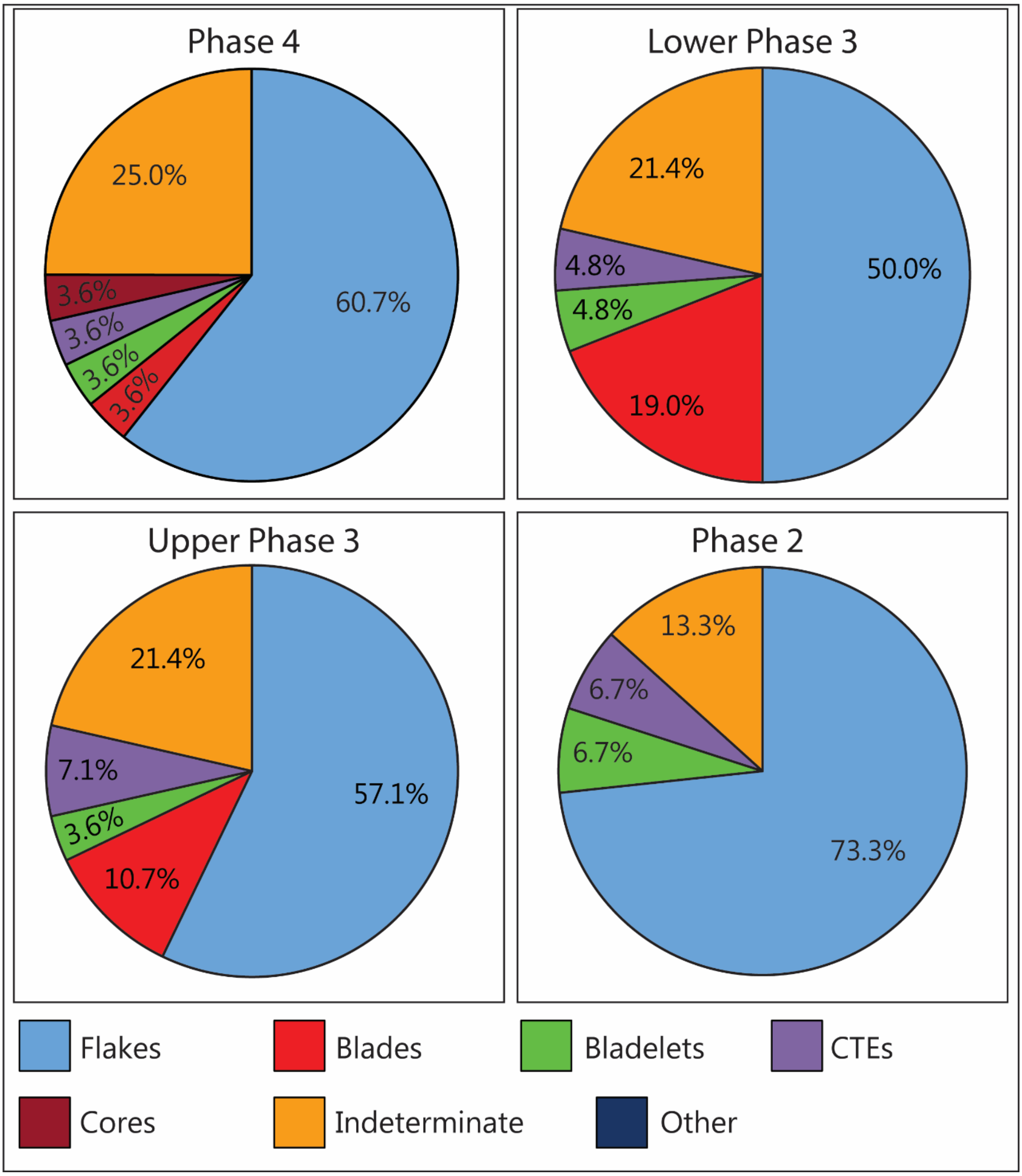


Figure 6.48: Multiple tool blank selection, by phase.

assemblage. By type, the burin/scraper combinations display a greater bias towards flake blanks (64.2%) than the other two types (**Table 6.10**). As with the regular scrapers, artefacts belonging to this type are also characterised by a complete absence of bladelet blanks being utilised in their manufacture.

In addition to their overall decline in size, the multiple tools also display a decline in the number of dorsal flake scars they exhibit. This drop is particularly apparent between Phase 4, where they possess an average of six scars, and the subsequent three assemblages, all of which have four scars on average (**Table 6.11**; **Fig. 6.49**). In line with their greater dimensions, the burin/scrapers also feature an extra flake scar on average compared to the other two multiple tool types. Unlike the scrapers, the multiple tools demonstrate a shift towards change of orientation scar patterns over time, rising from under a fifth of the Phase 4 pieces (18.5%), to almost half of the Phase 2 assemblage (46.7%; **Fig. 6.50**). The proportions of other scar layouts fluctuate across time.

The manufacture of multiple tools from cortex-rich debitage outliers disappears over time at Wadi Hammeh 27, with none of the Phase 2 artefacts exhibiting cortex on more than 50% of their dorsal surface (**Fig. 6.51**). Despite this decline, the proportions of cortex-free multiple tools remain relatively static over time, fluctuating between a high of 53.3% in Upper Phase 3 to 40.0% in Phase 2 (**Table 6.11**). The Lower Phase 3 multiple tools display the greatest mean cortical coverage for this tool group (22.3%), before incrementally falling to their lowest range in Phase 2 (12.0%). Burin/notched pieces feature a noticeably greater mean cortex coverage (24.1%) than the other two types.

6.4.2.3 Retouch attributes

Aside from a marginally lower average in Upper Phase 3, the mean retouch percentage of the multiple tools remains consistent over time, with two thirds of the average multiple tool edge being modified (**Table 6.11; Fig. 6.52**). Pieces with burin/scraper combinations contain a far greater amount of edge retouch on average (71.4%), than either the burin/truncations (53.4%) or burin/notched pieces (46.8%).

While all four multiple tool assemblages feature a high number of pieces with retouch in all four quadrats, the proportions of this layout varies across assemblages, ranging from half of the Lower Phase 3 artefacts to one third of those from Phase 2 (**Table 6.12; Fig. 6.53**).

Table 6.9: Multiple tool dimensions, by type (phases 2-4).

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Burin/ scraper	69	52.0	14.6	26.6-95.3	37.7	12.8	18.1-84.4	14.2	6.6	3.9-33.3	35.7	40.2	3.6-250.0
Burin/ truncation	20	42.4	12.5	19.8-60.2	28.9	13.1	9.8-55.7	8.9	4.1	2.6-16.9	12.8	12.1	0.4-43.3
Burin/ notched piece	23	40.0	11.2	20.0-60.6	28.8	14.6	13.9-74.6	8.4	4.1	3.3-20.5	11.6	11.7	1.4-47.0

Table 6.10: Blanks used to manufacture multiple tools, by type (Phases 2-4).

	N	Flake		Blade		Bladelet		CTE		Indeterminate		Other	
		N	%	N	%	N	%	N	%	N	%	N	%
Burin/scraper	67	43	64.2	4	6.0	0	-	3	4.5	16	23.9	1	1.5
Burin/ truncation	20	9	45.0	3	15.0	2	10.0	1	5.0	5	25.0	0	-
Burin/notched piece	23	11	47.8	4	17.4	3	13.0	2	8.7	3	13.0	0	-

Table 6.11: Multiple tool attributes, by phase.

	N	Flake scars			Percentage of cortex coverage			Percentage of edge retouch		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	27	6	3.6	2-16	16.7	20.9	0-70	66.7	23.7	20-100
Lower Phase 3	42	4	2.3	0-9	22.3	28.3	0-95	66.4	24.8	10-100
Upper Phase 3	28	4	2.3	0-8	16.8	24.1	0-80	56.6	22.8	20-95
Phase 2	15	4	2.4	2-11	12.0	14.1	0-50	61.7	16.3	30-90

Table 6.12: Distribution of retouch on multiple tools (in quadrats), by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
One quadrat										
1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2	1	3.7	0	0.0	1	3.6	0	0.0	2	1.8
3	1	3.7	0	0.0	0	0.0	0	0.0	1	0.9
4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Sub-total	**2**	**7.4**	**0**	**0.0**	**1**	**3.6**	**0**	**0.0**	**3**	**2.7**
Two quadrats										
1,2	0	0.0	1	2.4	1	3.6	0	0.0	2	1.8
1,3	0	0.0	0	0.0	1	3.6	0	0.0	1	0.9
1,4	0	0.0	1	2.4	0	0.0	0	0.0	1	0.9
2,3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2,4	0	0.0	1	2.4	0	0.0	0	0.0	1	0.9
3,4	0	0.0	2	4.9	3	10.7	1	6.7	6	5.4
Sub-total	**0**	**0.0**	**5**	**12.2**	**5**	**17.9**	**1**	**6.7**	**11**	**9.9**
Three quadrats										
1,2,3	1	3.7	4	9.8	3	10.7	2	13.3	10	9.0
1,2,4	1	3.7	0	0.0	0	0.0	0	0.0	1	0.9
1,3,4	3	11.1	4	9.8	5	17.9	2	13.3	14	12.6
2,3,4	9	33.3	8	19.5	3	10.7	5	33.3	25	22.5
Sub-total	**14**	**51.9**	**16**	**39.0**	**11**	**39.3**	**9**	**60.0**	**50**	**45.0**
Four quadrats										
Sub-total	**11**	**40.7**	**20**	**48.8**	**11**	**39.3**	**5**	**33.3**	**47**	**42.3**
Total	**27**	**100.0**	**41**	**100.0**	**28**	**100.1**	**15**	**100.0**	**111**	**99.9**

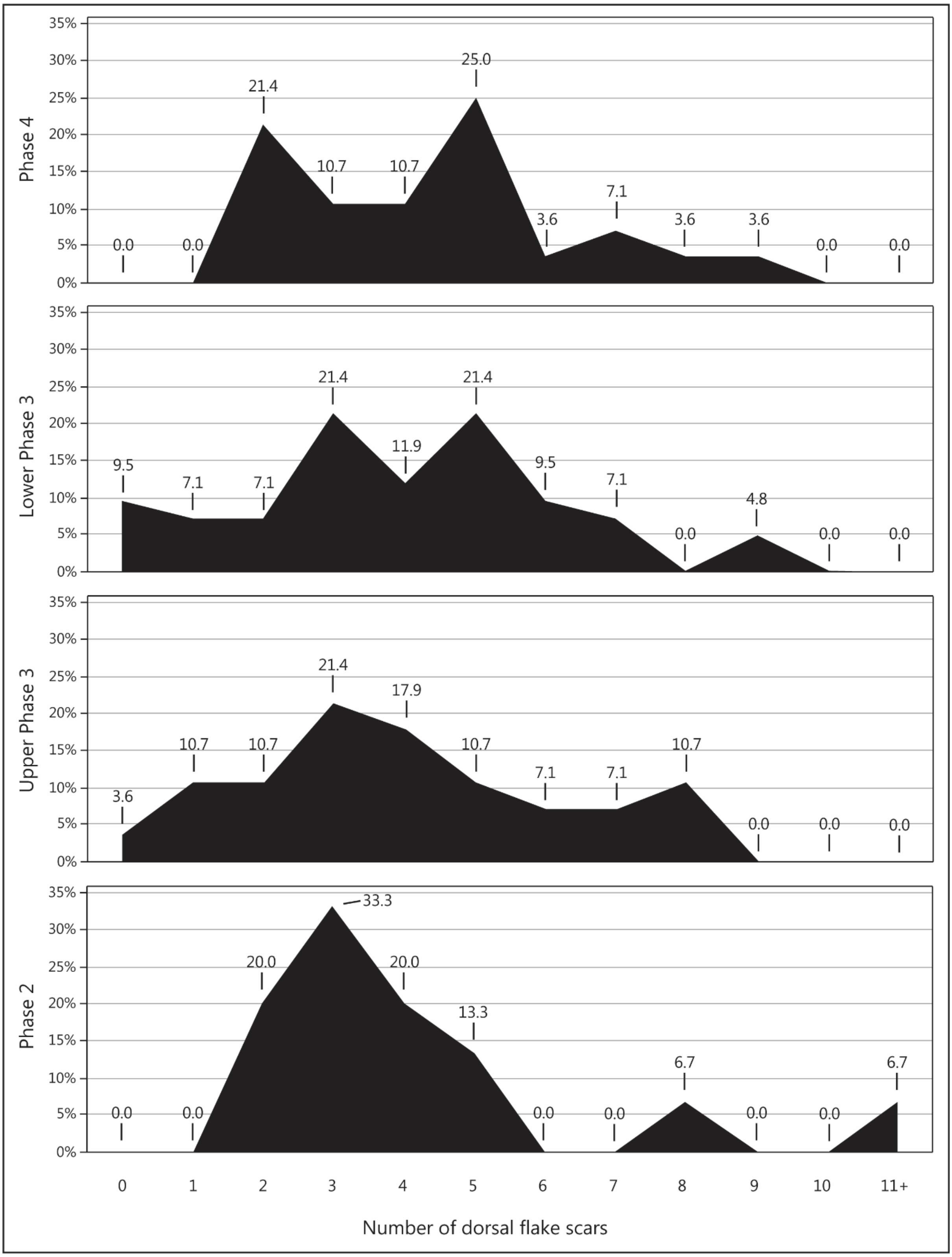


Figure 6.49: Number of negative flake scars on multiple tools, by phase.

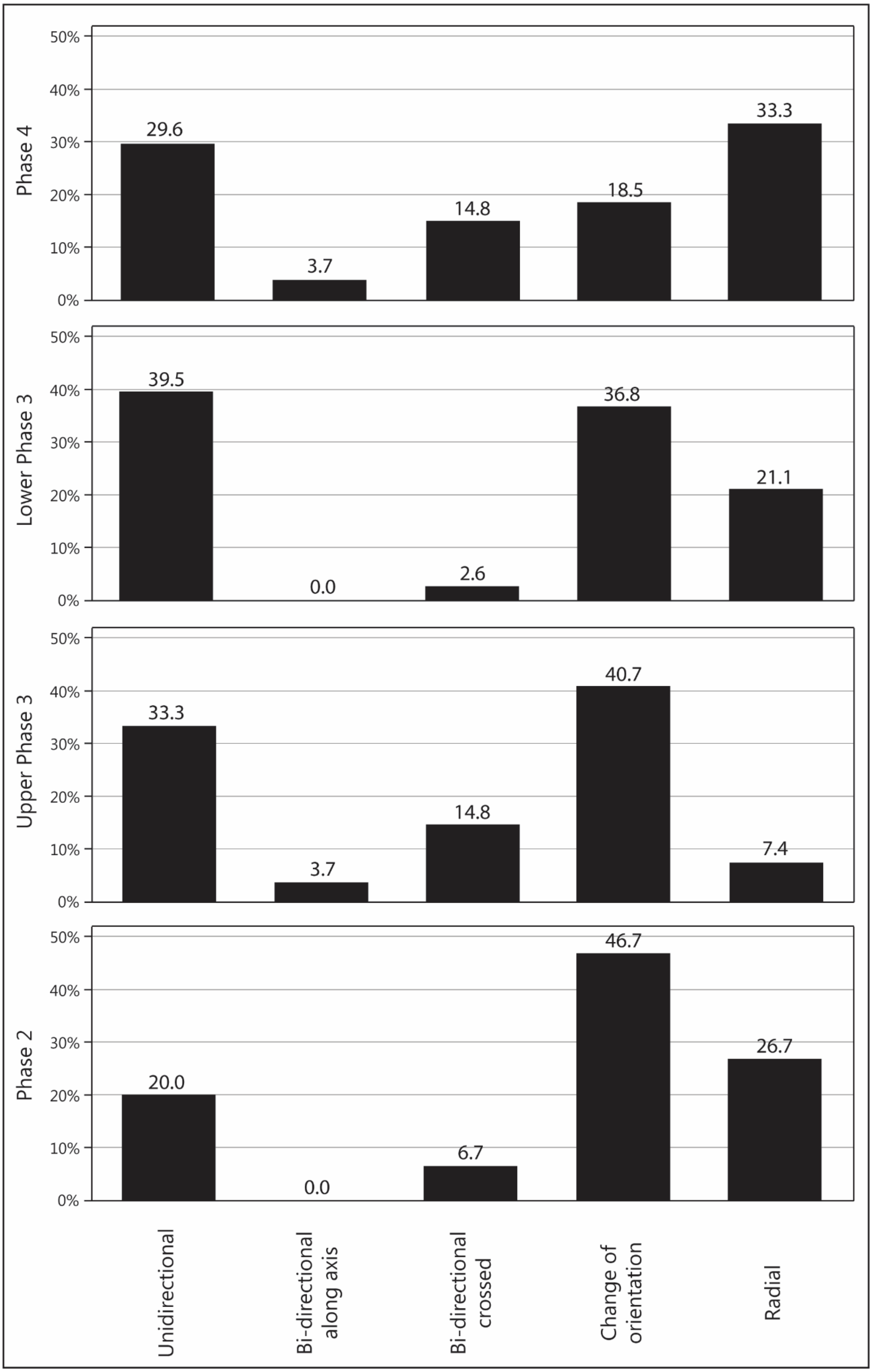


Figure 6.50: Multiple tool scar orientation, by phase.

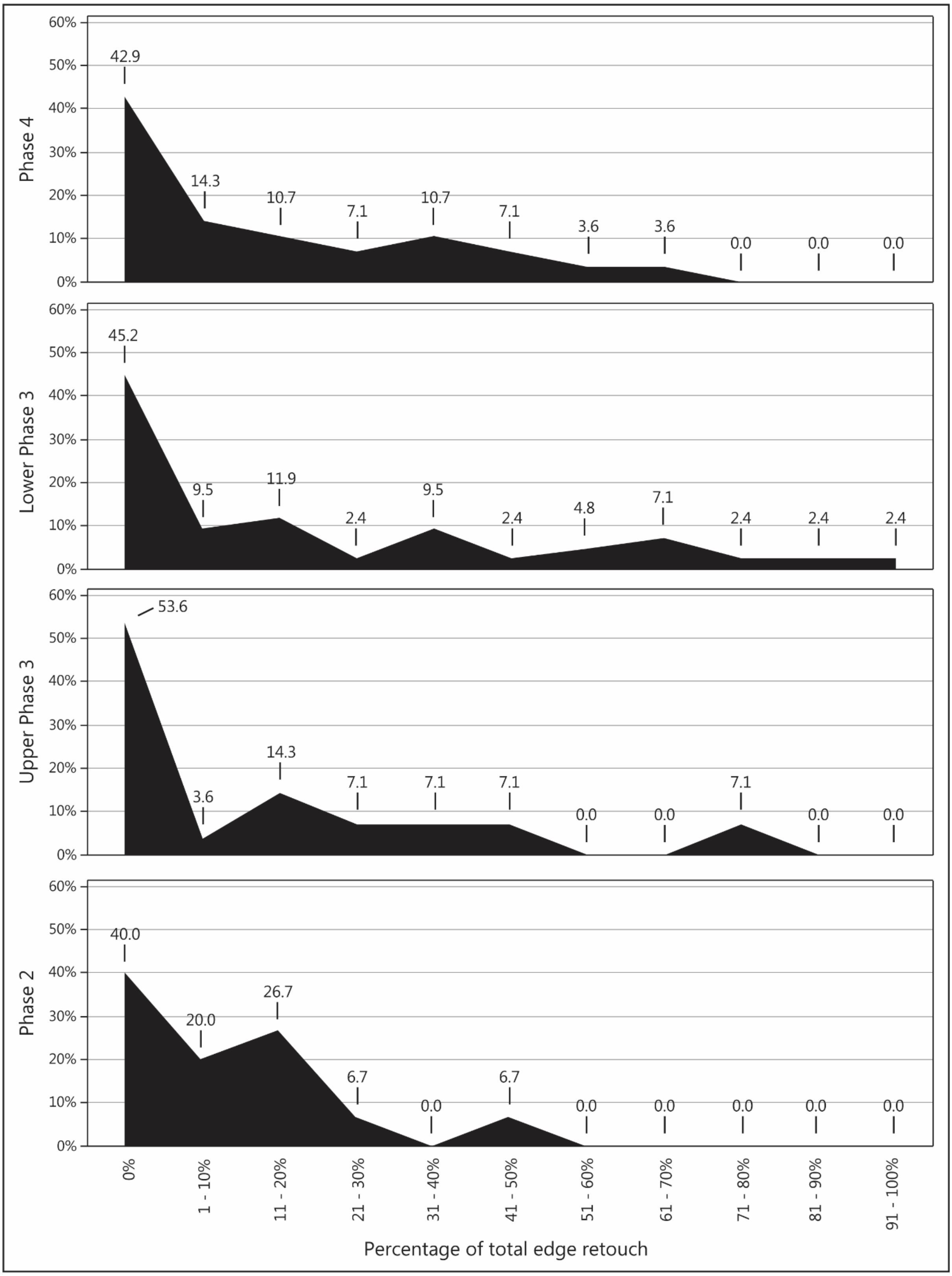


Figure 6.51: Multiple tool dorsal surface cortex coverage, by phase.

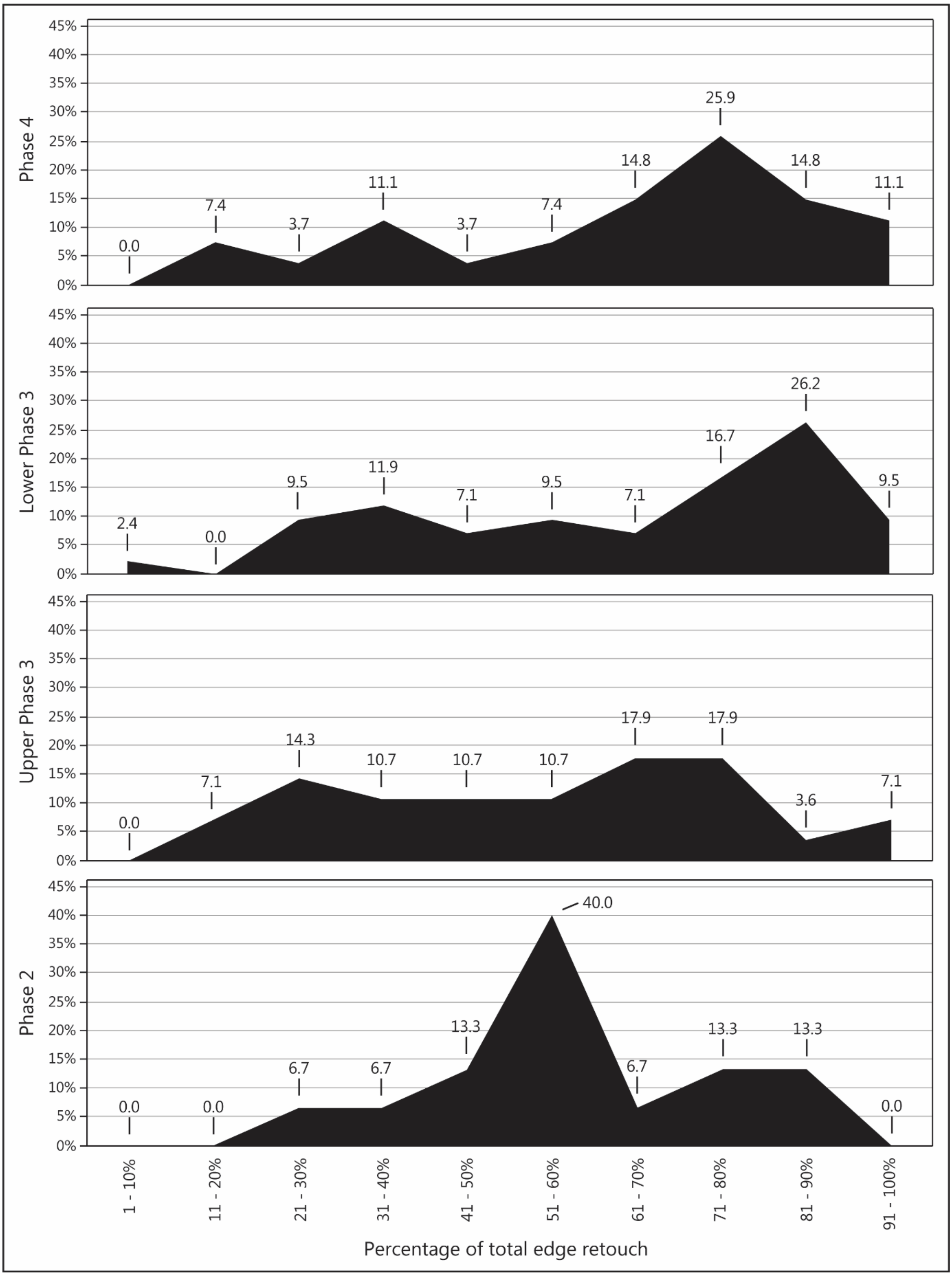


Figure 6.52: Percentage of total edge retouch on multiple tools, by phase.

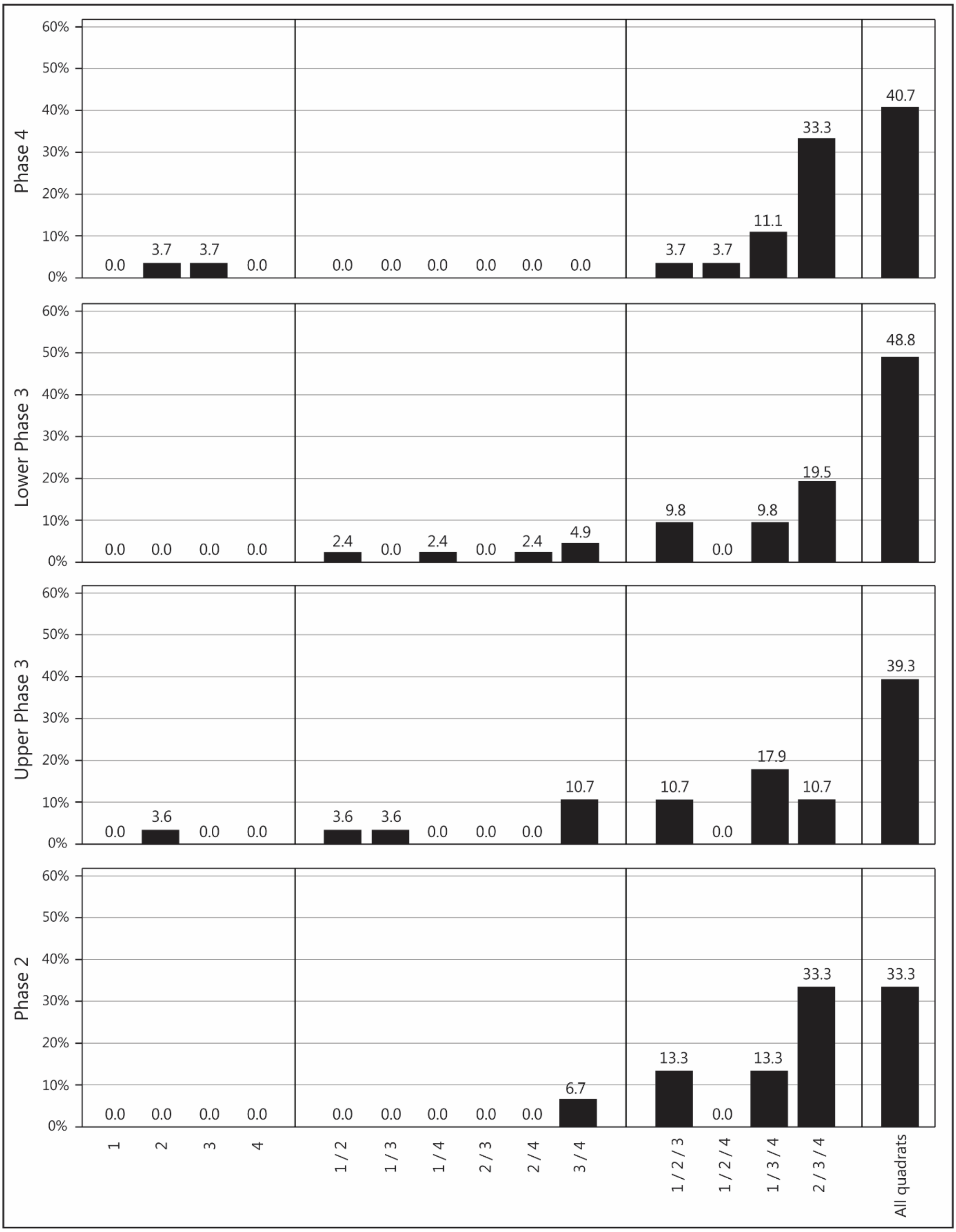


Figure 6.53: Retouch quadrat combinations on multiple tools, by phase.

Multiple tools with retouch distributed around the distal end and both lateral margins (Quadrats 2/3/4) are also common in Phases 4 and 2, comprising a third of either assemblage. Quadrat combinations are more diverse in the Upper and Lower Phase 3 assemblages, with no single combination (other than in all four quadrats) reaching 20% of the sample. The working edge angles of burin bits on the multiple tools vary across time, with the mean angles from the Lower and Upper Phase 3 assemblages being higher than with the Phase 4 and 2 multiple tools (**Table 6.17**).

6.4.3 Burins

6.4.3.1 Dimensions

Burin dimensions remain consistent over time at Wadi Hammeh 27, with the only noticeable variations being a slight decline in their mean width and mass (**Table 6.13**; **Fig. 6.54**). Burin dimensions similarly remain relatively uniform across types, with the main variation being the small number of exceptionally large outliers belonging to the dihedral burin and burin on oblique truncation types (**Table 6.14**; **Fig. 6.55**). Some degree of morphological variation is observable by type, however. For example, while the average burin on convex truncation features dimensions reflecting an elongated form, the transverse burin types exhibit lengths and width similar to one another, reflecting a squatter form on average.

6.4.3.2 Blank attributes

The burins display a greater degree of variability than either the scrapers or multiple tools when it comes to the debitage blanks utilised. Flakes remained the blank of choice for manufacturing burins in every assemblage, although the degree of preference varies across time (**Table 6.4**; **Fig. 6.56**). Upper Phase 3 is the only assemblage where flakes comprise more than half (56.6%) of burin blanks, while this debitage type is least prevalent (39.6%) in Phase 2. Burins manufactured from indeterminate blanks are the second-most common variety in every phase, with these pieces almost outnumbering burins made on flakes in Lower Phase 3. Burins prepared from blade blanks are most numerous in the Phase 4 (11.6%) and Phase 2 samples (13.2%), being noticeably less common in Lower Phase 3 (4.9%) and Upper Phase 3 (8.0%).

Table 6.13: Burin dimensions, by phase.

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	95	41.9	13.1	17.5-104.0	29.3	13.1	9.9-84.8	10.2	4.9	3.1-32.3	17.7	35.2	0.9-321.0
Lower Phase 3	103	39.4	12.6	18.3-107.4	27.3	11.6	10.3-68.7	9.6	5.2	2.3-25.7	15.3	27.7	1.0-252.0
Upper Phase 3	113	39.2	14.3	17.9-85.3	26.2	10.2	7.6-67.6	9.2	4.6	2.7-26.2	12.5	15.1	0.5-110.6
Phase 2	53	40.4	12.8	17.8-80.9	25.0	12.0	8.0-65.6	9.2	5.1	2.4-29.2	13.0	18.1	0.8-115.7

Table 6.14: Burin dimensions, by type (Phases 2-4).

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Dihedral burin	14	40.0	21.1	23.0-107.4	27.5	14.0	12.0-68.7	10.3	4.8	6.5-22.3	25.5	65.5	2.5-252.0
Offset dihedral burin	18	37.8	9.8	20.8-61.4	26.7	9.2	10.1-41.8	7.7	3.2	2.7-13.6	9.1	7.6	1.1-27.4
Dihedral angled burin	22	36.9	16.7	17.5-85.3	30.5	13.7	13.3-67.6	10.4	4.8	3.0-22.2	16.9	23.9	1.0-110.6
Double dihedral burin	7	32.3	6.6	24.2-42.3	28.3	8.6	16.3-39.5	9.5	3.2	5.8-13.4	9.6	4.6	2.6-15.6
Burin on natural surface	74	36.6	10.5	19.7-67.2	25.7	10.0	9.9-48.2	8.7	4.5	2.3-25.0	10.1	10.5	0.8-47.9
Double burin on natural Surface	11	33.2	12.8	17.8-62.5	19.8	9.7	8.2-36.7	6.9	3.2	3.2-11.4	6.2	5.6	1.0-15.0
Burin on straight truncation	14	42.3	14.5	27.9-80.5	24.3	8.4	15.2-41.3	9.2	5.5	3.5-21.2	13.3	14.2	2.6-42.4
Burin on oblique truncation	50	46.7	16.0	17.9-104.0	29.2	15.0	7.6-84.8	10.0	6.3	3.0-32.3	22.6	48.4	0.5-321.0
Burin on concave truncation	14	39.2	6.6	30.4-52.0	29.6	11.3	17.2-58.5	10.5	4.0	5.3-18.3	14.2	10.5	3.9-44.6
Burin on convex truncation	25	46.4	14.7	22.2-80.9	29.4	11.4	12.6-53.4	9.5	4.5	3.6-19.4	16.0	15.1	1.4-54.4
Double burin on truncation	23	43.4	12.1	27.2-71.9	23.7	8.4	12.3-44.4	9.0	4.4	3.1-18.4	13.0	11.4	1.1-35.1
Transverse burin on lateral retouch	20	35.9	9.8	21.7-61.9	30.5	14.6	12.6-69.5	9.1	4.5	2.4-19.5	14.1	21.6	1.0-93.6
Ventral burin	7	46.0	16.1	26.7-71.4	24.2	7.0	12.2-32.7	12.0	5.4	3.8-17.8	13.5	7.0	1.5-22.4
Transverse burin on retouched notch	7	39.9	9.3	30.9-54.3	37.8	9.8	21.7-54.0	13.4	5.7	9.0-25.7	26.3	29.0	8.4-90.7
Double mixed burin	55	39.8	10.8	18.8-84.5	25.9	10.8	8.0-62.7	10.1	4.8	3.8-26.2	13.3	13.2	1.1-70.2

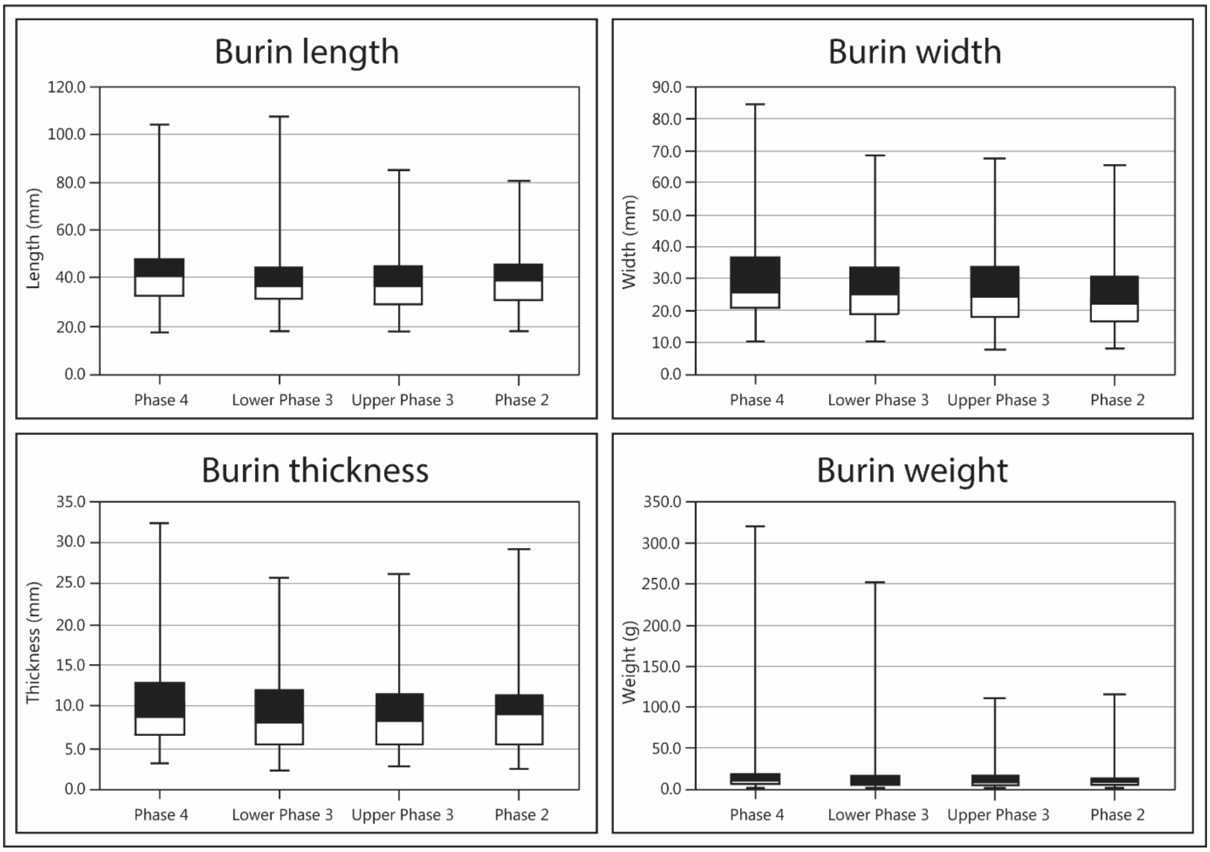


Figure 6.54: Burin dimensions, by phase.

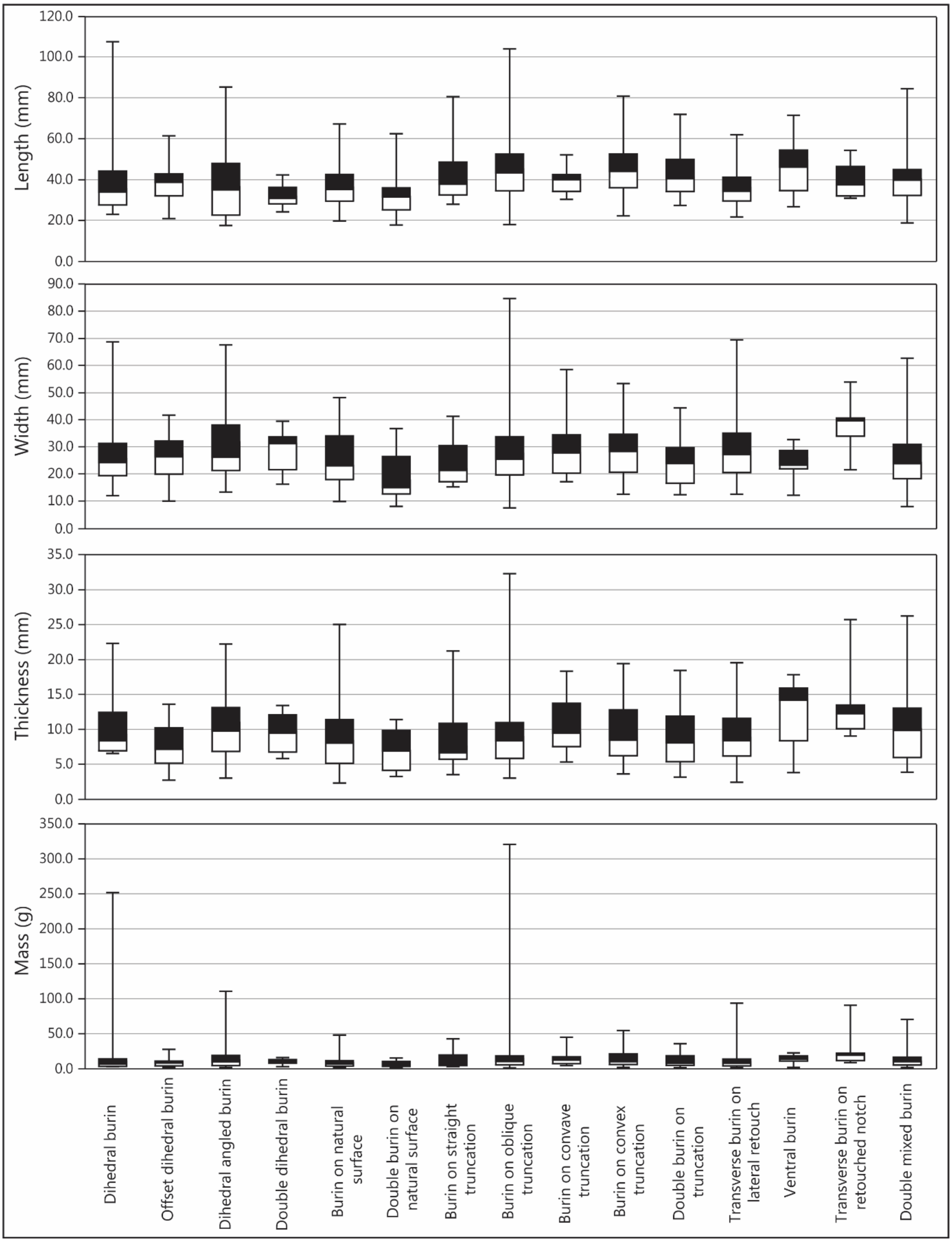


Figure 6.55: Burin dimensions, by type (Phases 2-4).

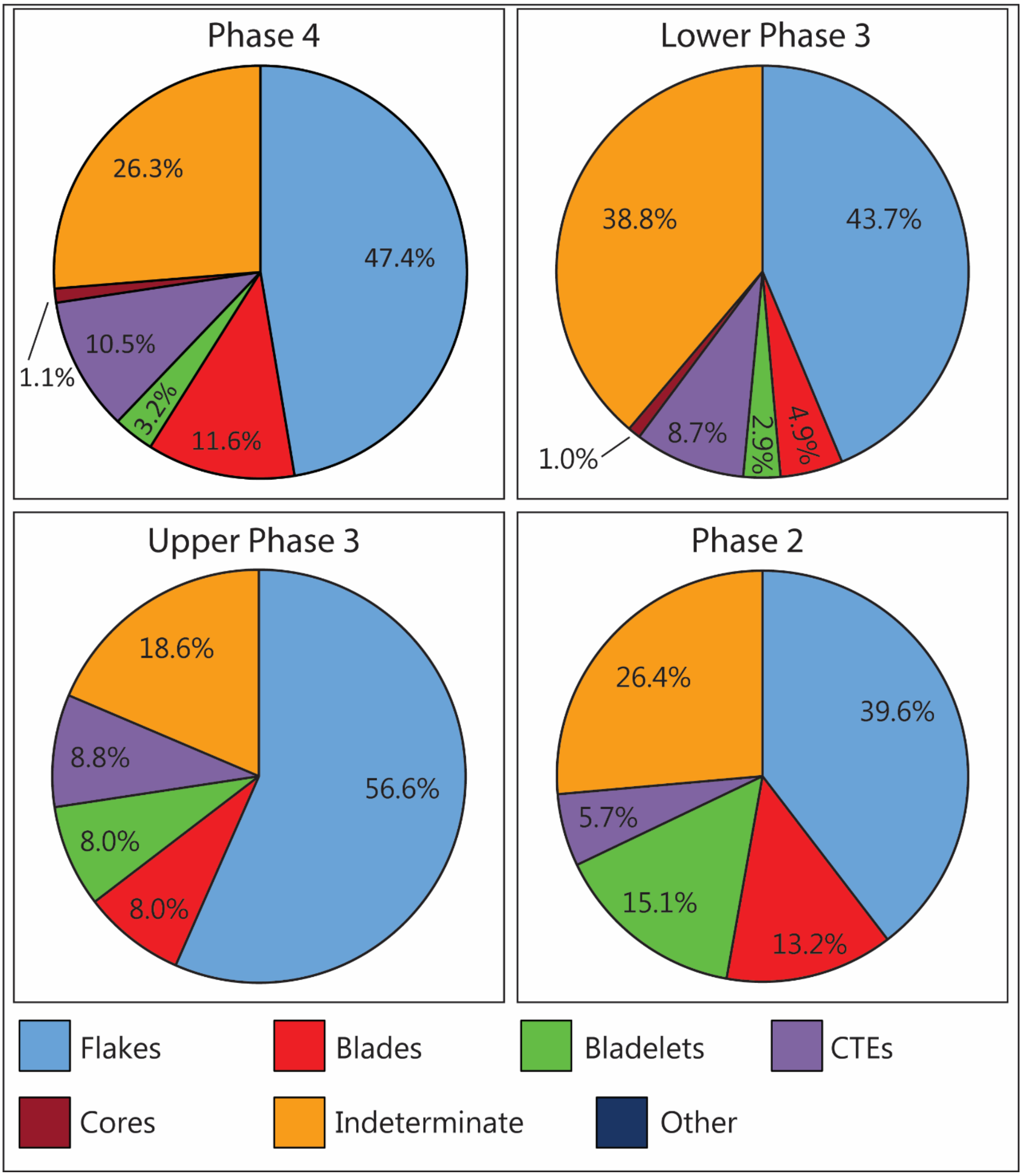


Figure 6.56: Burin blank selection, by phase.

A consistent increase in the proportion of lightweight burins made from bladelet blanks appears to have taken place over time. Such pieces are rare in Phase 4 (3.2%) and Lower Phase 3 (2.9%), before surging in the Upper Phase 3 (8.0%) and Phase 2 (15.1%) assemblages, with these artefacts even outnumbering blade blanks in the latter case. This rise coincides with a decline in the percentages of burins manufactured from core trimming elements between Phase 4 (10.5%) and Phase 2 (5.7%).

The burins are still mostly characterised by flake blanks when segregated by type, with a smaller number of types others being dominated by indeterminate blanks (**Table 6.15**). These latter types are all double-burins, so the increased retouch intensity obscures the type of blank utilised more than with the single burins.

The number of flake scars on burins remains uniform across time in terms of both the average count (N = 4; **Table 6.16**) and overall distribution (**Fig. 6.57**). Burin scar orientations vary slightly over time. The Phase 4 burins exhibit an even mixture of pieces with unidirectional, change of orientation and radial scar patterns (**Fig. 6.58**). The proportions of burins with radial scar patterns subsequently decline incrementally over time, falling from 29.3% in Phase 4 to 16.0% in Phase 2. Conversely, the shares of burins with unidirectional patterns rise over time, eventually comprising a majority (52.0%) in Phase 2.

Burin cortex coverage is consistently low, ranging from 16.1% in Lower Phase 3 to a high of 21.3% in Phase 2 (**Table 6.16**). A rise in the percentage of cortex-free burins is nonetheless observable between Phase 4 (36.8%) and Lower Phase 3 (57.3%), with the proportion of cortex-free burins remaining relatively high through the subsequent Upper Phase 3 (45.1%) and Phase 2 (54.7%) assemblages (**Fig. 6.59**). The relatively low portion of cortex-free Phase 4 burins are supplemented by greater proportions of burins with cortex on less than a third of their dorsal surface and fewer cortex-rich than the subsequent assemblages, however, explaining why the mean level of cortex coverage remains low. Cortex coverage also varies considerably by type, with the lowest mean value occurring on the dihedral burins (6.8%) and burins on concave truncations (12.4%). Conversely, the double burins on natural surface (30.5%), ventral burins (27.9%) and transverse burins on retouched notches (25.0%) all feature significantly greater average levels of cortex coverage, suggesting that the production of these burin types was more commonly associated with the initial reduction of blanks.

Table 6.15: Blanks used to manufacture burins, by type (Phases 2-4).

	N	Flake		Blade		Bladelet		CTE		Indeterminate		Other	
		N	%	N	%	N	%	N	%	N	%	N	%
Dihedral burin	14	6	42.9	0	-	1	7.1	2	14.3	5	35.7	0	-
Offset dihedral burin	18	10	55.6	1	5.6	1	5.6	4	22.2	2	11.1	0	-
Dihedral angled burin	22	12	54.5	3	13.6	0	-	0	-	7	31.8	0	-
Double dihedral burin	7	2	28.6	0	-	0	-	0	-	5	71.4	0	-
Burin on natural surface	74	51	68.9	1	1.4	10	13.5	7	9.5	5	6.8	0	-
Double burin on natural surface	11	1	9.1	1	9.1	2	18.2	1	9.1	6	54.5	0	-
Burin on straight truncation	14	5	35.7	0	-	1	7.1	2	14.3	6	42.9	0	-
Burin on oblique truncation	50	24	48.0	9	18.8	2	4.0	5	10.0	9	18.0	1	2.0
Burin on concave truncation	14	8	57.1	3	21.4	0	-	0	-	3	21.4	0	-
Burin on convex truncation	25	15	60.0	3	12.0	1	4.0	0	-	6	24.0	0	-
Double burin on truncation	23	5	21.7	5	21.7	2	8.7	1	4.3	10	43.5	0	-
Transverse burin on lateral retouch	20	12	60.0	2	10.0	1	5.0	2	10.0	3	15.0	0	-
Ventral burin	7	3	42.9	1	14.3	1	14.3	2	28.6	0	-	0	-
Transverse burin on retouched notch	7	5	71.4	0	-	0	-	2	28.6	0	-	0	-
Double mixed burin	55	16	29.1	3	5.5	1	1.8	4	7.3	31	56.4	0	-

Table 6.16: Burin attributes, by phase.

	N	Flake scars			Percentage of cortex coverage			Percentage of edge retouched		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	94	4	2.3	0-12	19.2	24.1	0-95	41.7	24.1	10-95
Lower Phase 3	103	4	2.5	0-13	16.1	25.2	0-90	48.1	24.0	10-100
Upper Phase 3	112	4	2.3	0-11	20.4	27.3	0-95	46.8	25.4	5-100
Phase 2	52	4	2.2	0-8	21.3	31.7	0-95	43.9	23.8	10-100

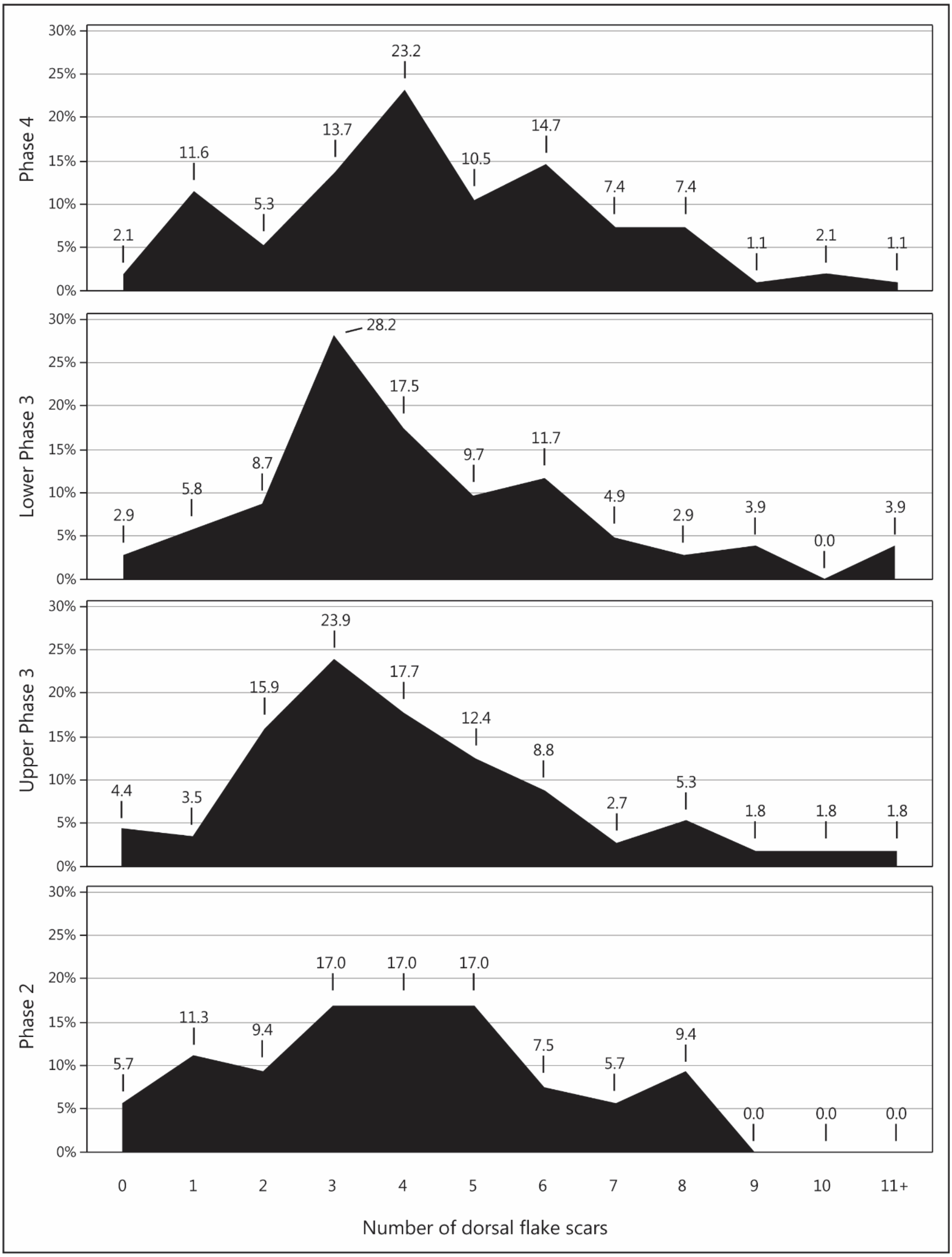


Figure 6.57: Number of negative flake scars on burins, by phase.

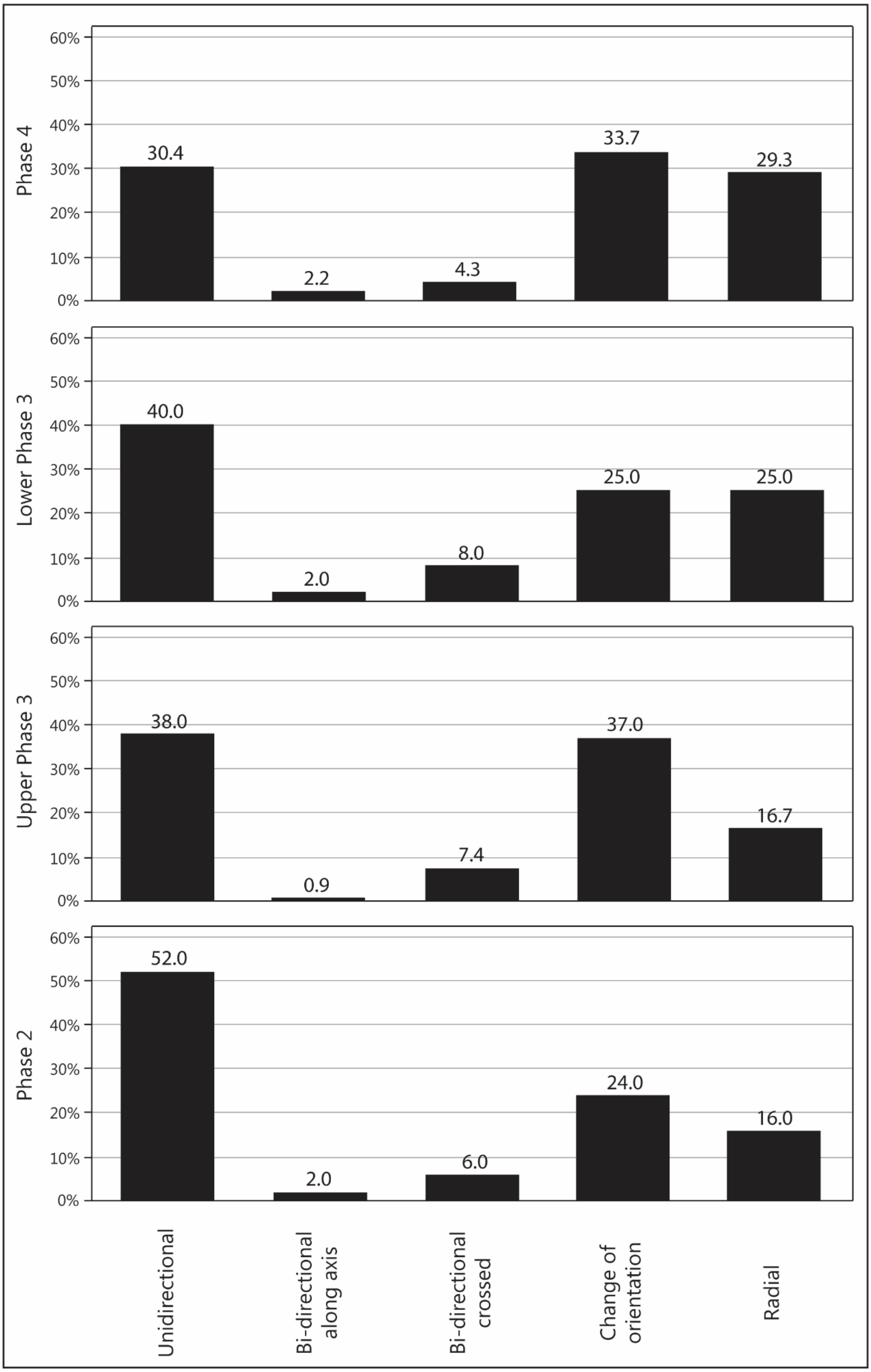


Figure 6.58: Burin scar orientation, by phase.

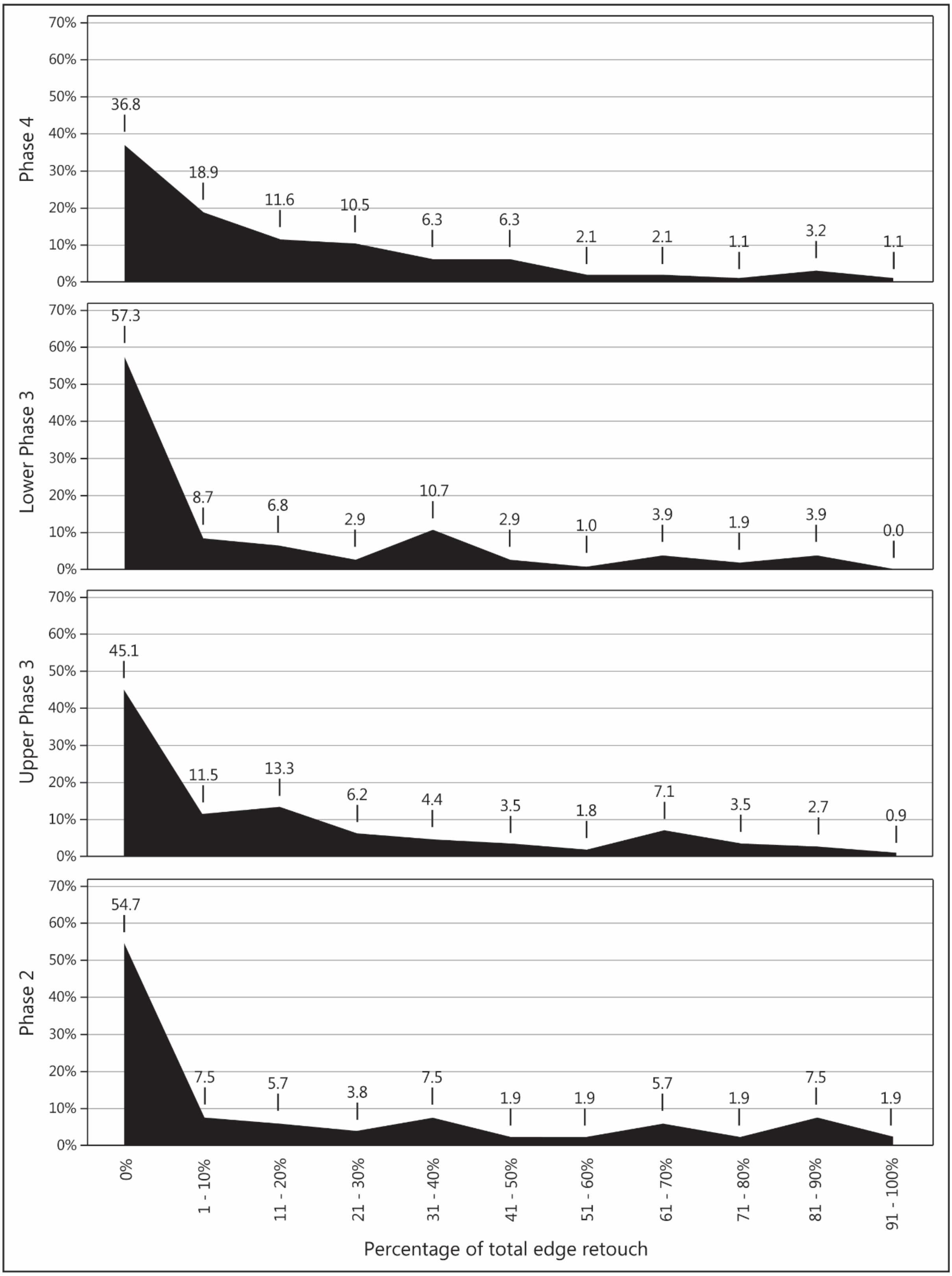


Figure 6.59: Burin dorsal surface cortex coverage, by phase.

6.4.3.3 *Retouch attributes*

The average degree of edge retouch applied the burins (including the percentage of their margins missing through the removal of spalls) remains static over time (**Table 6.16**), with each assemblage exhibiting a relatively even spread of lightly and heavily reduced pieces (**Fig. 6.60**). The amount of retouch varies significantly by type, however, with the burins on natural surface (22.6%) and ventral burins (25.7%) displaying the lowest mean percentages of edge retouch. This is an unsurprising find, given that the retouch on these pieces is restricted to the removal of a single burin spall.

As well as comprising one of the most common burin types in the Wadi Hammeh 27 assemblages, the burins struck from a natural surface are also some of the most morphologically diverse, with the spalls taken from a variety of locations and orientations. Some of the items assigned to this type are likely to represent unfinished dihedral burins, with the objects making their way into the archaeological record prior to the removal of secondary spalls. This explanation is supported by the fact that a large number of these objects possess obtuse working edges unsuited to the creation of the incised pieces found at Wadi Hammeh 27.

Retouch applied in the manufacture of dihedral and offset dihedral burins is primarily focussed on the distal end of the blank, with extensions into one or both of the lateral margins, depending on how invasively the burin spalls were struck. Dihedral angled burins similarly display a clear retouch bias towards the distal end, with the burin facets largely encompassing the termination and one lateral edge, the lateral facet in some cases extending to Quadrat 1.

The greatest amount of edge retouch occurs on double burins, with the average double burin on truncation presenting retouch along three quarters of its edge (77.2%), while the double dihedral burins (68.6%) and double mixed burins (64.3%) likewise exhibit relatively high mean percentages of edge retouch. Conversely, the double burins on natural surface present a far lower average level of edge retouch (50.6%). The presence of these types in each assemblage is reflected by the consistent proportions of burins with retouch covering all four quadrats (**Fig. 6.61**).

Burin bit angles remain relatively static across time and type at Wadi Hammeh 27, with mean angles regularly falling between 70° and 80° (**Table 6.17**). A slight unidirectional increase in the edge angles of truncation burins is nonetheless evident over time, rising from 77° in

Table 6.17: Burin working edge angle, by phase and abridged types. Each working edge has been entered separately for artefacts with two or more burin bits.

	Phase 4				Lower Phase 3				Upper Phase 3				Phase 2			
	N	Mean	SD	Range	N	Mean	SD	Range	N	Mean	SD	Range	N	Mean	SD	Range
Dihedral burins	17	70.6	15.4	39 - 90	19	69.6	11.8	53 - 92	23	70.9	11.8	45 - 90	9	81.8	12.9	62 - 99
Burins on natural surface	21	74.3	14.1	52 - 104	26	76.1	12.9	39 - 96	33	86.5	12.3	61 - 108	16	73.4	18.8	34 - 115
Burins on truncations	43	77.0	11.6	46 - 109	46	80.7	16.3	50 - 123	47	80.2	17.3	43 - 125	16	84.5	14.1	70 - 116
Transverse burins	6	72.5	13.1	54 - 86	8	75.9	24.6	47 - 114	6	73.5	17.3	55 - 100	7	77.7	10.4	67 - 95
Double mixed burins	24	79.9	13.9	52 - 101	35	78.6	17.1	46 - 113	39	73.6	13.3	46 - 108	14	75.7	20.3	37 - 108
Burin/ scrapers	22	79.1	17.2	48 - 123	25	82.3	19.7	31 - 119	17	80.4	12.6	53 - 100	10	77.1	10.9	59 - 95
Burin/ other	6	71.7	11.6	50 - 83	20	80.5	14.4	56 - 110	17	84.2	14.2	60 - 115	5	78.4	14.4	63 - 94

Table 6.18: Distribution of retouch on burins (in quadrats), by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
One quadrat										
1	0	0.0	1	1.0	3	2.7	1	1.9	5	1.4
2	2	2.1	1	1.0	1	0.9	0	0.0	4	1.1
3	9	9.6	6	5.9	5	4.5	2	3.8	22	6.1
4	1	1.1	1	1.0	0	0.0	1	1.9	3	0.8
Sub-total	**12**	**12.8**	**9**	**8.8**	**9**	**8.0**	**4**	**7.7**	**34**	**9.4**
Two quadrats										
1,2	6	6.4	4	3.9	3	2.7	2	3.8	15	4.2
1,3	0	0.0	0	0.0	2	1.8	1	1.9	3	0.8
1,4	7	7.4	6	5.9	6	5.4	6	11.5	25	6.9
2,3	17	18.1	17	16.7	23	20.5	12	23.1	69	19.2
2,4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3,4	7	7.4	8	7.8	13	11.6	3	5.8	31	8.6
Sub-total	**37**	**39.4**	**35**	**34.3**	**47**	**42.0**	**24**	**46.2**	**143**	**39.7**
Three quadrats										
1,2,3	6	6.4	9	8.8	5	4.5	5	9.6	25	6.9
1,2,4	3	3.2	4	3.9	7	6.3	0	0.0	14	3.9
1,3,4	10	10.6	5	4.9	6	5.4	4	7.7	25	6.9
2,3,4	12	12.8	15	14.7	9	8.0	7	13.5	43	11.9
Sub-total	**31**	**33.0**	**33**	**32.4**	**27**	**24.1**	**16**	**30.8**	**107**	**29.7**
Four quadrats										
Sub-total	**14**	**14.9**	**25**	**24.5**	**29**	**25.9**	**8**	**15.4**	**76**	**21.1**
Total	**94**	**100.1**	**102**	**100.0**	**112**	**100.0**	**52**	**100.1**	**360**	**99.9**

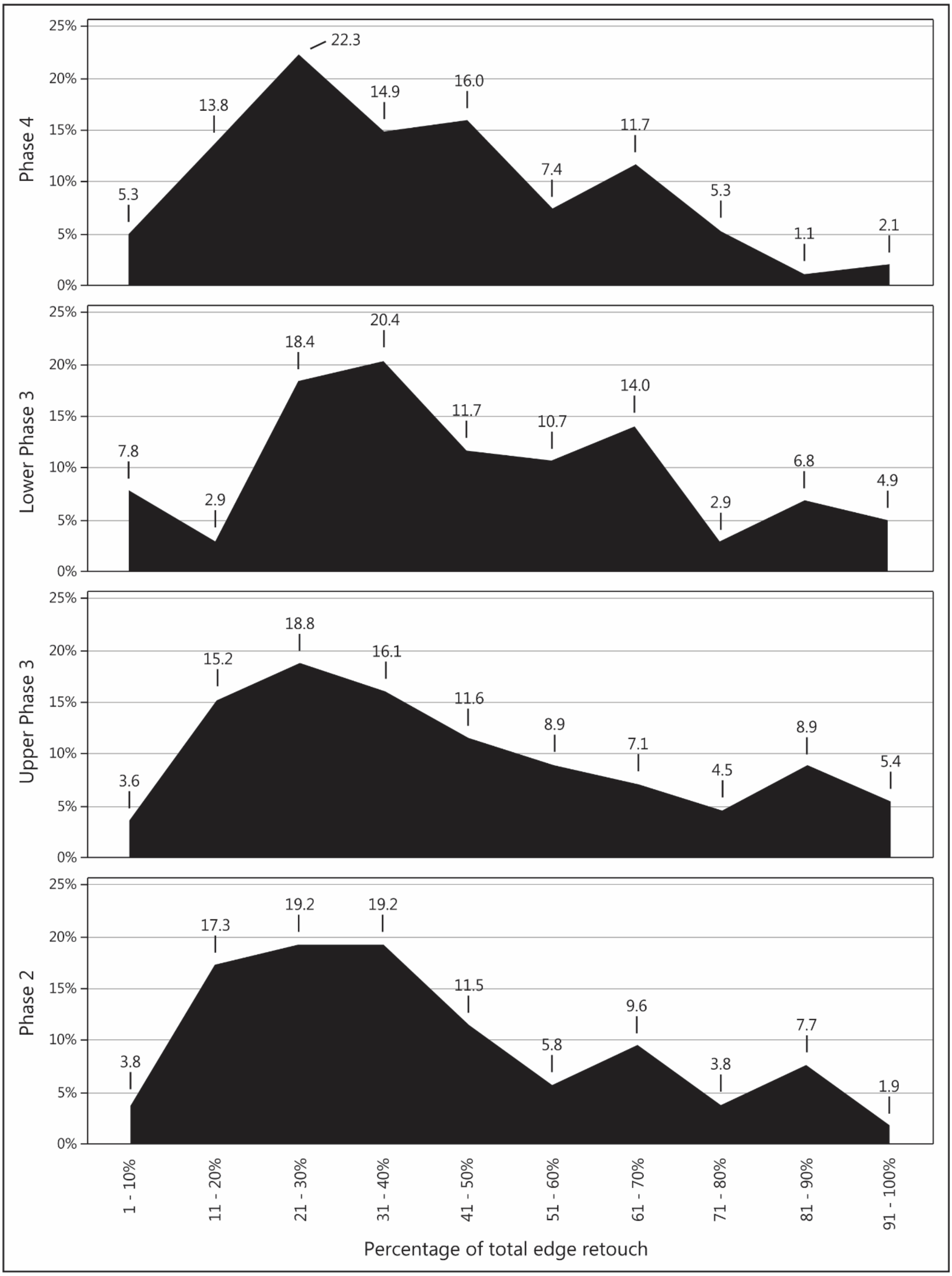


Figure 6.60: Percentage of total edge retouch on burins, by phase.

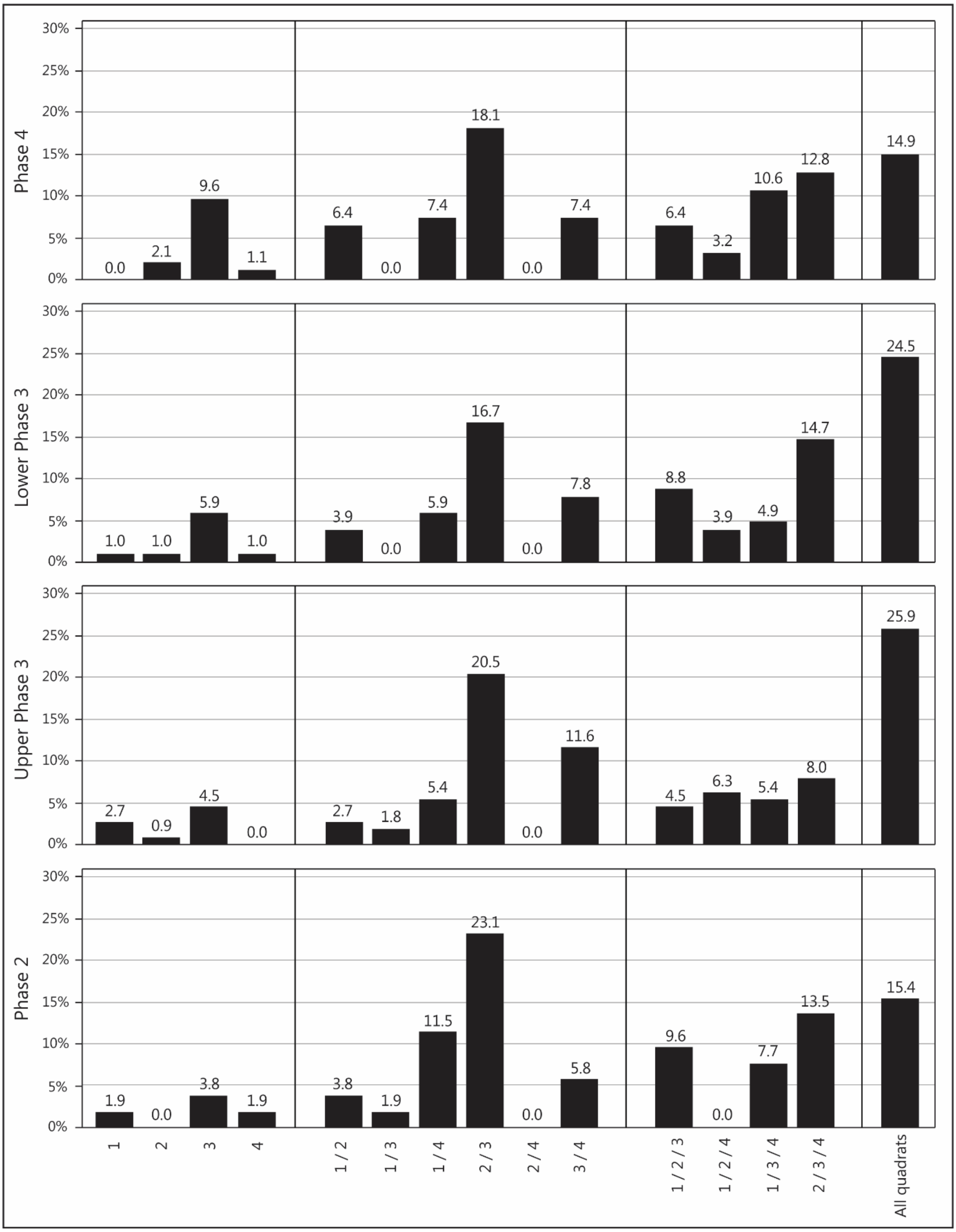


Figure 6.61: Retouch quadrat combinations on burins, by phase.

Phase 4 to 84.5° in Phase 2. The mean edge angle of the dihedral burins is also considerably higher in Phase 2 (81.8°) than in any of the underlying assemblages, where they fall consistently around 70°. Similarly, the mean working edge of the burins on a natural surface in Upper Phase 3 (86.5°) is notably higher than any of the other analysed samples for this type.

6.4.4 Retouched blades and non-geometric microliths

Given the arbitrary dimensional division between many of the retouched blade and non-geometric microlith types, the dimensions of these two tool groups are presented together in this subchapter. Conversely, the discussion of the debitage and retouch attributes of the retouched blades and non-geometric microliths are segregated under separate sub-headings.

6.4.4.1 Dimensions

The dimensions of retouched blades and bladelets remain largely static over time at Wadi Hammeh 27, with averages consistently falling within the microlithic range (**Table 6.19**; **Fig. 6.62**). Differentiations can nonetheless be made when the retouched blades and non-geometric microliths are segregated by mode of retouch (**Table 6.20**; **Fig. 6.63**). Blades and bladelets retouched on both edges tend to be larger and heavier on average than the other types, reflecting the invariable presence of small numbers of exceptionally large, most likely handheld, blades, and the underrepresentation of microliths with this retouch layout.

In contrast, the blades and bladelets with semi-steep, Helwan and abrupt retouch possess maximum ranges which barely surpass microlithic dimensions, indicating that pieces assigned to the relevant types were mainly utilised as hafted sickle elements. Likewise, while the majority of the blades and bladelets with alternating or inverse retouch exhibit microlithic dimensions, the maximum range of both artefact groups extend well into blade dimensions, suggesting that these types represent a combination of sickle elements and more versatile tools. The blades and bladelets utilising Helwan or abrupt retouch also present notably smaller standard deviations between their length and width than the other types, likely reflecting a greater degree of size standardisation.

Table 6.19: Retouched blade and non-geometric microlith dimensions, by phase.

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	35	36.9	15.4	20.7 - 95.2	12.2	6.7	6.0 - 33.8	3.8	2.4	1.8 - 14.2	3.4	7.8	0.3 - 42.1
Lower Phase 3	48	39.7	19.1	19.2 - 108.7	13.3	6.9	5.2 - 41.6	4.6	2.8	1.4 - 15.1	4.8	11.0	0.1 - 62.2
Upper Phase 3	36	41.0	15.8	22.7 - 106.0	14.0	6.9	6.8 - 42.7	4.0	2.1	1.7 - 12.1	3.8	8.1	0.2 - 48.6
Phase 2	32	37.2	9.9	22.3 - 66.7	11.7	4.5	6.3 - 23.8	3.6	1.6	2.0 - 9.9	2.3	2.5	0.2 - 9.5

Table 6.20: Retouched blade and non-geometric microlith dimensions, by mode of retouch (Phases 2-4).

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Partially retouched	21	37.0	9.9	20.6 - 55.0	13.5	4.8	7.2 - 55.0	3.8	1.9	1.8 - 7.8	2.2	2.0	0.2 - 6.8
Semi-steep retouch	12	35.1	11.5	20.7 - 56.8	11.1	4.2	6.3 - 22.6	3.3	0.9	2.0 - 5.0	1.8	2.1	0.3 - 7.8
Retouched on both edges	12	56.3	24.9	29.4 - 98.5	18.9	10.2	7.4 - 33.8	6.6	4.2	2.6 - 14.2	13.0	15.6	0.9 - 42.1
With alternating retouch	10	54.1	30.6	28.5 - 108.7	18.5	13.4	6.4 - 42.7	5.9	4.3	1.7 - 15.1	13.3	22.6	0.2 - 62.2
Inverse retouch	12	42.5	17.5	25.2 - 79.8	14.0	5.6	6.5 - 27.1	4.4	1.8	2.0 - 8.5	3.8	4.0	0.2 - 11.4
Helwan retouch	38	36.7	8.6	22.7 - 57.6	9.9	2.6	6.0 - 16.3	3.5	1.1	1.7 - 6.5	1.5	1.0	0.2 - 4.2
Abrupt retouch	26	34.2	8.3	20.0 - 55.2	11.2	3.4	6.6 - 21.7	3.4	1.6	1.7 - 9.9	1.8	1.9	0.4 - 8.9

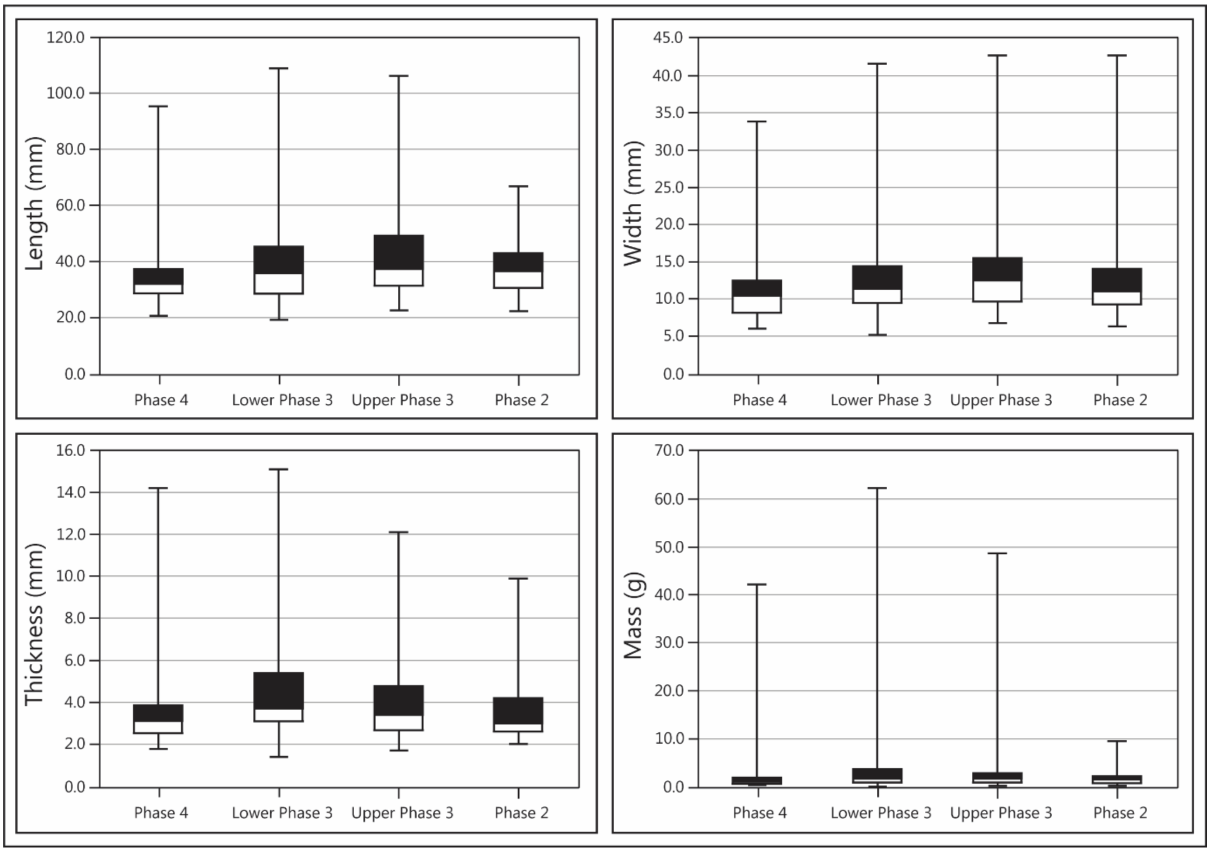


Figure 6.62: Retouched blade and non-geometric microlith dimensions, by phase.

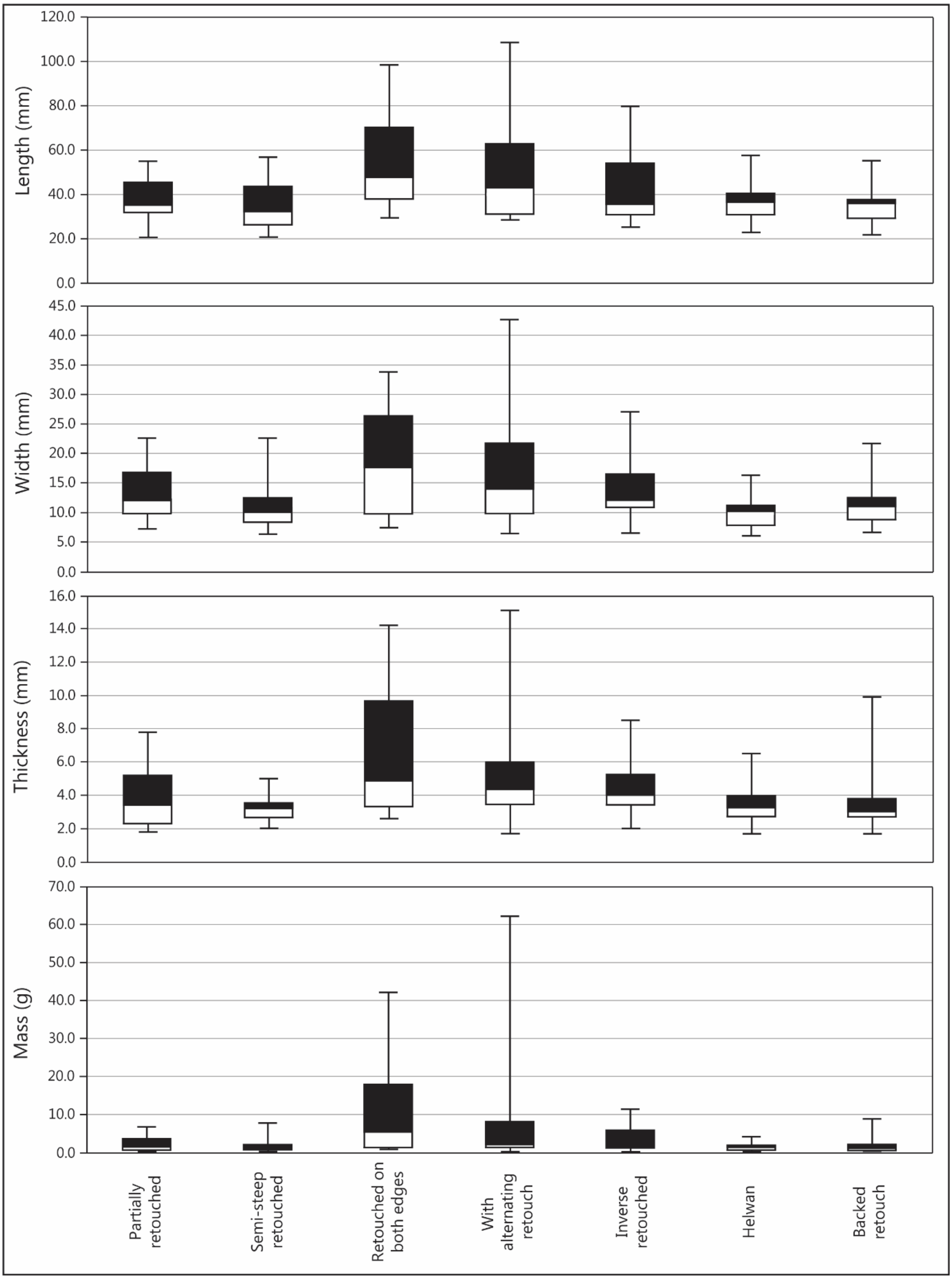


Figure 6.63: Retouched blade and non-geometric microlith dimensions, by mode of retouch (Phases 2-4).

6.4.4.2 Retouched blade blank attributes

The number of dorsal scars on the retouched blades vary over time, with the Phase 4 and Lower Phase 3 assemblages displaying preferences for pieces with three and four flake scars respectively, while the Upper Phase 3 and Phase 2 retouched blades present a more even spread of scar counts (**Table 6.21**; **Fig. 6.64**).

The scar orientation of the retouched blades is overwhelmingly unidirectional in Phases 4 and 2, whereas the Phase 3 assemblages feature more even combinations of unidirectional and change of orientation scar layouts (**Fig. 6.65**). Cortex is extremely scarce on the retouched blades, with none of the Phase 4 and 3 assemblages surpassing an average dorsal surface coverage of 5%, while none of the Phase 2 examples possess any cortex at all (**Table 6.21**). On a similar note, none of the analysed Helwan blades from each assemblage feature cortex, indicating that these artefacts were produced from similarly specialised, prepared blade cores as their microlithic counterparts.

6.4.4.3 Retouched blade retouch attributes

The retouched blades of Wadi Hammeh 27 neatly fall into three clusters based on the degree of edge retouch applied (**Fig. 6.66**). The first cluster involves pieces with retouch on 20% or less of the edge, all of which fall under the 'blade partially retouched on one edge' type. The second cluster represent pieces with retouch covering between 40% and 60% of their edge; these represent blades intensively retouched along one edge as well as the proximal and/or distal of the blade, primarily to serve as composite sickle elements. In many cases, the retouch applied to the hafted edge of the blade grades into an oblique curve at each end, blurring the line between edge retouch and truncation, while in other cases the truncated ends are more squared. The third cluster incorporates pieces with 80% and above of their edge being retouched, in most cases relating to the aforementioned robust blades retouched on both edges.

Of the pieces with retouch located on a single edge, the Phase 4 and Lower Phase 3 assemblages display no bias to either the left or right lateral margin (**Table 6.22**; **Fig. 6.67**). Conversely, the Upper Phase 3 sample features twice as many pieces with retouch covering the right lateral margin (Quadrats 1/3/4; 50.0%) than the left margin (Quadrats 1/2/3; 25.0%). This trend continues into Phase 2, where none of the blades exhibit targeted retouch along the

Table 6.21: Retouched blade attributes, by phase.

	N	Flake scars			Percentage of cortex coverage			Percentage of edge retouch		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	6	3	0.4	3-4	1.7	4.1	0-10	62.5	31.3	5-85
Lower Phase 3	11	5	1.9	2-8	5.0	12.4	0-40	56.4	27.3	10-90
Upper Phase 3	8	5	2.4	2-8	5.0	10.7	0-30	53.1	21.0	15-90
Phase 2	5	4	1.9	2-7	0.0	0.0	0	68.0	24.9	50-100

Table 6.22: Distribution of retouch on retouched blades (in quadrats), by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
One quadrat										
1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3	1	16.7	1	9.1	0	0.0	0	0.0	2	6.7
4	0	0.0	0	0.0	1	12.5	0	0.0	1	3.3
Sub-total	**1**	**16.7**	**1**	**9.1**	**1**	**12.5**	**0**	**0.0**	**3**	**10.0**
Two quadrats										
1,2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1,3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1,4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2,3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2,4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3,4	0	0.0	2	18.2	0	0.0	0	0.0	2	6.7
Sub-total	**0**	**0.0**	**2**	**18.2**	**0**	**0.0**	**0**	**0.0**	**2**	**6.7**
Three quadrats										
1,2,3	1	16.7	2	18.2	2	25.0	0	0.0	5	16.7
1,2,4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1,3,4	1	16.7	2	18.2	4	50.0	3	60.0	10	33.3
2,3,4	1	16.7	0	0.0	0	0.0	0	0.0	1	3.3
Sub-total	**3**	**50.0**	**4**	**36.4**	**6**	**75.0**	**3**	**60.0**	**16**	**53.3**
Four quadrats										
Sub-total	**2**	**33.3**	**4**	**36.4**	**1**	**12.5**	**2**	**40.0**	**9**	**30.0**
Total	**6**	**100.0**	**11**	**100.1**	**8**	**100.0**	**5**	**100.0**	**30**	**100.0**

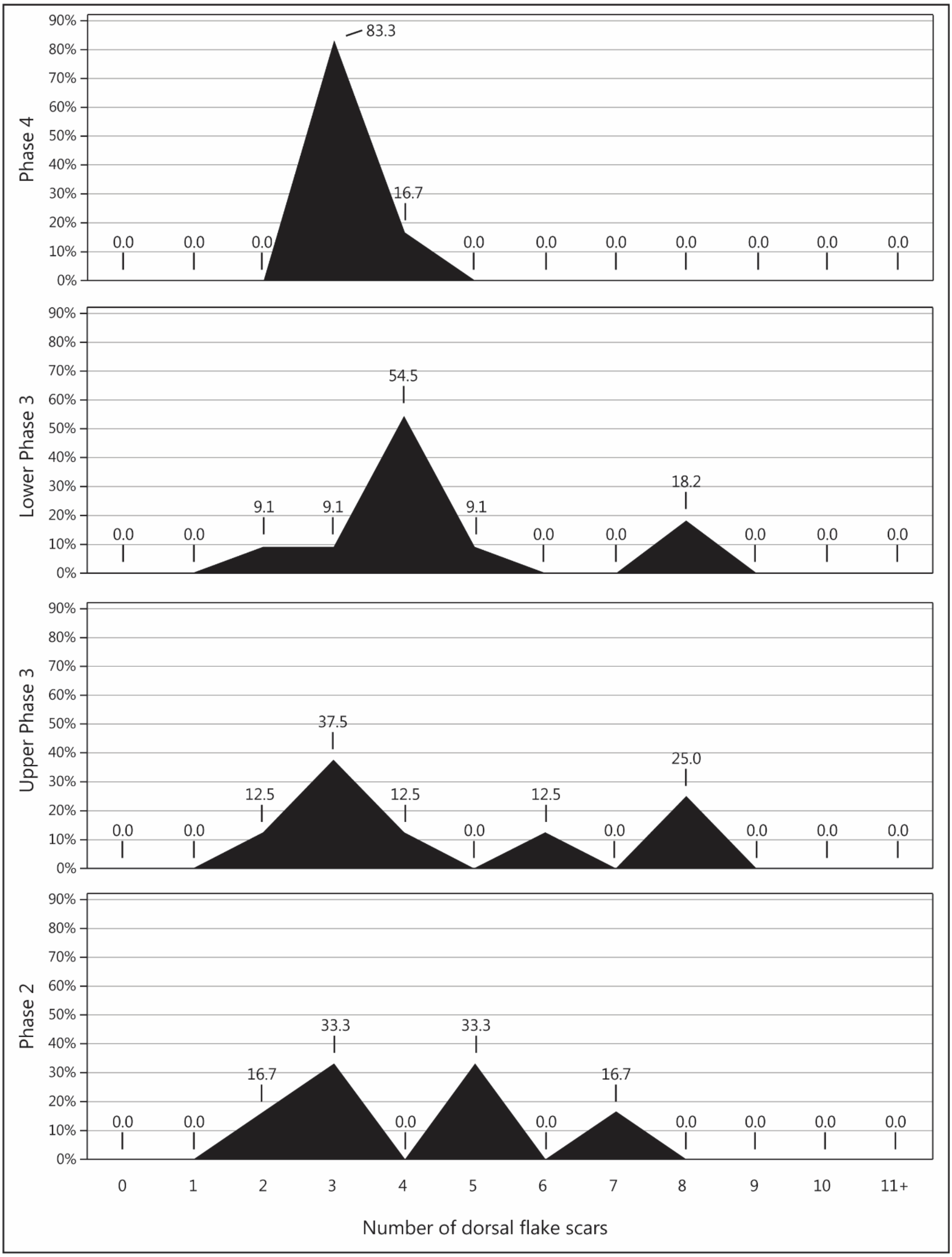


Figure 6.64: Number of negative flake scars on retouched blades, by phase.

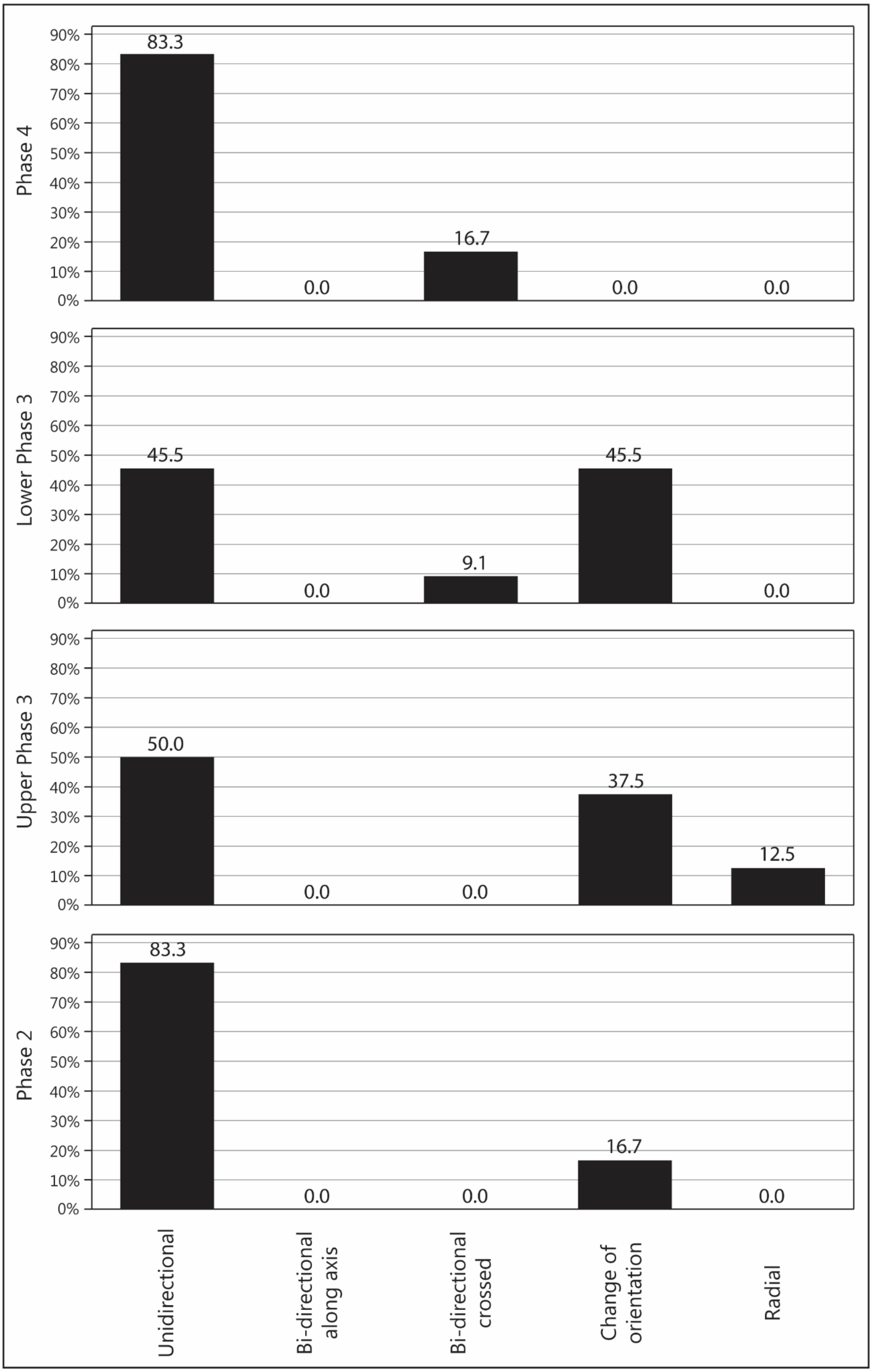


Figure 6.65: Retouched blade scar orientation, by phase.

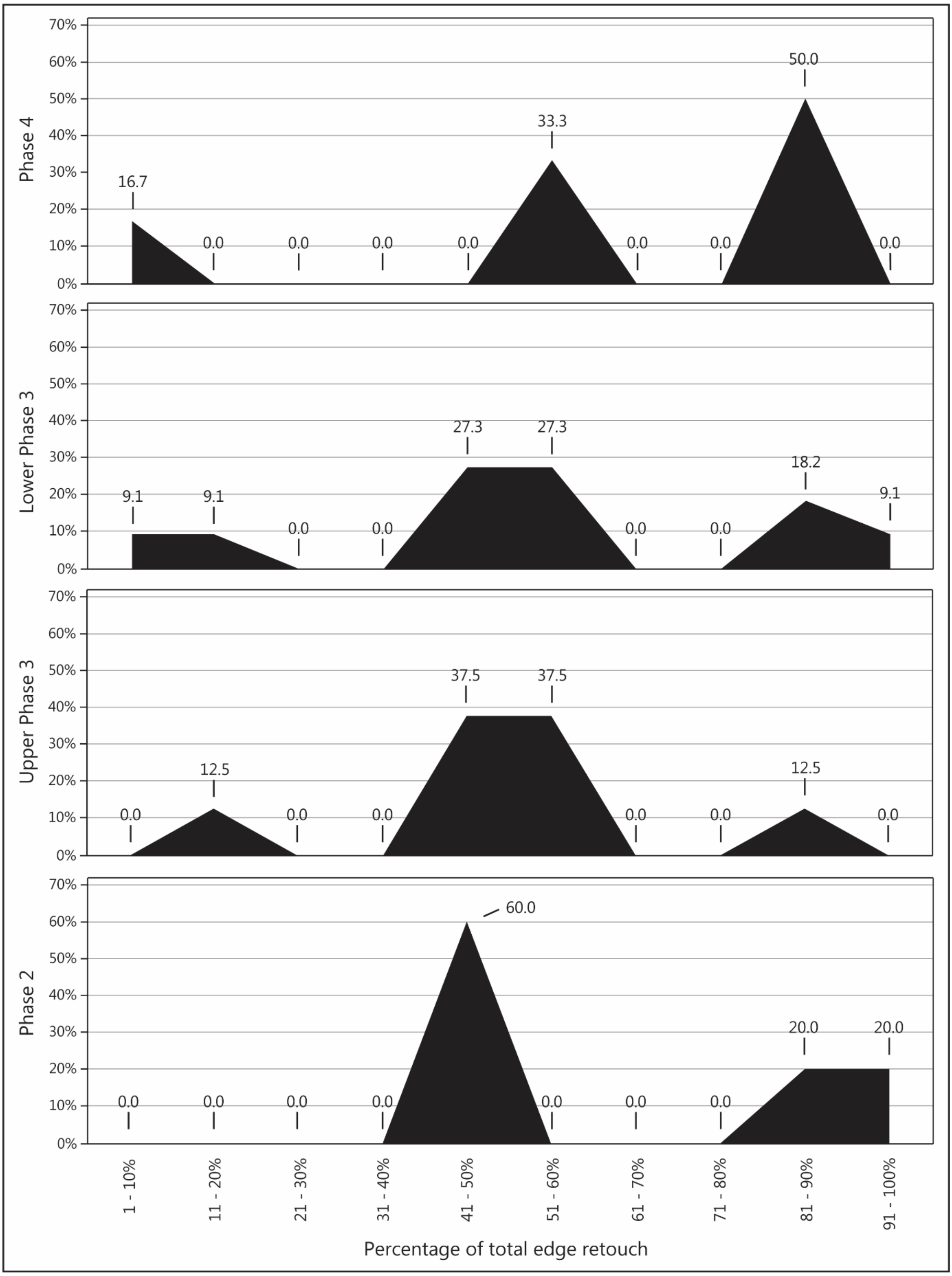


Figure 6.66: Percentage of total edge retouch on retouched blades, by phase.

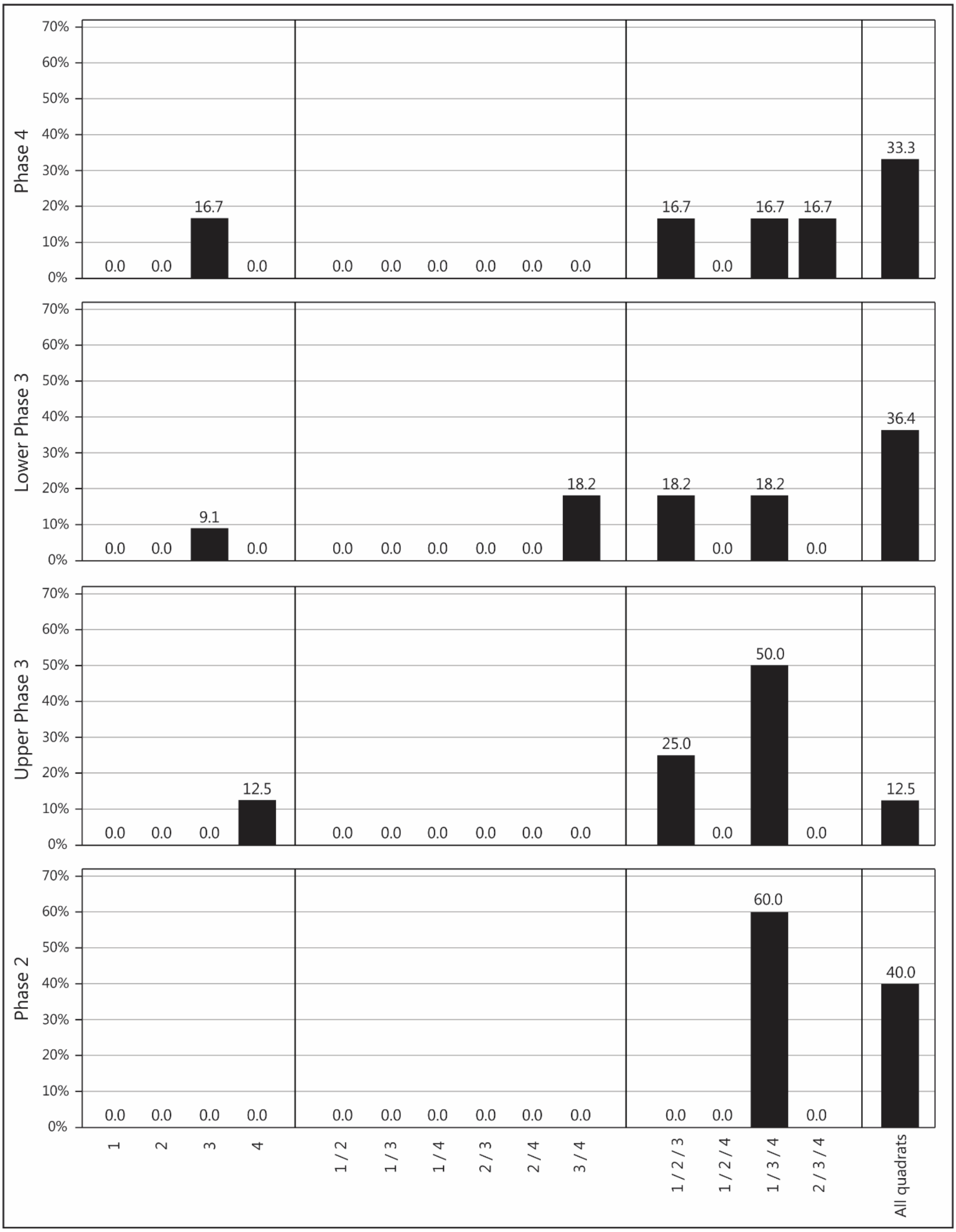


Figure 6.67: Retouch quadrat combinations on retouched blades, by phase.

left lateral margin, through this may be simply the result of bias from the small sample sizes involved rather than a genuine technological development. Aside from Helwan blades demonstrating a tendency towards being retouched along the right lateral margin (80.0%) and blades retouched on both edges featuring retouch in all four quadrats (83.3%), the sample sizes for the other types are too low for any trends in retouch distribution to be apparent.

The proportion of retouched blades with evidence of silica sheen is high, with a third (32.3%) of those analysed featuring this attribute (**Table 6.23**). This feature is particularly prevalent in Phase 4, where silica sheen was recorded on three of the six retouched blades analysed. The occurrence of silica sheen on the retouched blades is also heavily influenced by type. Four out of the five analysed Helwan blades exhibit extensive sheen along their working edge, as do three of the five backed blades. Conversely, only a single blade with alternating retouch and none of the six blades retouched on both edges bear silica sheen. These findings support the notion that these latter two types served primarily as generalised, handheld knives, whereas the application of Helwan and abrupt retouch was restricted to specialised sickle elements.

6.4.4.4 Non-geometric microlith blank attributes

The number of dorsal scars on non-geometric microliths remain consistent across time, with each assemblage averaging three or four flake scars (**Table 6.24**; **Fig. 6.68**). Unidirectional scar orientations dominate all four assemblages (**Fig. 6.69**). Non-geometric microliths with this pattern comprise steady proportions of the Phase 4 and 3 assemblages (67.6% to 71.4%), before surging in Phase 2, where they encompass most of the sample (86.2%). This rise partially coincides with a persistent decline in the shares of microliths with bi-directional crossed layouts from Phase 4 (17.2%) to Phase 2 (3.4%). The percentages of pieces with change of orientation layouts fluctuate across assemblages, being highest in Lower Phase 3 (21.4%) and relatively uncommon in Phases 4 and 2 (10.3% each). All four assemblages are dominated by pieces entirely free of cortex, with the highest average coverage in Lower Phase 3 (3.2%) and lowest in Phase 2 (0.7%; **Table 6.24**; **Fig. 6.70**).

Table 6.23: Percentages of retouched blades and non-geometric microliths with sickle sheen, by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		**Total**	
	N	%	N	%	N	%	N	%	**N**	**%**
Retouched blades										
Partially retouched	-	-	0	0.0	0	0.0	-	-	**0**	**0.0**
Semi-step retouch	-	-	-	-	-	-	0	0.0	**0**	**0.0**
Retouched on both edges	0	0.0	0	0.0	0	0.0	-	-	**0**	**0.0**
With alternating retouch	-	-	1	50.0	0	0.0	0	0.0	**1**	**20.0**
Inverse retouch	-	-	0	0.0	1	50.0	1	100.0	**2**	**50.0**
Helwan retouch	1	100.0	1	50.0	1	100.0	1	100.0	**4**	**80.0**
Backed retouch	1	100.0	0	0.0	1	100.0	1	50.0	**3**	**60.0**
Other	0	0.0	0	0.0	-	-	-	-	**0**	**0.0**
Total	**2**	**33.3**	**2**	**18.2**	**3**	**37.5**	**3**	**50.0**	**10**	**32.3**
Non-geometric microliths										
Partially retouched	0	0.0	0	0.0	0	0.0	1	33.3	**1**	**5.3**
Semi-step retouch	1	16.7	1	100.0	2	50.0	-	-	**4**	**9.1**
Retouched on both edges	-	-	1	33.3	2	66.7	-	-	**3**	**50.0**
With alternating retouch	1	100.0	0	0.0	-	-	0	0.0	**1**	**20.0**
Inverse retouch	1	50.0	1	33.3	1	100.0	1	33.3	**4**	**44.4**
Helwan retouch	6	66.7	4	44.4	3	60.0	5	50.0	**18**	**54.5**
Backed retouch	2	50.0	1	16.7	1	20.0	1	16.7	**5**	**23.8**
Other	0	0.0	0	0.0	1	25.0	0	0.0	**1**	**5.9**
Total	**11**	**37.9**	**8**	**21.6**	**10**	**35.7**	**8**	**29.6**	**37**	**30.6**

Table 6.24: Non-geometric microlith attributes, by phase.

	N	Flake scars			Percentage of cortex coverage			Percentage of edge retouched		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	29	3	1.5	1-9	1.0	3.9	0-15	42.6	17.9	10-60
Lower Phase 3	37	4	1.7	1-9	3.2	9.1	0-40	41.1	23.9	5-100
Upper Phase 3	28	4	1.7	2-8	1.3	4.0	0-15	40.7	23.1	5-95
Phase 2	27	3	1.4	1-7	0.7	3.8	0-20	46.5	20.4	5-80

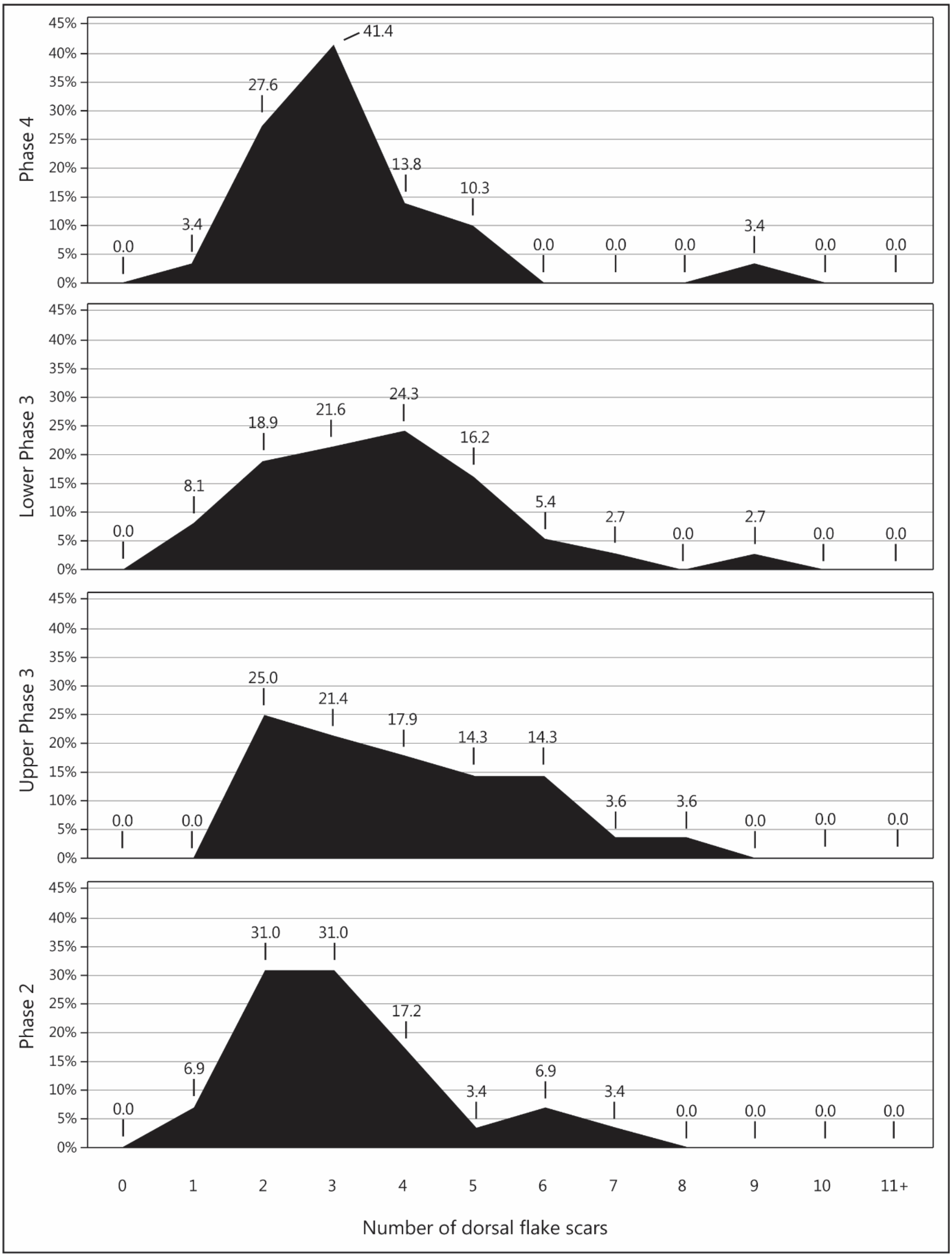


Figure 6.68: Number of negative flake scars on non-geometric microliths, by phase.

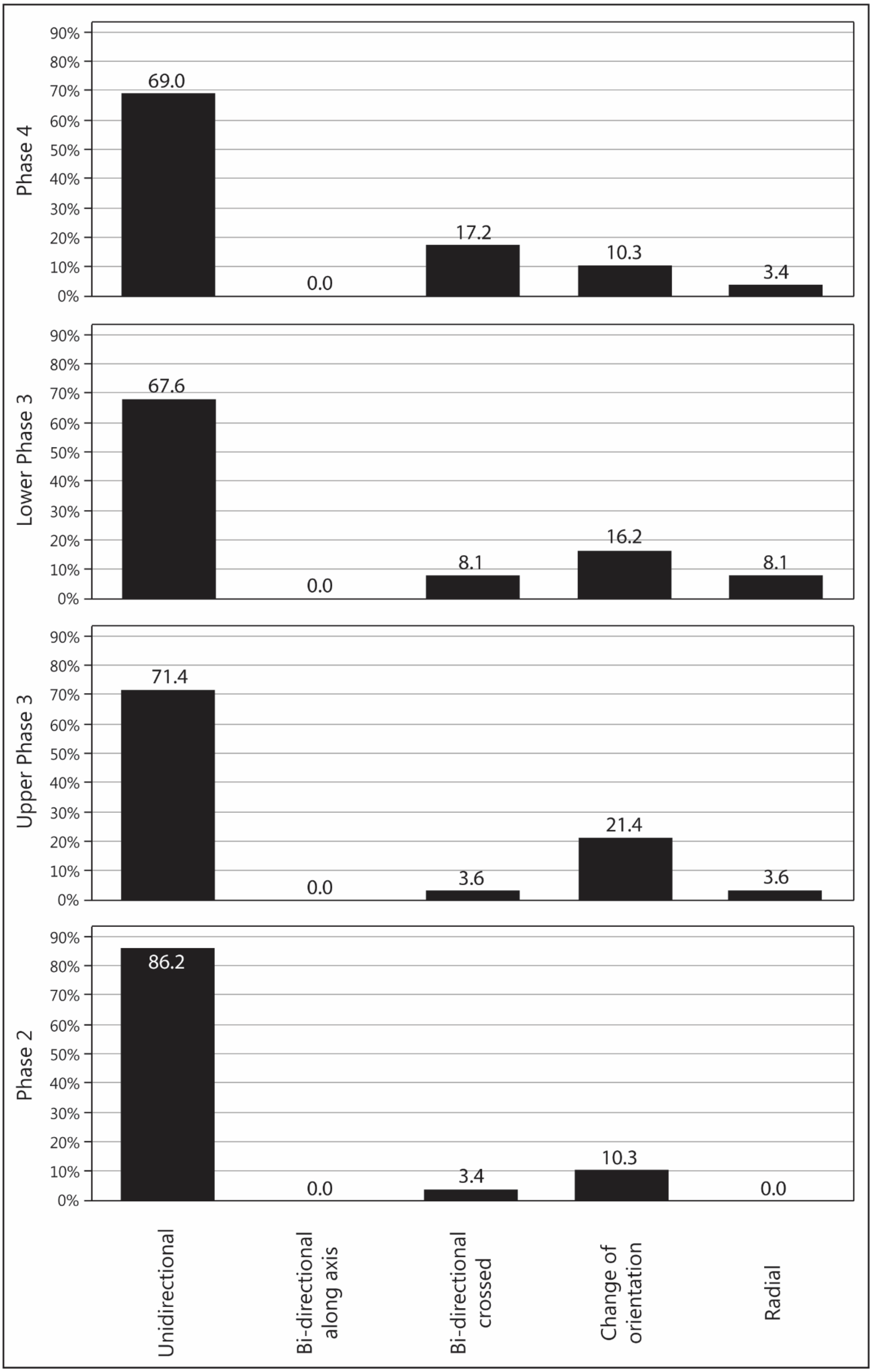


Figure 6.69: Non-geometric microlith scar orientation, by phase.

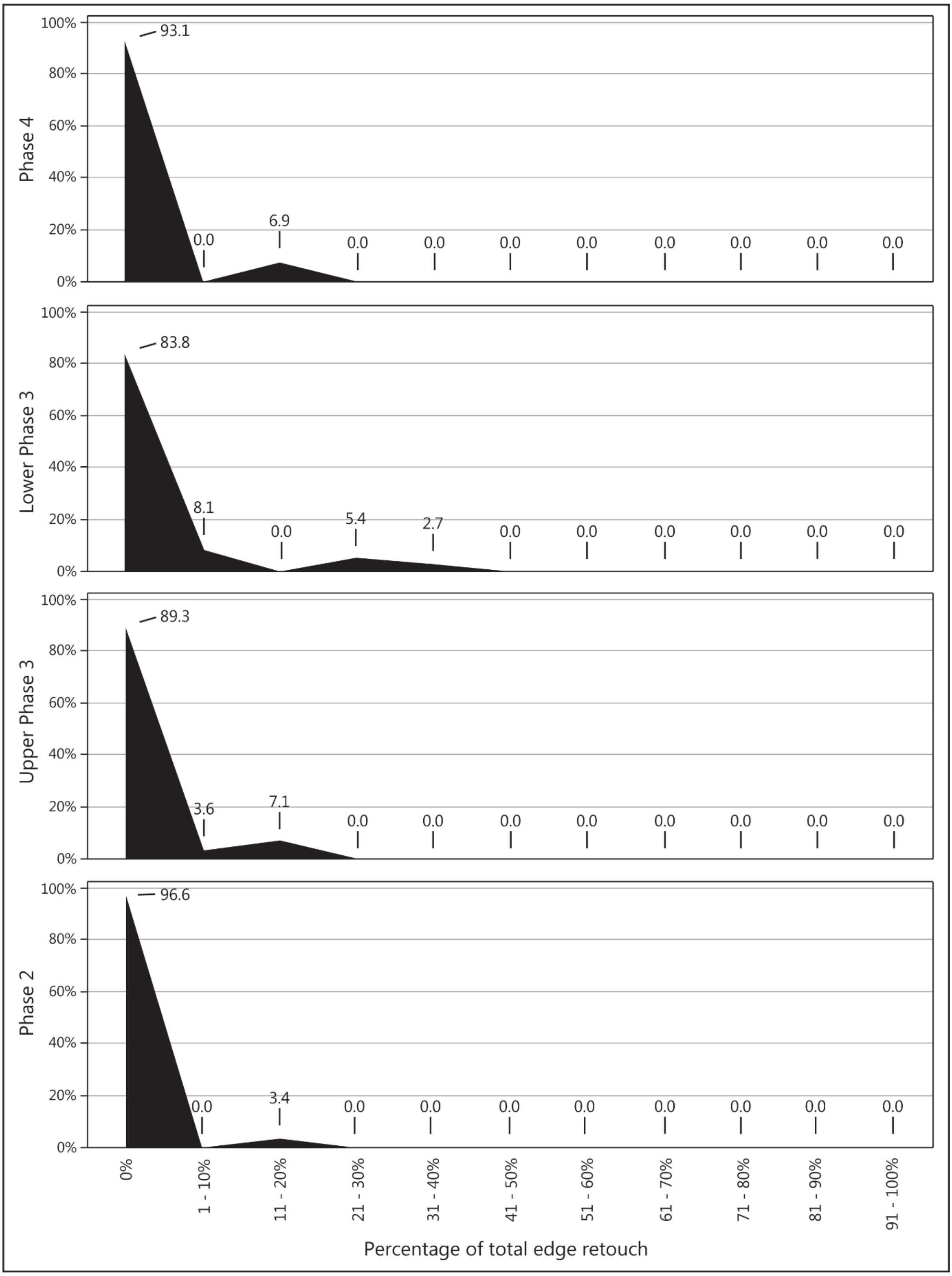


Figure 6.70: Non-geometric microlith dorsal surface cortex coverage, by phase.

6.4.4.5 Non-geometric microlith retouch attributes

The degree of retouch applied to the non-geometric microlith assemblages remains static over time, ranging between a low of 40.7% in Upper Phase 3 to a peak of 46.5% in Phase 2 (**Table 6.24**). Much like the retouched blades, the non-geometric microliths can be categorised primarily between those featuring irregular, disjoined retouch and those completely retouched along one edge, albeit with some overlap between these two groups (**Fig. 6.71**). These two clusters can also be assigned typologically by their mean percentages of edge retouch, with the first group being represented by the partially retouched bladelets (15.0%), along with types distinguished purely through a truncated end, such as the obliquely-truncated bladelets (12.2%) and convex-truncated bladelets (12.0%) On the other hand, bladelets with alternating retouch (51.0%), inverse bladelets (50.6%), Helwan bladelets (55.6%), curved backed bladelets (50.0%), obliquely-truncated backed bladelets (53.3%) straight-truncated retouched bladelets (53.3%) and straight bi-truncated backed bladelets (60.0%) all fall neatly into the second group. No clear preference for the location of edge retouch can be noted over time, with pieces retouched along the right lateral margin (Quadrats 1/3/4) slightly outnumbering those retouched along the left edge (Quadrats 1/2/3) in Phase 4 and Lower Phase 3, whereas the opposite situation is recorded in Upper Phase 3 and Phase 2 (**Table 6.25; Fig. 6.72**).

The manifestation of silica sheen on non-geometric microliths remains consistent over time, with around one third of the pieces analysed from each assemblage exhibiting this characteristic (**Table 6.23**). The only significant variation occurs in Lower Phase 3, where only one fifth of the artefacts sampled (21.6%) feature sheen. The typological occurrence of silica sheen on the non-geometric microliths resembles that of the retouched blades, with slightly over half of the Helwan bladelets (54.5%) bearing evidence of sheen. Comparatively high proportions of artefacts with sickle sheen are also recorded on the inverse bladelets (44.4%), as well as the bladelets retouched on both edges (50.0%). On the other hand, the partially retouched bladelets, bladelets retouched using obverse semi-steep retouch and bladelets retouched purely through one or two truncated ends all exhibit low rates of silica sheen occurrence, most of which resemble the Helwan bladelets in size and shape, supporting the identification of most of these pieces as unfinished or otherwise unused sickle elements.

Table 6.25: Distribution of retouch on non-geometric microliths (in quadrats), by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
One quadrat										
1	0	0.0	1	2.7	2	7.1	0	0.0	3	2.5
2	0	0.0	1	2.7	3	10.7	0	0.0	4	3.3
3	4	13.8	3	8.1	1	3.6	3	11.1	11	9.1
4	1	3.4	4	10.8	1	3.6	1	3.7	7	5.8
Sub-total	**5**	**17.2**	**9**	**24.3**	**7**	**25.0**	**4**	**14.8**	**25**	**20.7**
Two quadrats										
1,2	1	3.4	2	5.4	1	3.6	1	3.7	5	4.1
1,3	0	0.0	2	5.4	0	0.0	0	0.0	2	1.7
1,4	1	3.4	1	2.7	1	3.6	1	3.7	4	3.3
2,3	2	6.9	0	0.0	1	3.6	1	3.7	4	3.3
2,4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3,4	0	0.0	1	2.7	2	7.1	1	3.7	4	3.3
Sub-total	**4**	**13.8**	**6**	**16.2**	**5**	**17.9**	**4**	**14.8**	**19**	**15.7**
Three quadrats										
1,2,3	9	31.0	9	24.3	7	25.0	10	37.0	35	28.9
1,2,4	1	3.4	0	0.0	0	0.0	0	0.0	1	0.8
1,3,4	10	34.5	10	27.0	5	17.9	7	25.9	32	26.4
2,3,4	0	0.0	2	5.4	2	7.1	0	0.0	4	3.3
Sub-total	**20**	**69.0**	**21**	**56.8**	**14**	**50.0**	**17**	**63.0**	**72**	**59.5**
Four quadrats										
Sub-total	**0**	**0.0**	**1**	**2.7**	**2**	**7.1**	**2**	**7.4**	**5**	**4.1**
Total	**29**	**100.0**	**37**	**100.0**	**28**	**100.0**	**27**	**100.0**	**121**	**100.0**

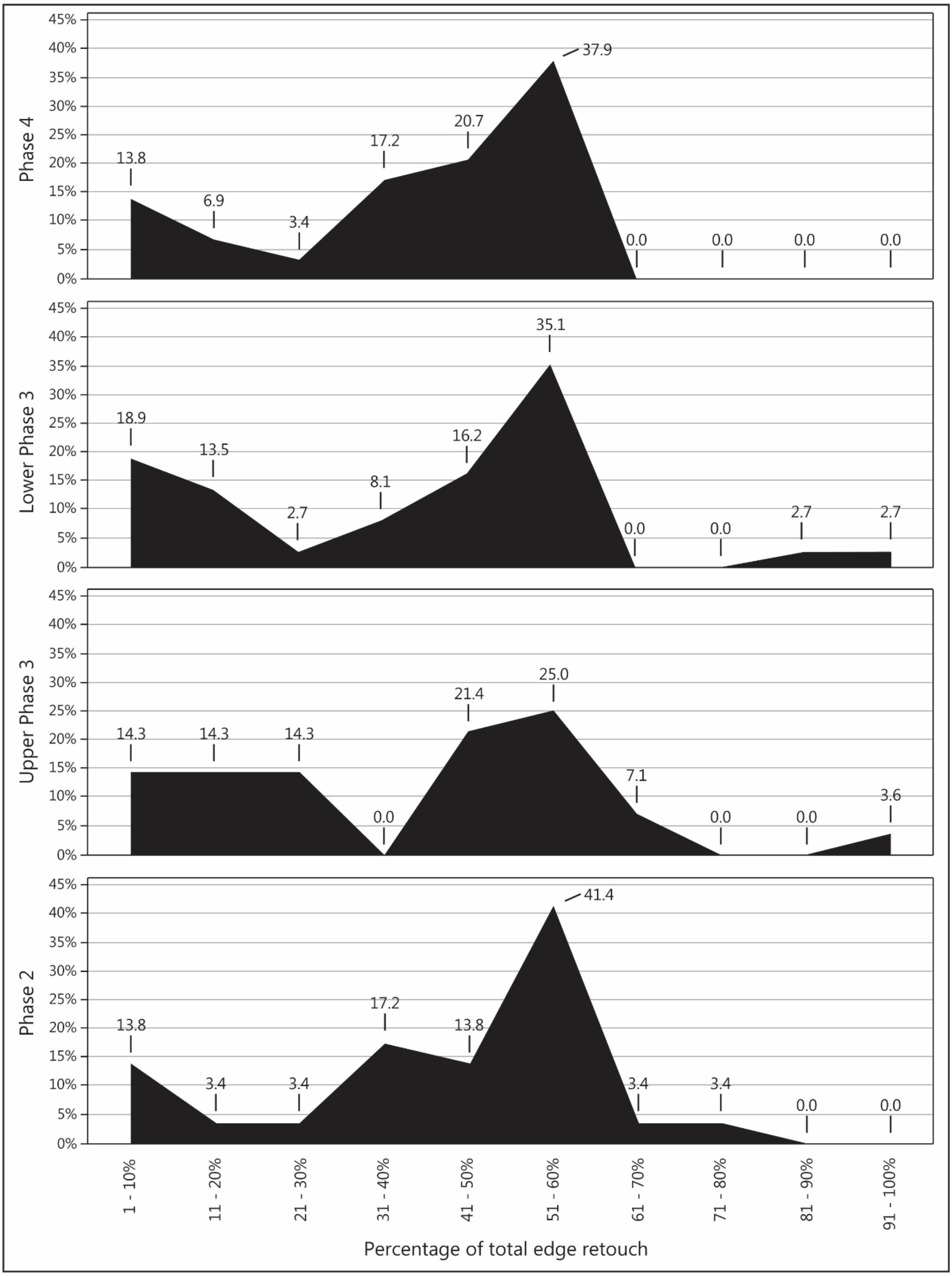


Figure 6.71: Percentage of total edge retouch on non-geometric microliths, by phase.

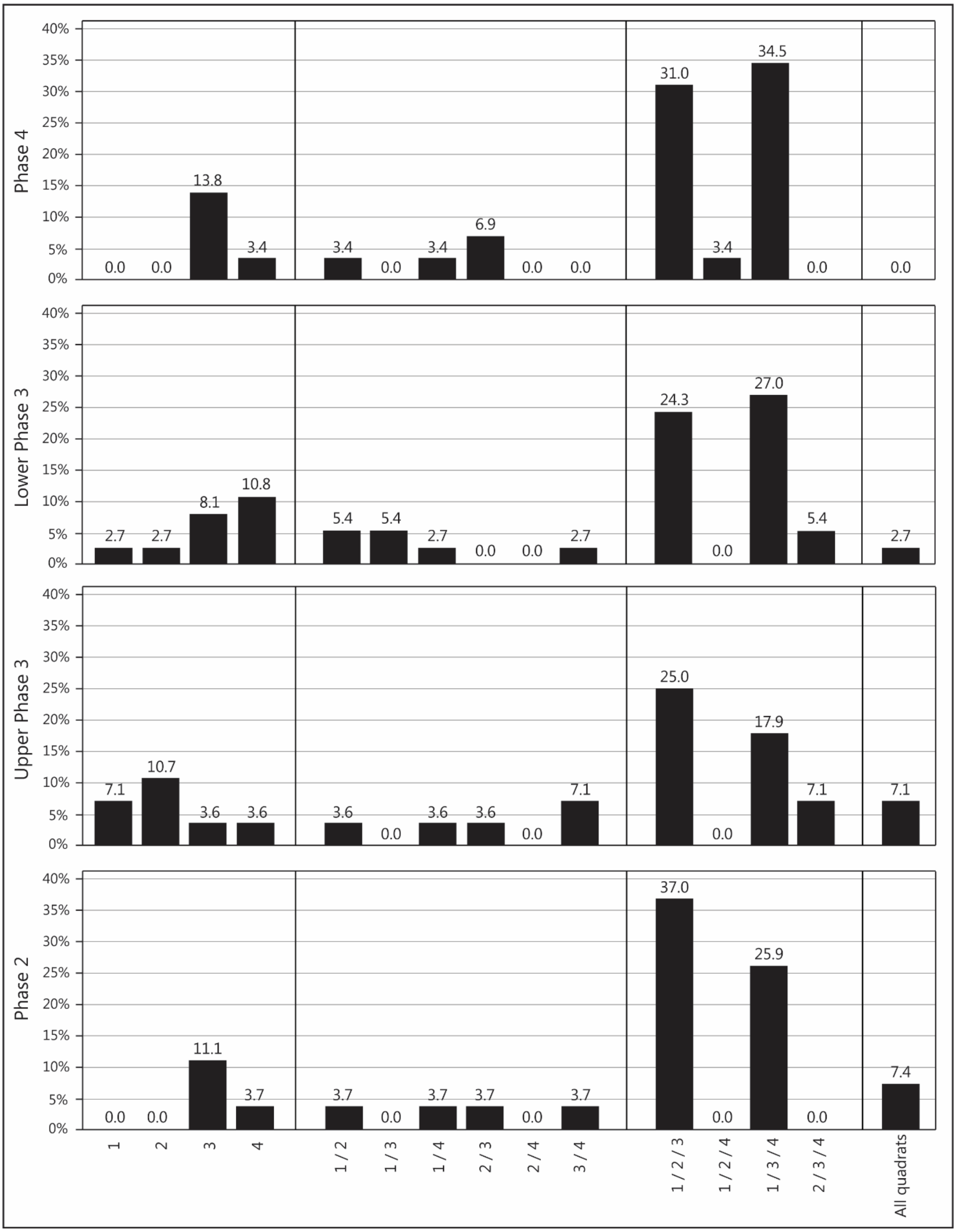


Figure 6.72: Retouch quadrats on non-geometric microliths, by phase.

6.4.5 Geometric microliths

6.4.5.1 Dimensions

The dimensions and weights of the lunates remain consistently alike across the four assemblages (**Table 6.26**; **Fig. 6.73**), demonstrating that they do not display significant diachronic change through time. Helwan lunates are slightly longer than the other lunate types on average (**Table 6.27**; **Fig. 6.74**), with those retouched with semi-steep or alternating retouch tied as the shortest. The lunates of Wadi Hammeh 27 exhibit a combination of squat and relatively elongated forms.

6.4.5.2 Blank attributes

Of the analysed geometric microliths, only two can be conclusively identified as flake products, these being an irregular microlith from Upper Phase 3 and an isosceles triangle from Phase 2 (**Table 6.4**). The remainder can either be identified as bladelet products (58.9%) or else they were retouched to such an extent that the identification of the original blank is impossible (40.6%). Aside from a notable increase in the proportions of identifiable bladelet products between Phase 4 (52.9%) and Lower Phase 3 (60.2%), these values remained steady across time.

Qualitative attributes of the geometric microliths also remain steady over time. Pieces featuring two extant flake scars are most common in all four assemblages, although the mean count in Lower Phase 3 is marginally greater due to a higher percentage of pieces with four or more flake scars (**Table 6.28**; **Fig. 6.75**). As with the non-geometric microliths, a clear increase in the proportions of geometric microliths with a unidirectional scar orientation is observable over time **(Fig. 6.76)**. These pieces comprise just over three quarters of the Phase 4 (78.4%) and Lower Phase 3 (77.7%) assemblages, before rising slightly in Upper Phase (83.8%). Their proportions then surge in Phase 2, where they encompass almost the entire assemblage (93.5%). This rise corresponds with a decline in geometric microliths with a change of orientation scar layout between Lower Phase 3 (16.5%) and Phase 2 (4.8%). Cortex is consistently scarce, with the mean coverage of all four assemblages remaining below 1% (**Table 6.28**).

Table 6.26: Geometric microlith dimensions, by phase.

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	102	18.8	3.0	13.0-33.3	7.2	1.1	5.5-12.4	2.4	0.6	1.2-4.4	0.3	0.2	0.1-1.8
Lower Phase 3	103	19.4	2.8	11.7-29.4	7.4	1.0	5.2-11.3	2.3	0.6	1.4-5.0	0.3	0.1	0.1-0.9
Upper Phase 3	105	18.7	2.6	12.5-24.2	7.5	1.2	5.2-12.3	2.3	0.6	1.3-4.4	0.3	0.1	0.1-0.7
Phase 2	61	19.0	3.6	11.8-30.0	7.5	1.3	3.0-11.7	2.4	0.5	1.5-3.9	0.3	0.2	0.1-1.0

Table 6.27: Geometric microlith dimensions, by type (Phases 2-4).

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Irregular microlith	18	16.4	2.8	11.8-22.2	8.5	1.6	5.9-12.3	2.5	0.8	1.5-4.4	0.3	0.2	0.1-0.7
Isosceles triangle	4	17.4	3.8	14.5-22.9	9.9	2.8	6.2-12.4	2.6	1.3	1.4-4.4	0.4	0.3	0.1-0.8
Inverse lunate	24	18.9	4.1	13.9-30.0	7.2	1.0	6.0-10.0	2.2	0.5	1.5-3.2	0.3	0.2	0.1-1.0
Semi-steep lunate	27	18.3	2.2	13.1-22.6	7.4	0.8	6.2-9.3	2.1	0.5	1.4-2.8	0.2	0.1	0.1-0.5
Abrupt lunate	27	18.7	4.4	11.7-33.3	7.3	1.6	5.2-12.4	2.6	0.8	1.5-5.0	0.3	0.3	0.1-1.8
Alternating lunate	50	18.3	2.4	13.0-26.2	7.1	0.8	5.5-8.9	2.1	0.5	1.2-3.3	0.2	0.1	0.1-0.5
Helwan	209	19.5	2.6	12.0-30.0	7.3	0.9	3.0-10.0	2.4	0.5	1.4-3.9	0.3	0.1	0.1-0.9
Mixed lunate	8	18.8	3.3	14.4-24.8	7.2	0.8	5.7-7.8	2.6	0.9	1.5-4.0	0.3	0.1	0.2-0.6

Table 6.28: Geometric microlith attributes, by phase.

	N	Flake scars			Percentage of cortex coverage			Percentage of edge retouched		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	102	2	0.9	1-5	0.6	4.0	0-30	58.9	4.5	30-75
Lower Phase 3	103	3	0.5	1-5	0.5	4.9	0-50	58.7	6.3	30-100
Upper Phase 3	105	2	0.7	1-4	0.2	1.8	0-15	58.7	7.9	15-100
Phase 2	60	2	0.9	1-5	0.2	1.3	0-10	58.3	8.4	30-100

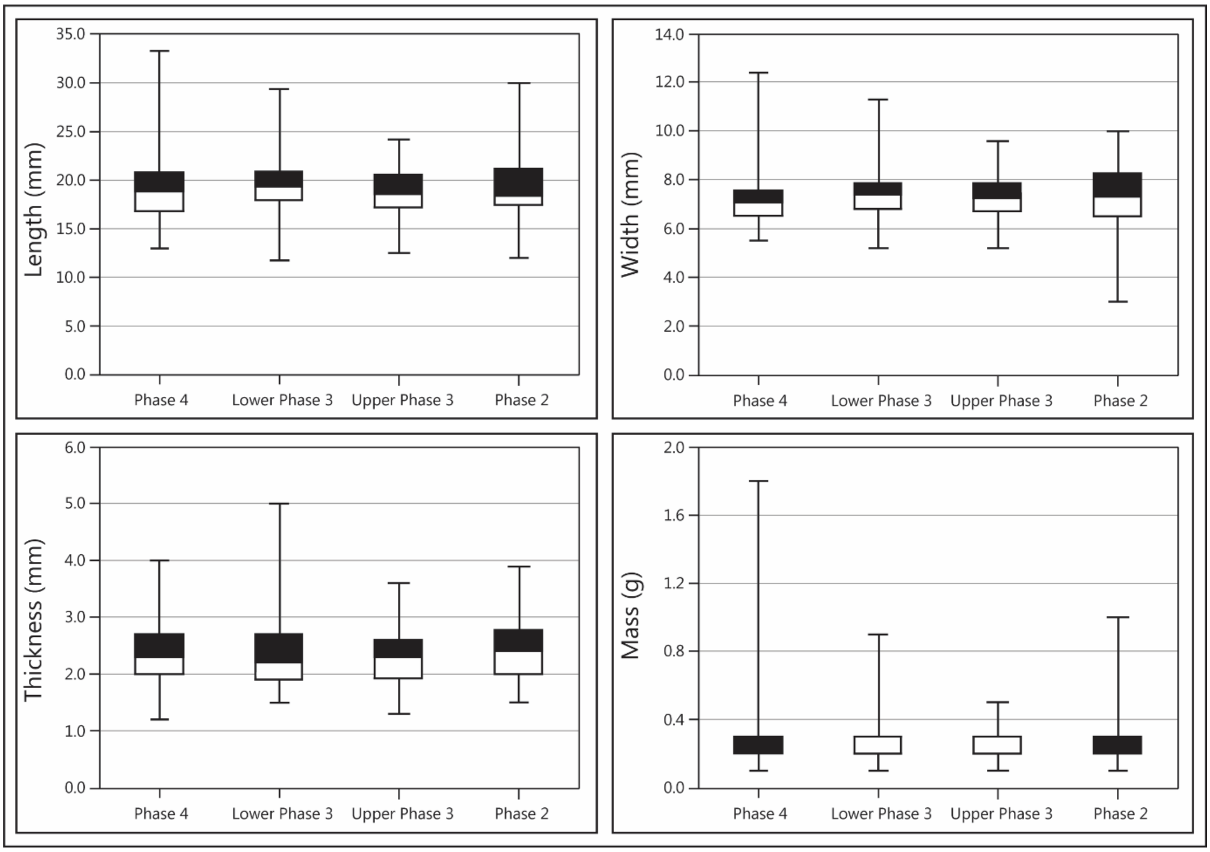


Figure 6.73: Lunate dimensions, by phase.

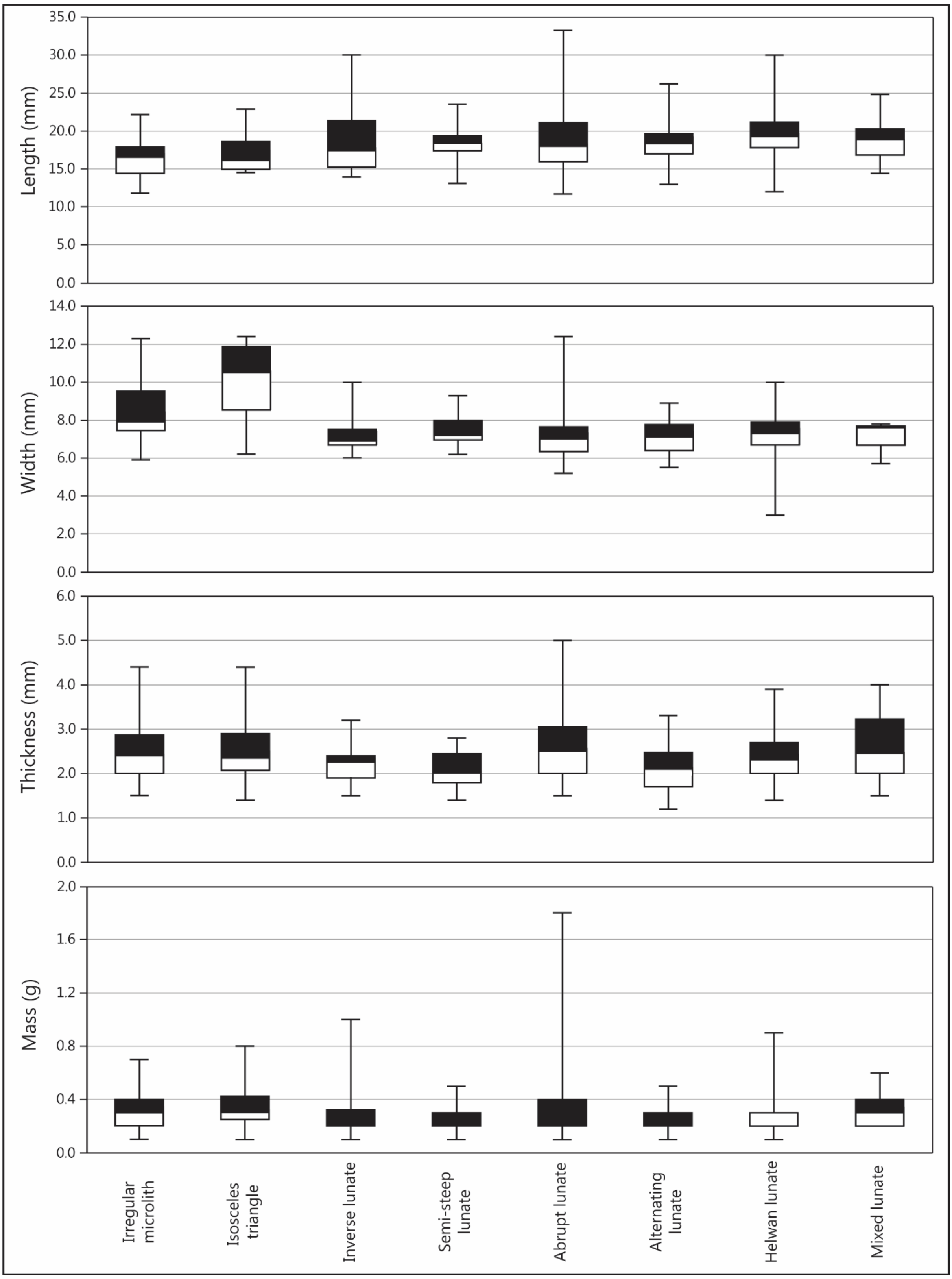


Figure 6.74: Geometric microlith dimensions, by type (Phases 2-4).

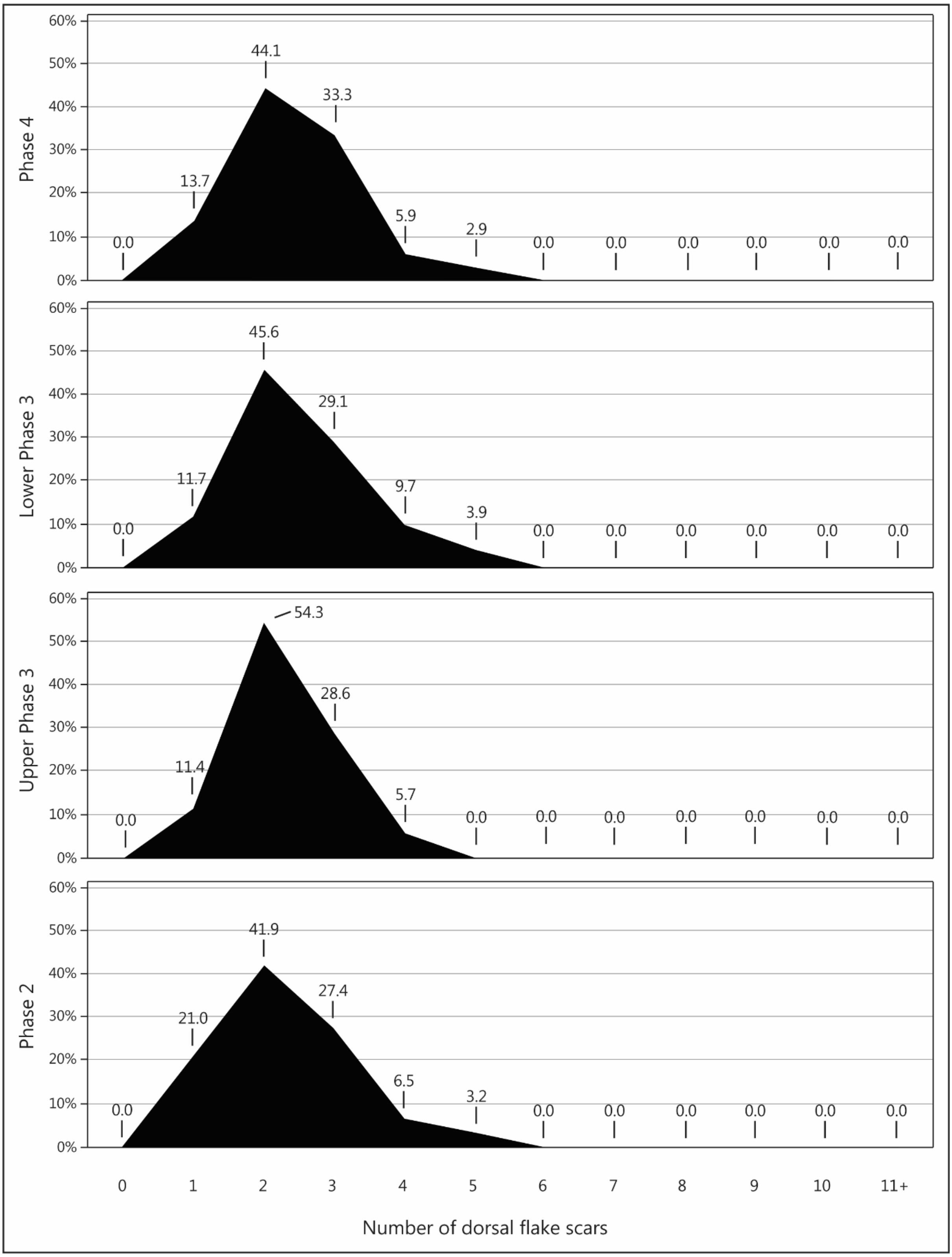


Figure 6.75: Number of negative flake scars on geometric microliths, by phase.

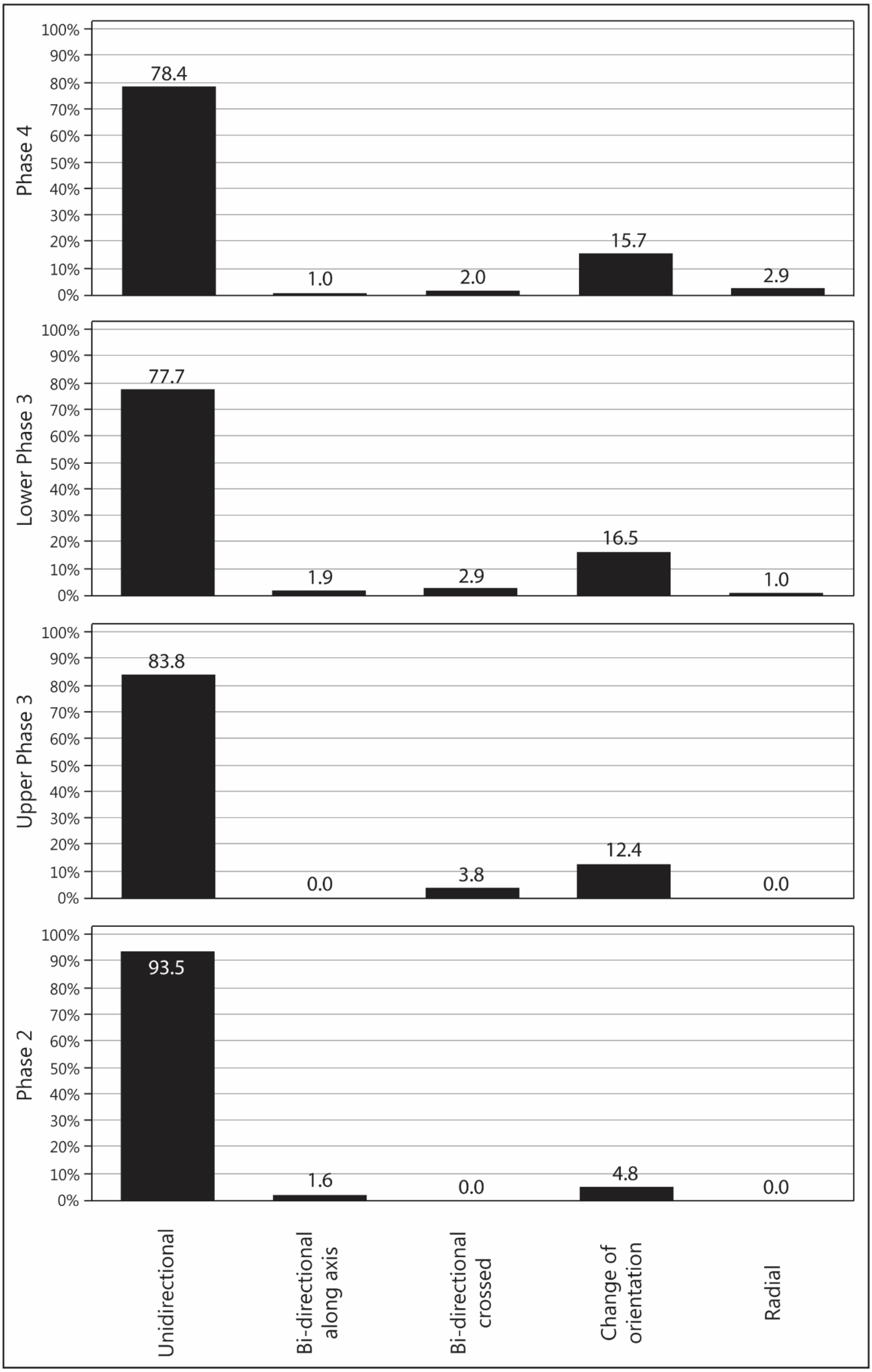


Figure 6.76: Geometric microlith scar orientation, by phase.

6.4.5.3 Retouch attributes

The retouch attribute data for the geometric microliths emphasise the uniform manner of lunate production over time at Wadi Hammeh 27. A clear majority of these artefacts feature retouch covering slightly over half of their perimeter (**Fig. 6.77**), generally along one lateral edge in order to produce the characteristic form of a lunate, while the mean percentages of edge retouch regularly range between 58% and 59% (**Table 6.28**). The percentage of geometric microliths within this range gradually decreases over time, however, falling from nine tenths (91.2%) of the Phase 4 assemblage to three quarters (78.7%) of Phase 2. This decline largely coincides with higher proportions of geometric microliths with 30% to 50% of their edge being retouched in the later assemblages, suggesting an increasing simplification in the manufacture of lunates over time. Geometric microliths with more than 60% edge retouch are consistently rare. Little variation in the mean amount of edge retouch is evident by lunate type. A slight, steadily increasing, bias towards the left lateral margin over the right is apparent across the four assemblages (**Table 6.29**; **Fig. 6.78**).

6.4.6 Notched and denticulated pieces

6.4.6.1 Dimensions

The dimensions of notched and denticulated pieces remain uniform over time, with the only detectable changes – a decline in width and weight – being consistent with a partial shift to bladelet blanks from flakes (**Table 6.30**; **Fig. 6.79**). Some variation in size is also evident by type, however, with pieces with a large notch being notably wider, thicker and heavier than the other three types on average (**Table 6.31**; **Fig. 6.80**). The pieces with multiple notches and denticulated pieces types are conversely much more elongated, with average lengths almost twice that of their width.

6.4.6.2 Blank attributes

Notched and denticulated pieces were primarily created using flake or bladelet blanks, with the proportion of these two debitage types fluctuating over time (**Table 6.4**). Flakes were utilised for a slight majority of pieces between Phases 4 and Upper Phase 3, where they consistently encompass between 53.8% and 55.9% of the artefacts in each assemblage (**Fig.**

Table 6.29: Distribution of retouch on geometric microliths (in quadrats), by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
One quadrat										
1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3	0	0.0	0	0.0	1	1.0	0	0.0	1	0.3
4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Sub-total	**0**	**0.0**	**0**	**0.0**	**1**	**1.0**	**0**	**0.0**	**1**	**0.3**
Two quadrats										
1,2	1	1.0	0	0.0	0	0.0	0	0.0	1	0.3
1,3	1	1.0	1	1.0	0	0.0	0	0.0	2	0.5
1,4	0	0.0	1	1.0	0	0.0	0	0.0	1	0.3
2,3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2,4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
3,4	0	0.0	0	0.0	3	2.9	0	0.0	3	0.8
Sub-total	**2**	**2.0**	**2**	**1.9**	**3**	**2.9**	**0**	**0.0**	**7**	**1.9**
Three quadrats										
1,2,3	50	49.5	51	49.5	54	51.4	33	53.3	188	50.7
1,2,4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1,3,4	48	47.5	48	46.6	46	43.8	25	41.7	167	45.0
2,3,4	0	0.0	1	1.0	0	0.0	0	0.0	1	0.3
Sub-total	**98**	**97.0**	**100**	**97.1**	**100**	**95.2**	**58**	**93.5**	**356**	**96.0**
Four quadrats										
Sub-total	**1**	**1.0**	**1**	**1.0**	**1**	**1.0**	**4**	**6.5**	**7**	**1.9**
Total	**101**	**100.0**	**103**	**100.0**	**105**	**100.1**	**62**	**100.0**	**371**	**100.1**

Table 6.30: Notched and denticulated piece dimensions, by phase.

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	33	37.3	9.3	20.1-55.5	24.9	10.9	10.6-58.7	5.7	2.8	2.3-16.7	6.4	7.5	0.7-35.8
Lower Phase 3	39	33.3	9.9	18.1-60.1	21.6	13.3	11.7-90.3	5.1	2.9	2.3-14.1	5.0	10.5	0.7-64.6
Upper Phase 3	34	35.1	9.8	20.2-66.6	20.7	7.8	8.1-39.2	5.0	2.3	1.3-11.4	4.1	4.0	0.2-17.2
Phase 2	24	36.4	8.9	19.6-54.0	19.4	8.5	10.0-49.9	5.0	2.1	2.2-11.4	3.5	2.8	0.7-13.7

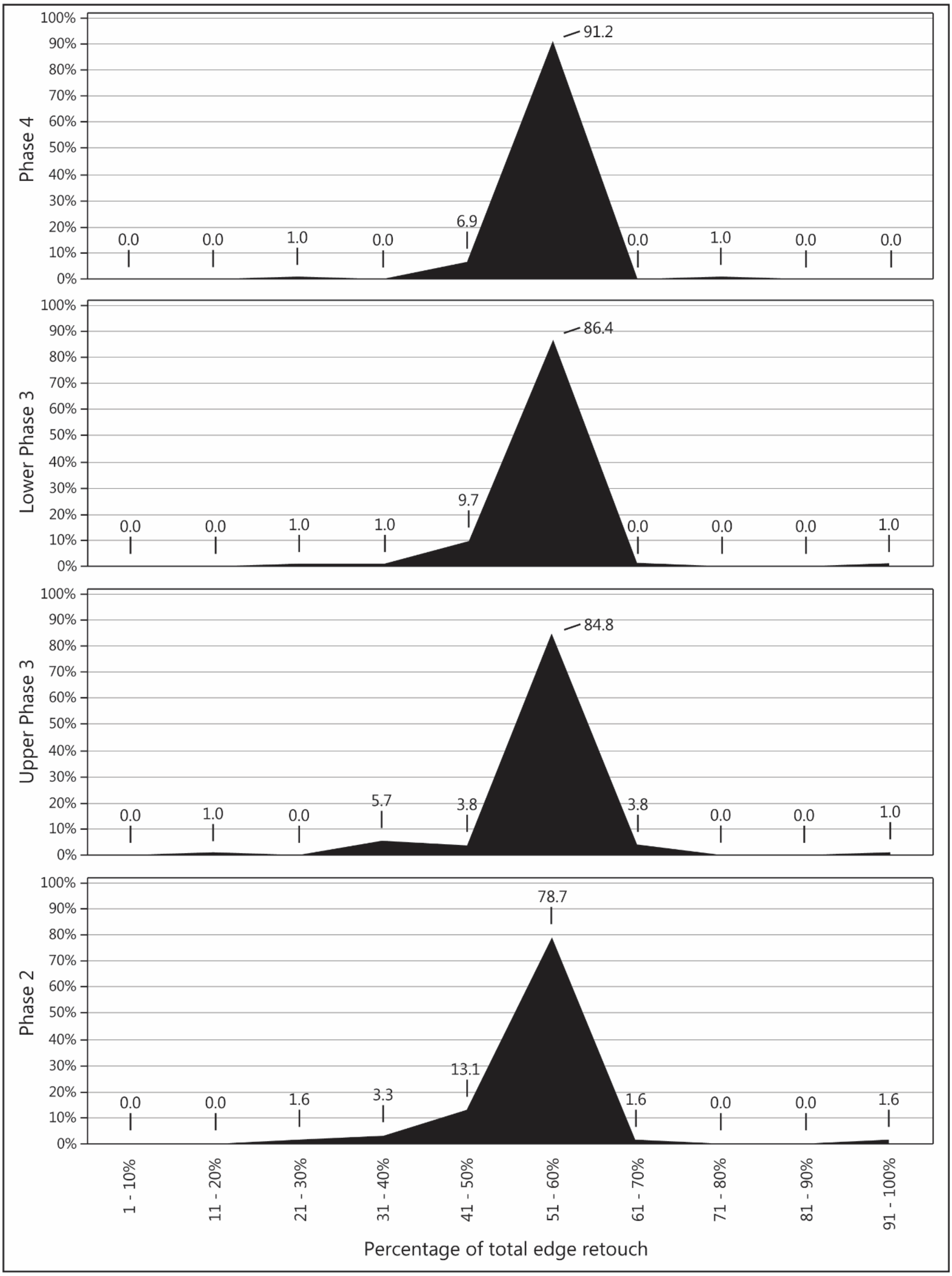


Figure 6.77: Percentage of total edge retouch on geometric microliths, by phase.

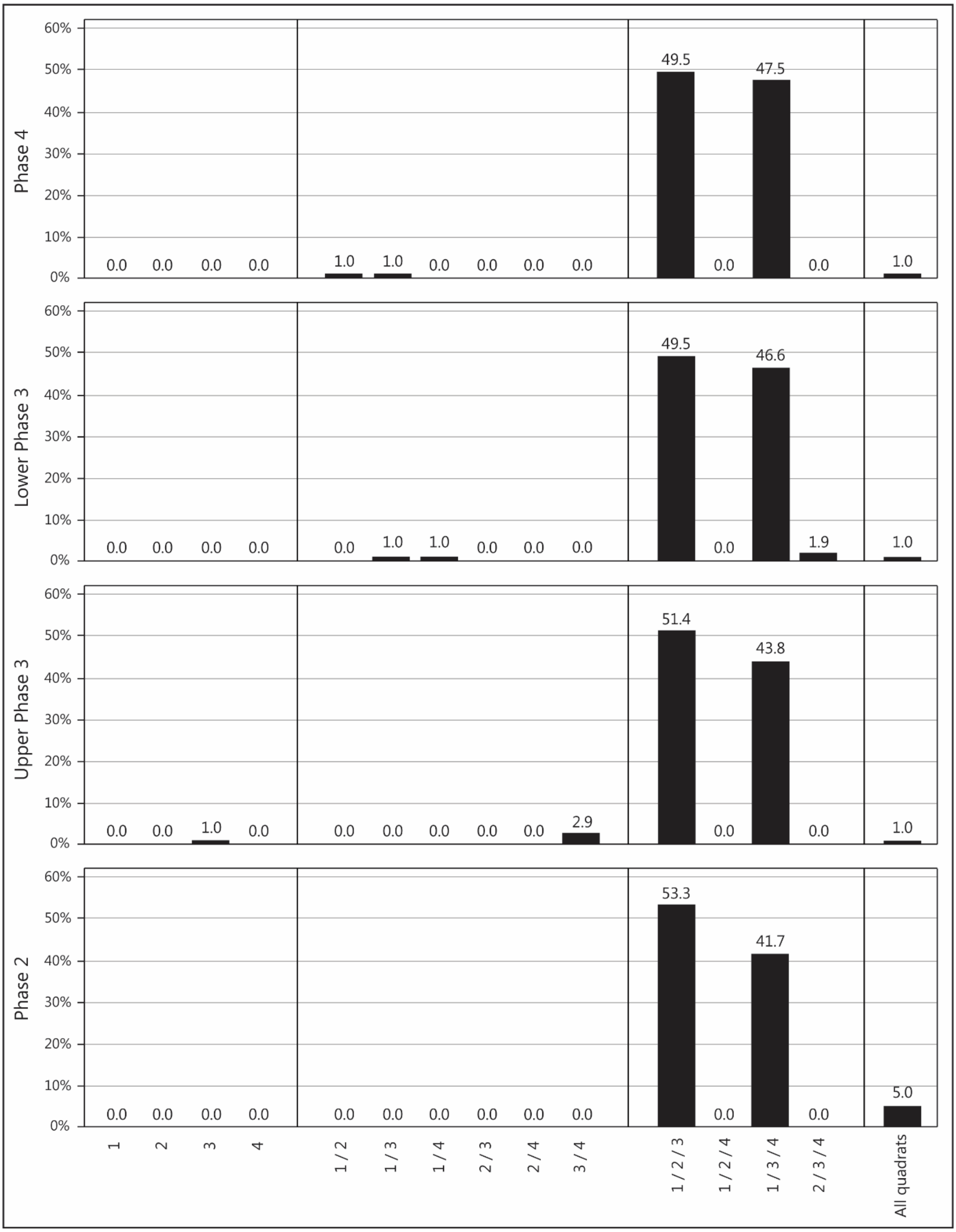


Figure 6.78: Retouch quadrat combinations on geometric microliths, by phase.

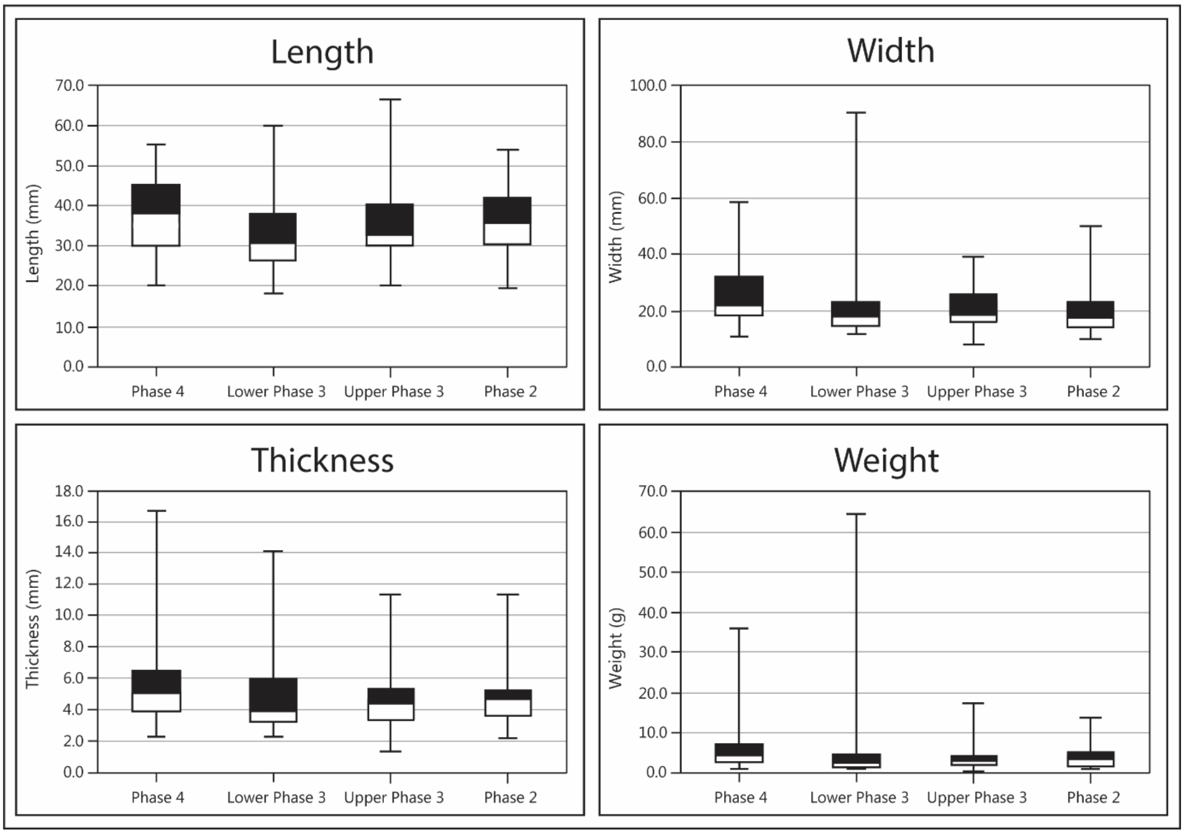


Figure 6.79: Notched and denticulated piece dimensions, by phase.

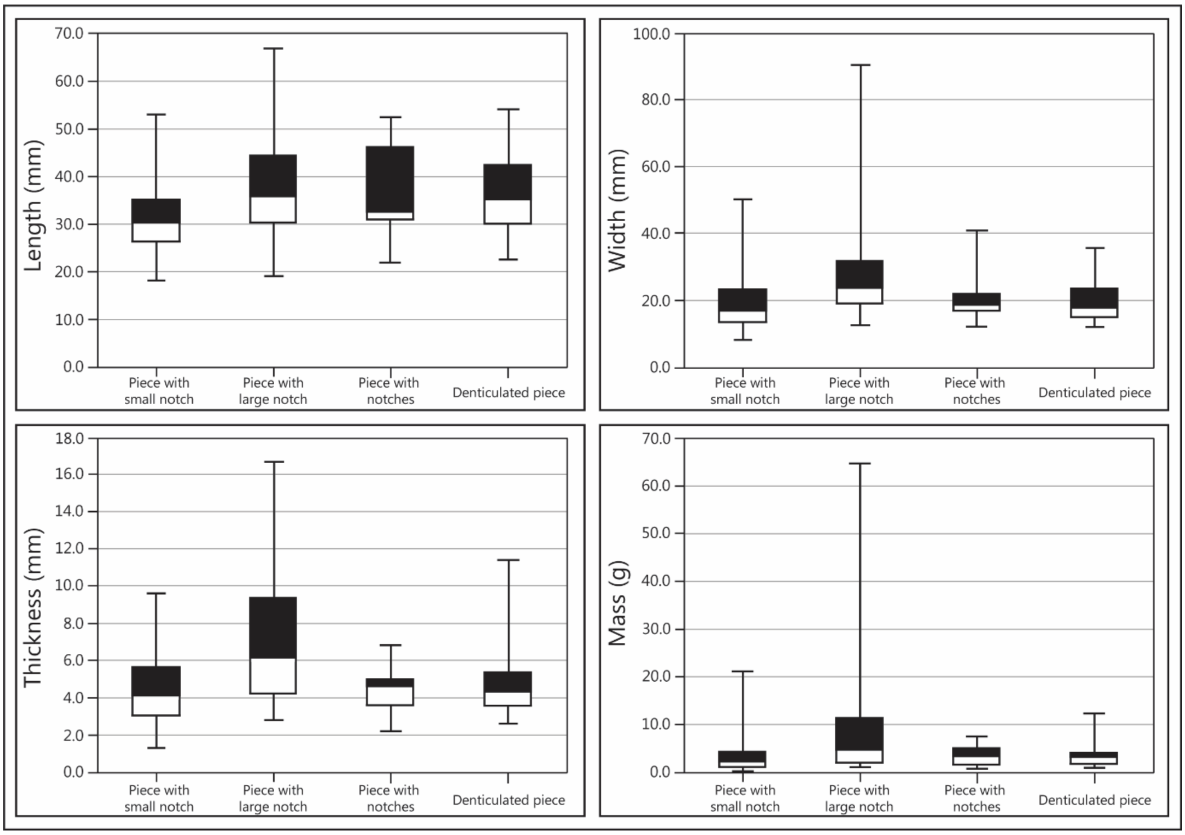


Figure 6.80: Notched and denticulated piece dimensions, by type (Phases 2-4).

6.81). Artefacts in this tool group manufactured from bladelet blanks occur in smaller proportions in these three assemblages, ranging from 43.6% in Lower Phase 3 to 32.4% in Upper Phase 3. The Phase 2 assemblage conversely exhibits an unambiguous shift towards the usage of bladelet blanks (50.0%), with a notable decline in the percentage of artefacts made from flake blanks (37.5%). Notched and denticulated pieces created from blade blanks also reach a substantially greater proportion of the Phase 2 assemblage (12.5%) than in any of the underlying deposits. While flakes appear to have been favoured in the manufacture of pieces with a large notch (70.0%), no such biases are evident for the other three types, which are represented by more-or-less even combinations of flake and bladelet products (**Table 6.32**).

The range of negative flake scars on notched and denticulated pieces remain static over time, with an average of five scars per artefact in each assemblage (**Table 6.33**; **Fig. 6.82**). Scar orientations are almost identical between the Phase 4 and Lower Phase 3 assemblages, with notched and denticulated pieces with a unidirectional layout slightly outnumbering those featuring a 90° change of orientation (**Fig. 6.83**). The Upper Phase 3 assemblage remains largely consist with these two assemblages, albeit with a slight shift towards change of orientation (47.1%) over unidirectional layouts (32.4%). Conversely, the shift towards bladelet blanks in Phase 2 results in a clear majority of pieces possessing unidirectional flake layouts (62.5%). A notable decline in the proportion of pieces with a radial scar layout is also observable in Phase 2 (4.2%), with these pieces comprising between 10% and 12% percent of the preceding three assemblages.

Cortical coverage is consistently low on notched and denticulated pieces, ranging from an average of 10.9% in Upper phase 3 to 3.8% in Lower Phase 3 (**Table 6.33**). Cortex is absent from slightly over 60% of the Phase 4, Upper Phase 3 and Phase 2 assemblages, whereas the Lower Phase 3 assemblage featured a noticeably lower percentage of cortex-free pieces (51.3%; **Fig. 6.84**), with the low average in this assemblage instead being due to the lack of cortex-rich outliers. The pieces with a large notch have a greater average cortex coverage percentage (11.5%), with this likely being due to the preference of flake blanks for this type.

6.4.6.3 Retouch attributes

The amount of edge retouch on notched and denticulated pieces is primarily affected by type, with the piece with small notch type featuring the lowest average percentage of edge retouch

Table 6.31: Notched and denticulated piece dimensions, by type (Phases 2-4).

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Piece with small notch	35	31.5	7.8	18.1-52.8	19.8	9.2	8.1-50.2	4.6	2.2	1.3-9.6	3.3	3.9	0.2-21.1
Piece with large notch	30	37.7	12.0	19.0-66.6	28.6	15.9	12.6-90.3	7.0	3.6	2.8-16.7	9.8	13.3	1.0-64.6
Piece with notches	17	36.8	9.7	21.9-52.3	20.5	7.4	12.2-40.9	4.4	1.2	2.2-6.8	3.4	2.2	0.7-7.5
Denticulated piece	48	36.2	8.4	22.5-54.0	19.4	6.2	12.0-35.6	4.7	1.8	2.6-11.4	3.4	2.2	0.9-12.3

Table 6.32: Blanks used to manufacture notched and denticulated pieces, by type (Phases 2-4).

	N	Flake		Blade		Bladelet		CTE		Indeterminate		Other	
		N	%	N	%	N	%	N	%	N	%	N	%
Piece with small notch	35	19	54.3	1	2.9	14	40.0	1	2.9	0	-	0	-
Piece with large notch	30	21	70.0	0	-	6	20.0	3	10.0	0	-	0	-
Piece with notches	17	7	41.2	2	11.8	8	47.1	0	-	0	-	0	-
Denticulated piece	48	20	41.7	3	6.3	24	50.0	1	2.1	0	-	0	-

Table 6.33: Notched and denticulated piece attributes, by phase.

	N	Flake scars			Percentage of cortex coverage			Percentage of edge retouched		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	33	5	2.3	1-11	9.2	17.6	0-70	15.9	12.8	5-50
Lower Phase 3	39	5	2.1	2-12	3.8	10.5	0-55	19.6	18.2	5-75
Upper Phase 3	34	5	2.2	1-12	10.9	17.3	0-60	13.5	14.5	5-80
Phase 2	24	5	2.0	2-10	8.1	15.0	0-50	21.5	14.7	5-60

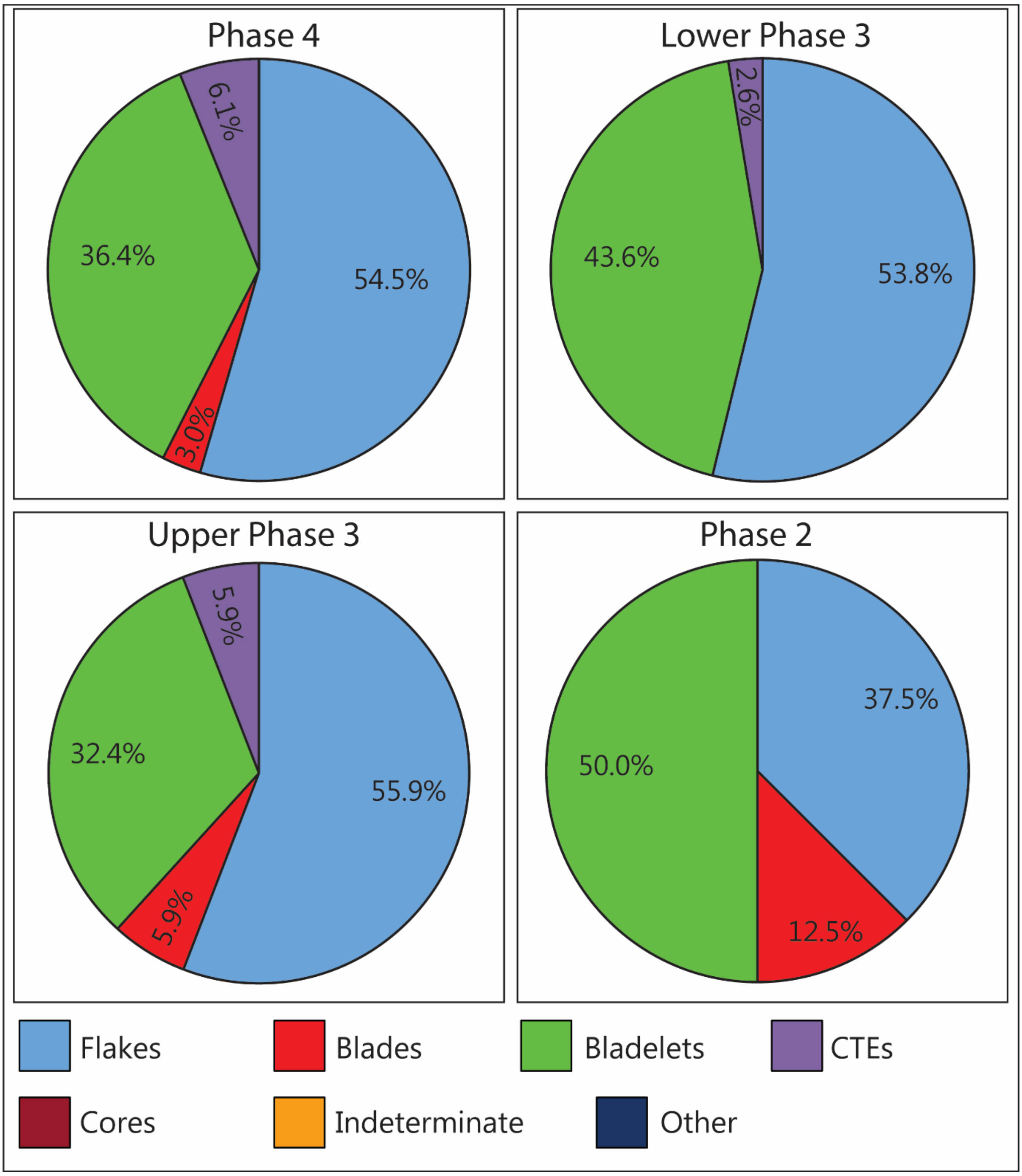


Figure 6.81: Notched and denticulated piece blank selection, by phase.

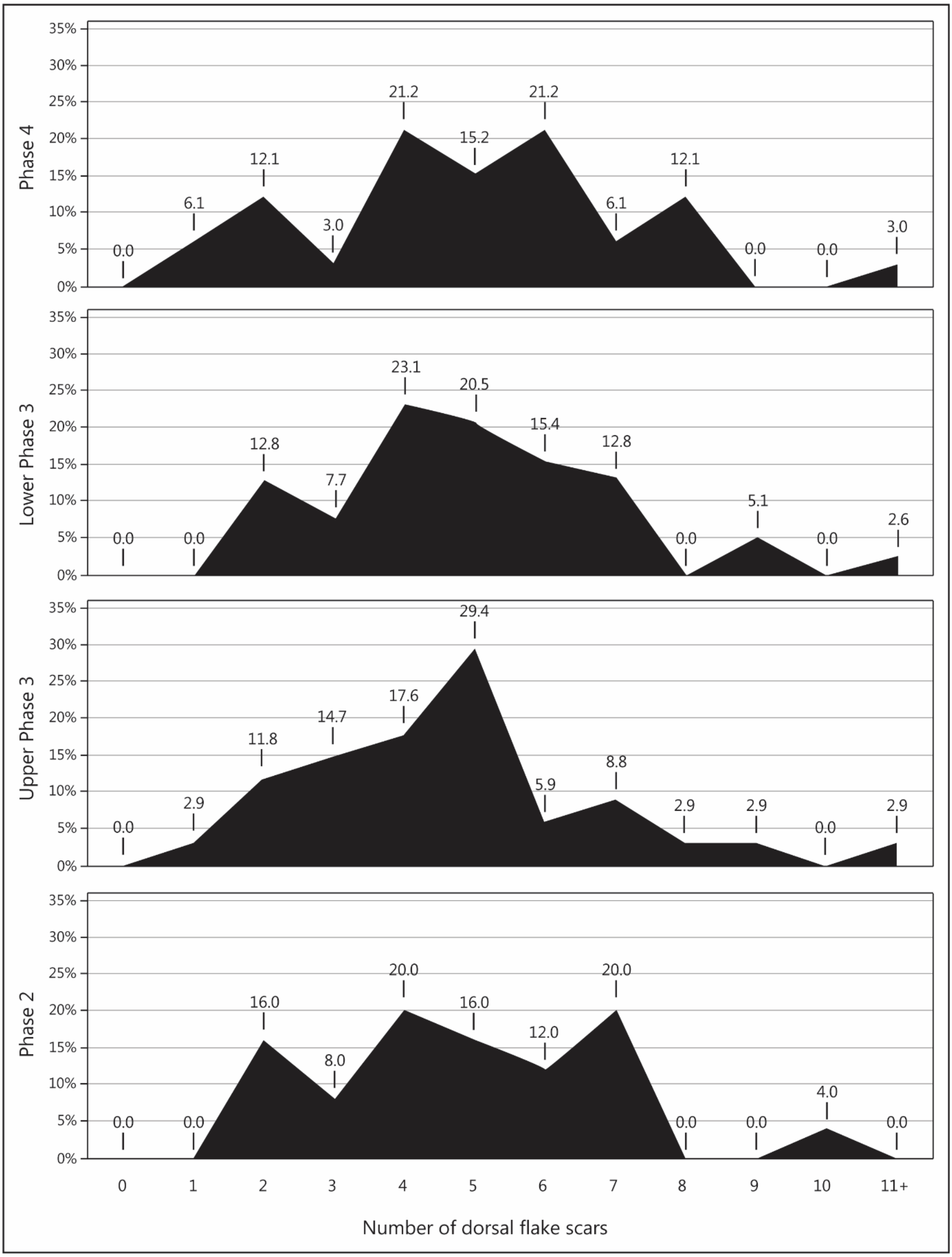


Figure 6.82: Number of negative flake scars on notched and denticulated pieces, by phase.

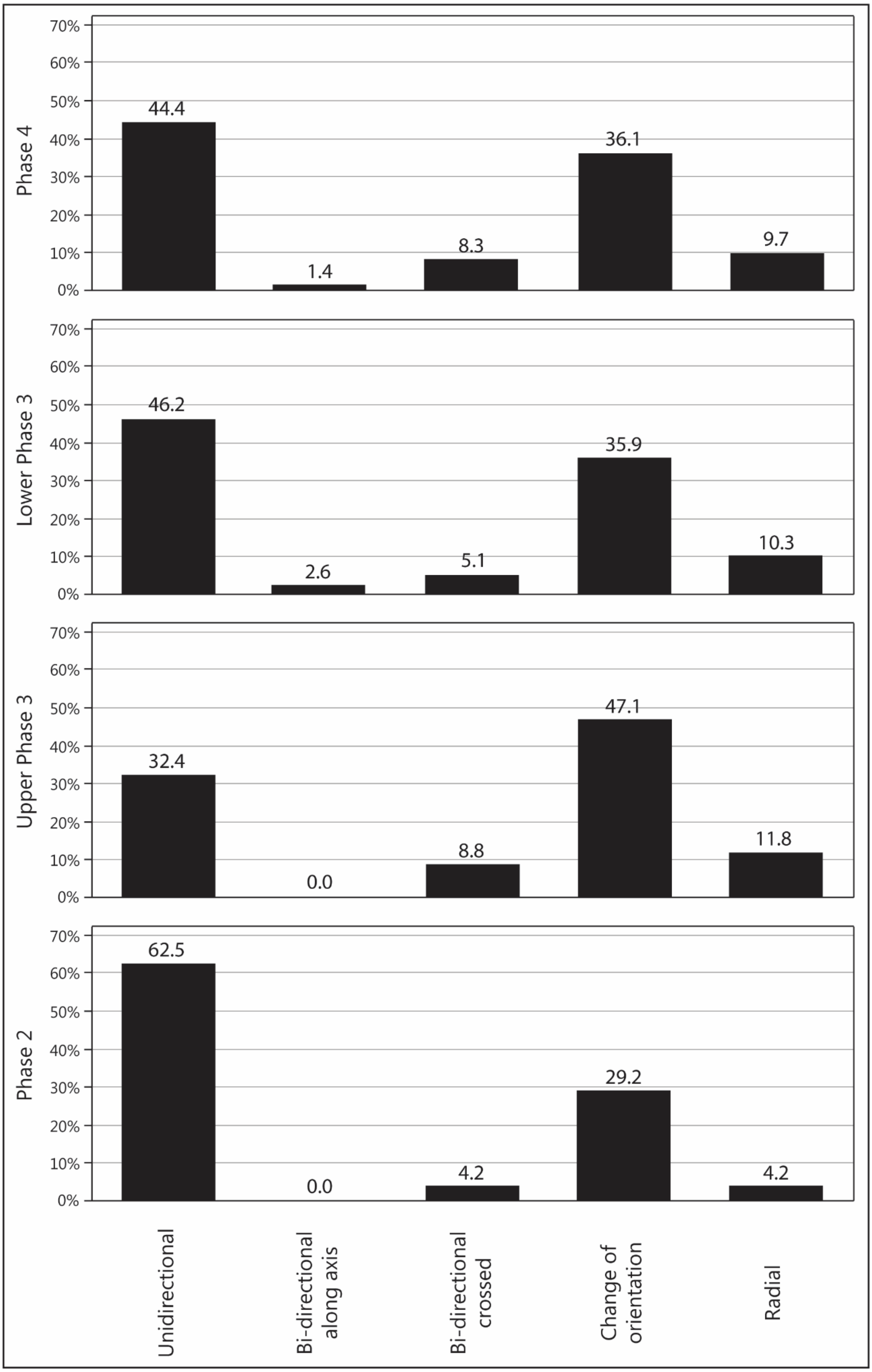


Figure 6.83: Notched and denticulated piece scar orientation, by phase.

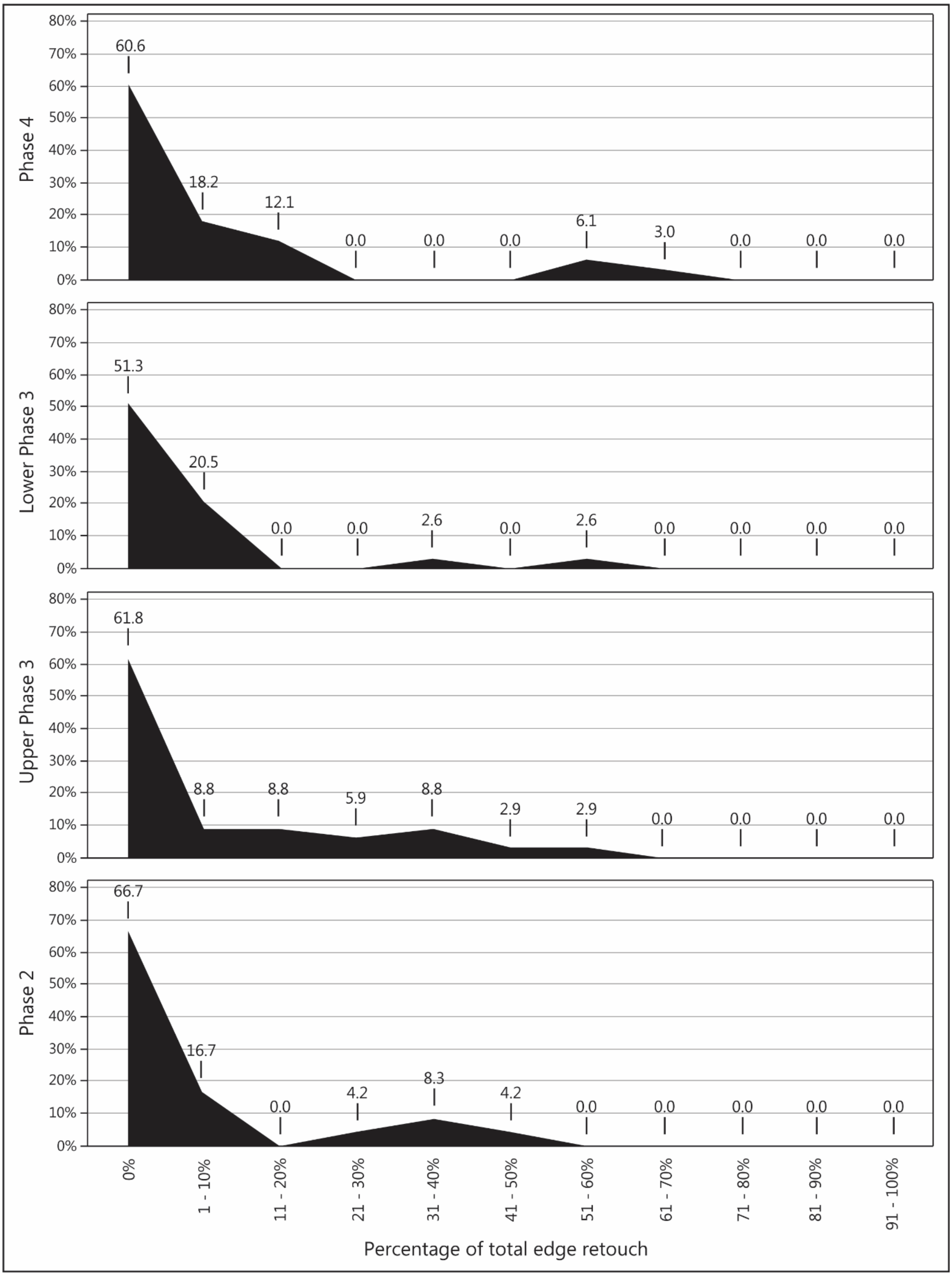


Figure 6.84: Notched and denticulated piece dorsal surface cortex coverage.

(6.4%) out of all the retouched artefact types analysed in the current study. Retouch on this type and the pieces with a large notch are restricted, never encompassing more than 20% of the total edge and is mostly restricted to the thinner edges along the lateral margins (Quadrats 2 and 4). The other two types in this tool group display a considerably greater amount of variety in the amount of retouch applied, with the pieces with multiple notches and denticulated pieces displaying a maximum of 60% and 80% edge retouch respectively. The mean percentage of edge retouch on these types nonetheless remains low (20.6% and 28.6%). The 'pieces with notches' type is characterised by retouch in two quadrats (64.7%), with the most prevalent layout being along both lateral margins (41.2%). The distribution of denticulated retouch is more diverse, ranging from artefacts with partial retouch along one edge, to pieces extensively retouched along both lateral margins. As such, the consistently low mean levels of retouch for this tool group (**Table 6.33; Fig. 6.85**) and large quantities of pieces with retouch in a single quadrat (**Table 6.34; Fig. 6.86**) can be explained by the high numbers of pieces with a small notch in each assemblage.

6.4.7 Borers and awls

6.4.7.1 Dimensions

The lengths of awls and borers vary slightly with the mode of retouch applied. Bilaterally-backed and alternatively-retouched pieces are shorter on average than the small numbers of awls manufactured using semi-steep obverse, inverse, or Helwan retouch (**Table 6.35**). Objects assigned to these first two types at Wadi Hammeh 27 exhibit a combination of squat and elongated forms, with the only unifying aspect for either type being the mode of retouch applied. As such, the various awl and borer types from the lower deposits of Wadi Hammeh 27 may be viewed as variations of one or two varieties of perforator, with the sole variable being the blank size, type and mode of retouch utilised to achieve the final form.

6.4.7.2 Blank attributes

Awl and borers blank selection varies on a typological basis, with the bilaterally backed borers and Helwan, inverse and semi-steep retouched awls all exhibiting a bias towards blade blanks, whereas the alternately-retouched awls were manufacture from a more diverse range of blanks (**Table 6.36**). At least one of the awls at Wadi Hammeh 27 was manufactured

Table 6.34: Distribution of retouch on notched and denticulated pieces (in quadrats), by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
One quadrat										
1	0	0.0	1	2.6	0	0.0	1	4.3	2	1.6
2	4	12.1	7	17.9	8	24.2	3	13.0	22	17.2
3	2	6.1	3	7.7	2	6.1	2	8.7	9	7.0
4	10	30.3	7	17.9	10	30.3	2	8.7	29	22.7
Sub-total	**16**	**48.5**	**18**	**46.2**	**20**	**60.6**	**8**	**34.8**	**62**	**48.4**
Two quadrats										
1,2	2	6.1	0	0.0	0	0.0	1	4.3	3	2.3
1,3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1,4	1	3.0	0	0.0	0	0.0	1	4.3	2	1.6
2,3	2	6.1	4	10.3	5	15.2	5	21.7	16	12.5
2,4	3	9.1	2	5.1	3	9.1	3	13.0	11	8.6
3,4	3	9.1	5	12.8	2	6.1	1	4.3	11	8.6
Sub-total	**11**	**33.3**	**11**	**28.2**	**10**	**30.3**	**11**	**47.8**	**43**	**33.6**
Three quadrats										
1,2,3	0	0.0	1	2.6	1	3.0	0	0.0	2	1.6
1,2,4	0	0.0	1	2.6	0	0.0	2	8.7	3	2.3
1,3,4	0	0.0	1	2.6	0	0.0	0	0.0	1	0.8
2,3,4	4	12.1	5	12.8	2	6.1	0	0.0	11	8.6
Sub-total	**4**	**12.1**	**8**	**20.5**	**3**	**9.1**	**2**	**8.7**	**17**	**13.3**
Four quadrats										
Sub-total	**2**	**6.1**	**2**	**5.1**	**0**	**0.0**	**2**	**8.7**	**6**	**4.7**
Total	**33**	**100.0**	**39**	**100.0**	**33**	**100.0**	**23**	**100.0**	**128**	**100.0**

Table 6.35: Awl and borer dimensions, by type (Phases 2-4).

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Alternately-retouched awl	9	45.4	13.7	29.7 - 73.2	16.1	5.8	9.3 - 29.0	8.3	5.2	3.3 - 18.7	6.1	7.0	1.6 - 23.9
Bilaterally-backed borer	10	41.6	15.1	23.8 - 66.8	17.6	4.9	11.5 - 24.3	5.0	2.1	2.8 - 9.2	4.0	3.1	1.1 - 9.0
Other awls	6	59.5	13.6	38.0 – 73.8	16.5	5.4	11.5 - 24.8	4.9	0.6	4.0 - 5.7	4.8	2.5	1.6 - 9.0

Table 6.36: Blanks used to manufacture awls and borers, by type (Phases 2-4).

	N	Flake		Blade		Bladelet		CTE		Indeterminate		Other	
		N	%	N	%	N	%	N	%	N	%	N	%
Alternately-retouched awl	9	2	22.2	2	22.2	3	33.3	0	0.0	0	0.0	2	22.2
Bilaterally-backed borer	10	1	10.0	6	60.0	2	20.0	0	0.0	1	0.0	0	0.0
Other awls	4	0	0.0	4	60.0	1	16.7	1	16.7	0	0.0	0	0.0

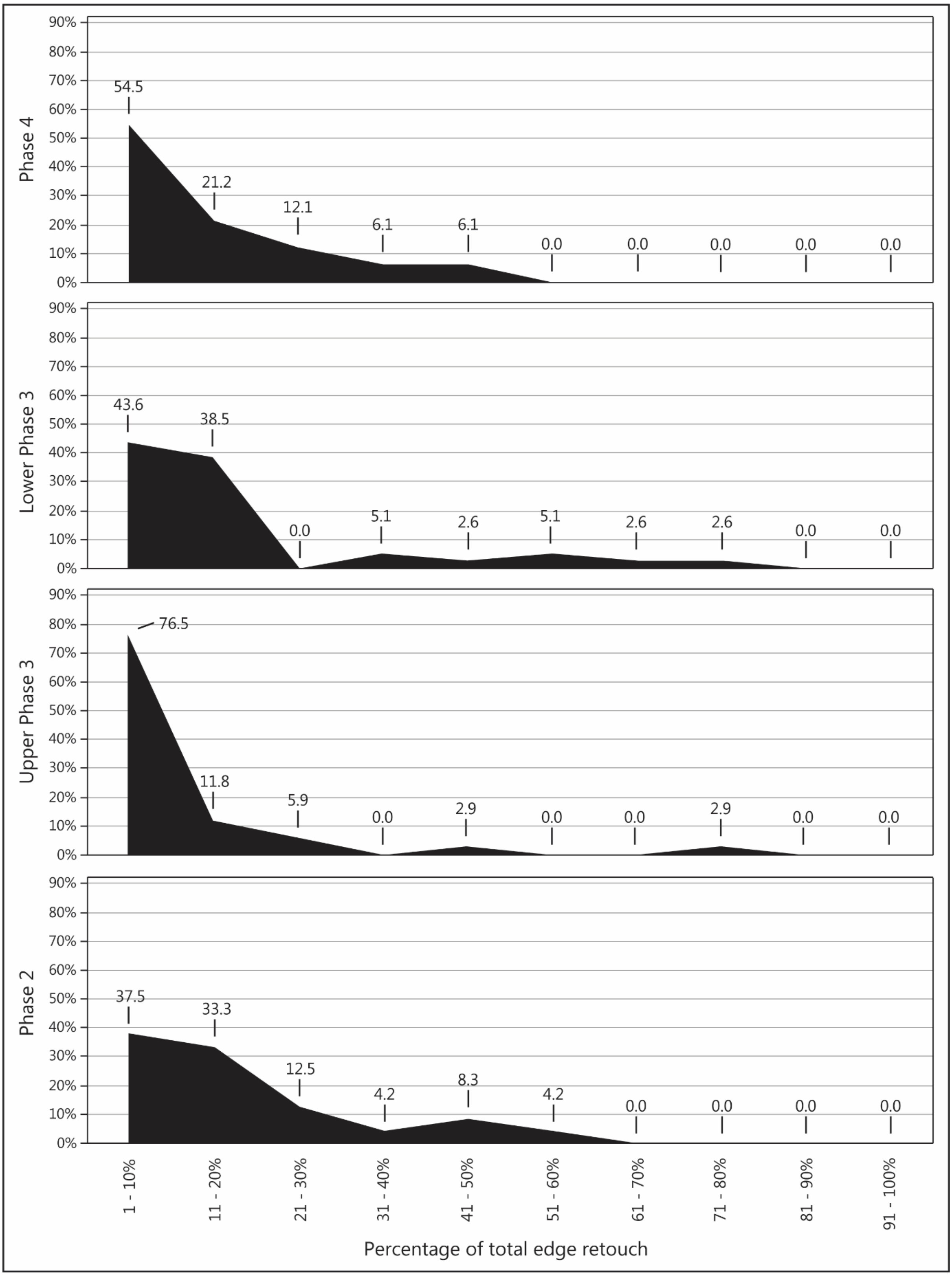


Figure 6.85: Percentage of total edge retouch on notched and denticulated pieces, by phase.

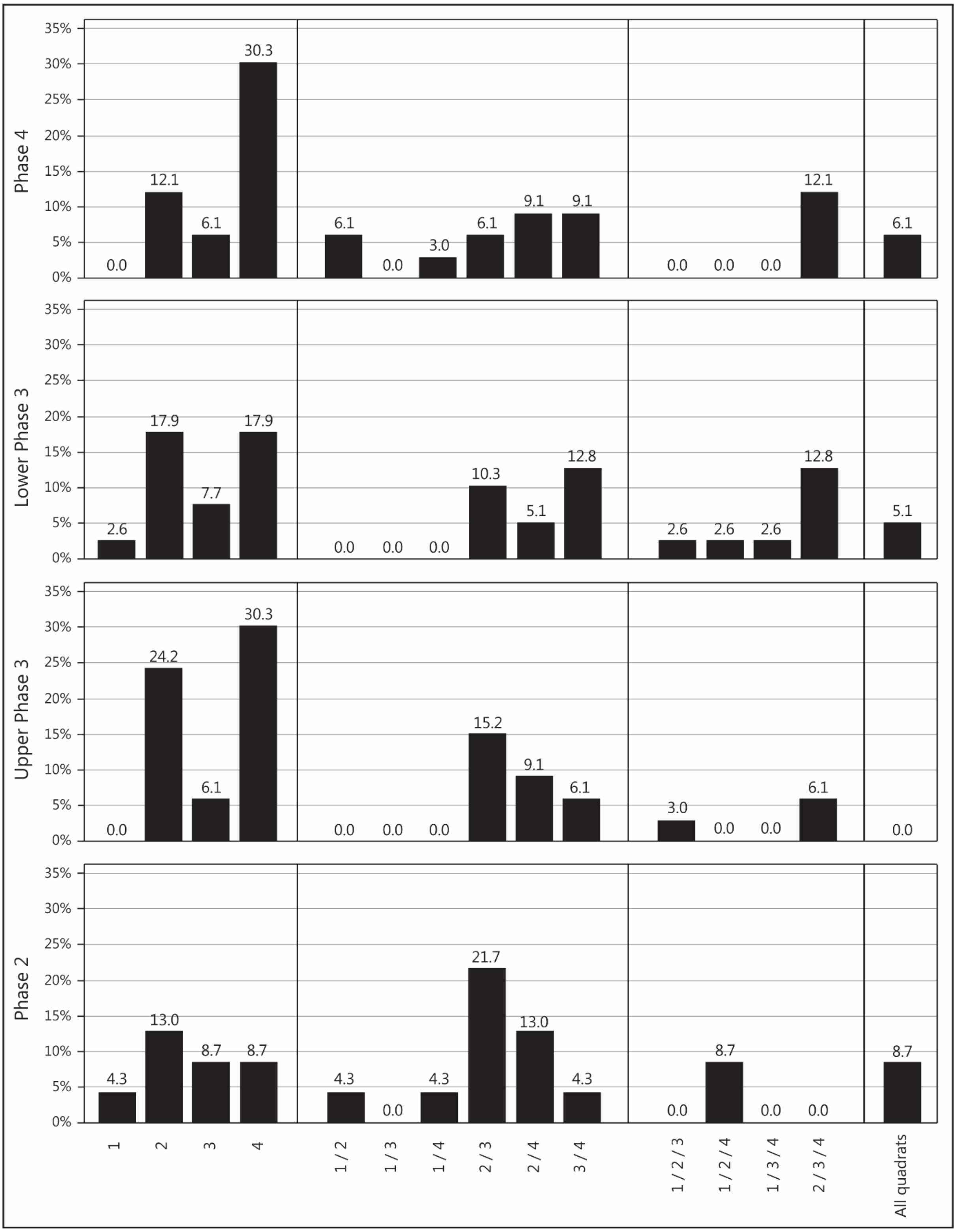


Figure 6.86: Retouch quadrat combinations on notched and denticulated pieces, by phase.

from a recycled sickle component, as demonstrated by the presence of an alternately-retouched awl with sickle sheen partially preserved along its left lateral margin (**Fig. 6.27**: 2).

The majority of the awls and borers feature a unidirectional scar orientation (73.9%), supplemented by smaller proportions of artefacts with 90° change of orientation (17.4%) and radial (8.7%) layouts. No examples of awls or borers with a bi-directional scar orientation were encountered. Cortex is scarce amongst the awls and borers, with almost three quarters (72.0%) not retaining any cortex.

6.4.7.3 Retouch attributes

Alternately-retouched awls feature relatively low amounts of edge retouch, with the average artefact of this type bearing retouch on less than a third of its edge. Conversely, the average bilaterally backed borer exhibits twice as much edge retouch (64.5%), while the other awl types have an average degree of retouch covering three quarters of their total edge. All of these types nonetheless display similar a similarly high maximum range (between 80% to 90%), demonstrating the large degree of variety between types.

6.4.8 Retouched flakes

6.4.8.1 Dimensions

The retouched flakes from the Phase 4 and 3 assemblages remain consistent in size and weight (**Table 6.37**; **Fig. 6.87**). Conversely, the Phase 2 retouched flakes demonstrate a notable decline in these fields, although this may be due to the comparatively small analytical sample (N = 9) from this assemblage. The 'retouched flake' type is larger and heavier on average than either the Helwan-retouched flakes or backed flakes (**Table 6.38**; **Fig. 6.88**), indicating that the more expedient or incidental retouch seen on the first type was applied more often to larger flakes.

6.4.8.2 Blank attributes

Consistent with their decline in size, the Phase 2 retouched flakes also tend to feature smaller numbers of dorsal flake scars (**Table 6.39**; **Fig. 6.89**). Dorsal scar orientations fluctuate in

Table 6.37: Retouched flake dimensions, by phase.

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	13	29.4	7.9	17.7-44.0	24.5	10.2	11.3-45.7	6.9	3.1	2.2-14.0	5.5	4.8	0.5-17.7
Lower Phase 3	29	29.6	11.8	10.2-58.5	25.1	10.0	11.5-51.0	6.7	3.8	2.2-16.9	7.7	11.7	0.2-55.8
Upper Phase 3	26	29.2	9.6	15.3-50.0	24.7	7.3	9.4-44.1	7.0	3.6	2.7-17.2	6.4	9.0	0.3-37.7
Phase 2	9	26.2	8.0	20.2-45.7	17.0	9.6	6.9-40.8	4.9	2.1	2.5-9.2	2.6	4.5	0.4-14.5

Table 6.38: Retouched flake dimensions, by type (Phases 2-4).

	N	Length (mm)			Width (mm)			Thickness (mm)			Mass (g)		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Retouched flake	62	30.1	10.4	15.3-58.5	25.8	9.2	9.4-51.0	7.2	3.6	2.2-17.2	7.4	10.0	0.3-55.8
Helwan-retouched flake	4	23.5	10.2	10.2-32.2	17.0	5.7	11.5-23.6	3.9	0.7	2.9-4.4	1.5	1.1	0.2-2.6
Backed flake	11	25.2	5.2	16.3-34.5	16.2	4.9	6.9-25.6	4.7	1.8	2.2-8.7	1.6	1.3	0.4-5.3

Table 6.39: Retouched flake attributes, by phase.

	N	Flake scars			Percentage of cortex coverage			Percentage of edge retouched		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Phase 4	13	5	2.3	2-9	9.6	14.6	0-45	20.4	15.2	5-60
Lower Phase 3	29	5	2.5	2-11	9.3	14.1	0-45	22.8	12.7	5-55
Upper Phase 3	26	5	2.0	1-11	6.5	12.7	0-55	16.9	13.4	5-65
Phase 2	9	3	2.0	0-6	12.2	29.4	0-90	27.8	15.8	5-50

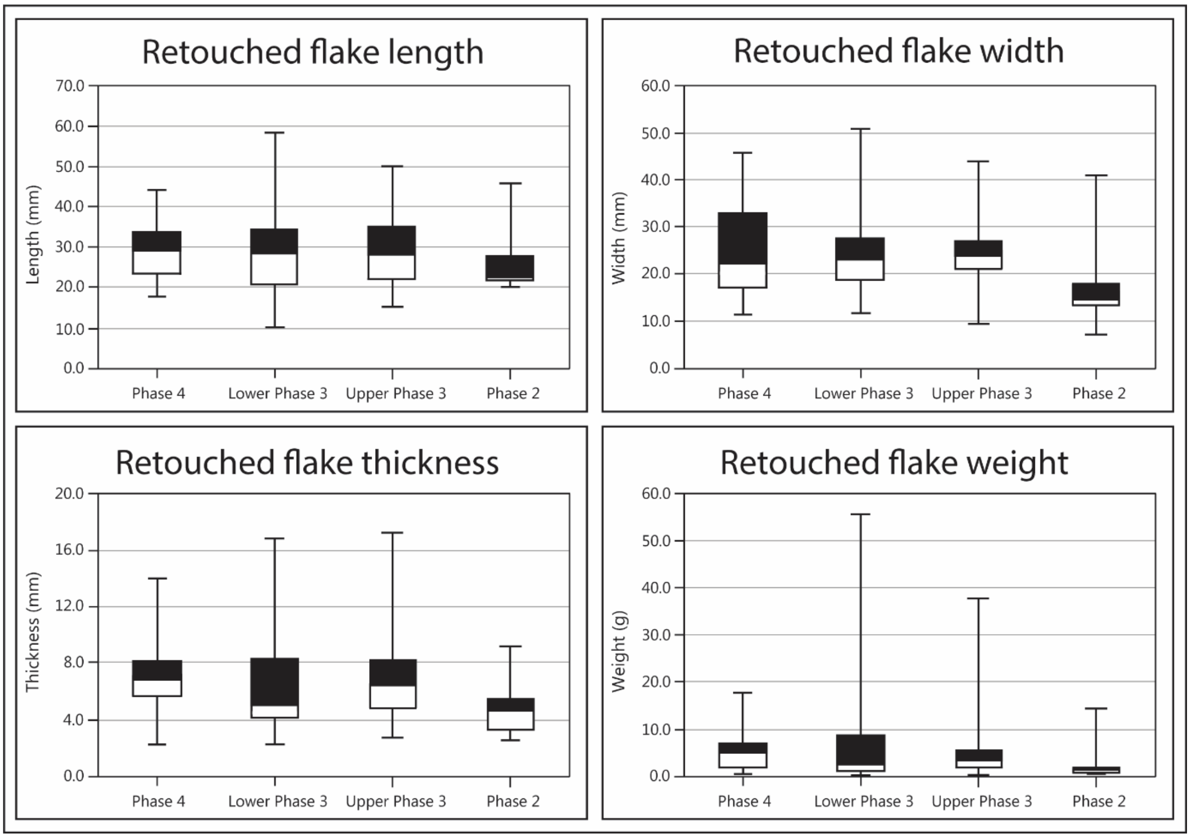


Figure 6.87: Retouched flake dimensions, by phase.

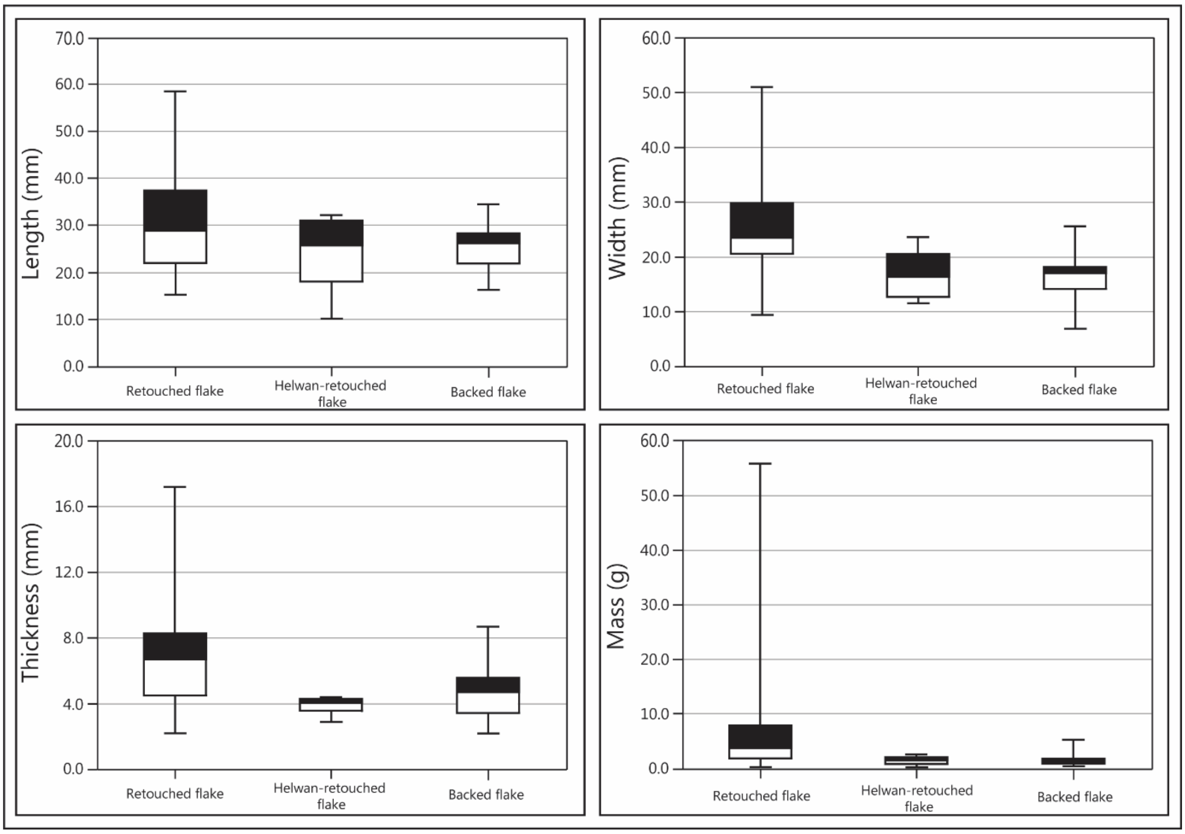


Figure 6.88: Retouched flake dimensions, by type (Phases 2-4).

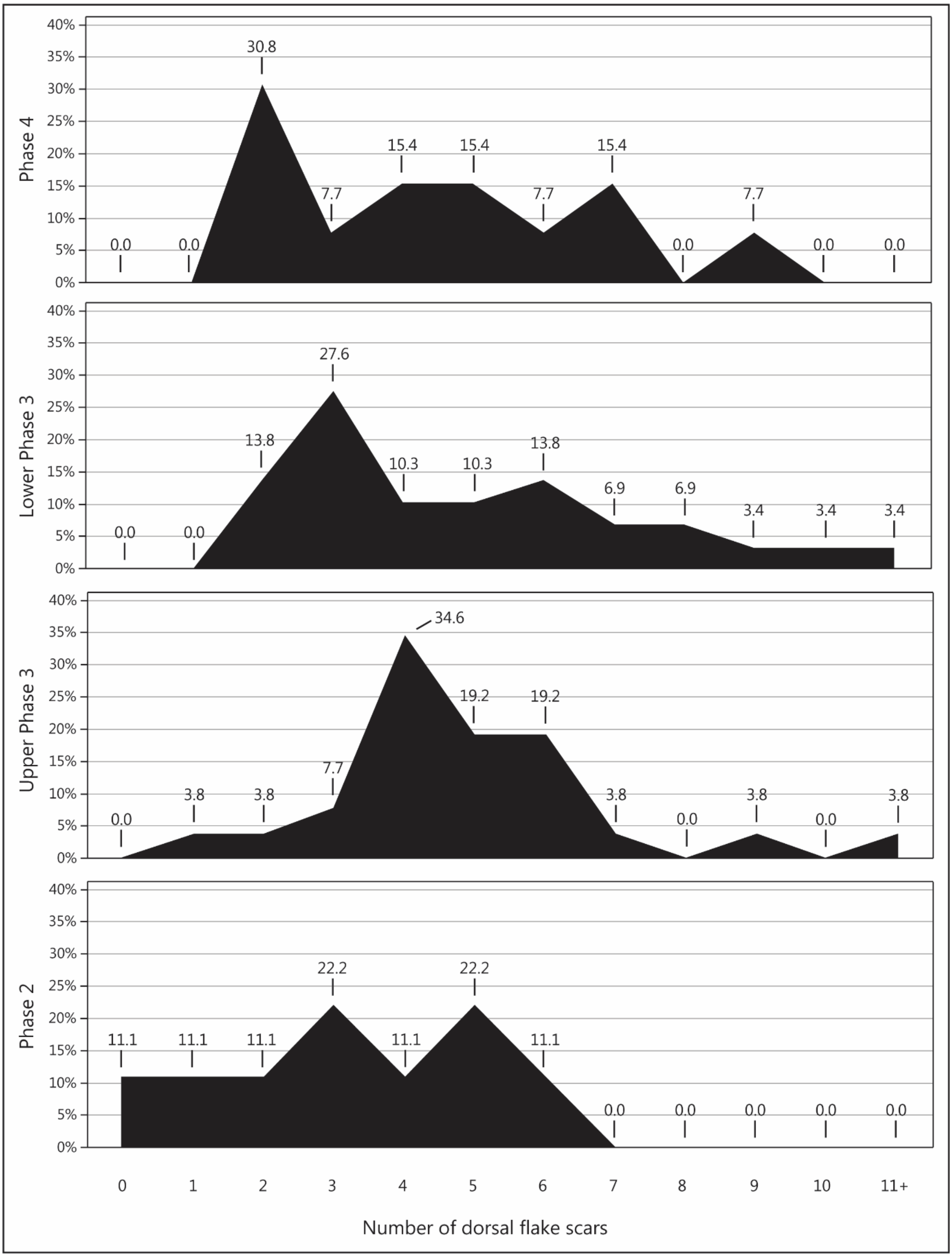


Figure 6.89: Number of negative flake scars on retouched flakes.

prominence across assemblages (**Fig. 6.90**), with the Phase 4 retouched flakes tending to possess unidirectional orientations (46.2%) over change of orientation layouts (30.8%). A more even split between unidirectional (37.9%) and change of orientation layouts (34.5%) then occurs in Lower Phase 3, before shifting in favour of change of orientation layouts in Upper Phase 3 (46.2% over 26.9%). This bias then reverts to an even split in Phase 2 (37.5% each). Between half and two thirds of the retouched flakes in each assemblage are free of cortex (**Fig. 6.91**).

6.4.8.3 Retouch attributes

While all three types in this tool group exhibit similar ranges of edge retouch, the 'retouched flake' type features an average edge coverage (17.8%) half that of the other two types. The typological dominance of the 'retouched flake' type in each assemblage thus results in consistently low average edge retouch percentages for this tool group (**Fig. 6.92**), ranging from 16.9% in Upper Phase 3 to 27.8% in Phase 2. (**Table 6.39**). The distribution of retouch is rarely spread across more than two quadrats, with the Upper Phase 3 assemblage possessing a strong bias (65.4%) towards artefacts with retouched restricted to a single quadrat, particularly along the right-hand lateral margin (**Table 6.40; Fig. 6.93**).

6.5 Summary

With the exception of the bifacial tools, which are absent from Phase 2, every retouched lithic group is well represented in each assemblage, indicating that the overall range of activities carried out onsite remained consistent from the foundation of the site until its final abandonment. While exhibiting some clear typological shifts over time, such as a reduced emphasis on burins struck from truncations, an increase in Helwan retouch between Upper Phase 3 and Phase 2 and an increase in burins and gradual decline in the proportion of multiple tools, the retouched artefact assemblages of Wadi Hammeh 27 likewise remain similar over time. Artefact attributes similarly remain largely uniform across assemblages outside of some relatively minor fluctuations. Most of the attribute changes observed, such as the rise in scrapers, burins and geometric microliths with unidirectional scar layouts, or the rise in burins manufactured from bladelet blanks, can be correlated with modifications made to the core reduction sequence. This relationship is discussed in more detail in Chapters 8 and

9. Having detailed the typological composition of each flaked stone artefact assemblage at Wadi Hammeh 27 across the past three chapters, their spatial distribution may now be explored in the following chapter.

Table 6.40: Distribution of retouch on retouched flakes (in quadrats), by phase.

	Phase 4		Lower Phase 3		Upper Phase 3		Phase 2		Total	
	N	%	N	%	N	%	N	%	N	%
One quadrat										
1	0	0.0	0	0.0	2	7.7	0	0.0	2	3.0
2	0	0.0	6	20.7	2	7.7	0	0.0	8	11.9
3	2	15.4	2	6.9	3	11.5	2	22.2	9	13.4
4	1	7.7	3	10.3	10	38.5	1	11.1	15	22.4
Sub-total	**3**	**23.1**	**11**	**37.9**	**17**	**65.4**	**3**	**33.3**	**34**	**50.7**
Two quadrats										
1,2	0	0.0	1	3.4	1	3.8	2	22.2	4	6.0
1,3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1,4	0	0.0	0	0.0	1	3.8	1	11.1	2	3.0
2,3	5	38.5	6	20.7	2	7.7	0	0.0	13	19.4
2,4	2	15.4	1	3.4	1	3.8	0	0.0	4	6.0
3,4	1	7.7	6	20.7	2	7.7	1	11.1	10	14.9
Sub-total	**8**	**61.5**	**14**	**48.3**	**7**	**26.9**	**4**	**44.4**	**23**	**34.3**
Three quadrats										
1,2,3	0	0.0	1	3.4	1	3.8	1	11.1	3	4.5
1,2,4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1,3,4	1	7.7	1	3.4	0	0.0	1	11.1	3	4.5
2,3,4	0	0.0	2	6.9	1	3.8	0	0.0	3	4.5
Sub-total	**1**	**7.7**	**4**	**13.8**	**2**	**7.7**	**2**	**22.2**	**9**	**13.4**
Four quadrats										
Sub-total	**1**	**7.7**	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**1**	**1.5**
Total	**13**	**100.0**	**29**	**100.0**	**26**	**100.0**	**9**	**99.9**	**67**	**99.9**

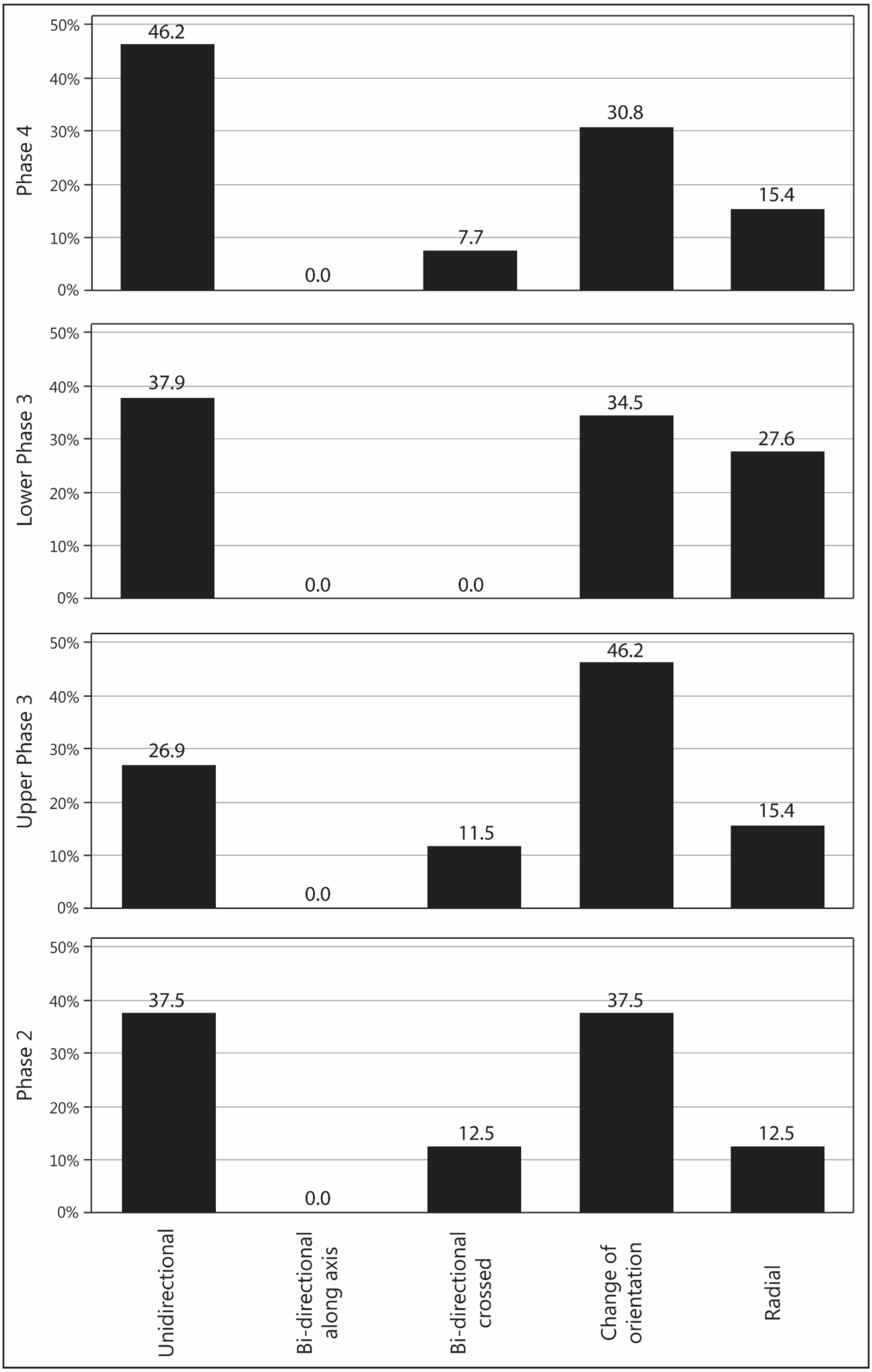


Figure 6.90: Retouched flake scar orientation, by phase.

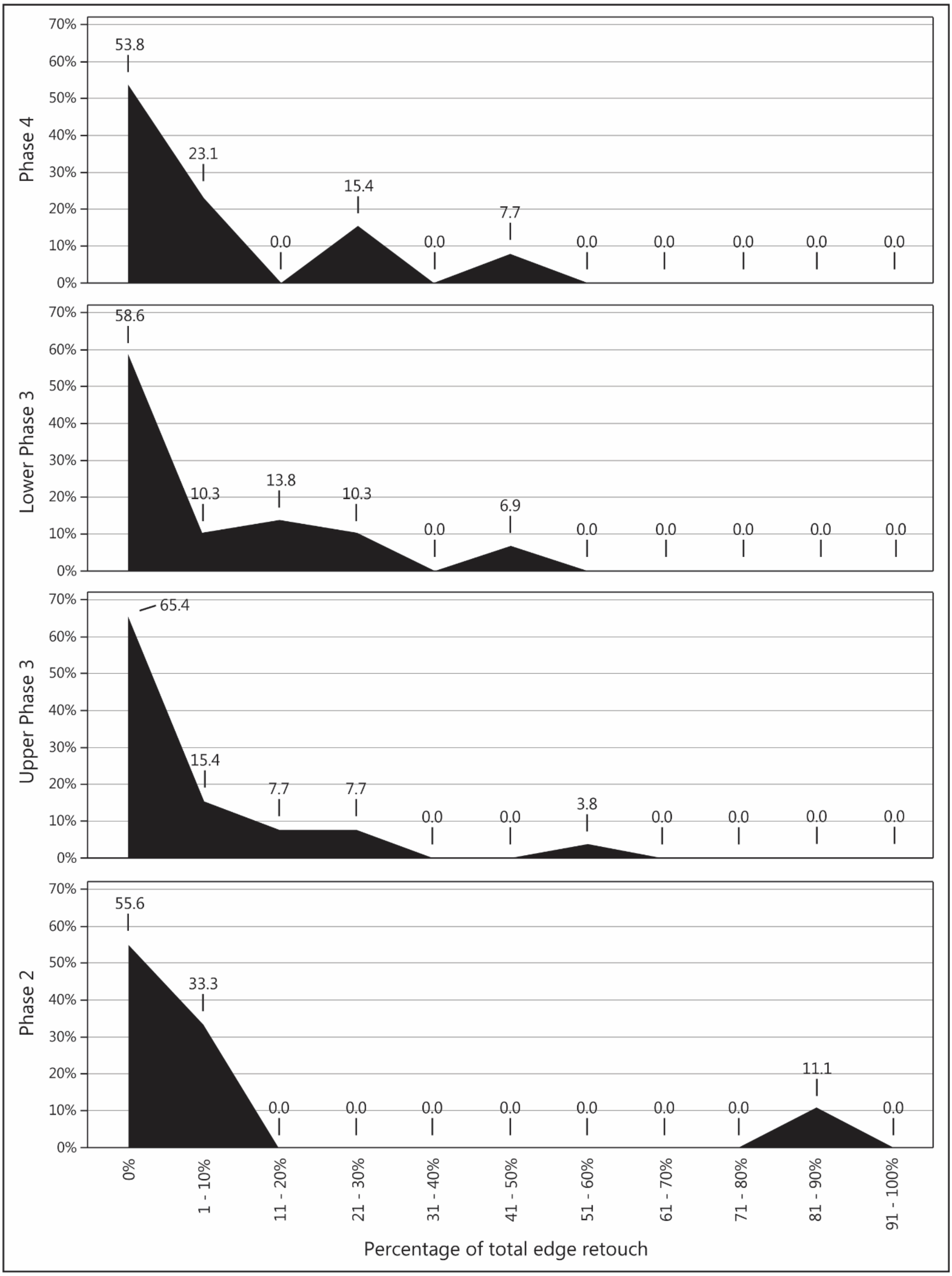


Figure 6.91: Retouched flake dorsal surface cortex coverage, by phase.

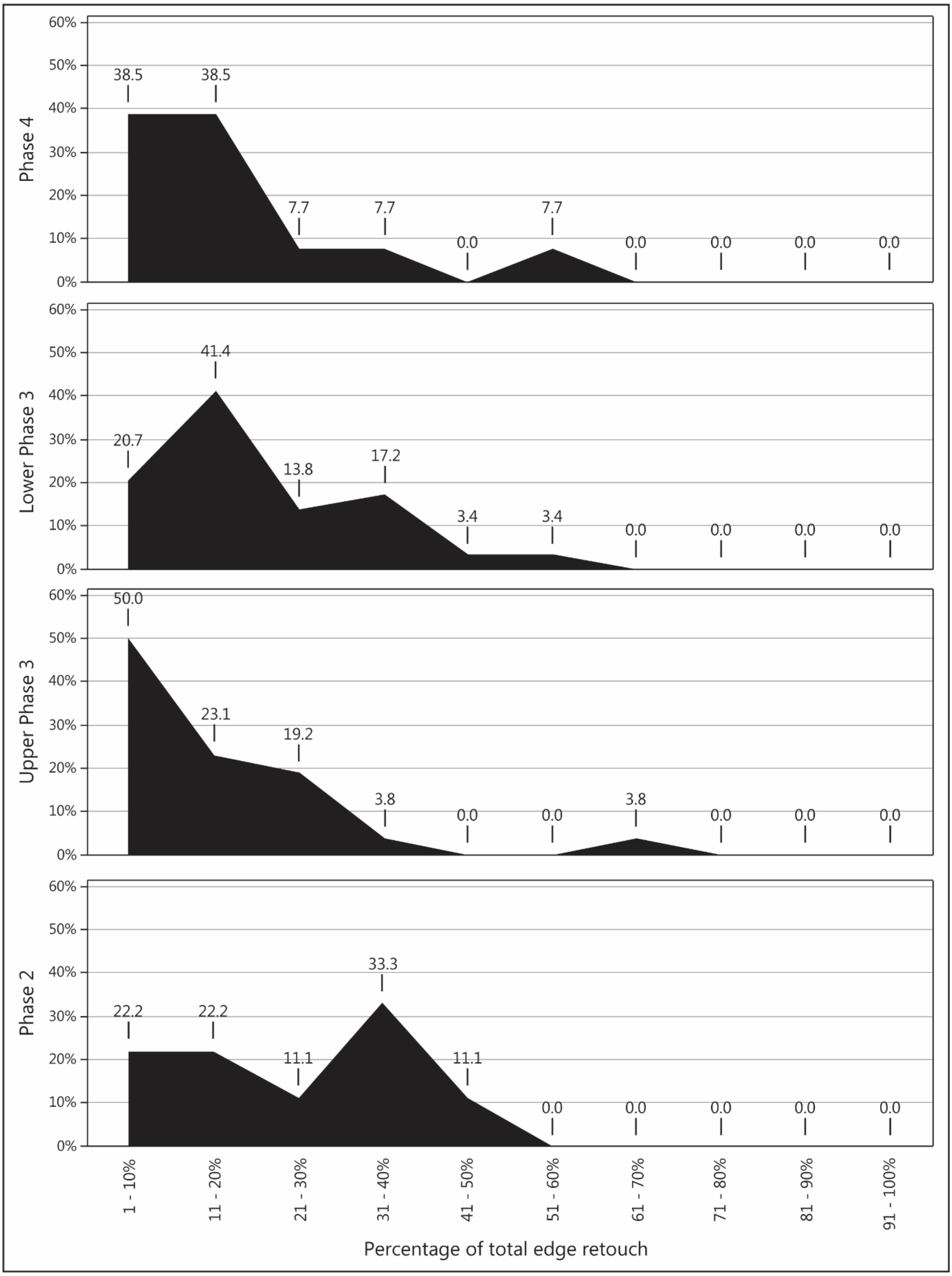


Figure 6.92: Percentage of total edge retouch on retouched flakes, by phase.

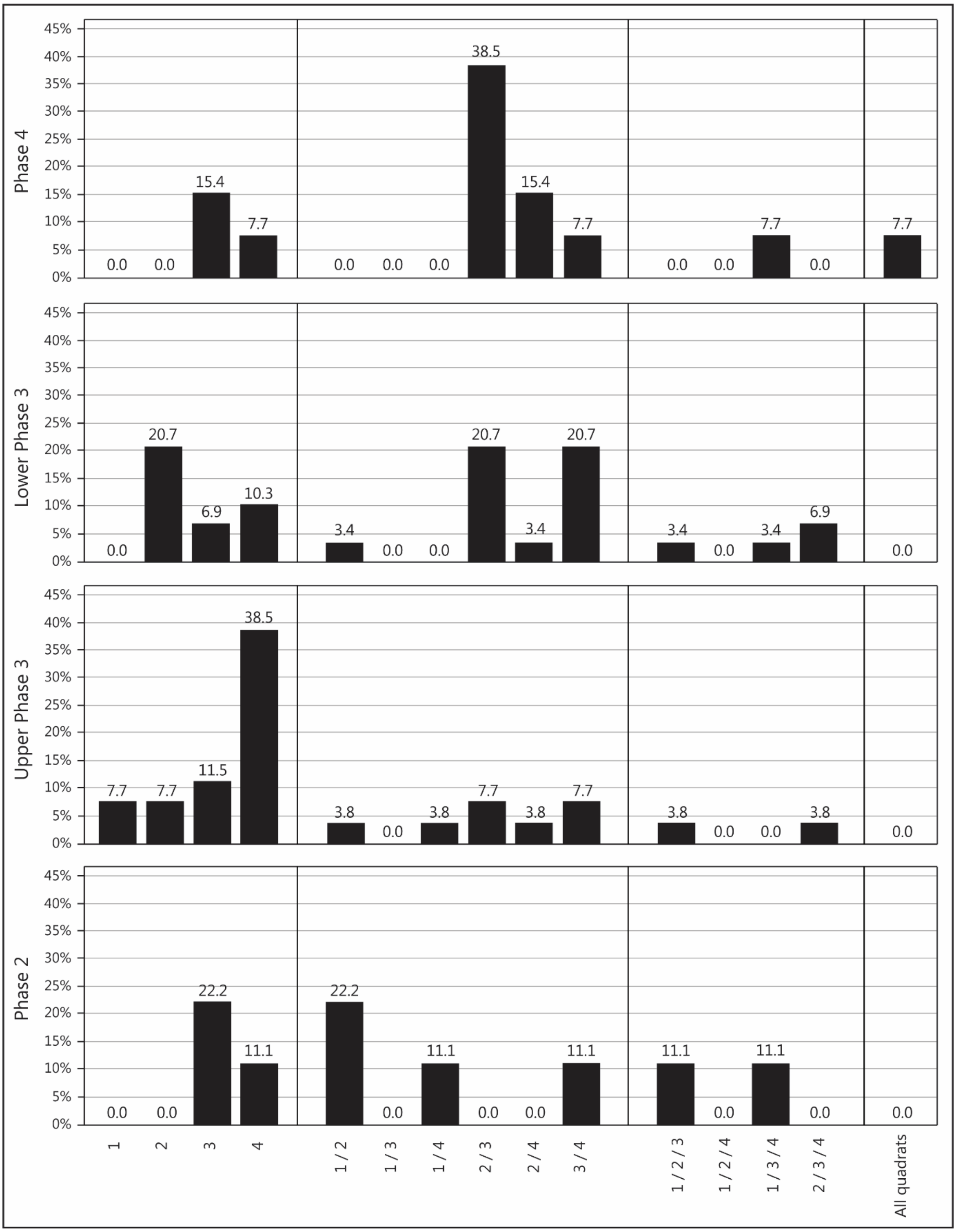


Figure 6.93: Retouch quadrat combinations on retouched flakes, by phase.

Chapter 7: The spatial distribution of cultural material at Wadi Hammeh 27

7.1 Introduction

The 1980s exposure of the Phase 1 occupational surfaces at Wadi Hammeh 27 provided an ideal opportunity to investigate the spatial relationship between the large curvilinear structures that characterised this phase and their associated material culture. Ultimately, a clear association of discards with the interior deposits of both structures was demonstrated, indicative of significant primary refuse deposits accumulating in these spaces. The investigators argued that this layout represents the retention of a 'Palaeolithic' approach to refuse disposal at Wadi Hammeh 27, continued in a novel architectural milieu that presaged later Neolithic settlement (Hardy-Smith & Edwards 2004; Edwards & Hardy-Smith 2013). This chapter applies a similar approach to the earlier phases by describing the spatial relationships of various architectural features and their associated artefact assemblages.

Although similar spatial analyses have been successfully undertaken at `Ain Mallaha (Samuelian 2013), El Wad Terrace (Yeshurun et al. 2014) and Phase 1 of Wadi Hammeh 27 (Edwards & Hardy-Smith 2013), the current study is innovative in several aspects. First and foremost, the multi-phase, GIS-aided density analysis applied in this chapter represents the first of its kind to be applied in a Natufian setting across an extensive stratigraphic sequence. Furthermore, the fact that all five of the lower-phase lithic assemblages have been catalogued in their entirety allows for more detailed analyses than had been possible for Hardy-Smith and Edwards (2004), whose analysis was limited to counting and weighing the bulk lithic assemblage. Here it has been possible to track the lateral distribution of individual debitage types and retouched tool groups, in addition to the other artefact and refuse groups, and to estimate their statistical relationships. This chapter primarily serves as a description of the spatial analyses. Interpretations and theoretical implications are explored in Chapter 10 in conjunction a consideration of broader site formation processes at the site.

7.2 Methodology and research design

The IAV excavations offer considerably greater areal exposures of the earlier occupational surfaces than previously available. In particular, the clear demarcation in Upper and Lower Phase 3 between interior and exterior domestic space allows for similar investigations as afforded by the Phase 1 occupation of Structures 1 and 2, if on a somewhat smaller scale. The loci utilised for the GIS-aided plots are as follows: Locus 2.5 for Phase 2; Loci 2.6, 6.1 and 7.1 for Upper Phase 3; Loci 8.1 and 9.1 for Lower Phase 3 and Loci 8.3 and 9.5 for Upper Phase 4.

While detailed analyses have yet to be undertaken on the faunal assemblages recovered from the 2014-16 excavations at Wadi Hammeh 27, all of this material was sorted, weighed and counted by the end of the third excavation season, and their overall distribution is therefore available to be compared with the flaked stone material. As with the flaked stone artefacts, the distribution of faunal material is charted in terms of both their specimen numbers and weights, with the latter parameter providing a more reliable means of identifying locations where the actual bulk of faunal material was deposited, as opposed to measuring spaces with a greater rate of fragmentation.

The spatial distribution plots presented in this chapter were produced using ArcGIS ArcMap version 10.6. These plots illustrate the horizontal distribution of artefacts across each phase. The density classes utilised in most plots were automatically generated using the Jenks natural breaks classification method, which aims to maximise the statistical variance between different classes. The only situations in which the Jenks optimization method has not been applied is in cases where the artefact type in question does not exceed more than five pieces in any square, rendering its usage unnecessary. The total distributions of lithic artefacts and faunal remains for each phase are plotted according to both areal density (N / square metre) and volumetric density (N / cubic metre of sediment). The distribution of individual lithic debris, debitage and tool types also been plotted according to their areal density in each square, while rare objects (in this case, groundstone and worked bone artefacts) have been plotted according to their absolute numbers. In addition to these density plots, the statistical relationships of each assemblage are calculated through the application of Pearson's correlation coefficient (r) in Microsoft Excel.

7.3 Description of artefact distributions, by phase

7.3.1 Phase 2

7.3.1.1 Lithic distributions

The areal distributions of flaked stone artefacts are clustered along the eastern and southern edges of the excavation area (**Figs. 7.2 - 7.3**). By volume, the distribution of Phase 2 lithic artefacts varies considerably between the number of artefacts and artefact weights, with the former category exhibiting particularly high densities Squares B4, C2, E4 and E6 (**Fig. 7.4**). In contrast, the distribution of volumetric lithic weights is centred on two broader clusters centred respectively along the northern edge of Wall 1 and Squares E4 and E5 in the south (**Fig. 7.5**).

7.3.1.1.1 Debris, debitage and cores

The distribution of debris and debitage types in Phase 2 vary somewhat. A broadly common pattern is shared by the chunks, chips, flakes, flakes <2cm, broken flakes, bladelets, bladelets 2cm, broken blades and bladelets and burin spalls, with these types all exhibiting their highest quantities in squares along the southern baulk and the edge of the XX F sondage (**Figs. 7.6 – 7.14**). Some minor variations between these distributions may nonetheless be noted: the whole flakes, broken flakes and broken blades and bladelets are relatively evenly distributed across these areas, whereas the flakes <2cm, bladelets, bladelets <2cm and burin spalls are more clustered towards the south-east corner of the exposure. The chips, on the other hand, are most common immediately to the east of Feature 7, in Square C2, while the richest quantities of chunks extend across Squares C2 and D2. The blades are the only type of debitage to stray from this layout to any real extent, instead being recovered almost exclusively along the southern baulk and being absent from the squares bordering the XX F sondage (**Fig. 7.15**).

The distribution of Phase 2 cores varies considerably by group. The flake cores exhibit a clear inclination towards the southern-eastern corner of the excavation area, with the squares bordering Wall 1 almost all being devoid of these artefacts (**Fig. 7.16**). Conversely, the bladelet cores are primarily distributed between three clusters centred on squares B2, E2 and E5 respectively (**Fig. 7.17**), while the core fragments are mainly clustered along the southern

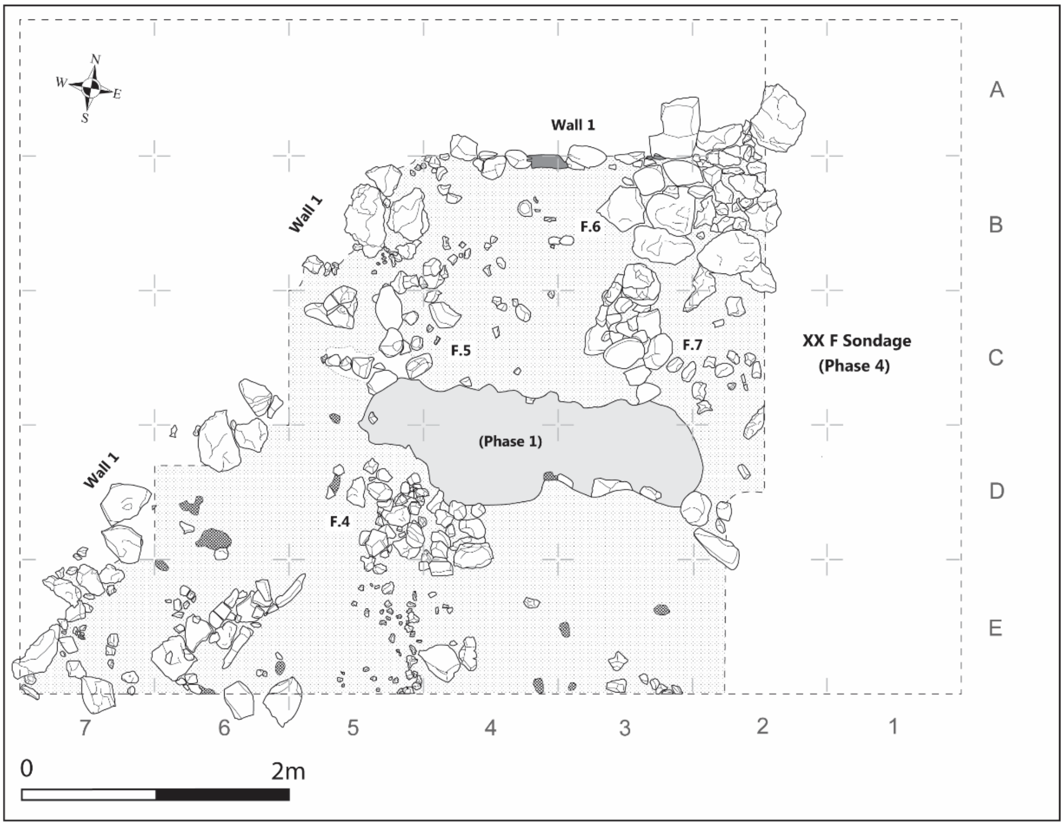


Figure 7.1: Plan of the Area XX F, Phase 2 exposure.

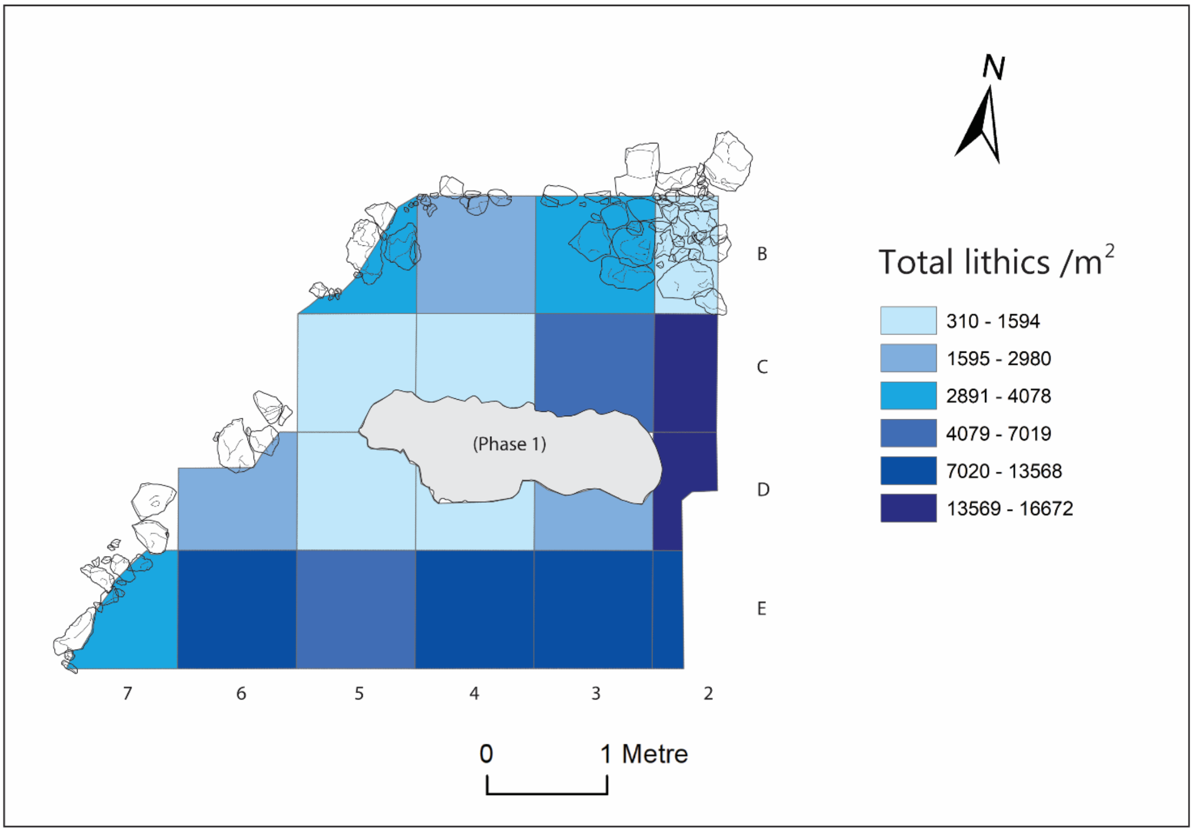


Figure 7.2: Distribution of Phase 2 flaked stone artefacts, by areal density.

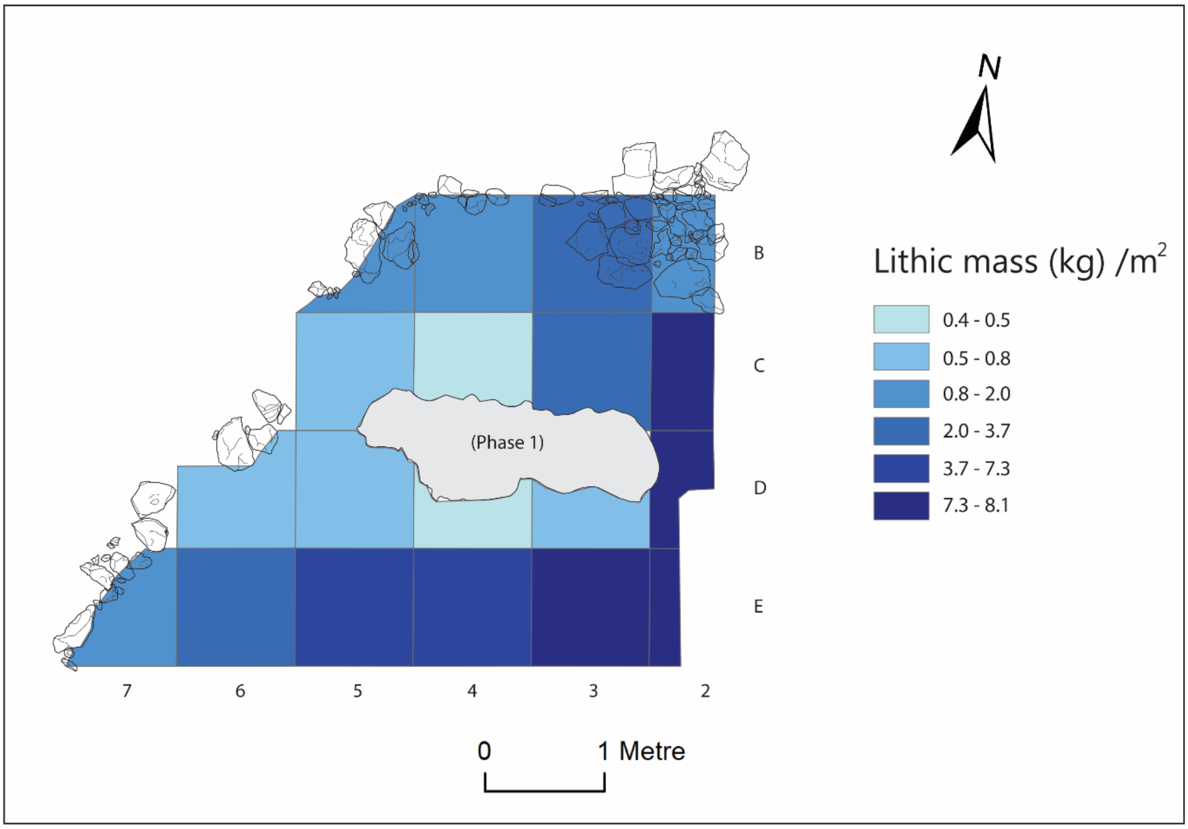


Figure 7.3: Distribution of Phase 2 flaked stone weights, by areal density.

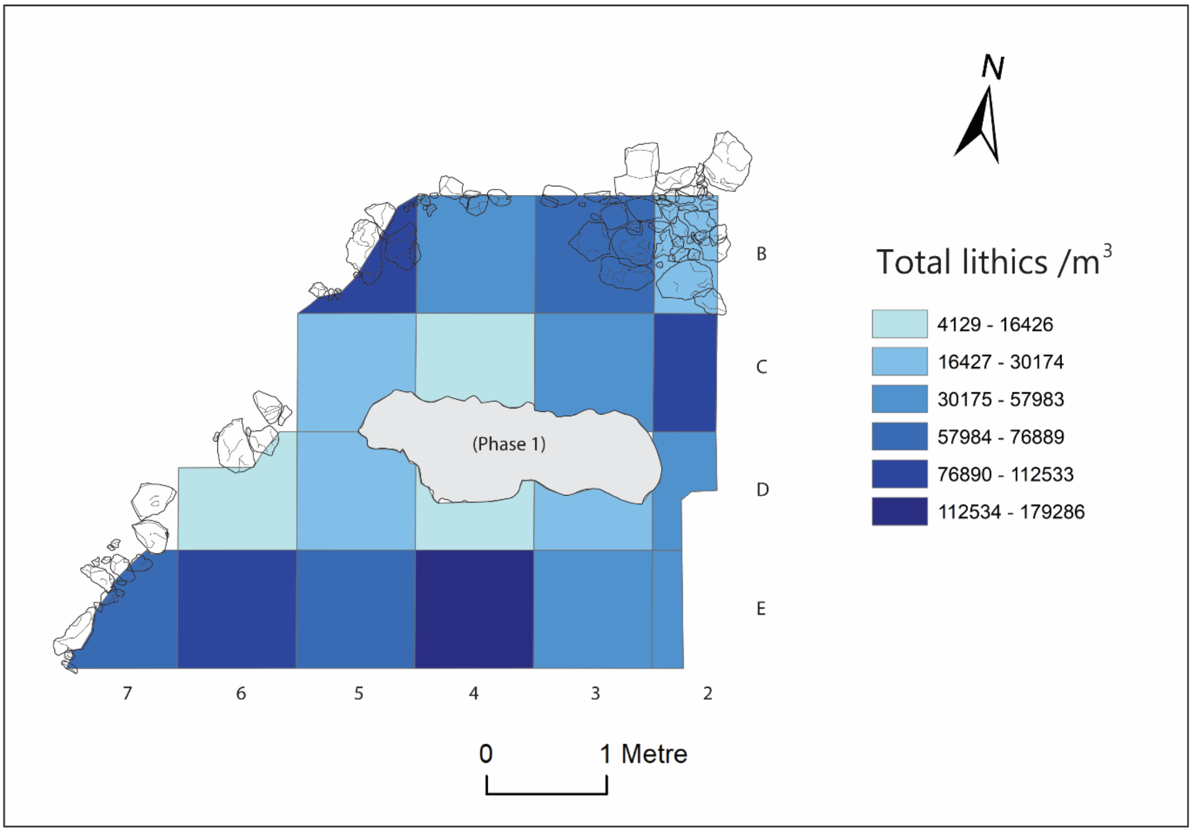


Figure 7.4: Distribution of Phase 2 flaked stone artefacts, by volumetric density.

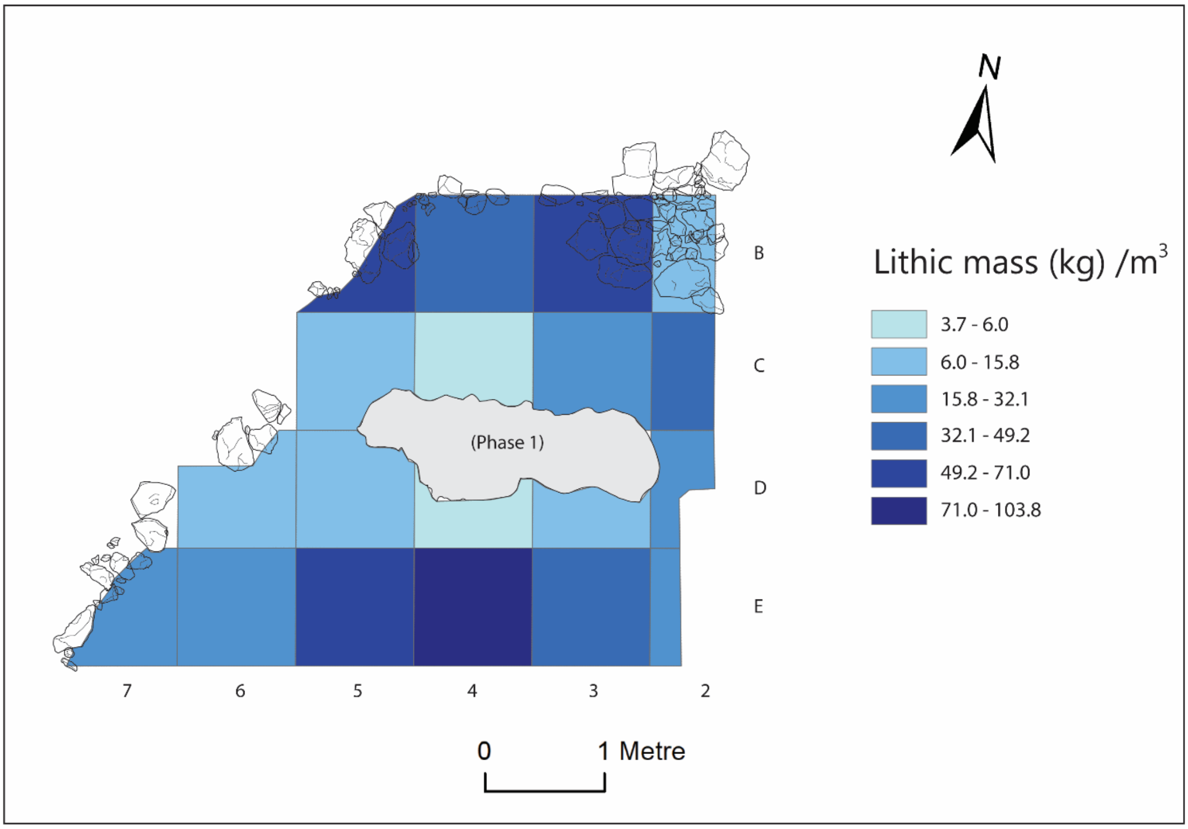


Figure 7.5: Distribution of Phase 2 flaked stone weights, by volumetric density.

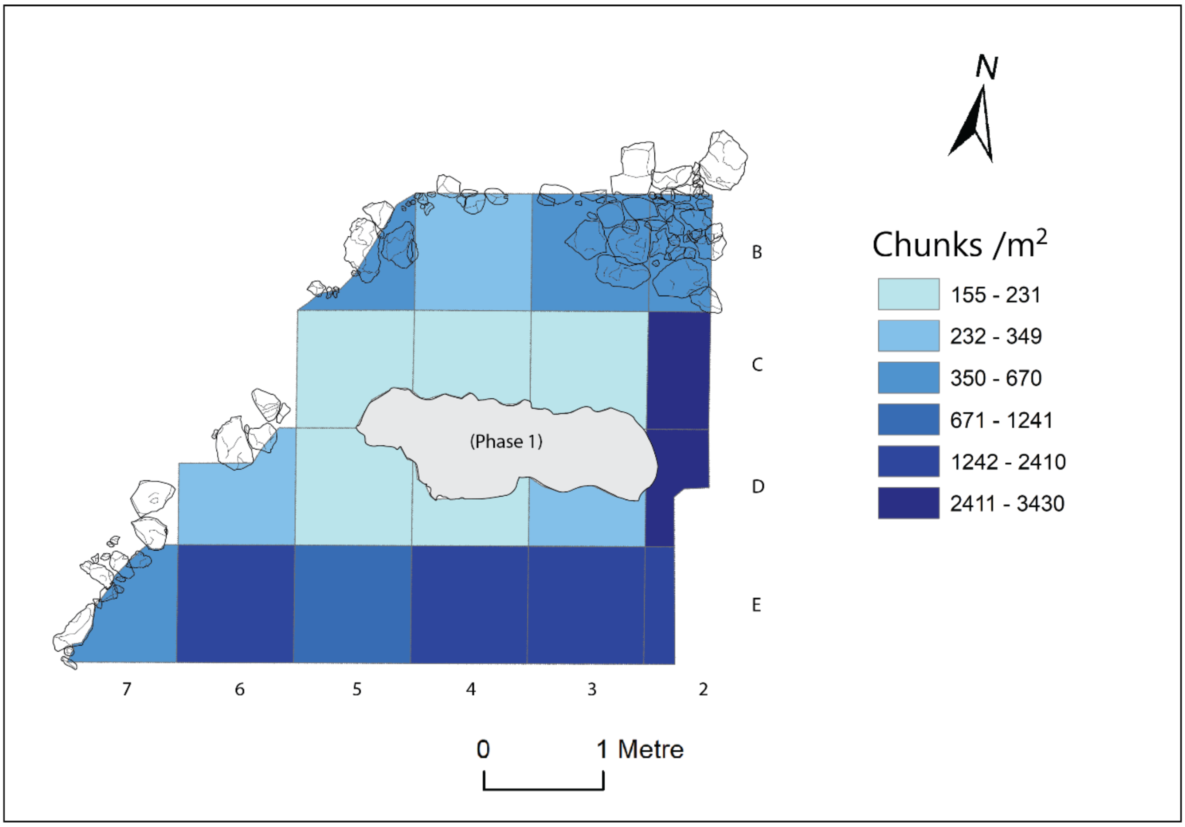


Figure 7.6: Distribution of Phase 2 chunks.

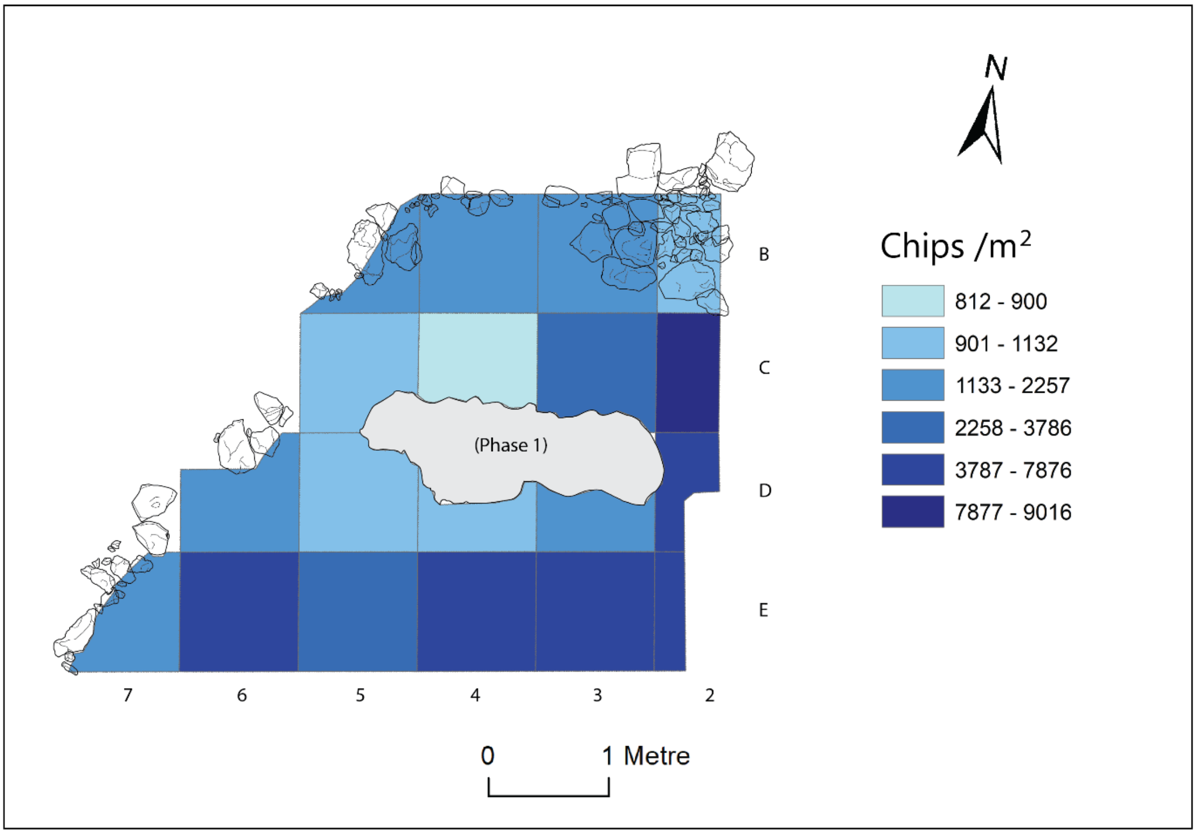


Figure 7.7: Distribution of Phase 2 chips.

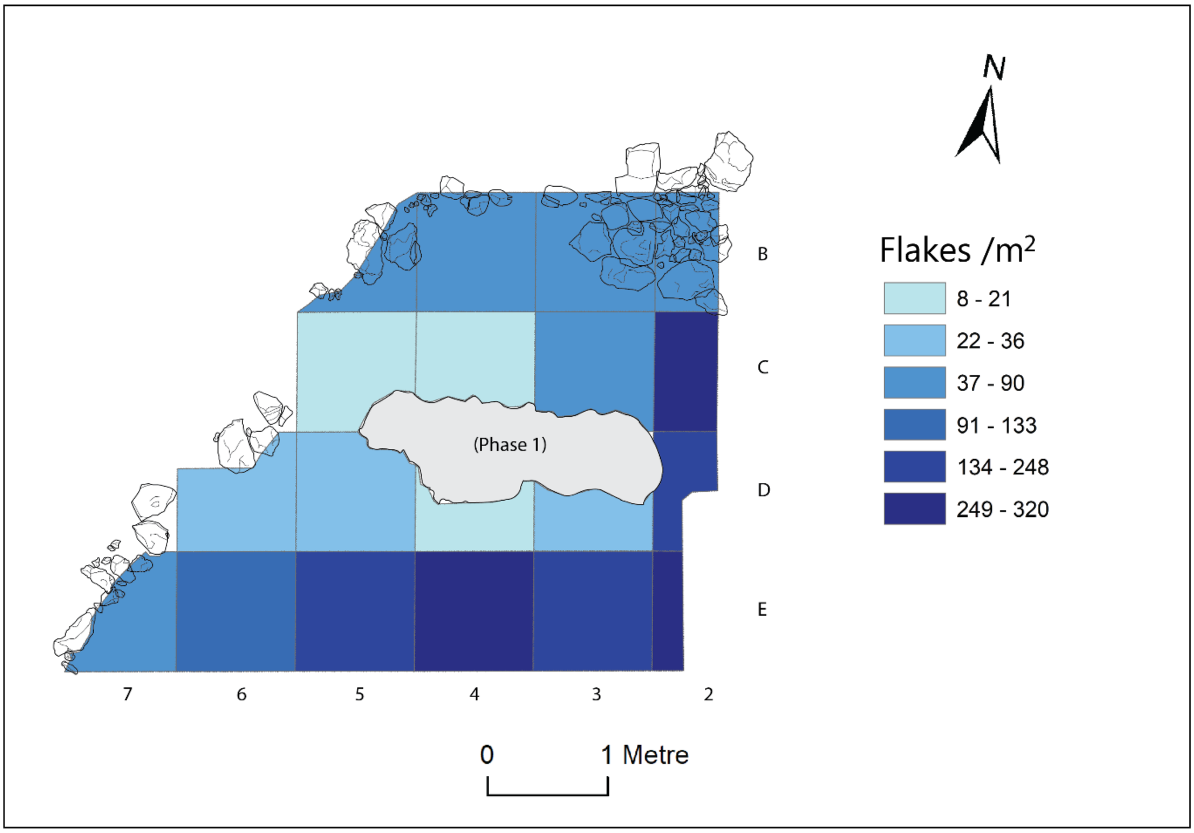


Figure 7.8: Distribution of Phase 2 flakes.

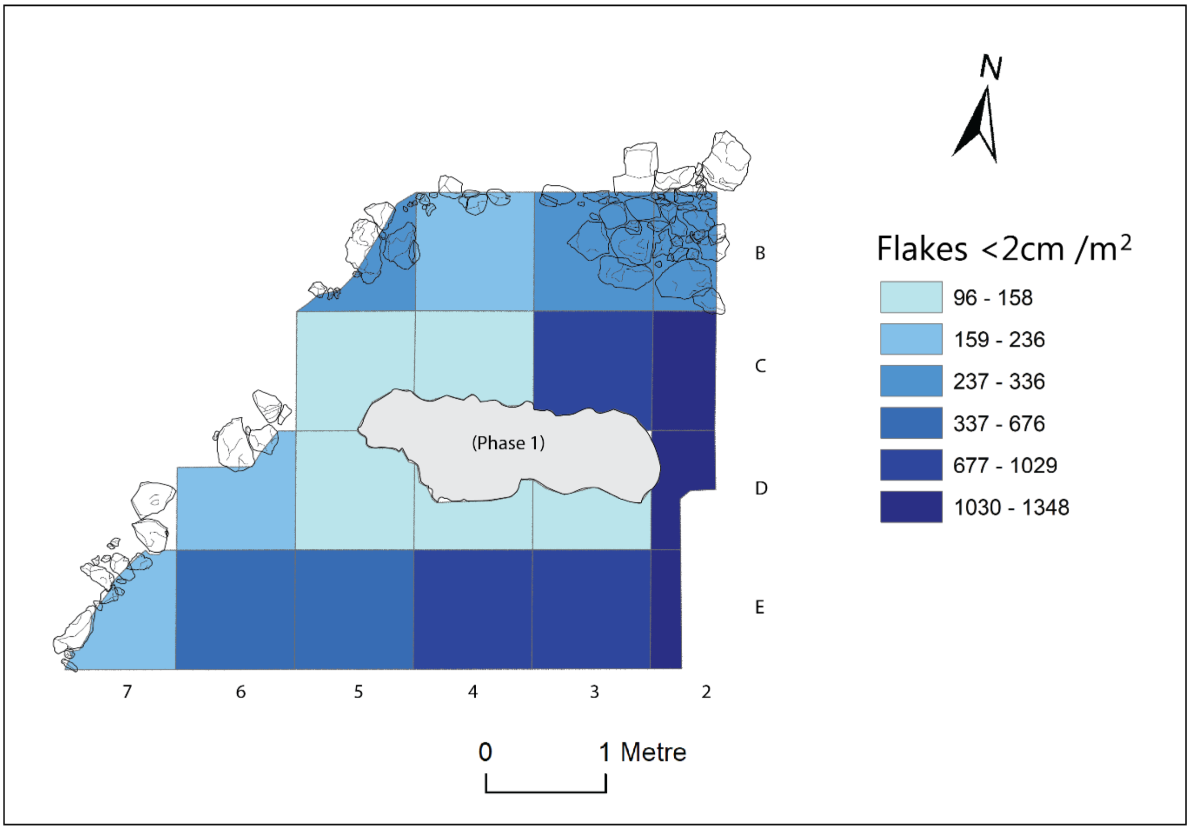


Figure 7.9: Distribution of Phase 2 flakes <2cm.

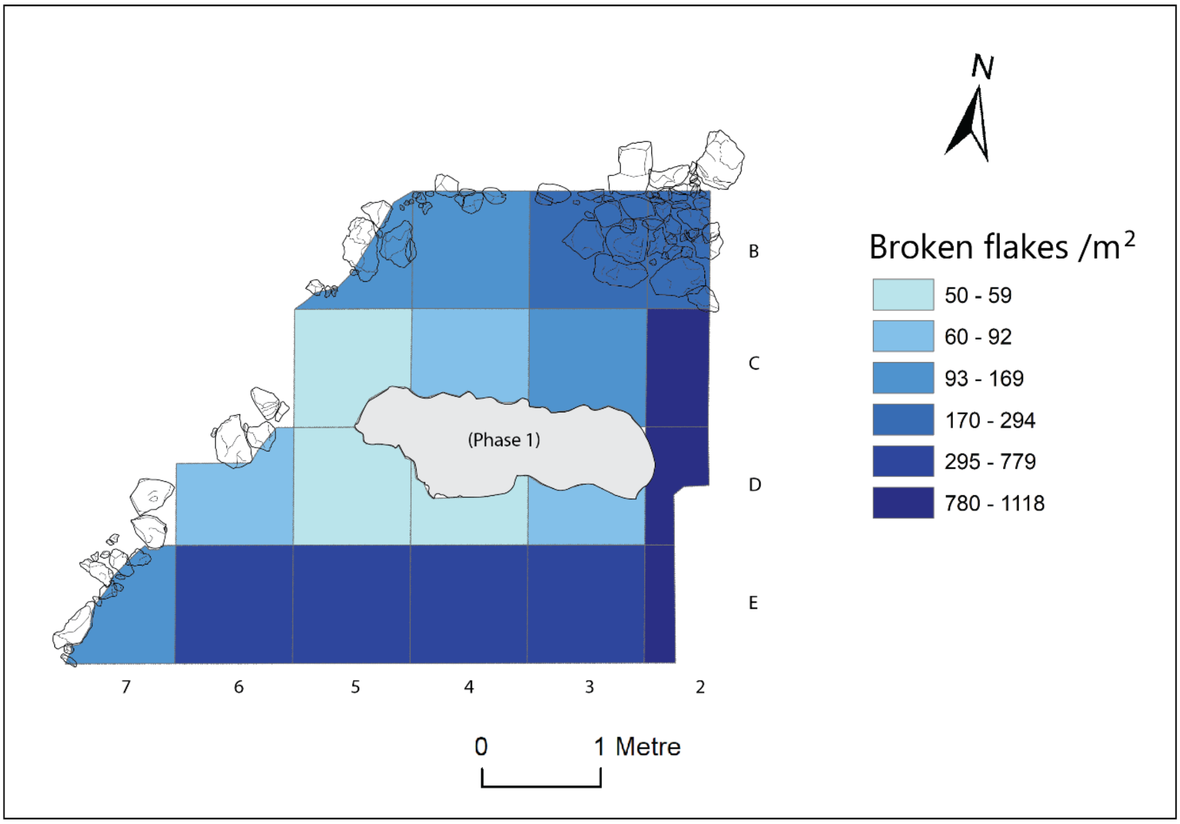


Figure 7.10: Distribution of Phase 2 broken flakes.

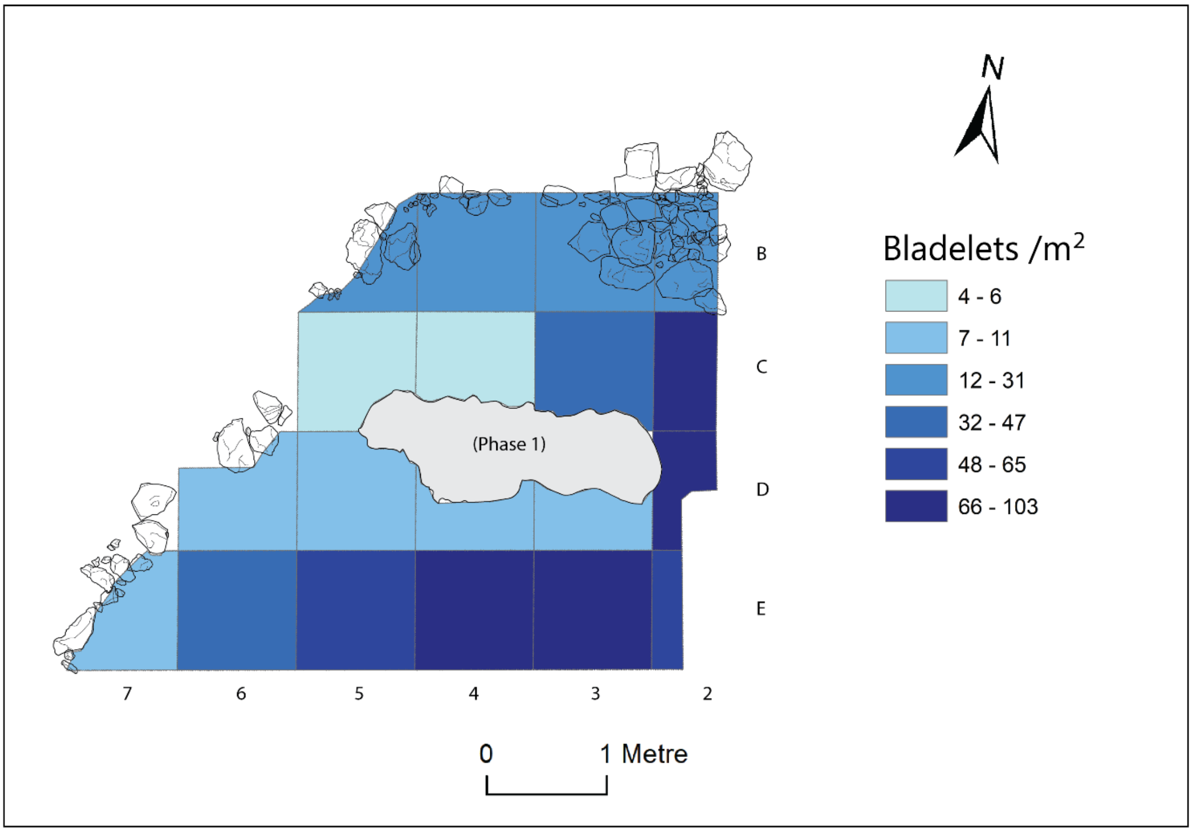


Figure 7.11: Distribution of Phase 2 bladelets.

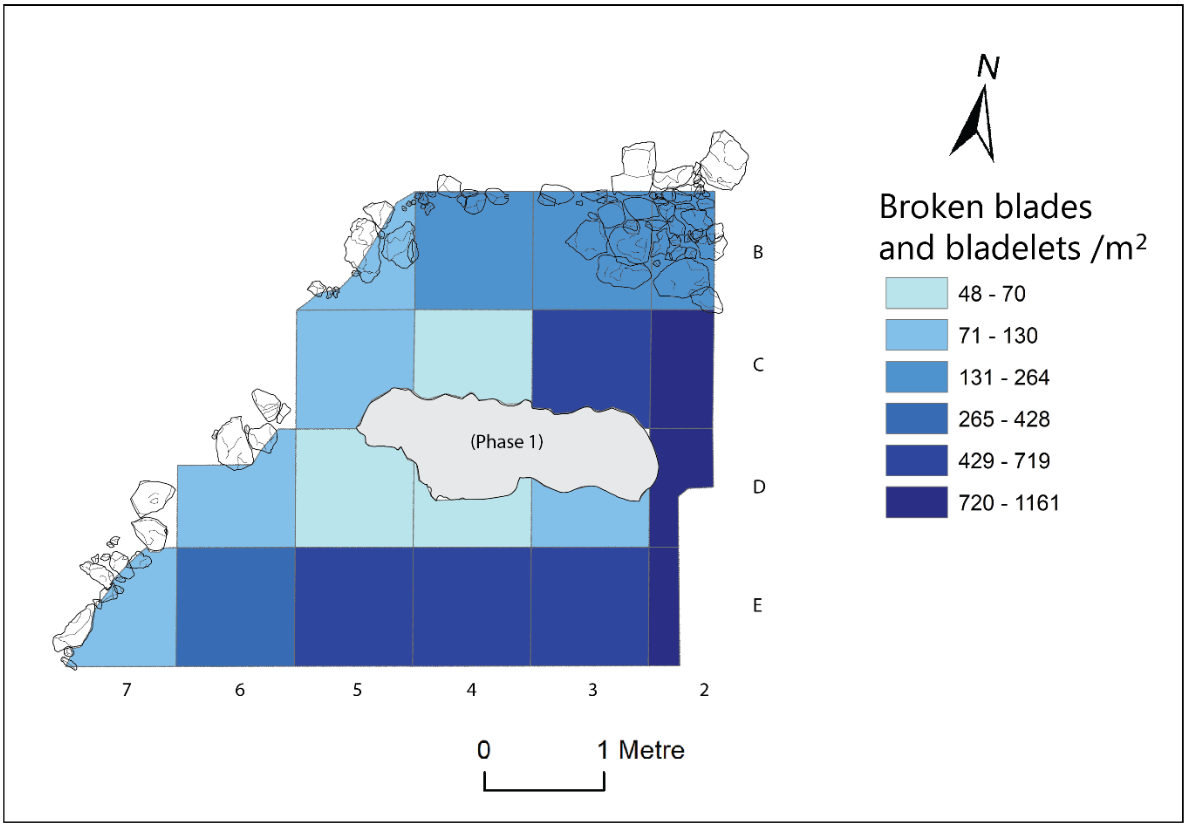


Figure 7.12: Distribution of Phase 2 broken blades and bladelets.

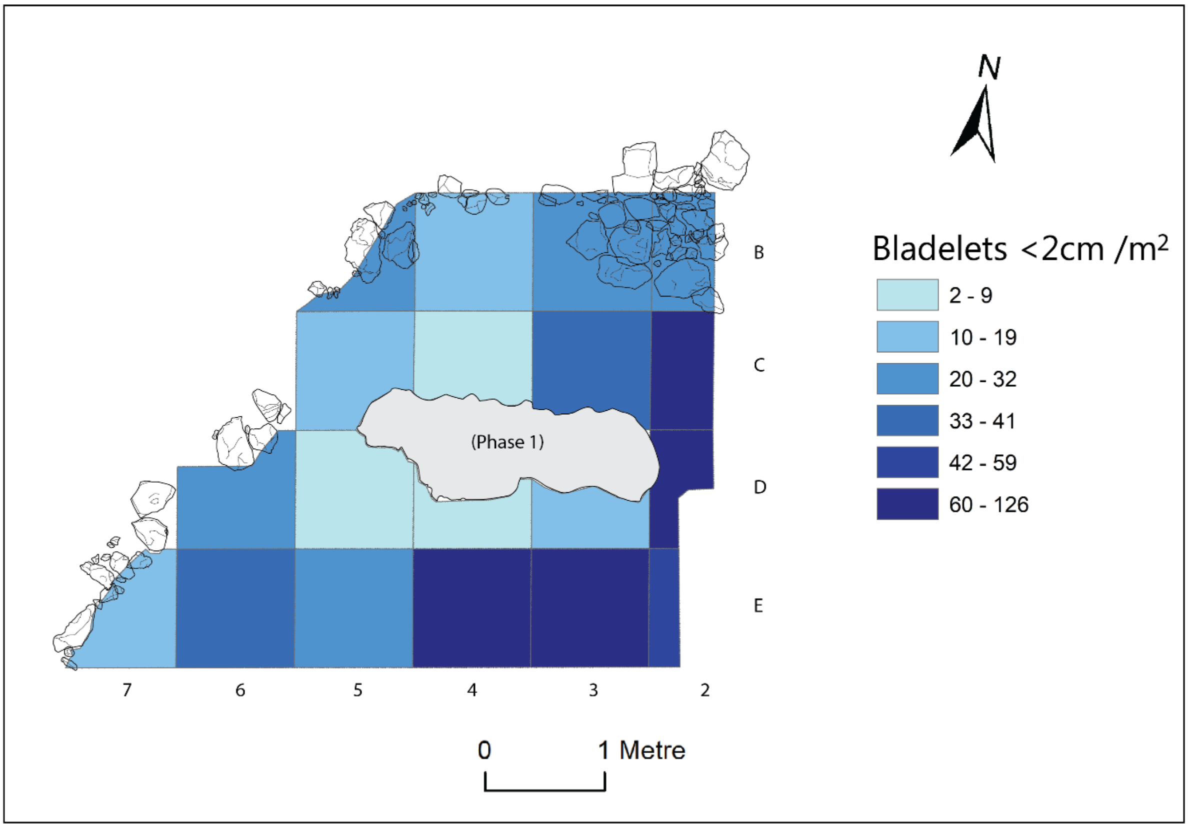


Figure 7.13: Distribution of Phase 2 bladelets <2cm.

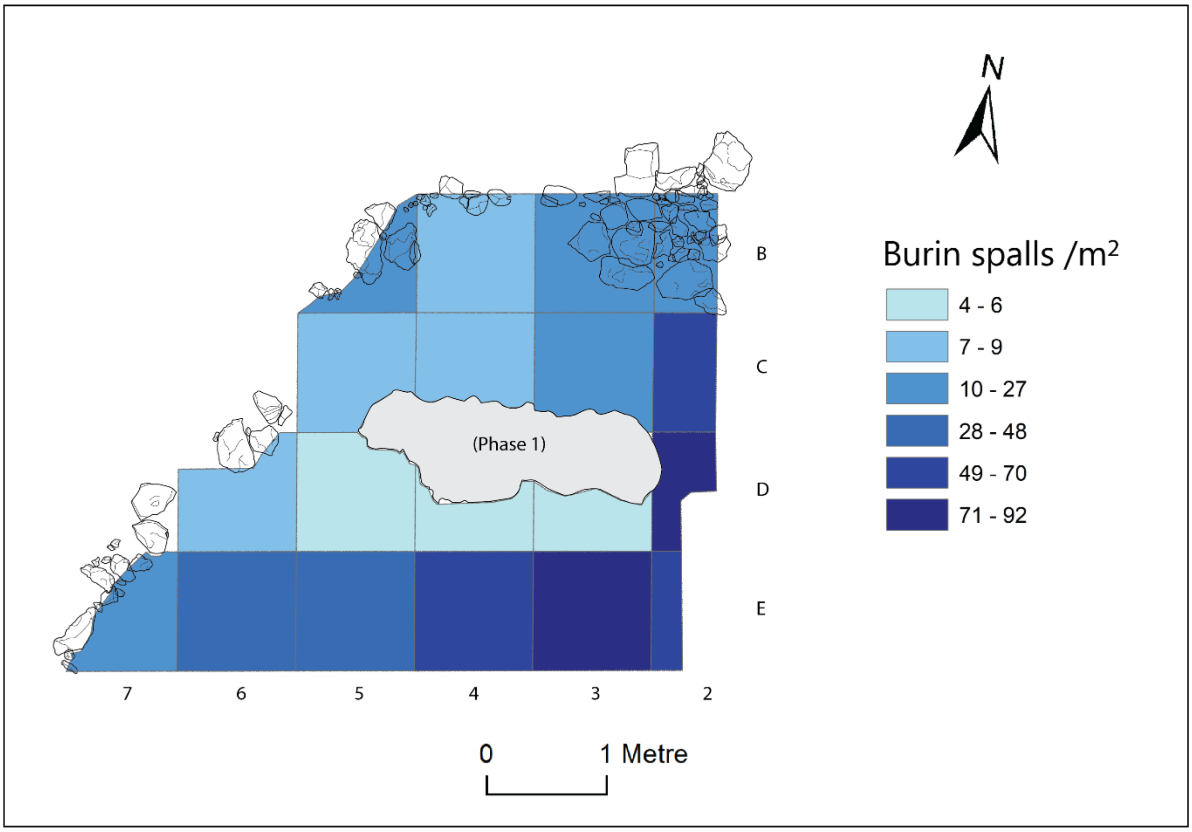


Figure 7.14: Distribution of Phase 2 burin spalls.

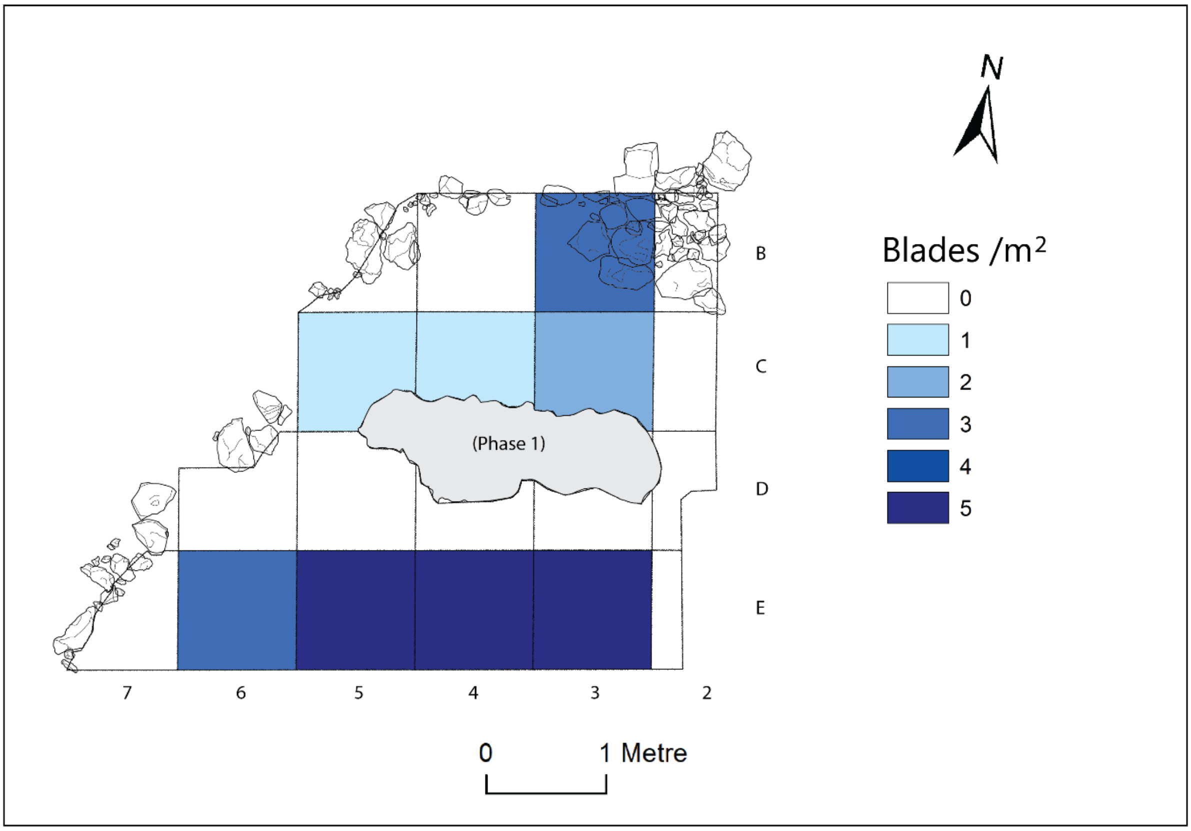


Figure 7.15: Distribution of Phase 2 blades.

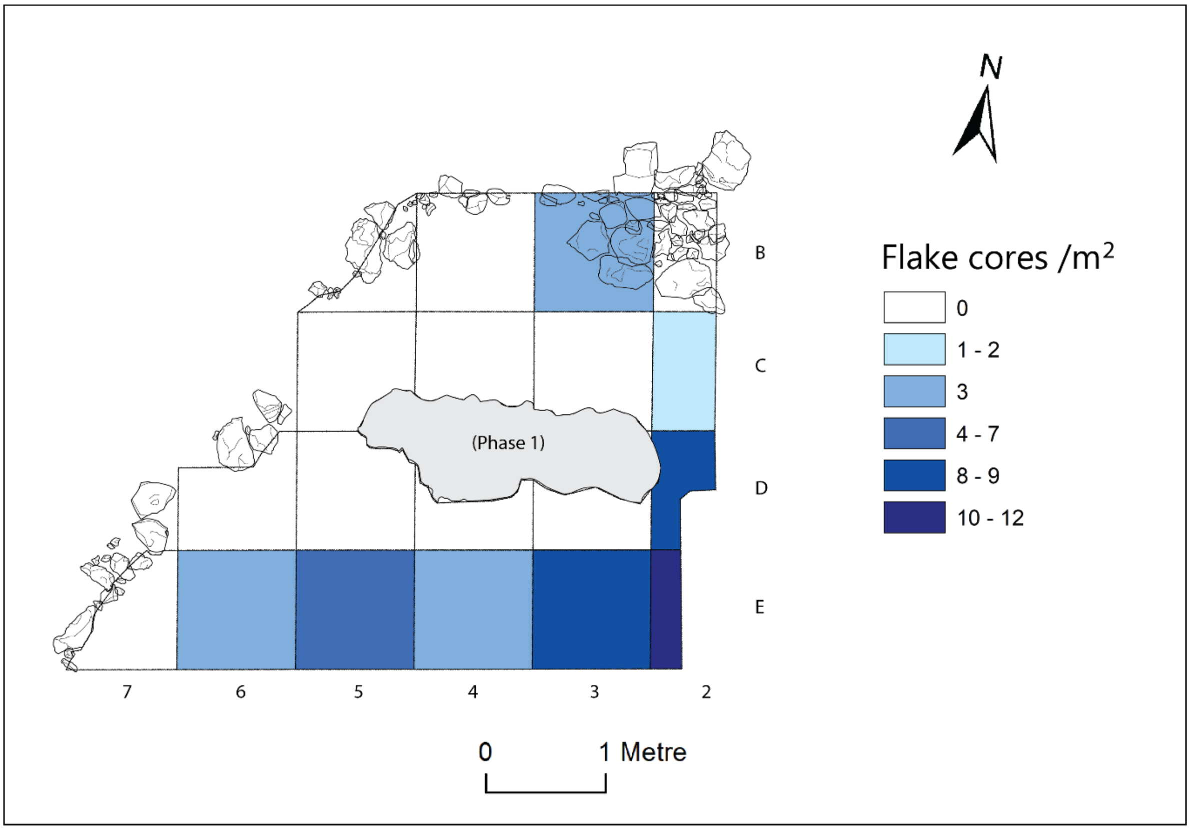


Figure 7.16: Distribution of Phase 2 flake cores.

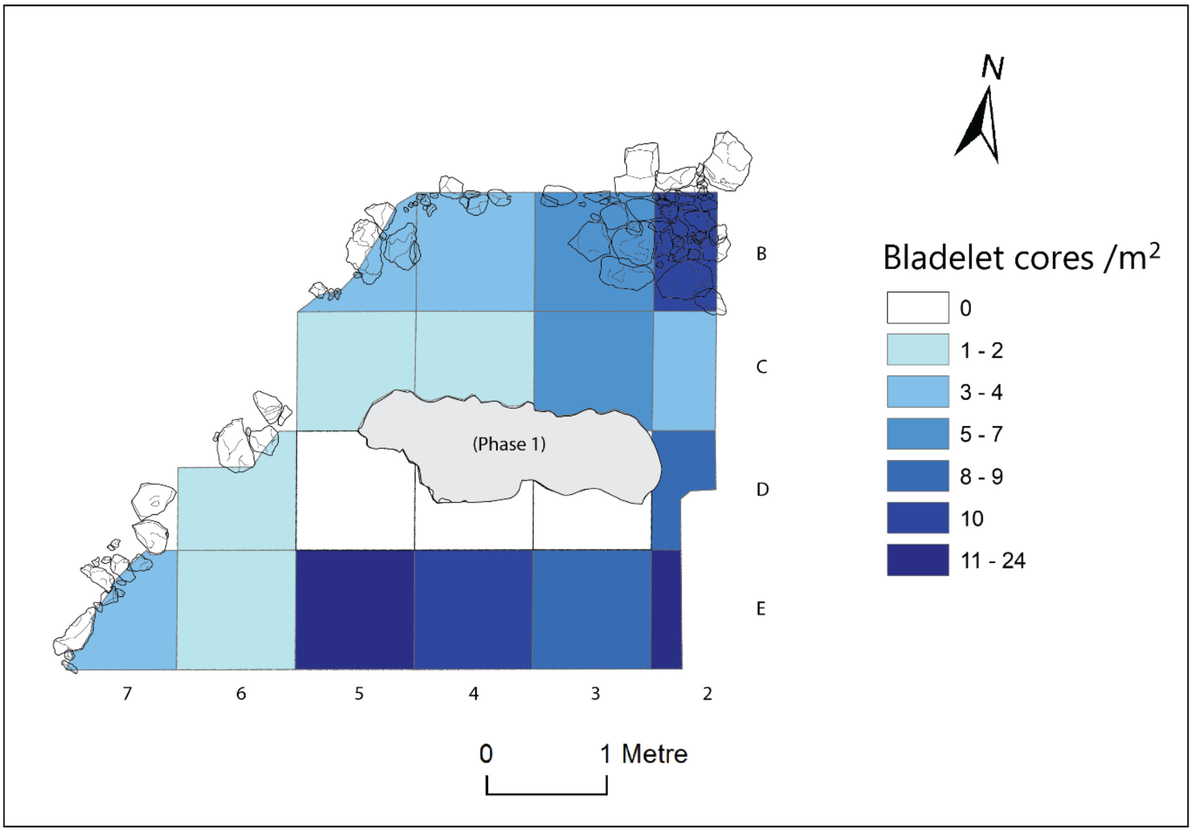


Figure 7.17: Distribution of Phase 2 bladelet cores.

baulk, with a secondary, smaller cluster present in the north in Square B4 (**Fig. 7.18**). The two blade cores were both recovered from Square E4.

7.3.1.1.2 Retouched artefacts

With a few exceptions, the distribution of individual tool groups conforms to the overall distributions of debris and debitage. The distributions of Phase 2 scrapers and burins are almost identical, occurring in two clusters centred on Feature 7 in the north-east,and along the southern baulk (**Figs. 7.19 - 7.20**). In contrast, scrapers are non-existent in the squares bordering the western arc of Wall 1, while burins occur in limited numbers in this area. Burins are also common in Square E3, whereas scrapers are scarce in this space. The distribution of multiple tools is reminiscent of the scrapers and burins, with the main divergence being the clustering of multiple tools in Square E6 (**Fig. 7.21**).

The distributions of non-geometric microliths (**Fig. 7.22**), geometric microliths (**Fig. 7.23**) and retouched fragments (**Fig. 7.24**) all follow similar patterns one another, with high densities both along the southern edge of Area XX F and in Square C2. In contrast, the truncated pieces (**Fig. 7.25**), notched and denticulated pieces (**Fig. 7.26**) and awls and borers (**Fig. 7.27**) exhibit a pronounced degree of clustering towards the south-east corner of the excavation area. A similar pattern is attested to in the case of the retouched flakes (**Fig. 7.28**), albeit in this case with Square E2 being free of these pieces. The tool group which deviates most from the overall patterns of refuse disposal are the retouched blades (**Fig. 7.29**), which are instead focused around two clusters in Squares C3 and E5. The former cluster may be partially explained through to the presence of the two retouched blades comprising Artefact Cluster 19 in this square (see Chapter 10).

7.3.1.1.3 Burnt artefact distributions

The proportions of burnt flaked stone artefacts remain high throughout the Phase 2 deposits, with at least two thirds of the lithic artefacts in each square exhibiting signs of uncontrolled exposure to fire. A particularly high rate of artefact burning is nonetheless evident in the south-west corner of the sampled area. This concentration is primarily due to the high rates of artefact burning for the intact and broken flakes (**Fig. 7.30**), broken blades and bladelets, and bladelets <2cm (**Fig. 7.31**) in this space. The bladelets over 2cm in length and burin spalls

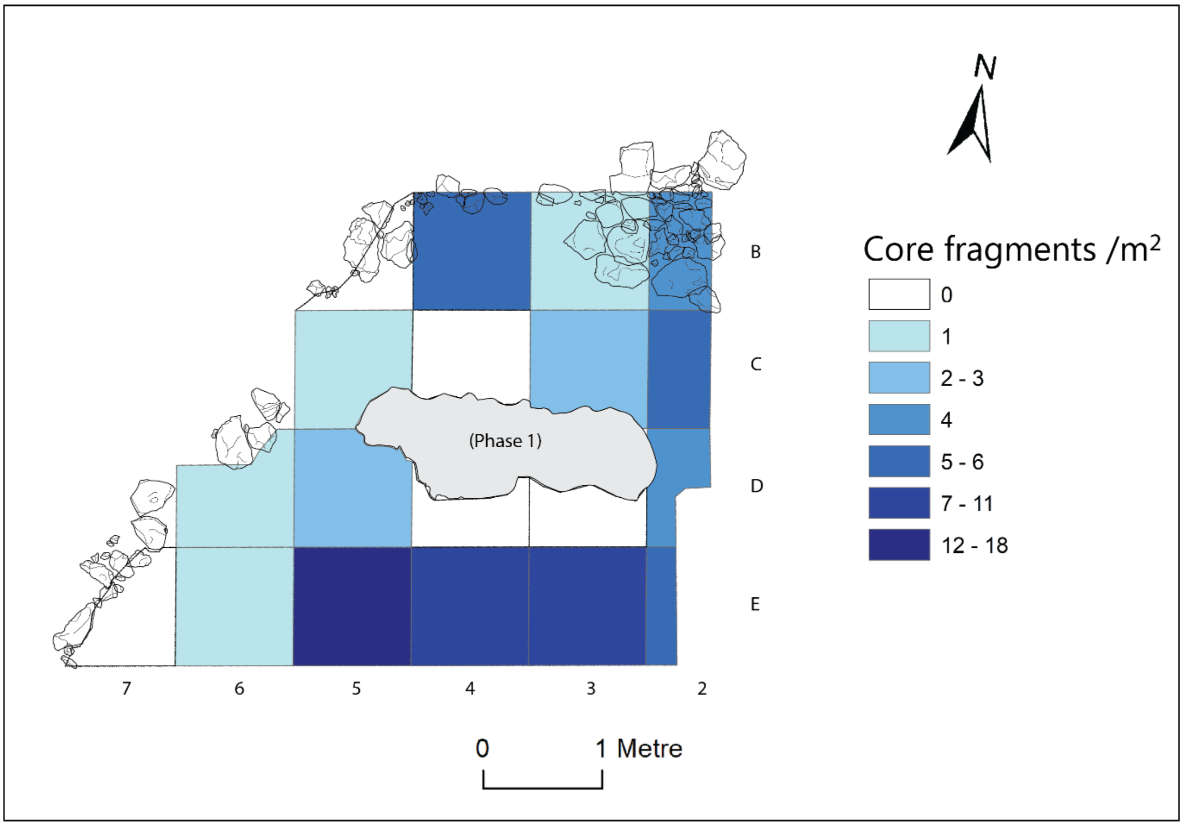


Figure 7.18: Distribution of Phase 2 core fragments.

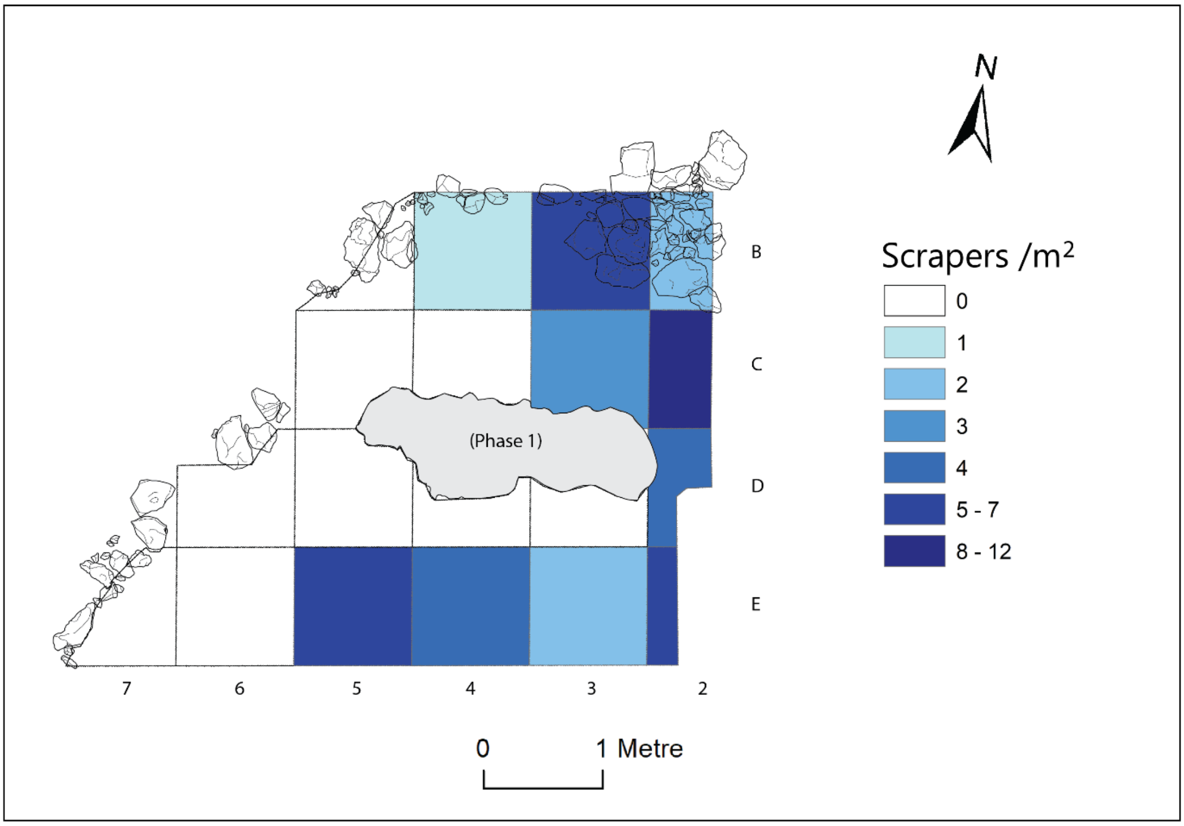


Figure 7.19: Distribution of Phase 2 scrapers.

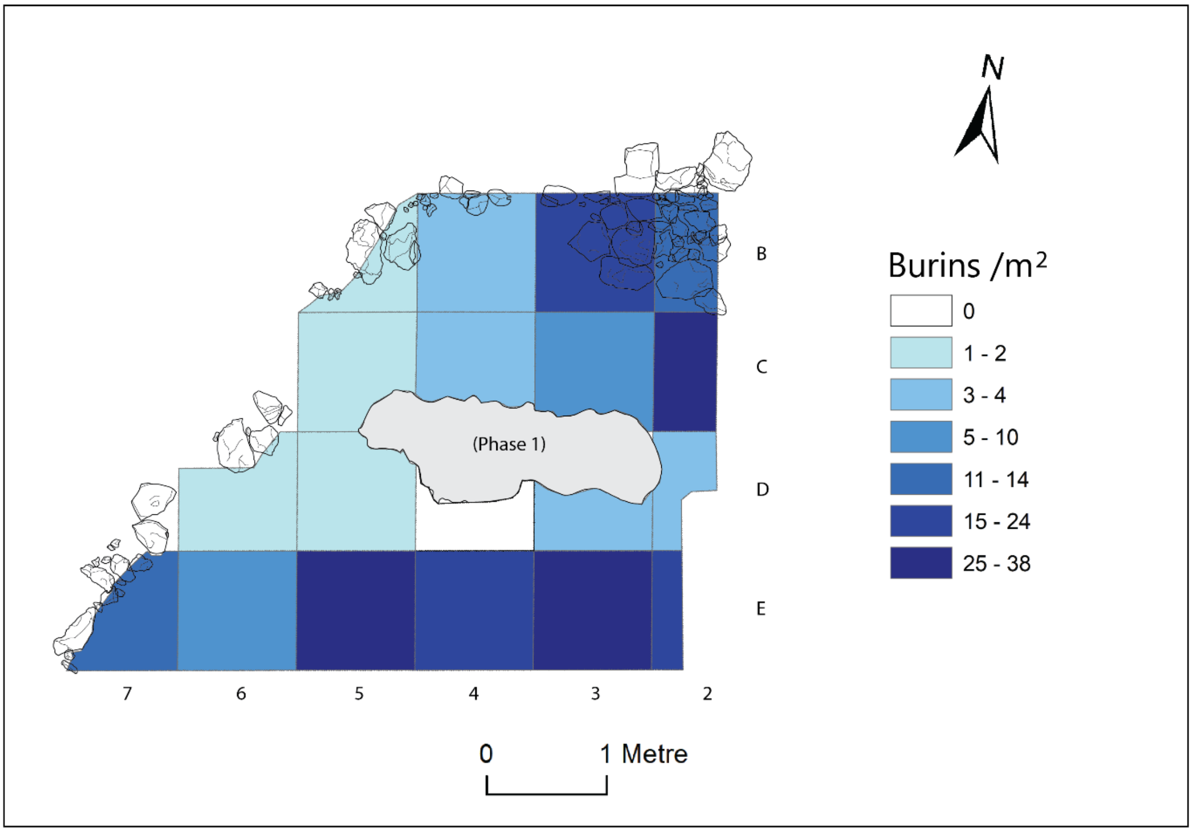


Figure 7.20: Distribution of Phase 2 burins.

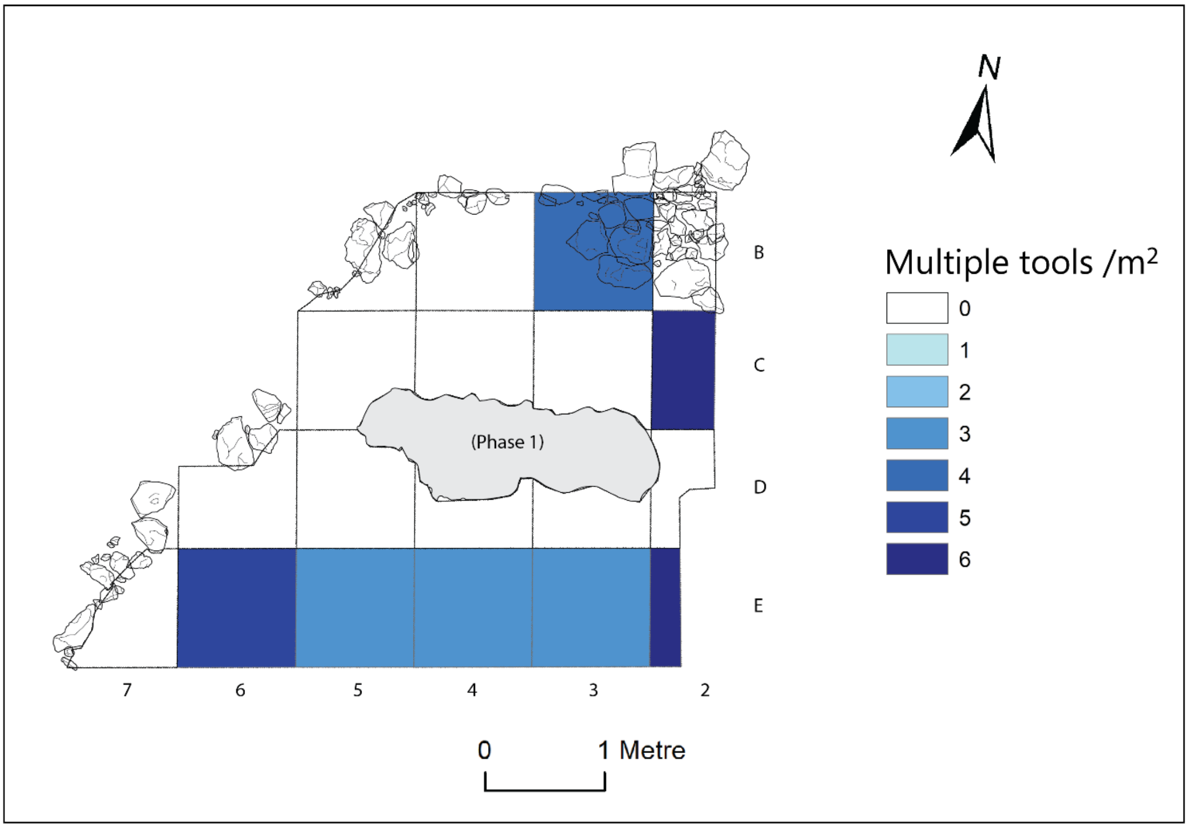


Figure 7.21: Distribution of Phase 2 multiple tools.

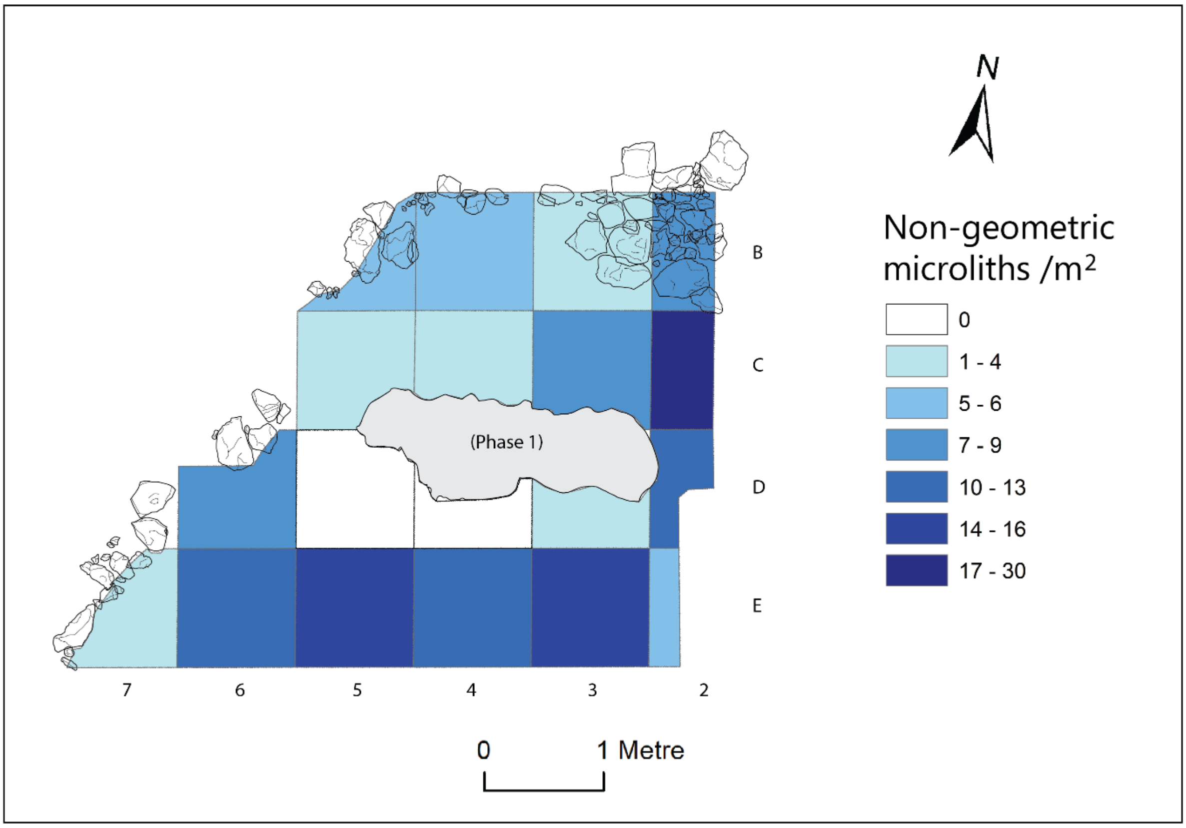


Figure 7.22: Distribution of Phase 2 non-geometric microliths.

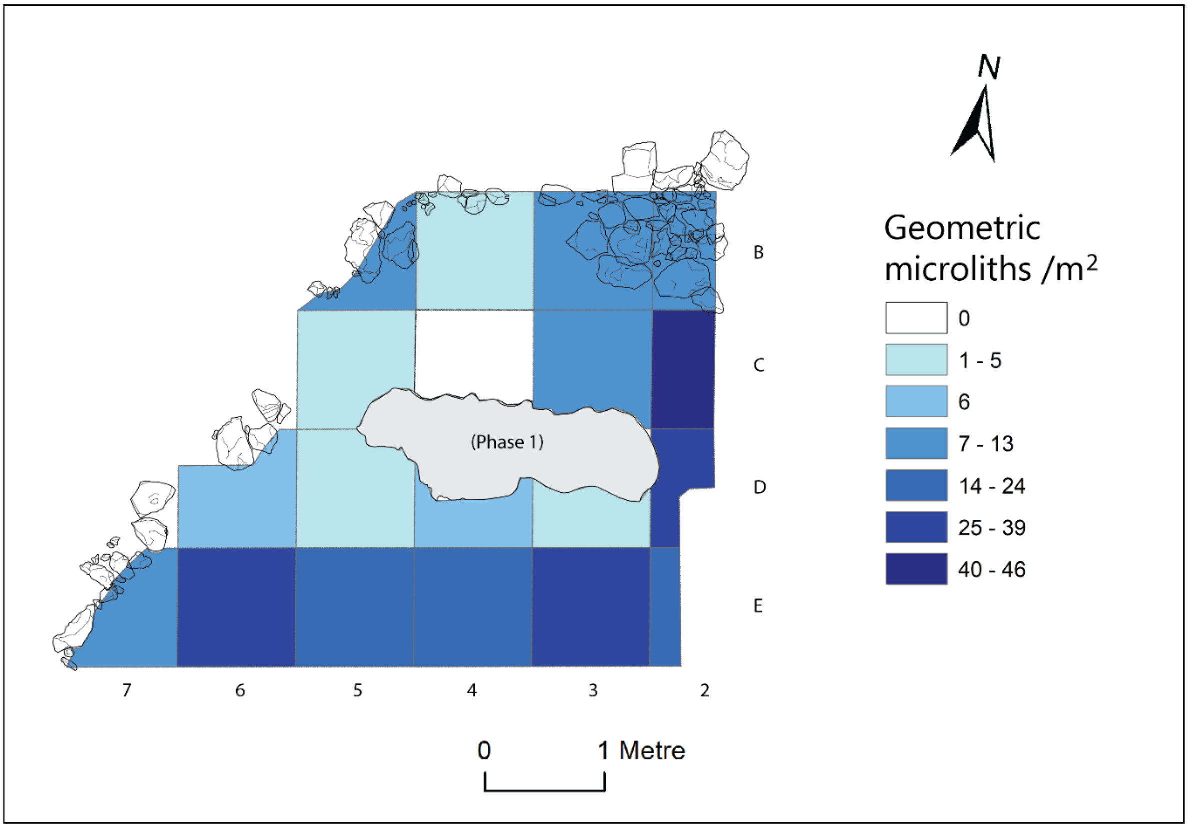


Figure 7.23: Distribution of Phase 2 geometric microliths.

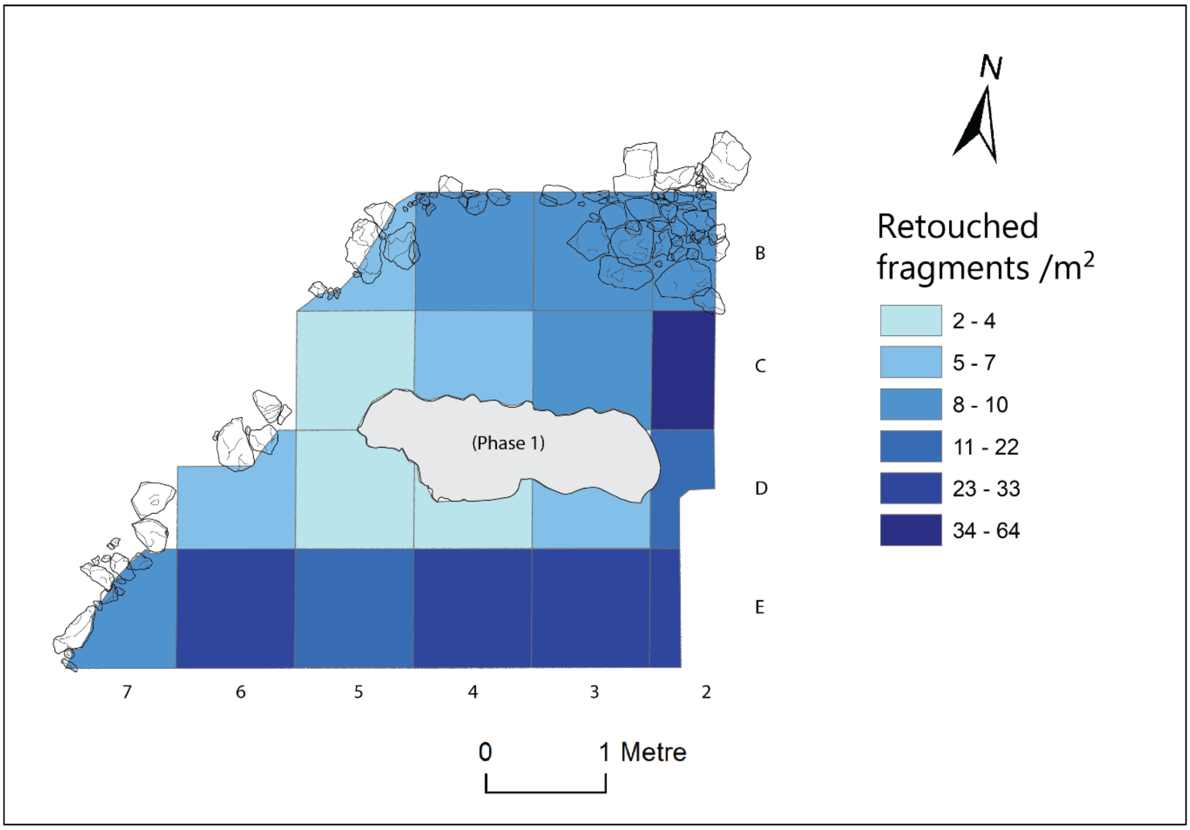


Figure 7.24: Distribution of Phase 2 retouched fragments.

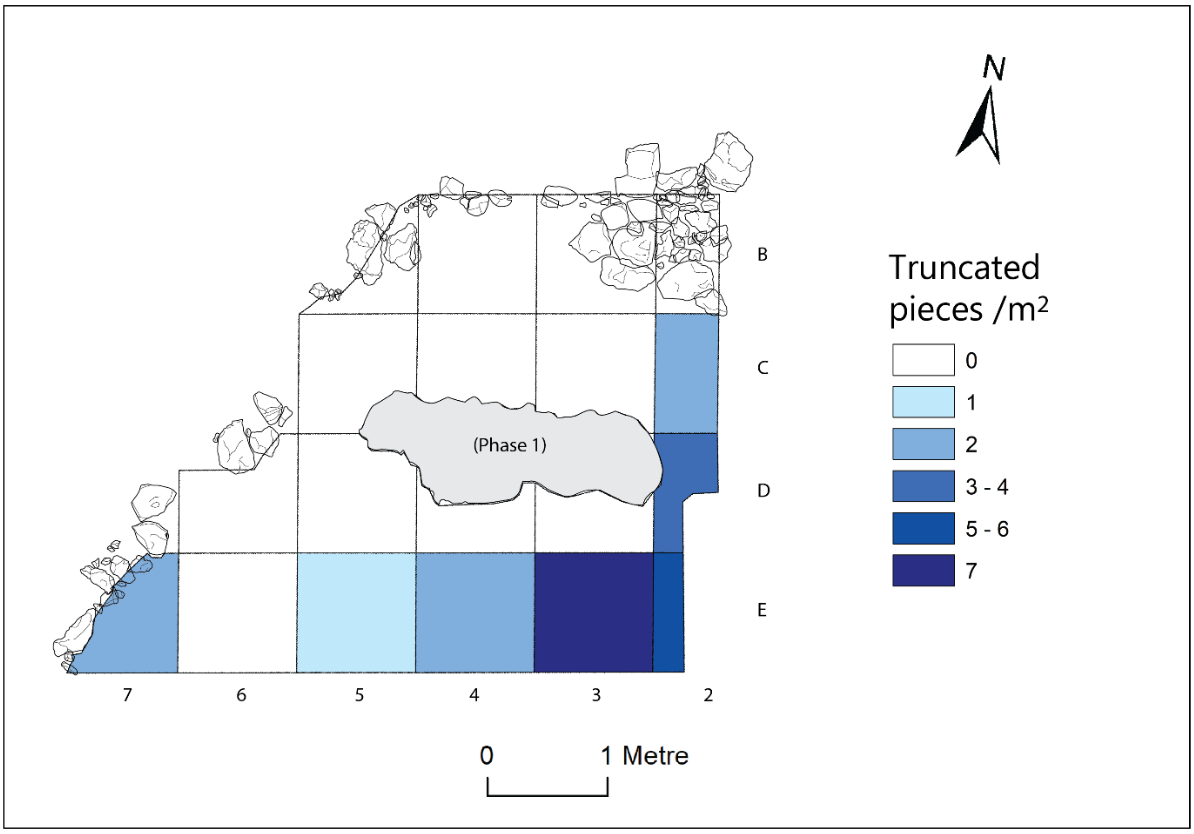


Figure 7.25: Distribution of Phase 2 truncated pieces.

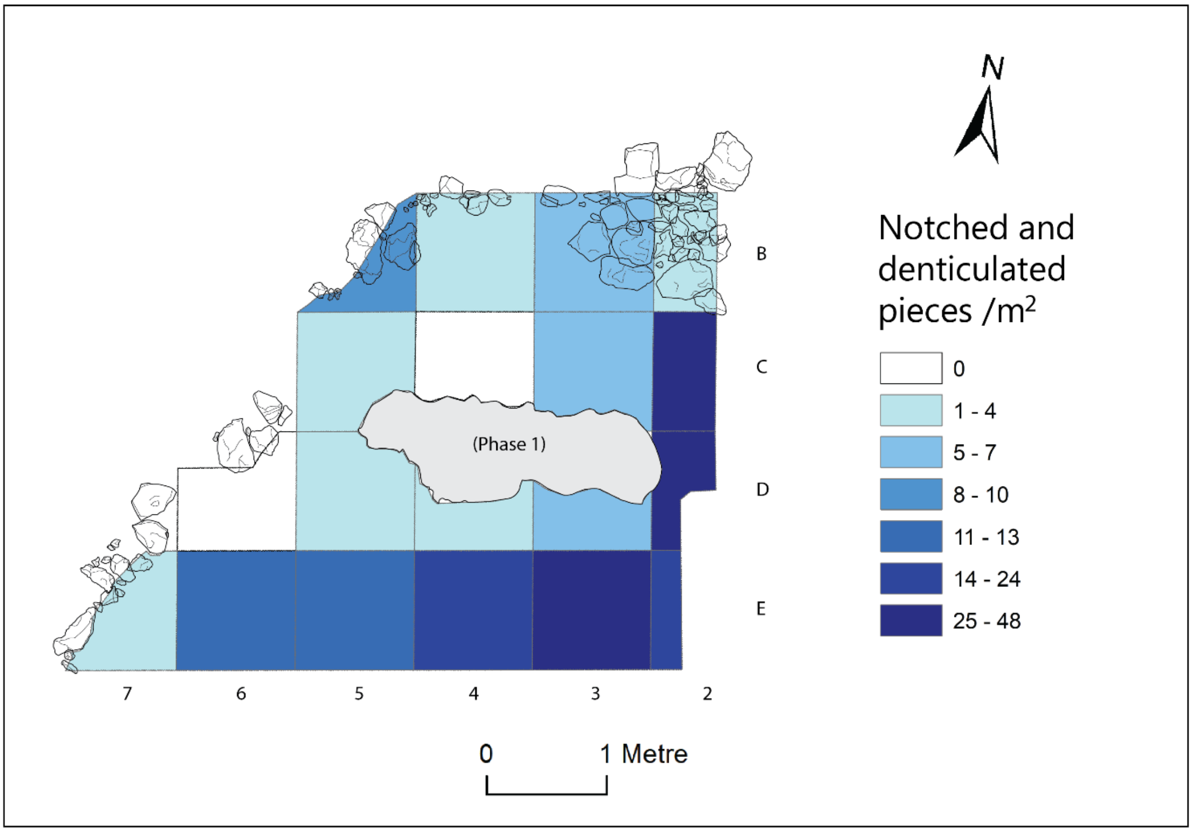


Figure 7.26: Distribution of Phase 2 notched and denticulated pieces.

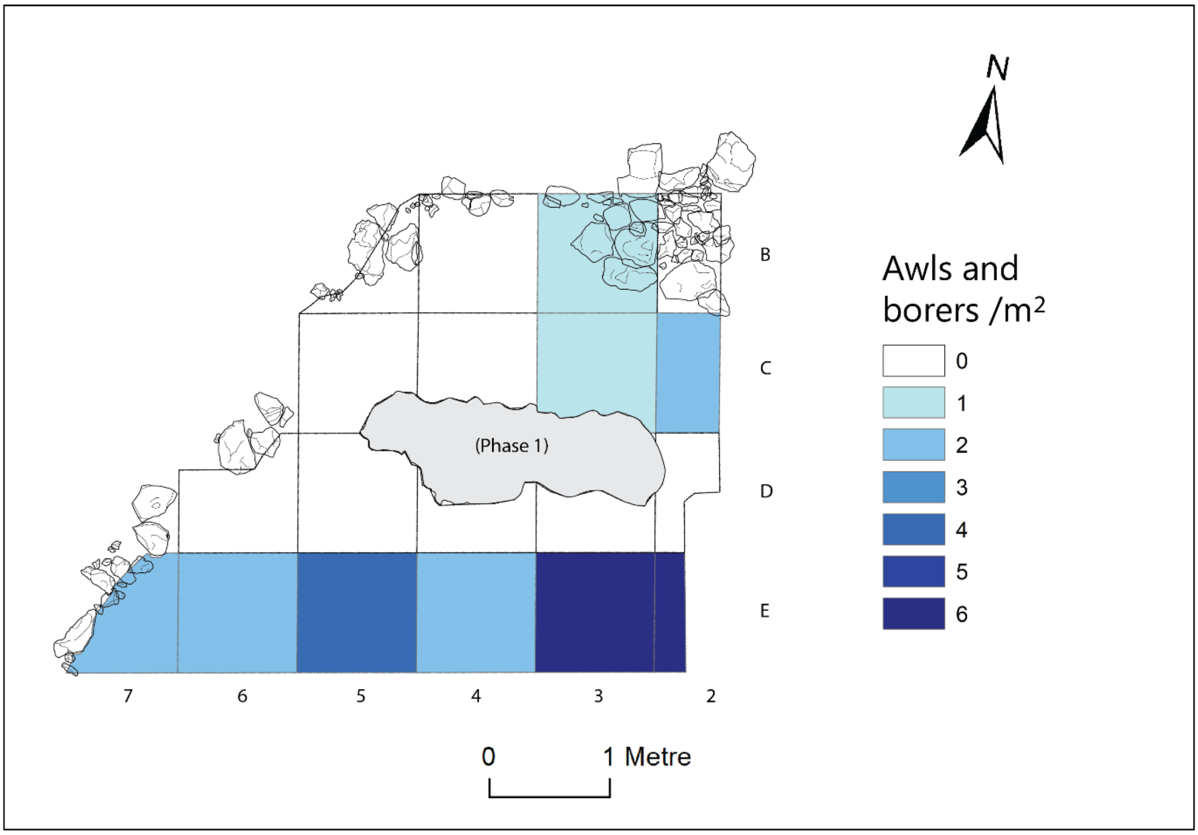


Figure 7.27: Distribution of Phase 2 awls and borers.

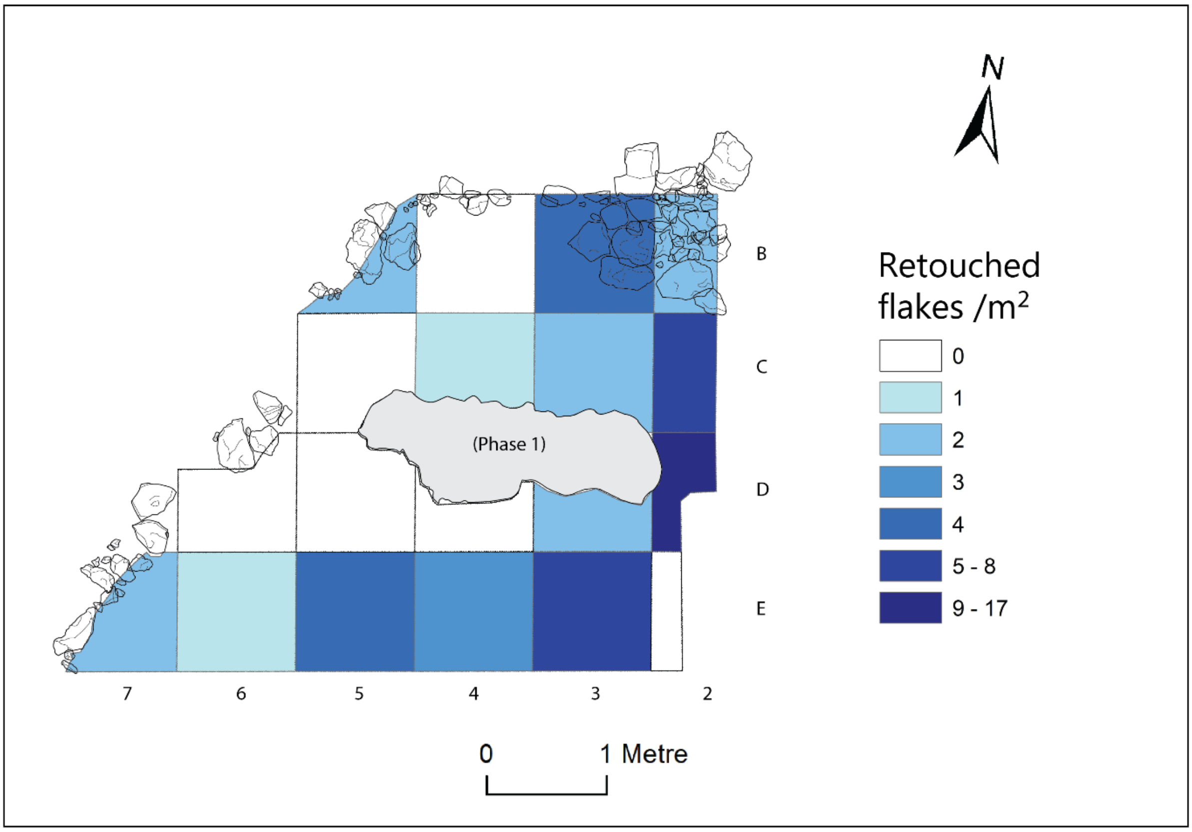


Figure 7.28: Distribution of Phase 2 retouched flakes.

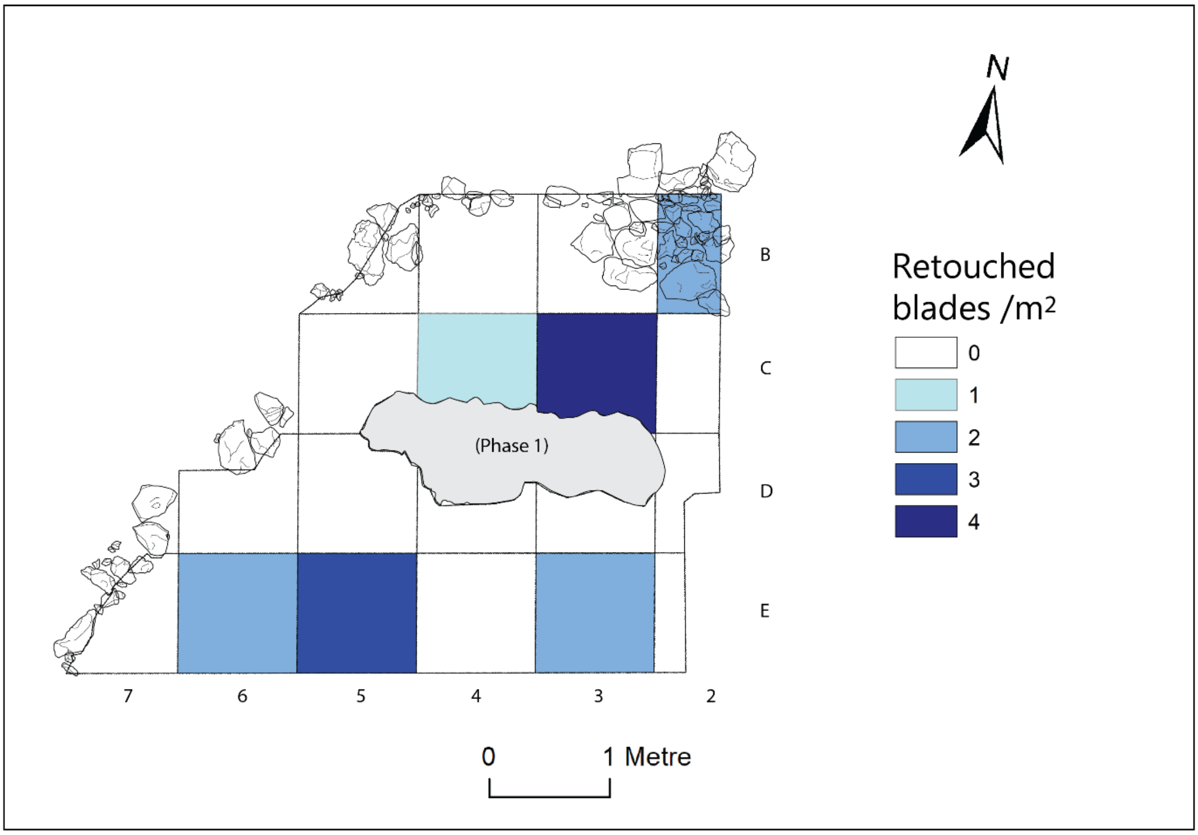


Figure 7.29: Distribution of Phase 2 retouched blades.

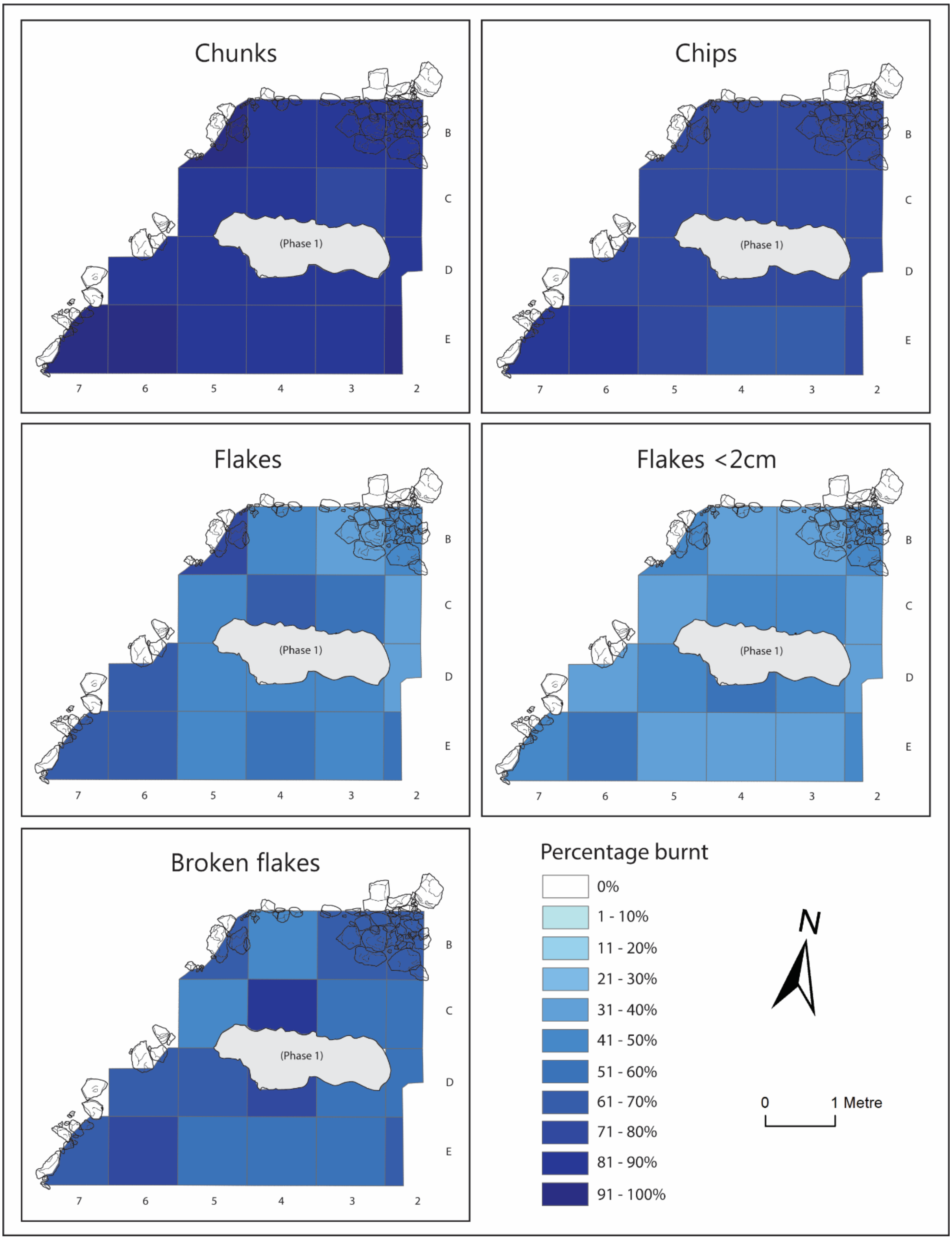


Figure 7.30: Distribution of burnt flaked stone artefacts in Phase 2 (1/2).

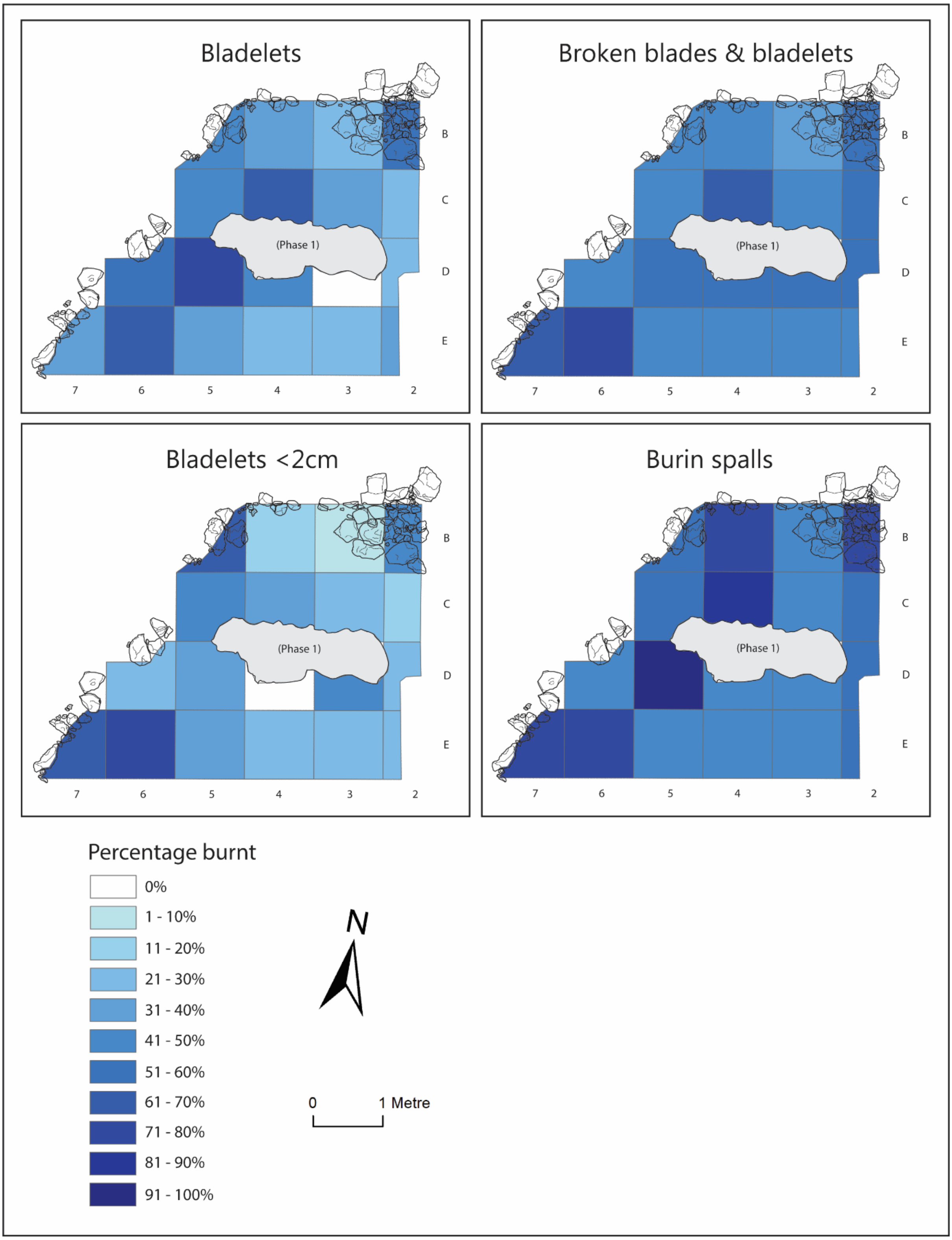


Figure 7.31: Distribution of burnt flaked stone artefacts in Phase 2, by square (2/2).

similarly show a high degree of burning in this area, albeit as part of an arc of burnt artefacts running parallel to Wall 1 (**Fig. 7.31**). The chunks display high rates of burning regardless of their area of deposition, with none of the analytical units recording a percentage less than 80% (**Fig. 7.30**). In contrast, the chips display a reduced rate of burning in the south-east corner of the sampled area, although the percentage of burnt artefacts in the relevant squares nonetheless remain comparatively high (61-70%) in relation to the debitage types.

7.3.1.2 Faunal remains

The areal distribution of faunal remains is largely consistent with that of the lithic artefacts, albeit with a notable degree of clustering in Squares C2, E4 and E6. (**Fig. 7.32**). The areal distribution of faunal weights likewise largely mirrors that of the lithic weights, although in this case without a pronounced degree of clustering in the south-east corner (**Fig. 7.33**). Assuming that the overall layout of the Structure 1 wall remains identical in Phase 2 as in Phase 1, these patterns point to the clustering of artefacts towards the centre of Structure 1 and away from its walls.

In contrast to the lithics, the volumetric distribution of faunal remains is more widely dispersed, being densest along the southern edge between Squares E4 and E7, and supplemented by smaller clusters along the northern and north-east edges of the excavation area (**Fig. 7.34**). Conversely, the faunal weights exhibit a particularly high density centred on a single square, E4 (**Fig. 7.35**).

7.3.1.3 Groundstone artefacts

The spatial distribution of intact groundstone pieces differs radically from both the lithic and faunal material, reflecting the clustering of groundstone artefacts in the south-west corner, along the interior of Wall 1 in the south-west corner of the area sampled (**Fig. 7.36**). Conversely, the distribution of fragmentary groundstone artefacts recalls the distributions of lithic and faunal material, with clusters focussed on squares C2 and between E4 and E5 (**Fig. 7.37**). This pronounced degree of variation is significant, suggesting that broken groundstone objects were disposed of alongside lithic and faunal remains as primary refuse, whereas the intact pieces were intentionally clustered inside the entrance of Structure 1.

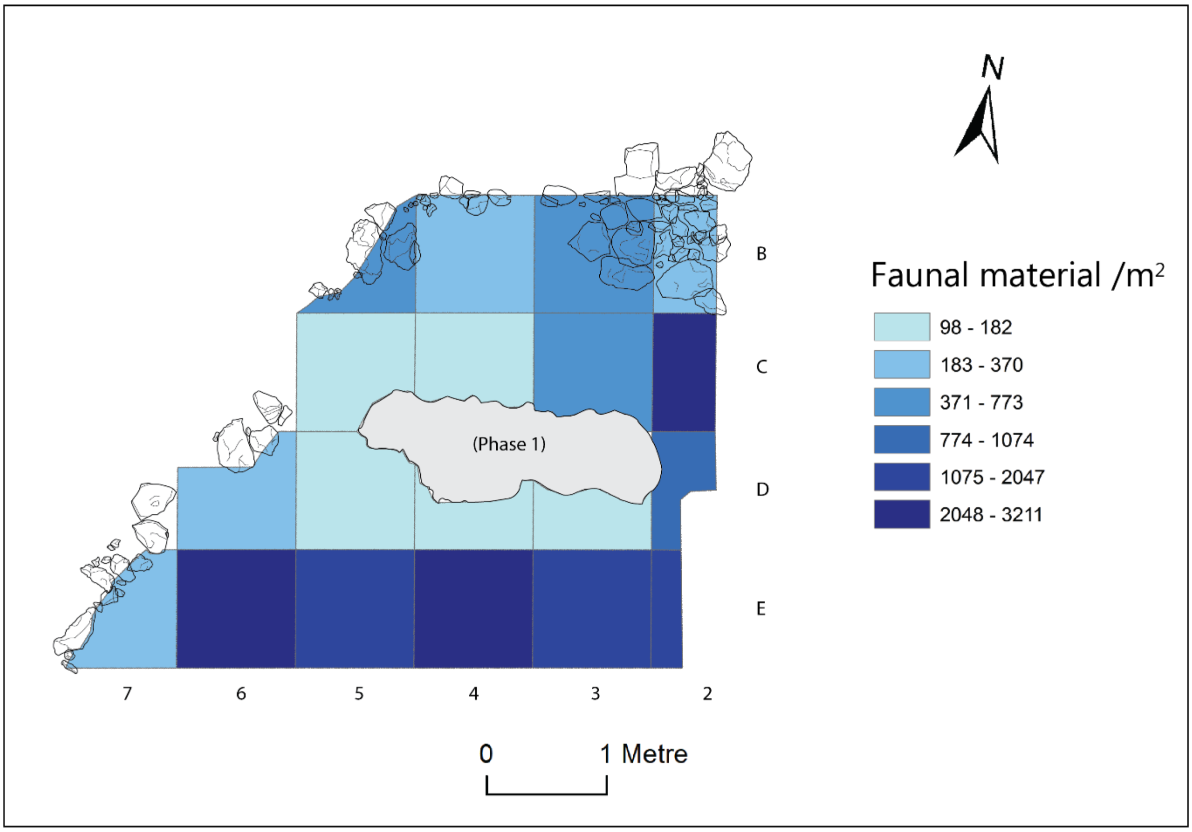


Figure 7.32: Distribution of Phase 2 faunal material, by areal density.

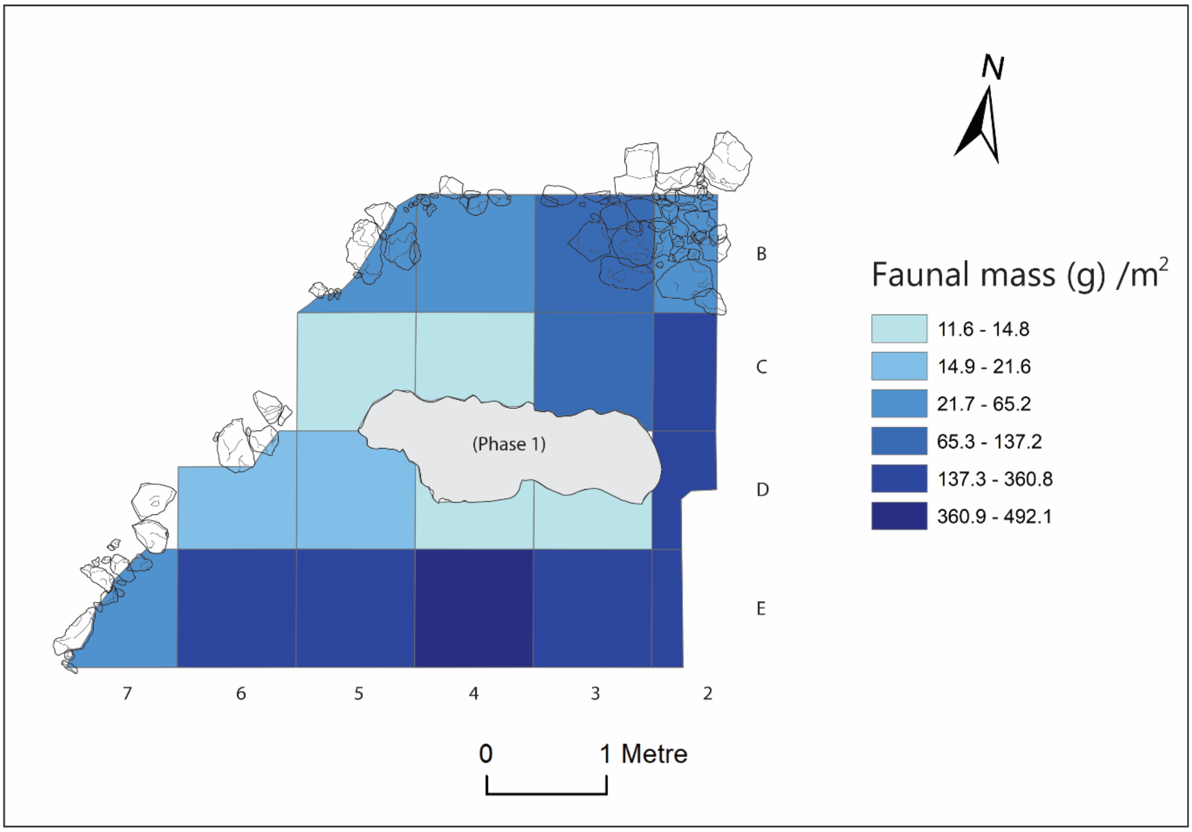


Figure 7.33: Distribution of Phase 2 faunal weights, by areal density.

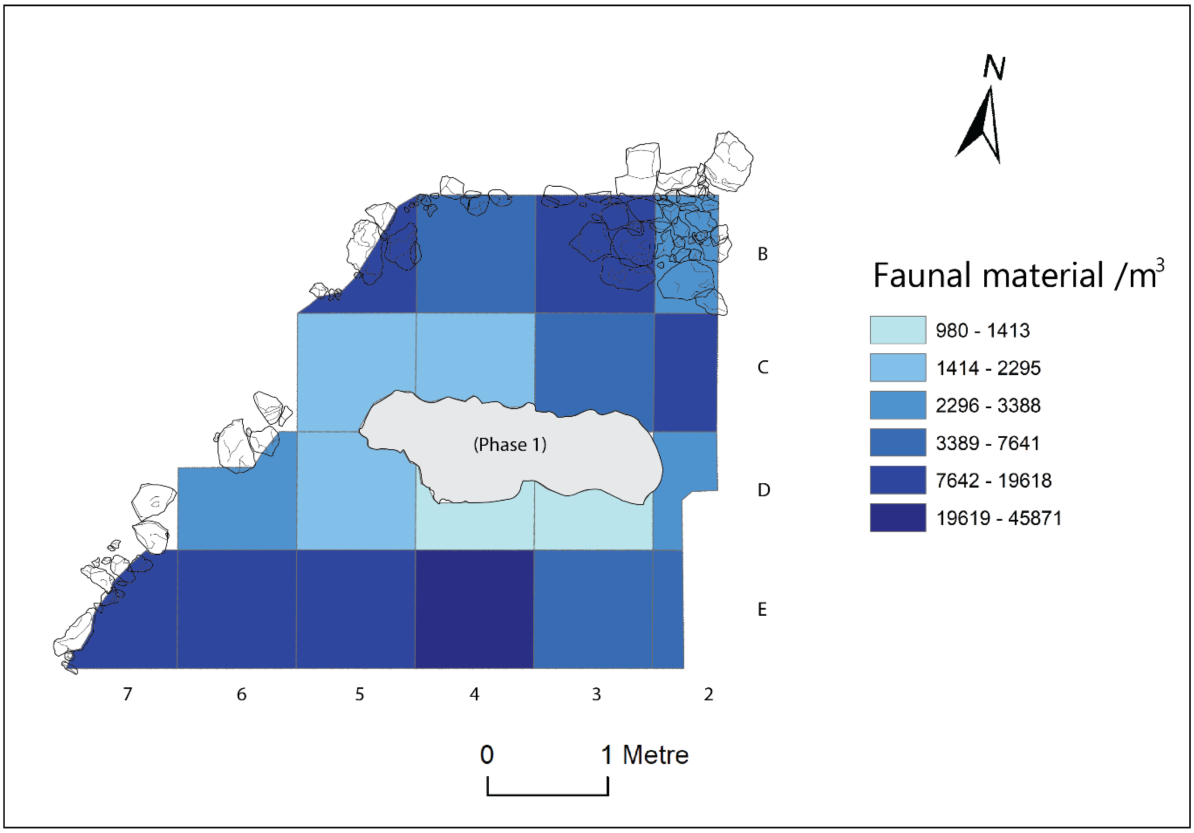


Figure 7.34: Distribution of Phase 2 faunal material, by volumetric density.

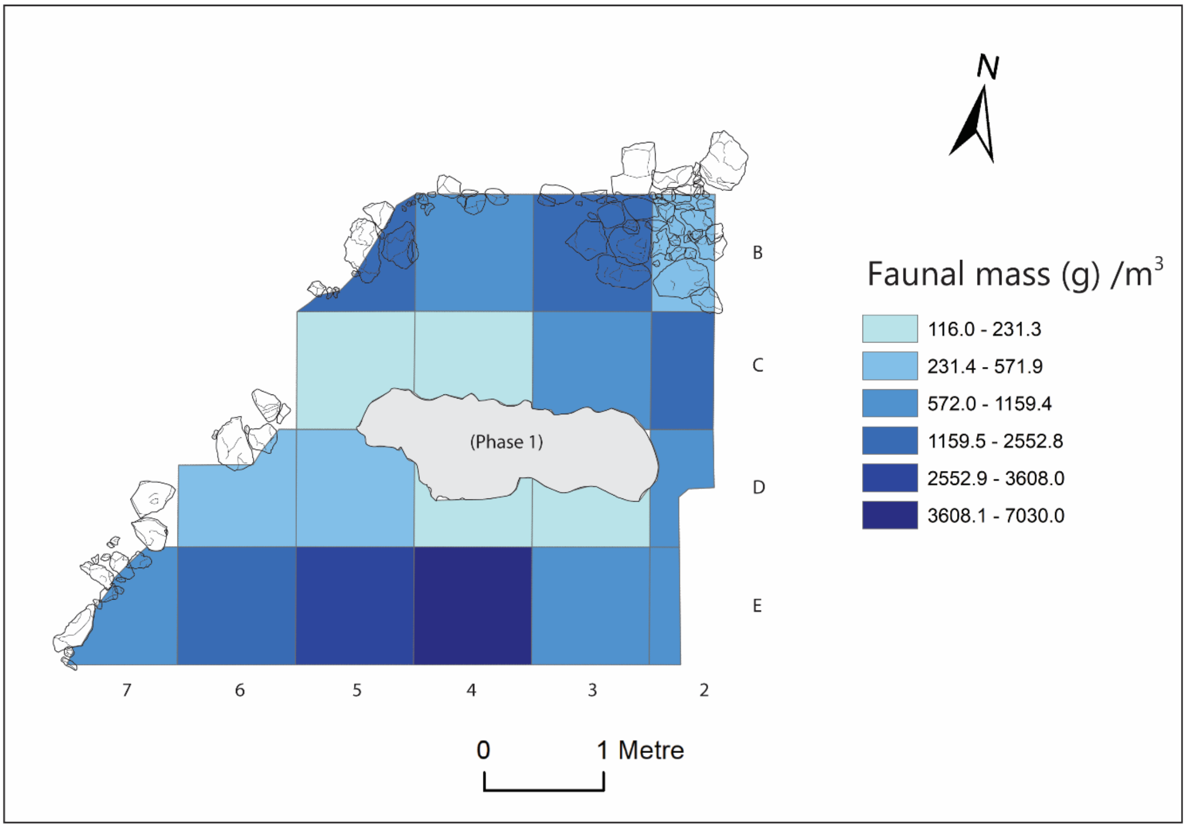


Figure 7.35: Distribution of Phase 2 faunal weights, by volumetric density.

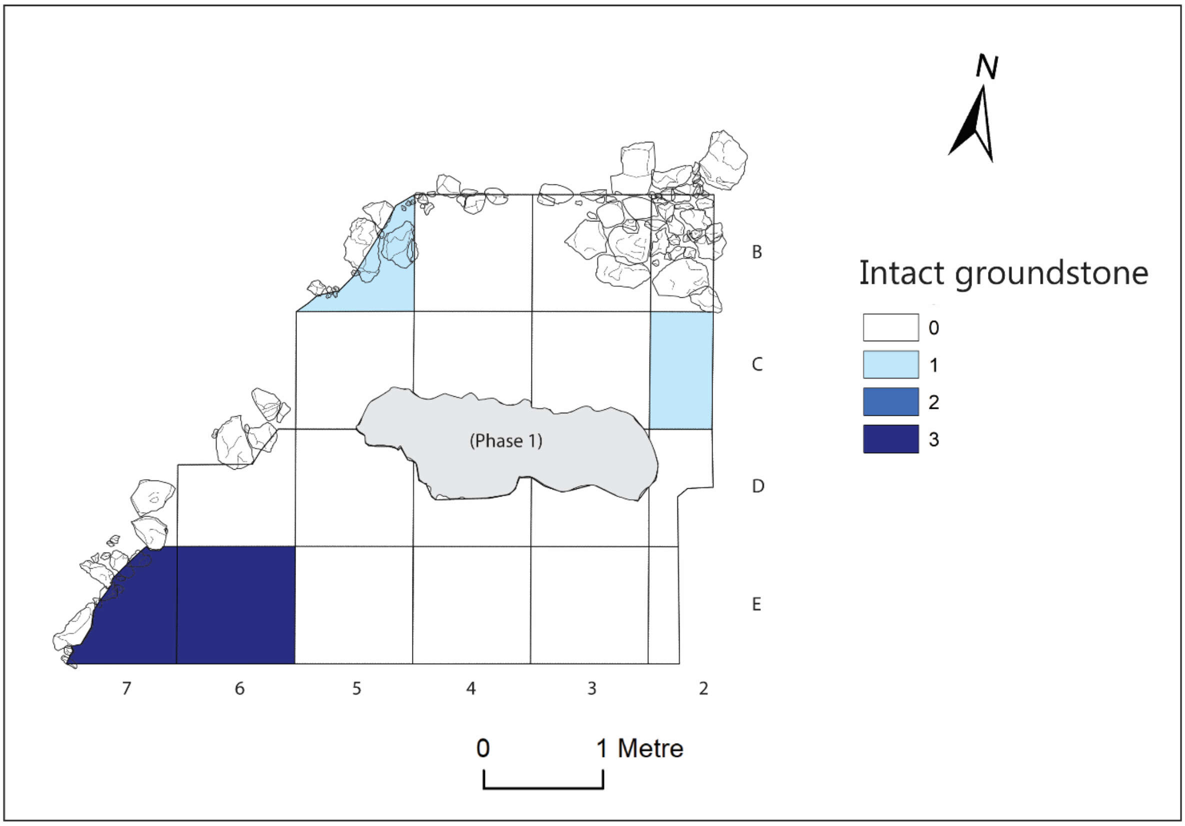


Figure 7.36: Distribution of Phase 2 intact groundstone artefacts.

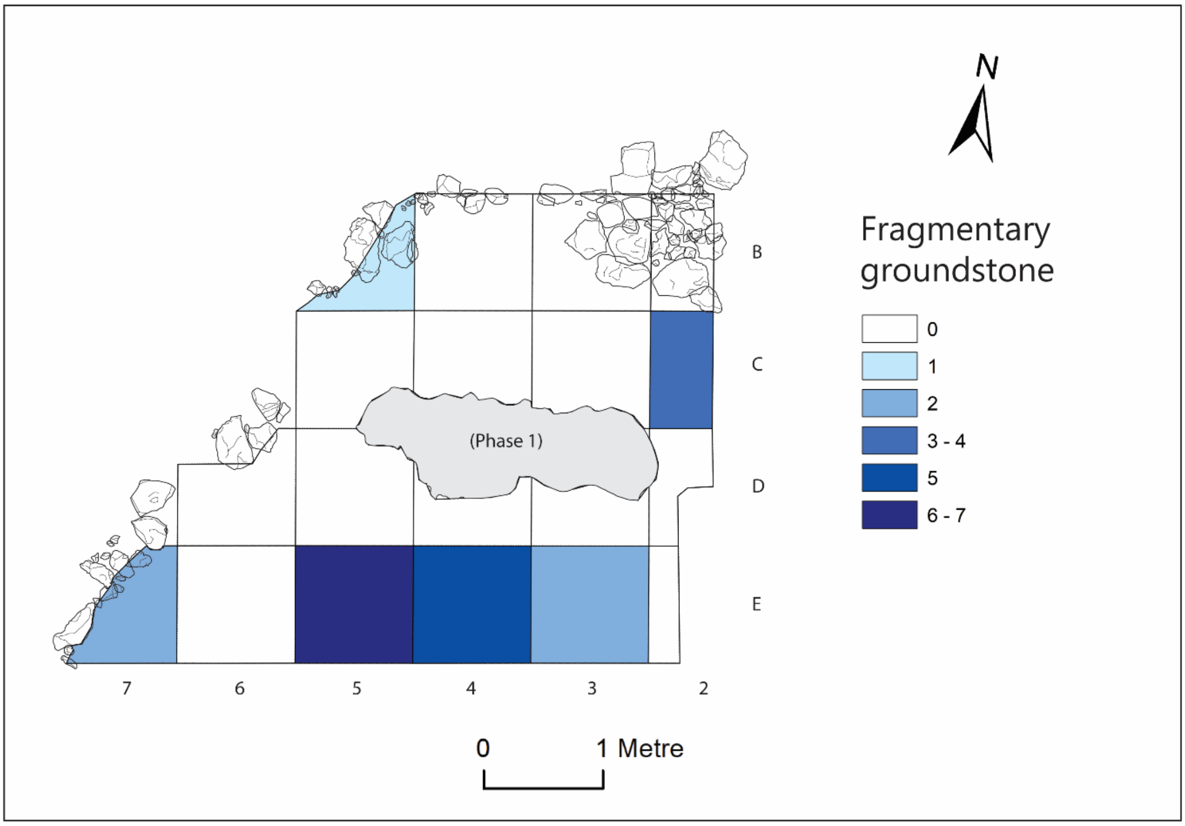


Figure 7.37: Distribution of Phase 2 fragmentary groundstone artefacts.

7.3.1.4 Bone artefacts

The bone artefacts display a conspicuous degree of clustering in Square E6, with a gradually declining number of artefacts in neighbouring squares to the east (**Fig. 7.38**).

7.3.1.5 Scaphopod artefacts

The scaphopod artefacts also exhibit a strong degree of clustering in E6 (**Fig. 7.39**), reflecting the presence of 138 of these pieces as part of Artefact Cluster 21. Secondary clusters of Tusk Shell artefacts are also evident to the east in Squares E4 and E3, and to the east of Feature 7.

7.3.1.6 Statistical significance of Phase 2 artefact distributions

Pearson's r correlation confirmed observations made from the Phase 2 plot density graphs. Particularly strong correlations are noted between the distribution of lithic artefacts and faunal material (**Table 7.1**), both by artefact count ($r = 0.936$) and weight ($r = 0.920$), confirming the fact that little to no variation is evident in the overall disposal of these two classes. The numerical distribution of flaked stone artefacts shares less similarity with the other artefact classes, although the correlation between flaked stone artefacts and bone tools is still fairly powerful ($r = 0.726$). The correlations between flaked stone weights and intact groundstone, bone tools and scaphopod fragments are all weaker than their correlations with the numerical distribution of flaked stone artefacts, suggesting a differentiation in disposal between these artefacts and the bulkier lithic refuse. This situation is particularly pronounced in the case of the intact groundstone artefacts, with a slight negative correlation existing between these pieces and the lithic weights ($r = -0.020$), emphasising the clustering of intact groundstone in the south-west corner of the excavation area. In contrast, the correlation between fragmentary groundstone ($r = 0.747$) and lithic weights is stronger than the correlation between fragmentary groundstone and the numerical distribution of lithics ($r = 0.551$), suggesting a degree of similarity in the disposal of broken groundstone fragments and bulky lithic material.

The correlations between most debris and debitage types are strong (**Table 7.2**), with the firmest coefficients existing between the 'flakes <2cm' and 'broken blades and bladelets'

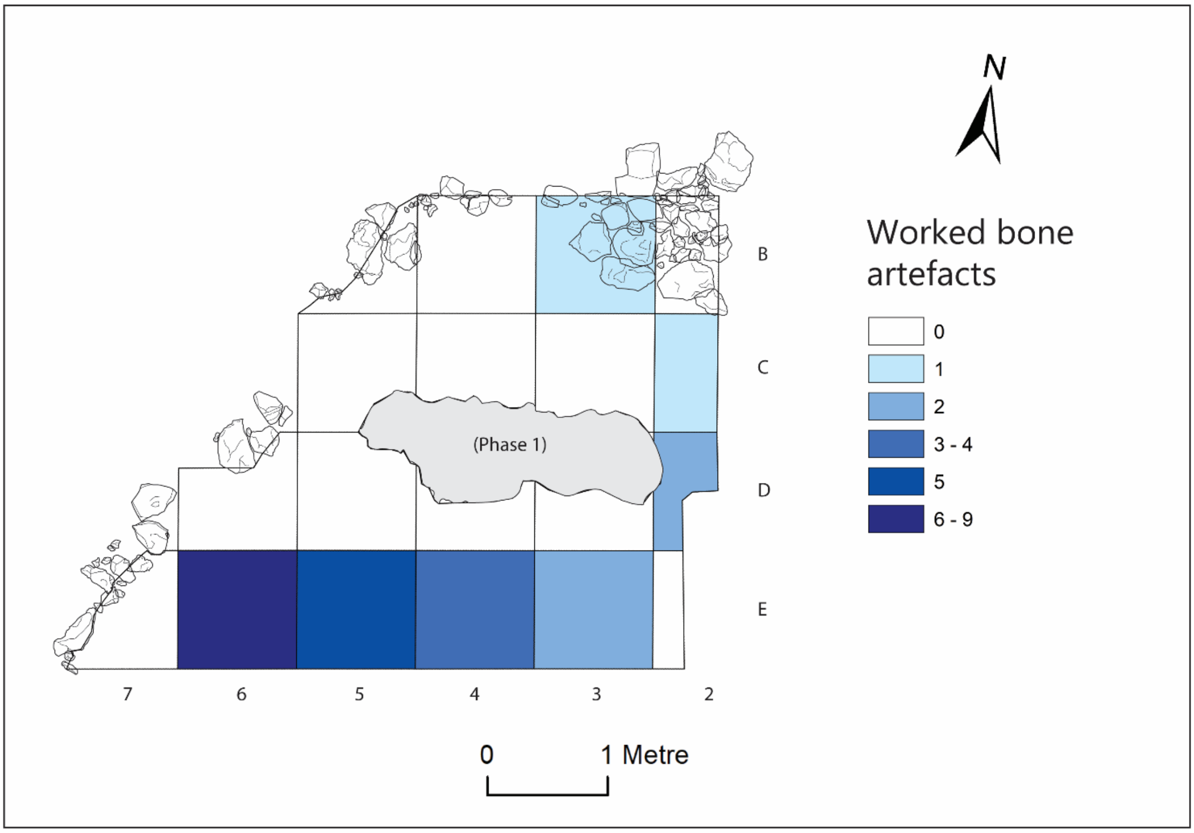


Figure 7.38: Distribution of Phase 2 bone artefacts.

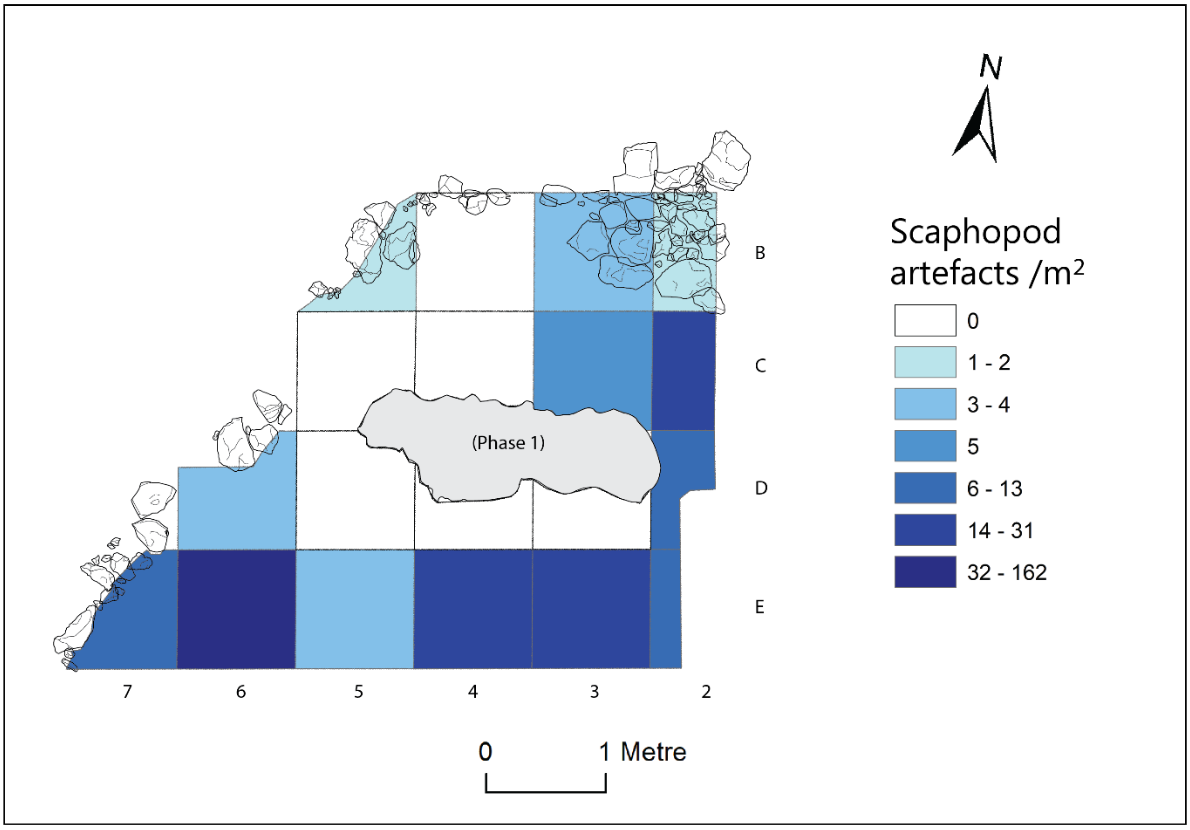


Figure 7.39: Distribution of Phase 2 scaphopod (*Antalis sp.*) artefacts.

Table 7.1: Correlation coefficients (r) for the overall Phase 2 artefact assemblage, by excavation square.

	Flaked-stone artefacts (no.)	Flaked-stone artefacts (mass)	Faunal material (no.)	Faunal material (mass)	Intact groundstone	Fragmentary groundstone	Worked-bone artefacts	Antalis fragments
Flaked-stone artefacts (no.)	XXXXX							
Flaked-stone artefacts (mass)	0.907	XXXXX						
Faunal material (no.)	0.936	0.871	XXXXX					
Faunal material (mass)	0.891	0.920	0.974	XXXXX				
Intact groundstone	0.212	-0.020	0.219	0.104	XXXXX			
Fragmentary groundstone	0.551	0.747	0.639	0.740	0.061	XXXXX		
Worked-bone artefacts	0.726	0.611	0.805	0.780	0.435	0.416	XXXXX	
Antalis fragments	0.610	0.312	0.625	0.495	0.639	0.005	0.849	XXXXX

Table 7.2: Correlation coefficients (r) for the Phase 2 flaked stone artefact assemblage, by excavation square. BBaB = Broken blades and bladelets, RA = Retouched artefacts.

	Chunks	Chips	Flakes	Flakes <2cm	Broken flakes	Blades	Bladelets	BBaB	Bladelets <2cm	Burin spalls	Flake cores	Bladelet cores	Core fragments	RA
Chunks	XXXXX													
Chips	0.940	XXXXX												
Flakes	0.860	0.871	XXXXX											
Flakes <2cm	0.816	0.924	0.849	XXXXX										
Broken flakes	0.966	0.902	0.898	0.862	XXXXX									
Blades	0.730	0.796	0.857	0.800	0.774	XXXXX								
Bladelets	0.807	0.885	0.967	0.928	0.858	0.861	XXXXX							
BBaB	0.831	0.896	0.906	0.975	0.898	0.817	0.951	XXXXX						
Bladelets <2cm	0.822	0.894	0.880	0.884	0.830	0.749	0.923	0.876	XXXXX					
Burin spalls	0.894	0.909	0.924	0.911	0.937	0.875	0.932	0.923	0.931	XXXXX				
Flake cores	0.762	0.685	0.763	0.686	0.849	0.828	0.717	0.725	0.651	0.864	XXXXX			
Bladelet cores	0.460	0.468	0.744	0.600	0.605	0.801	0.725	0.694	0.480	0.670	0.748	XXXXX		
Core fragments	0.562	0.545	0.798	0.634	0.689	0.799	0.761	0.729	0.554	0.742	0.805	0.934	XXXXX	
RA	0.944	0.897	0.885	0.884	0.982	0.757	0.866	0.917	0.845	0.932	0.794	0.588	0.673	XXXXX

(r = 0.975), flakes and bladelets (r = 0.967) and chunks and broken flakes (r = 0.966). The weakest correlations largely relate to the distributions of cores and core fragments with other flaked stone artefact types, although these nonetheless remained moderately powerful, with the weakest coefficient (between chunks and bladelet cores) still reaching a value of 0.460.

The correlations between different retouched tool groups exhibit more variation in Phase 2 than the debris and debitage types (**Table 7.3**). The strongest coefficient pairings occur between burins and awls and borers (r = 0.955), geometric microliths and retouched fragments (r = 0.950) and the geometric microliths and notched and denticulated pieces (r = 0.881). Conversely, the weakest coefficients concern the scrapers, retouched blades and truncated pieces, with the weakest relationship existing between the retouched blades and truncated pieces (r = 0.210). The correlations between different tool groups and the rest of the flaked stone assemblage also vary significantly, with the geometric microliths (r = 0.971), retouched fragments (r = 0.950) and notched and denticulated pieces (r = 0.905) presenting the strongest correlations with debris and debitage. Conversely, the distribution of debris and debitage shares notably weaker correlations with retouched blades (r = 0.444) and scrapers (r = 0.472), further emphasising the spatial disconnect of these two tool groups.

7.3.1.7 Interpretation of Phase 2 distributional data

Given that the walls of Structure 1 follow the same arc in Phase 2 as in Phase 1, the deposition of the Phase 2 artefactual material displays a clear correlation with the centre of this building. This pattern differs somewhat from the Phase 1 material, where the densest interior deposits are instead concentrated towards the northern end of Structure 1 and western side of Structure 2 (Edwards & Hardy-Smith 2013: 96, 98). The distribution of Phase 2 material nonetheless establishes a distinct pattern of refuse accumulation associated with these large buildings at Wadi Hammeh 27, where the majority of refuse was allowed to accumulate within in a relatively restricted area of each interior surface. The only artefacts to diverge from this pattern are the intact groundstone artefacts, which are instead clustered towards the western end of Structure 1, most likely in a context of intentional deposition near its entrance.

The percentage of burnt artefacts in Square E6 is exceptionally high, leading to the possibility that a hearth or another variety of combustive feature exists in this area. This situation stands

Table 7.3: Correlation coefficients (r) for Phase 2 retouched artefact tool groups, by excavation square. NGM = Non-geometric microliths, NaD = Notched and denticulated pieces.

	Scrapers	Multiple tools	Burins	Retouched blades	Truncated pieces	NGM	Geometric microliths	NaD	Awls and borers	Retouched flakes	Retouched fragments	Debris and debitage	Cores
Scrapers	XXXXX												
Multiple tools	0.583	XXXXX											
Burins	0.664	0.654	XXXXX										
Retouched blades	0.342	0.301	0.519	XXXXX									
Truncated pieces	0.213	0.388	0.805	0.210	XXXXX								
NGM	0.632	0.695	0.807	0.562	0.569	XXXXX							
Geometric microliths	0.487	0.870	0.767	0.475	0.630	0.877	XXXXX						
NaD	0.449	0.678	0.840	0.292	0.869	0.788	0.881	XXXXX					
Awls and borers	0.491	0.683	0.955	0.548	0.833	0.769	0.800	0.834	XXXXX				
Retouched flakes	0.552	0.524	0.862	0.392	0.827	0.671	0.709	0.868	0.814	XXXXX			
Retouched fragments	0.512	0.867	0.676	0.348	0.518	0.874	0.950	0.815	0.675	0.570	XXXXX		
Debris and debitage	0.472	0.822	0.766	0.444	0.658	0.866	0.971	0.905	0.787	0.686	0.945	XXXXX	
Cores	0.691	0.557	0.876	0.535	0.576	0.732	0.611	0.654	0.840	0.687	0.525	0.638	XXXXX

in sharp contrast to the presence of exceptionally high numbers of unburnt chips in the space immediately to the east of E6, indicating that this latter space served as a focal point for knapping activities under Sergant and colleagues (2006: 1006)'s parameters for detecting hearths and activity areas.

The statistical analysis of the Phase 2 assemblage confirms the visual inspections made of the density plots: the more common artefact types tend to possess the strongest correlations with one another. In contrast, the cores exhibit relatively weak coefficients with most debitage types and tool groups, suggesting that even though the Phase 2 deposits represent a relatively broad temporal unit, a disconnect between the deposition of artefacts distant from one another within the *chaîne opératoire* is still detectable.

7.3.2 Upper Phase 3

7.3.2.1 Lithic artefacts

The Upper Phase 3 lithic artefacts are largely concentrated inside Structure 3, with the richest deposits found in the eastern end of the structure (**Fig. 7.41**). The areal distribution of lithic artefacts by weight differs considerably from this arrangement, however, with a second, pronounced, cluster also present along the northern edge of the exterior area, while the interior weights are more evenly distributed (**Fig. 7.42**).

When plotted by volumetric density, the positive correlation between the distribution of flaked stone artefacts and Structure 3 is lost, as the thinner deposits of some exterior squares heavily skew the corresponding distributions (**Figs. 7.43** - **7.44**). This effect is most apparent in the case of Square B3, with the presence of the tranchet axe - weighing over a kilogram – in conjunction with the low sediment volume (0.056m^3) resulting in a particularly high volumetric density in this square.

7.3.2.1.1 Debris, debitage and cores

The distributions of Upper Phase 3 chunks and chips are similar and both show a strong association with the interior squares of Structure 3 (**Figs. 7.45 - 7.46**). Most debitage types also demonstrate a clear correlation with the interior deposits of Structure 3, including a radial decline in the exterior space surrounding it. This pattern is particularly pronounced in

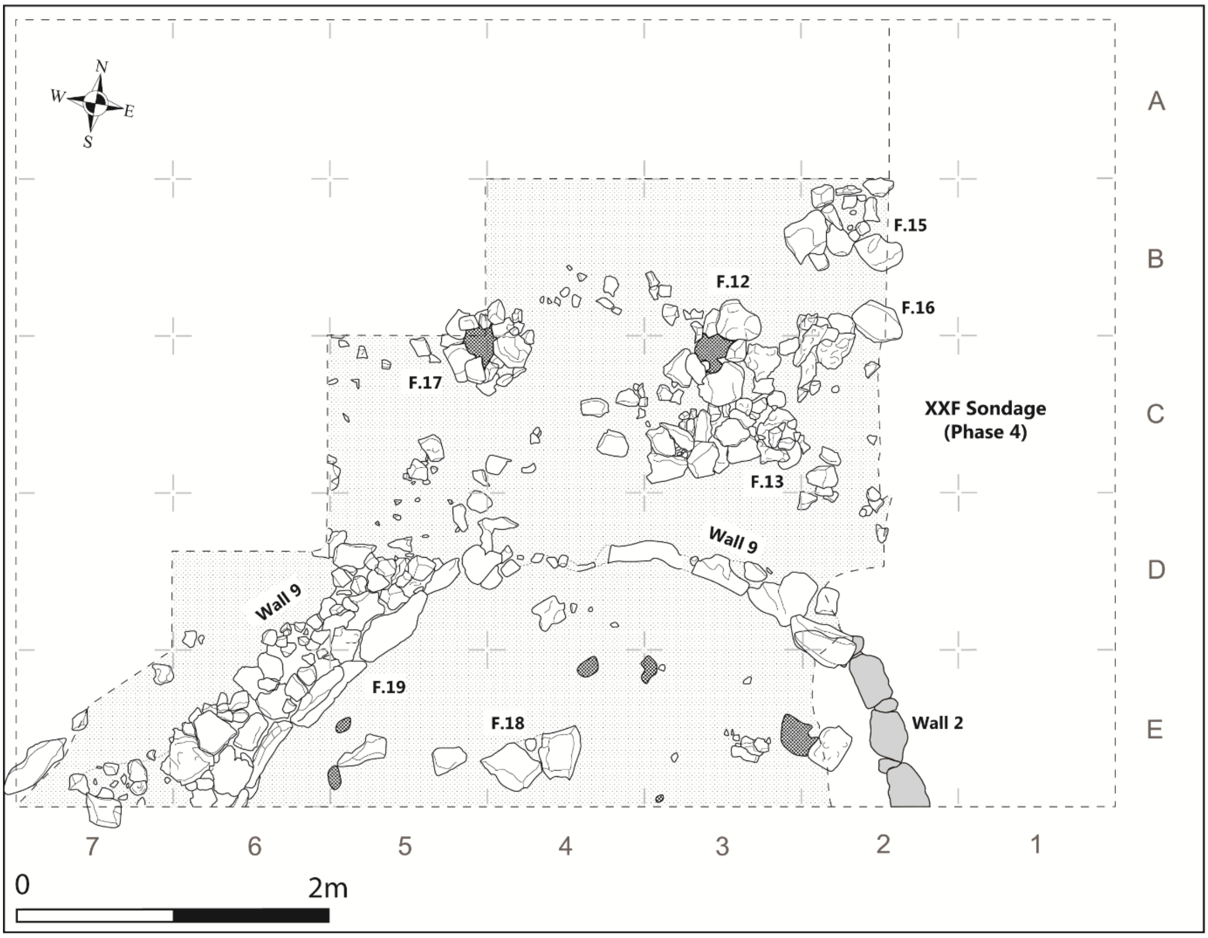


Figure 7.40: Plan of the Area XX F, Upper Phase 3 exposure.

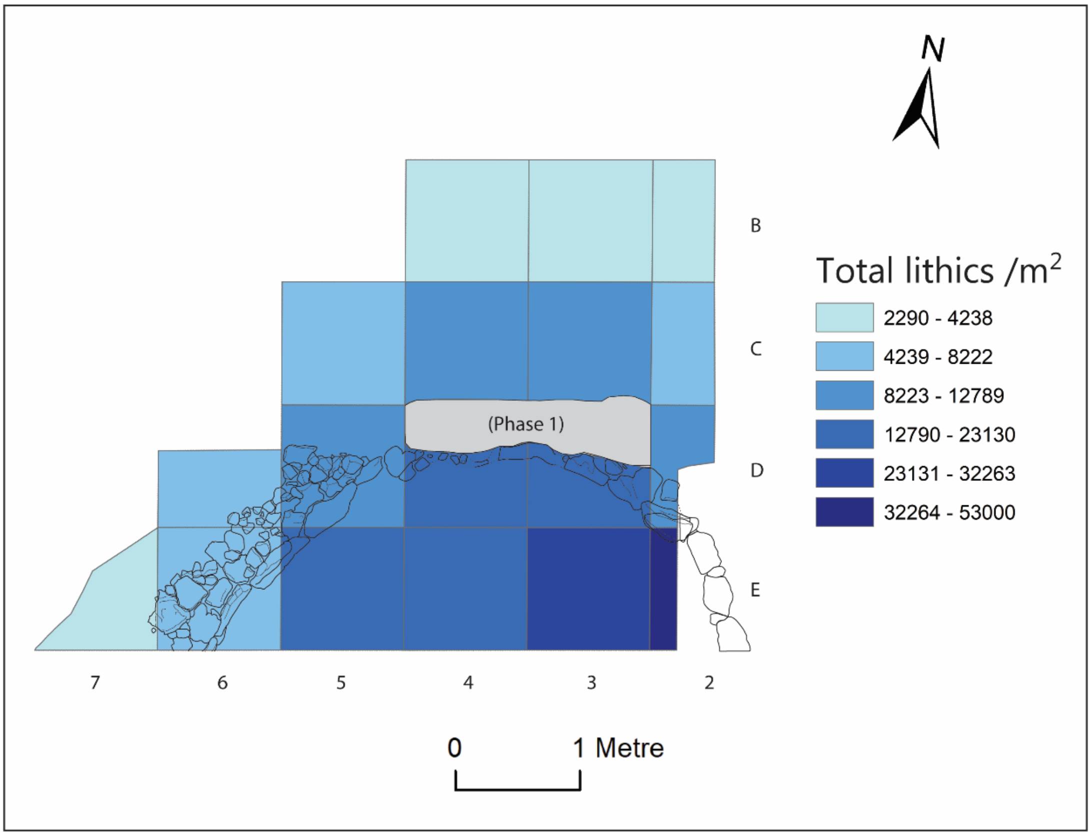


Figure 7.41: Distribution of Upper Phase 3 flaked stone artefacts, by areal density.

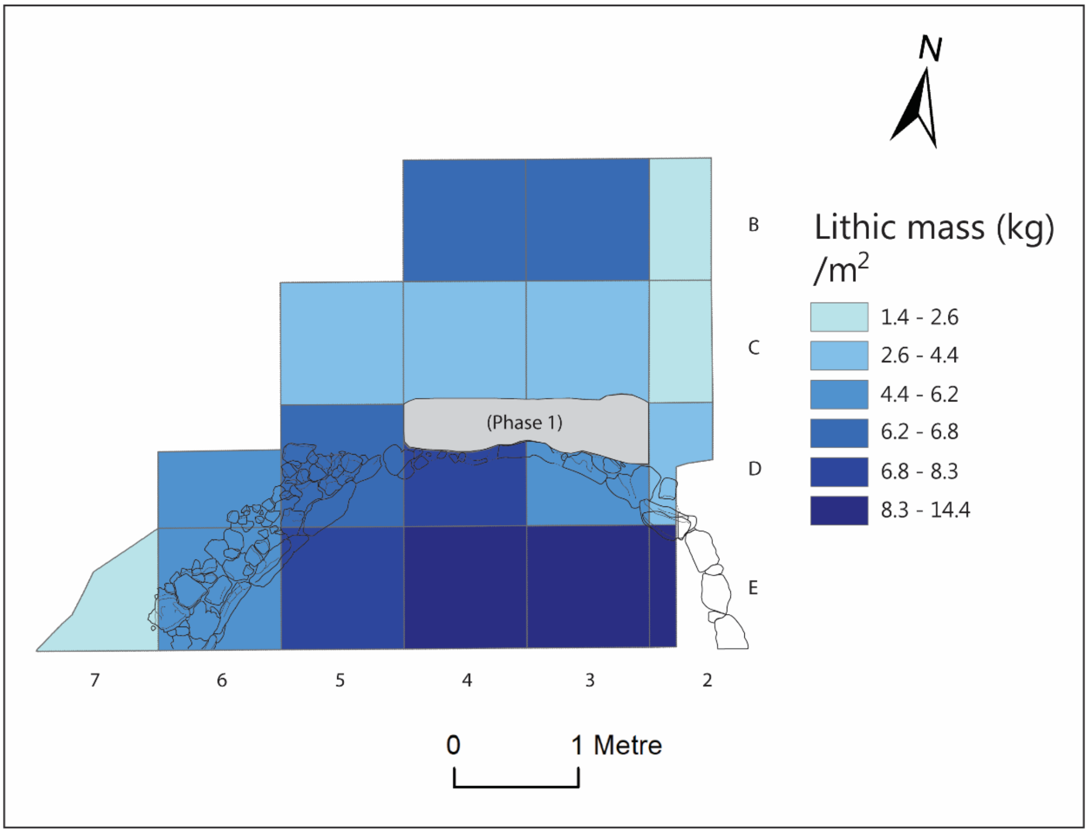


Figure 7.42: Distribution of Upper Phase 3 flaked-stone artefact mass, by areal density.

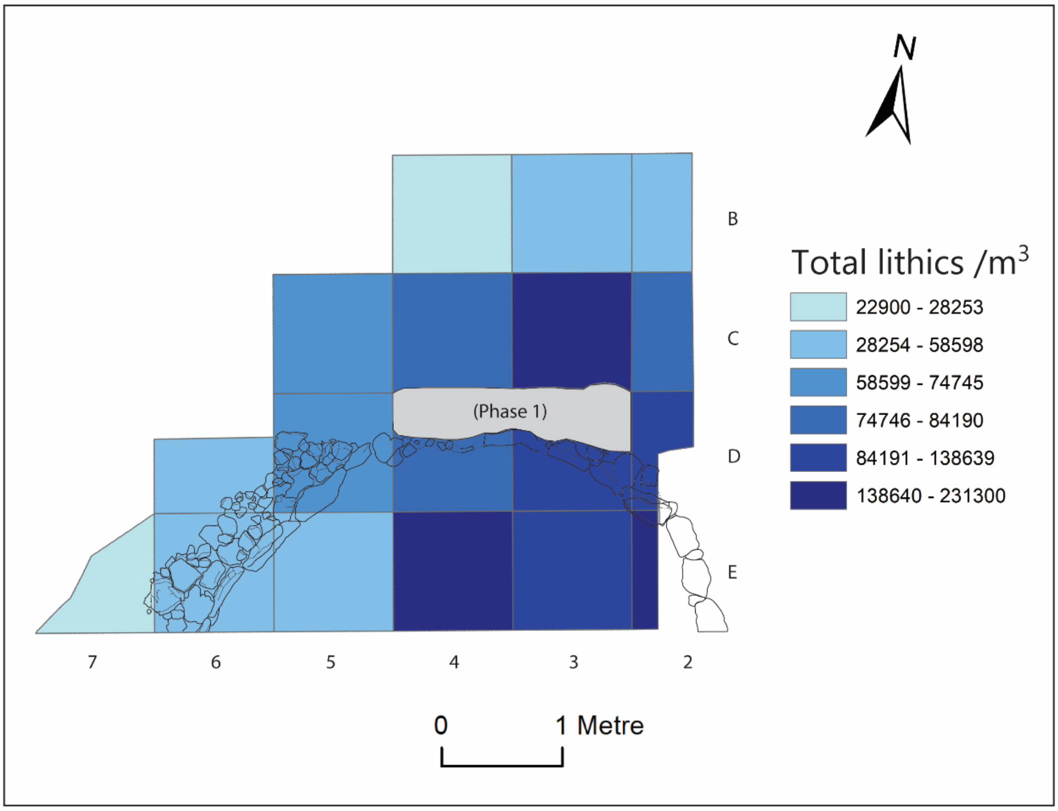


Figure 7.43: Distribution of Upper Phase 3 flaked stone artefacts, by volumetric density.

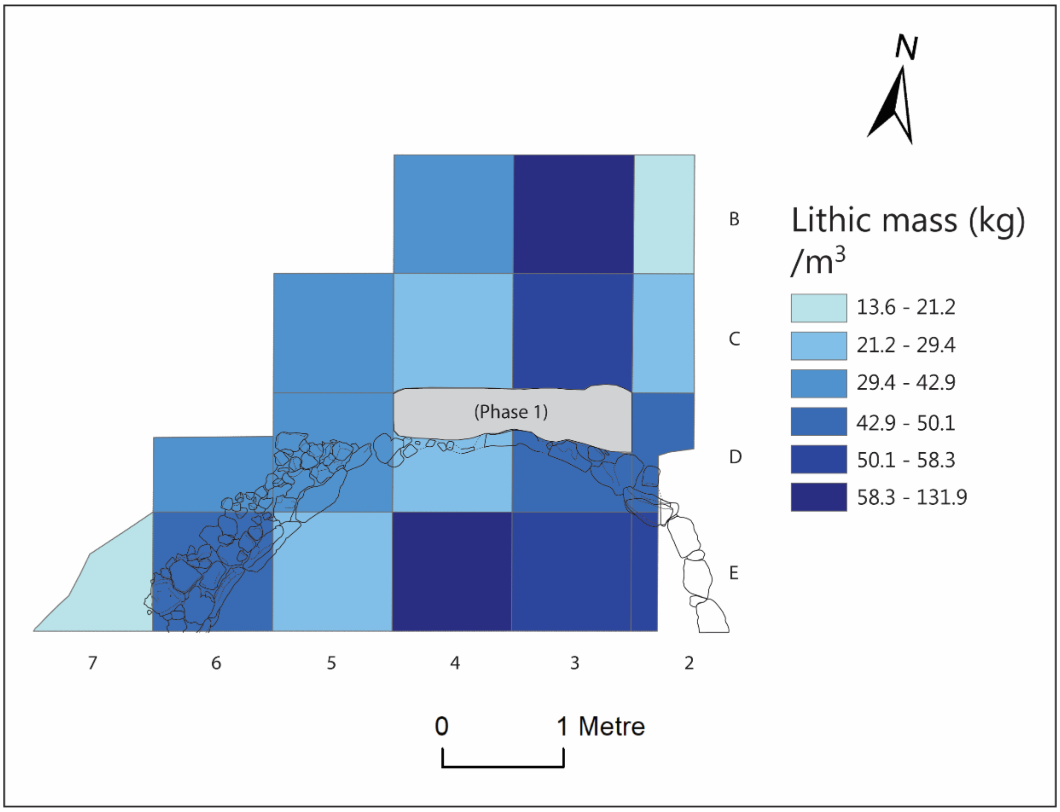


Figure 7.44: Distribution of Upper Phase 3 flaked stone artefact weights, by volumetric density.

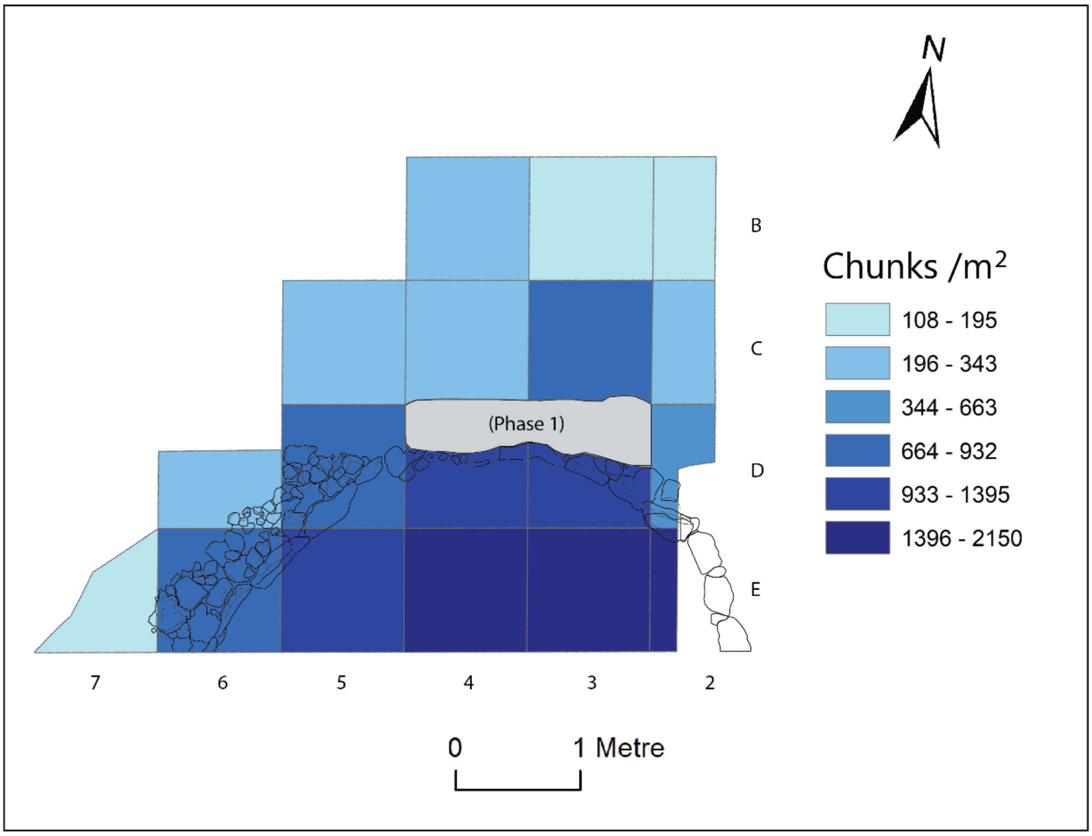


Figure 7.45: Distribution of Upper Phase 3 chunks.

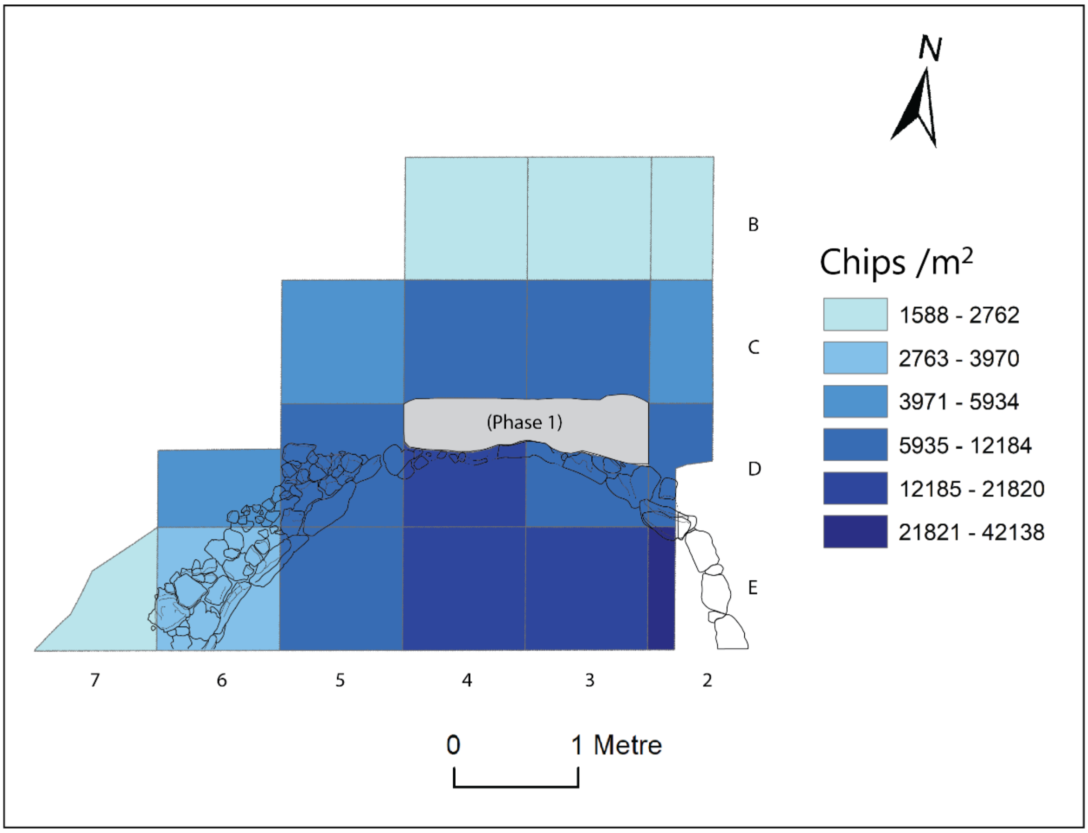


Figure 7.46: Distribution of Upper Phase 3 chips.

the case of the flakes <2cm (**Fig. 7.47**), broken flakes (**Fig. 7.48**), blades (**Fig. 7.49**) bladelets (**Fig. 7.50**) broken blades and bladelets (**Fig. 7.51**), bladelets <2cm (**Fig 7.52**) and burin spalls (**Fig. 7.53**). The whole flakes over 2cm in length also follow this distribution, albeit with a noticeably greater representation along the northern baulk (**Fig. 7.54**). The Upper Phase 3 cores are primarily distributed into three clusters, with little variation in disposal location based on the type of blanks being produced (**Figs. 7.55 – 7.57**). They comprise an indoor cluster, a second concentration west of Wall 3 in Square D6 and a third cluster along the northern baulk.

7.3.2.1.2 Retouched artefacts

Much like in Phase 2, the distribution of retouched pieces differs considerably by tool group. The tool groups represented primarily by microlithic pieces exhibit clear associations with the centre of Structure 3, as is the case with the truncated pieces (**Fig. 7.58**), non-geometric microliths (**Fig. 7.59**), geometric microliths (**Fig. 7.60**), notched and denticulated pieces (**Fig. 7.61**) and retouched fragments (**Fig. 7.62**). In contrast, while the distribution of scrapers (**Fig. 7.63**), multiple tools (**Fig. 7.64**), burins (**Fig. 7.65**) and retouched flakes (**Fig. 7.66**) also occur in large quantities inside Structure 3, they are also represented by exterior clusters along the northern baulk. As in Phase 2, the relatively low numbers of retouched blades and awls and borers are reflected by relatively restricted distributions. The retouched blades are strongly concentrated in Square D5 (**Fig. 7.67**), while the awls and borers are entirely absent north of Wall 3 (**Fig. 7.68**).

7.3.2.1.3 Burnt artefact distribution

The concentrations of burnt artefacts in Upper Phase 3 are reminiscent of the pattern for the Phase 2 chips, with deposits in the south-east corner of the excavated area generally exhibiting lower percentages than elsewhere. This pattern is applicable to the chips, flakes, broken flakes (**Fig. 7.69**), broken blades and bladelets and burin spalls (**Fig. 7.70**). In contrast, the chunks, flakes <2cm (**Fig. 7.69**) and bladelets (**Fig. 7.70**) all evince relatively uniform distributions of artefact burning, whereas the bladelets <2cm present an unusually

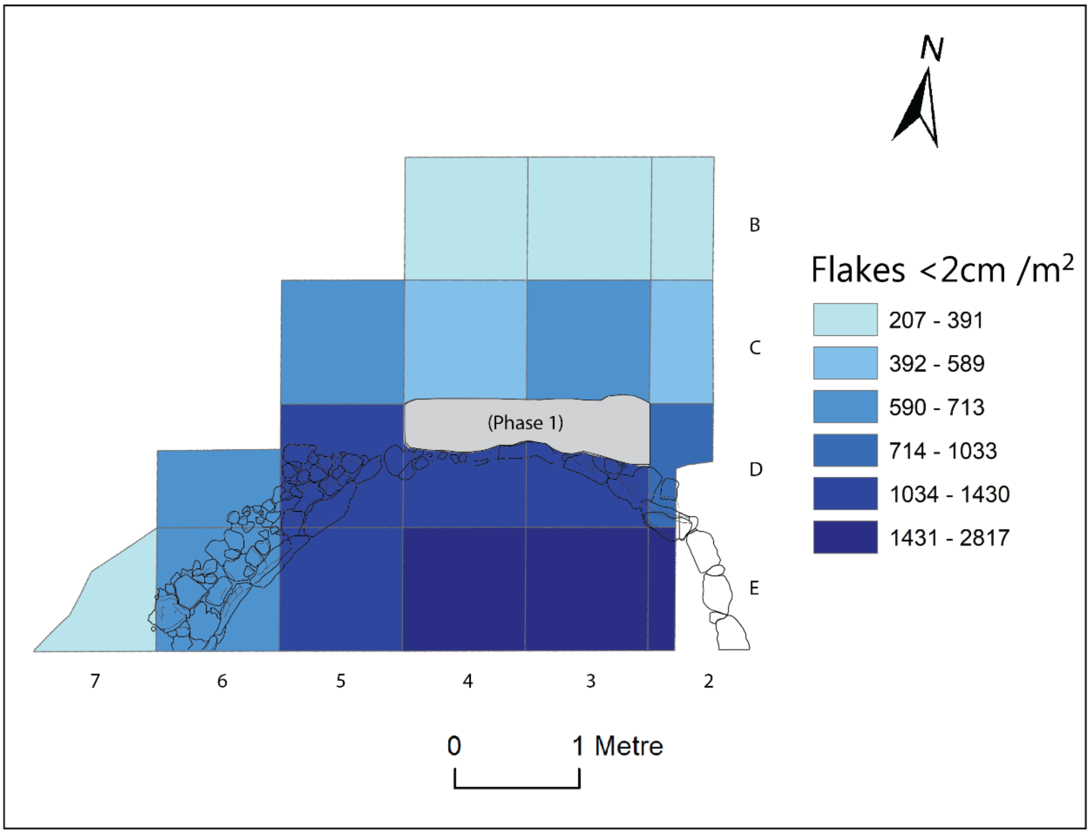


Figure 7.47: Distribution of Upper Phase 3 flakes <2cm.

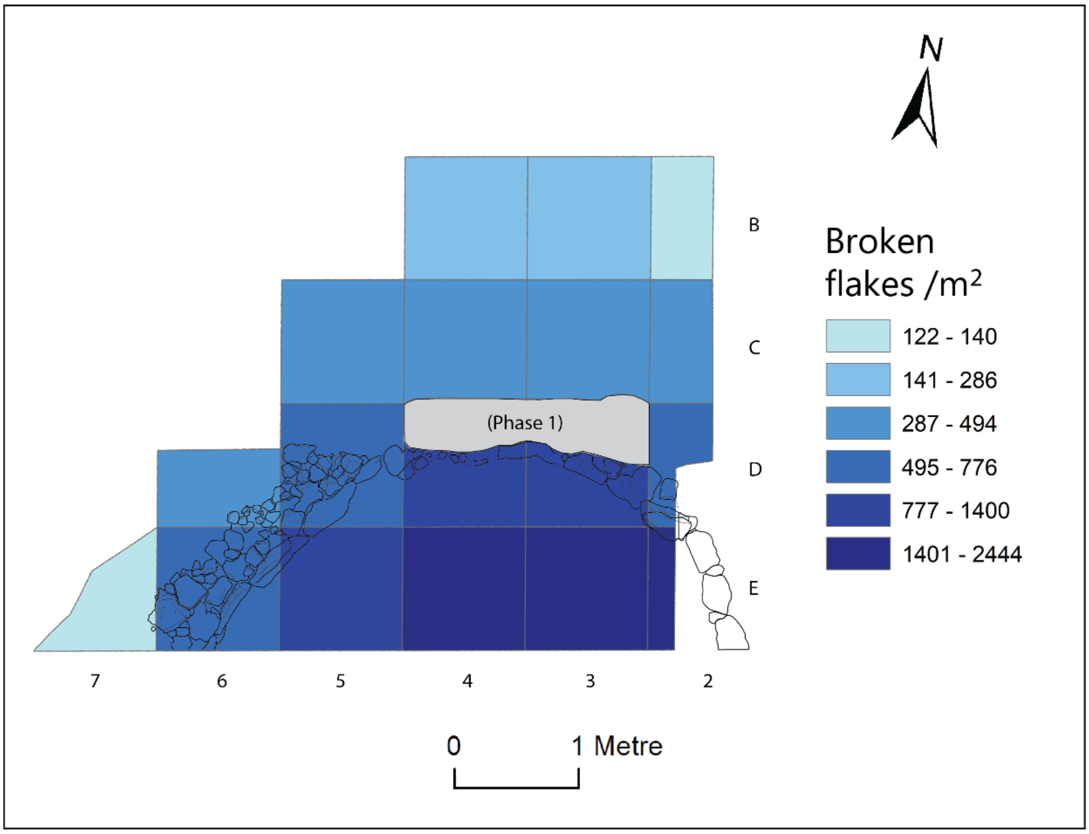


Figure 7.48: Distribution of Upper Phase 3 broken flakes.

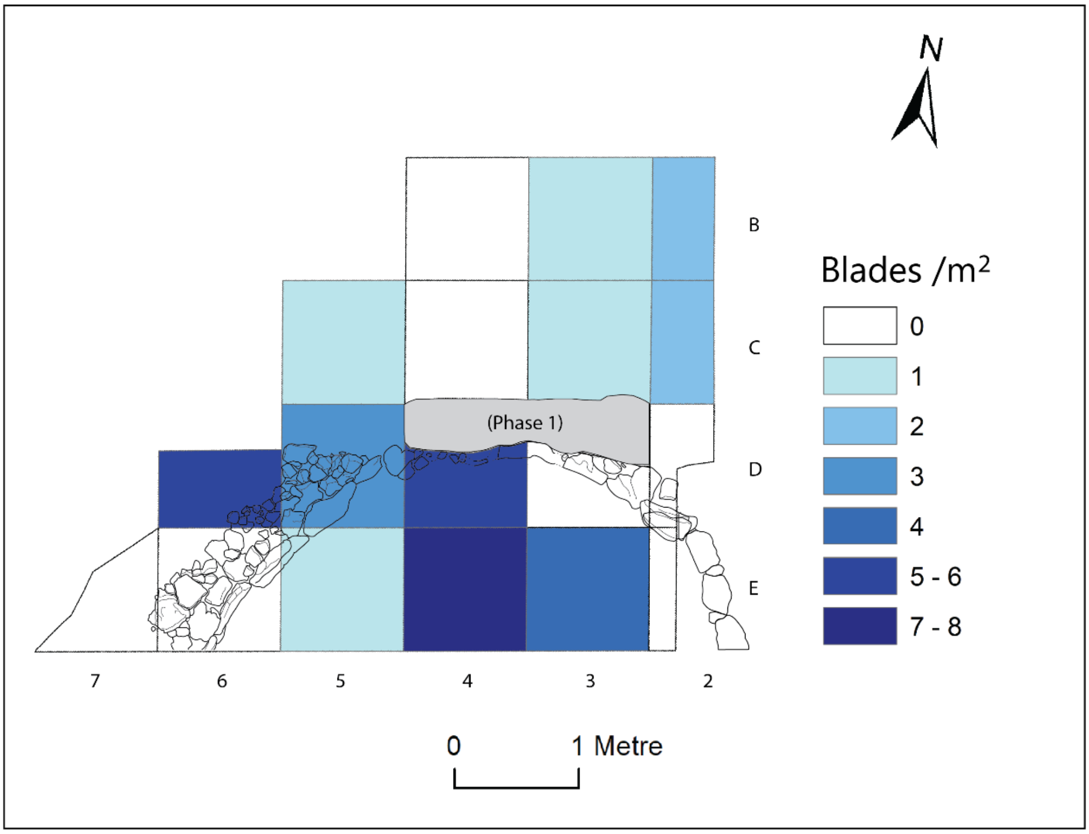


Figure 7.49: Distribution of Upper Phase 3 blades.

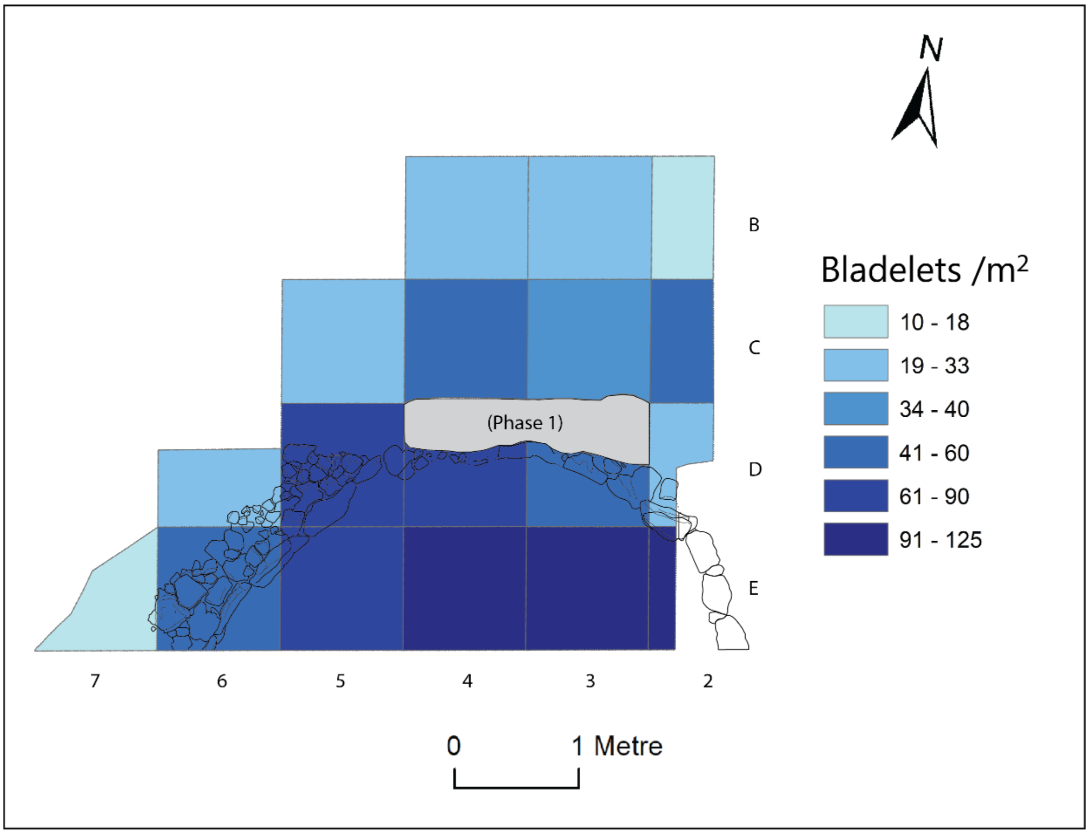


Figure 7.50: Distribution of Upper Phase 3 bladelets.

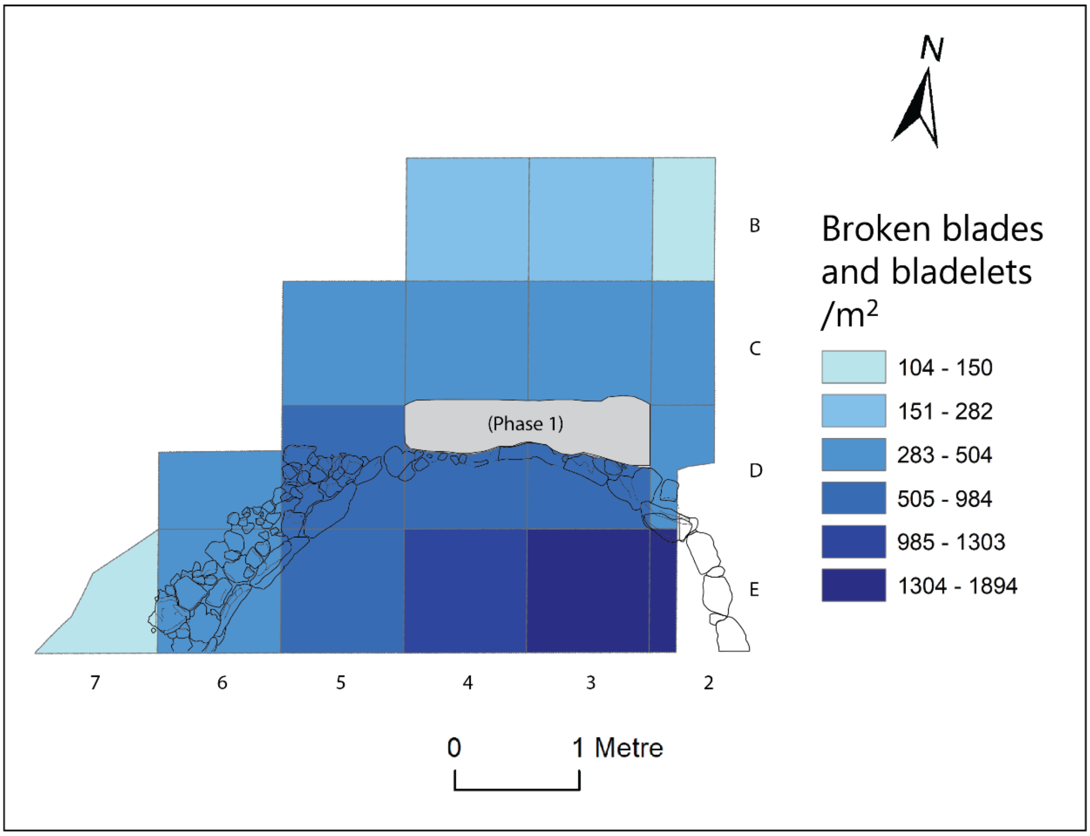


Figure 7.51: Distribution of Upper Phase 3 broken blades and bladelets.

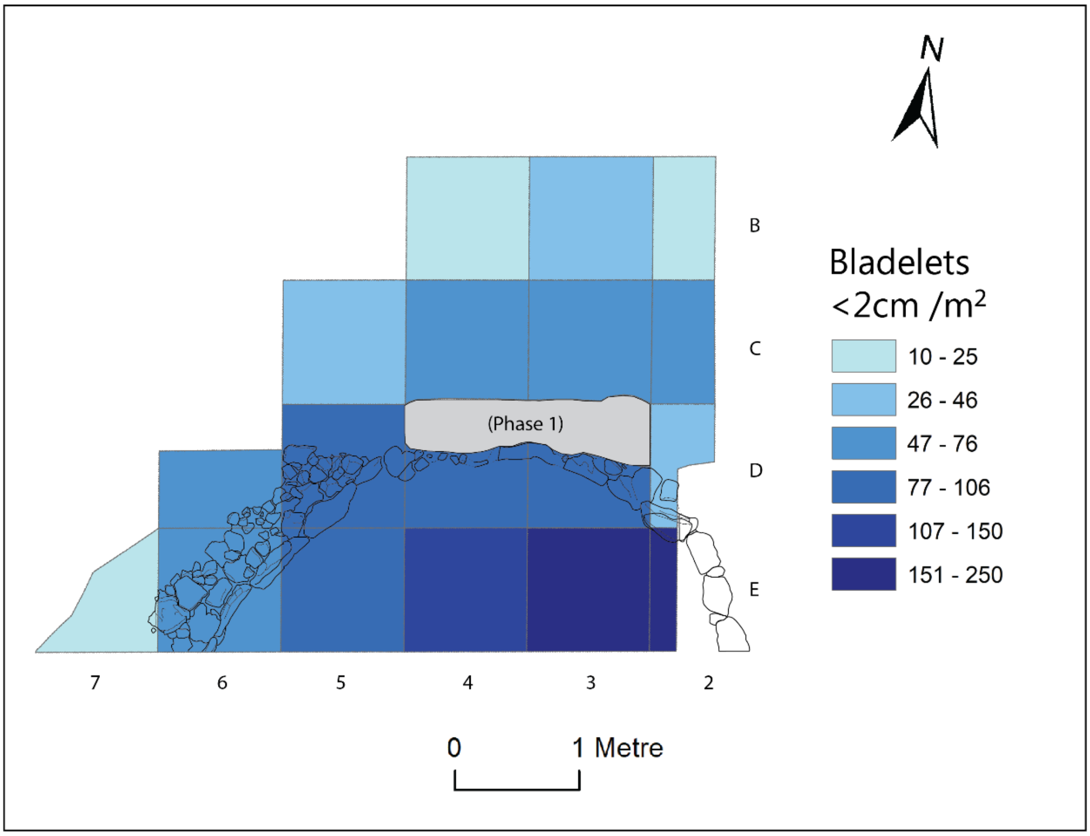


Figure 7.52: Distribution of Upper Phase 3 bladelets <2cm.

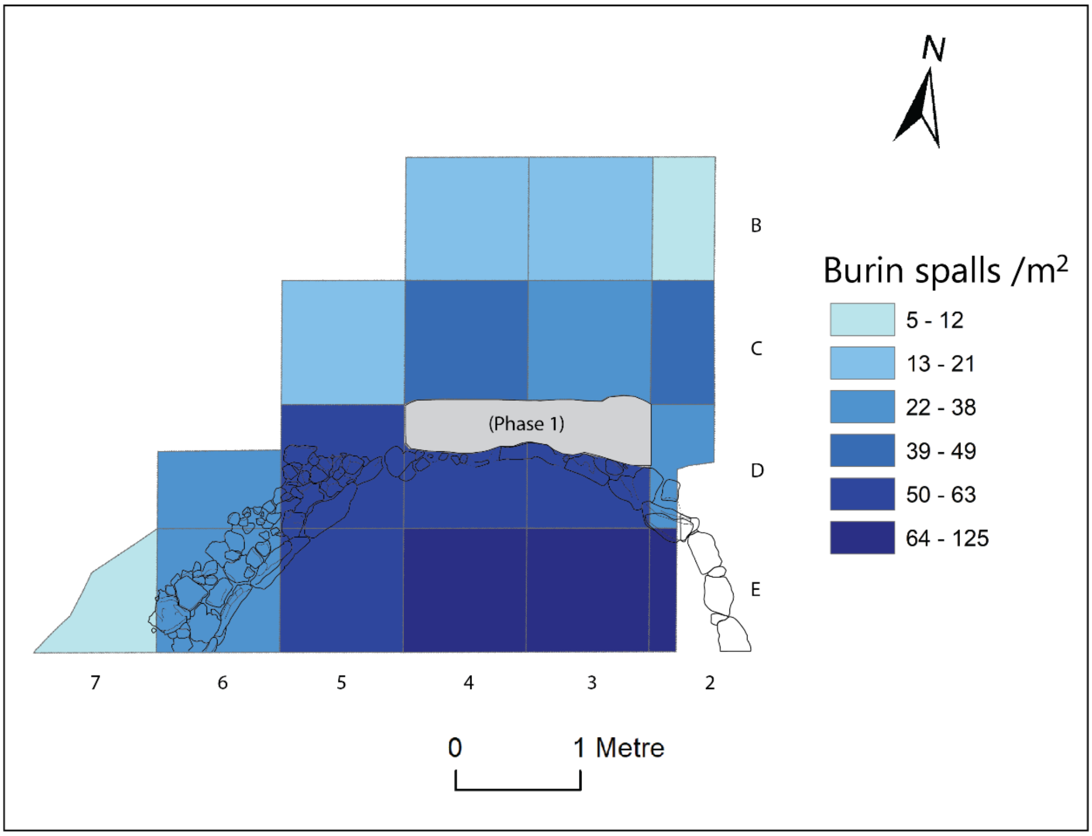


Figure 7.53: Distribution of Upper Phase 3 burin spalls.

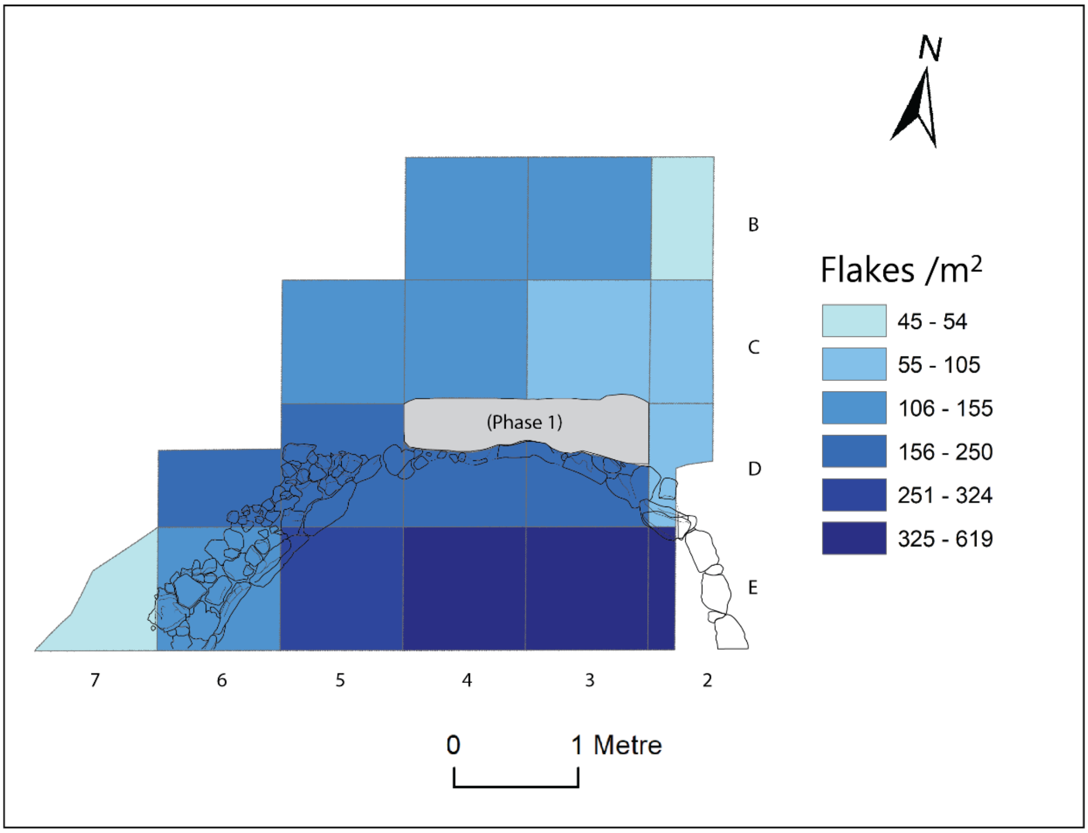


Figure 7.54: Distribution of Upper Phase 3 flakes.

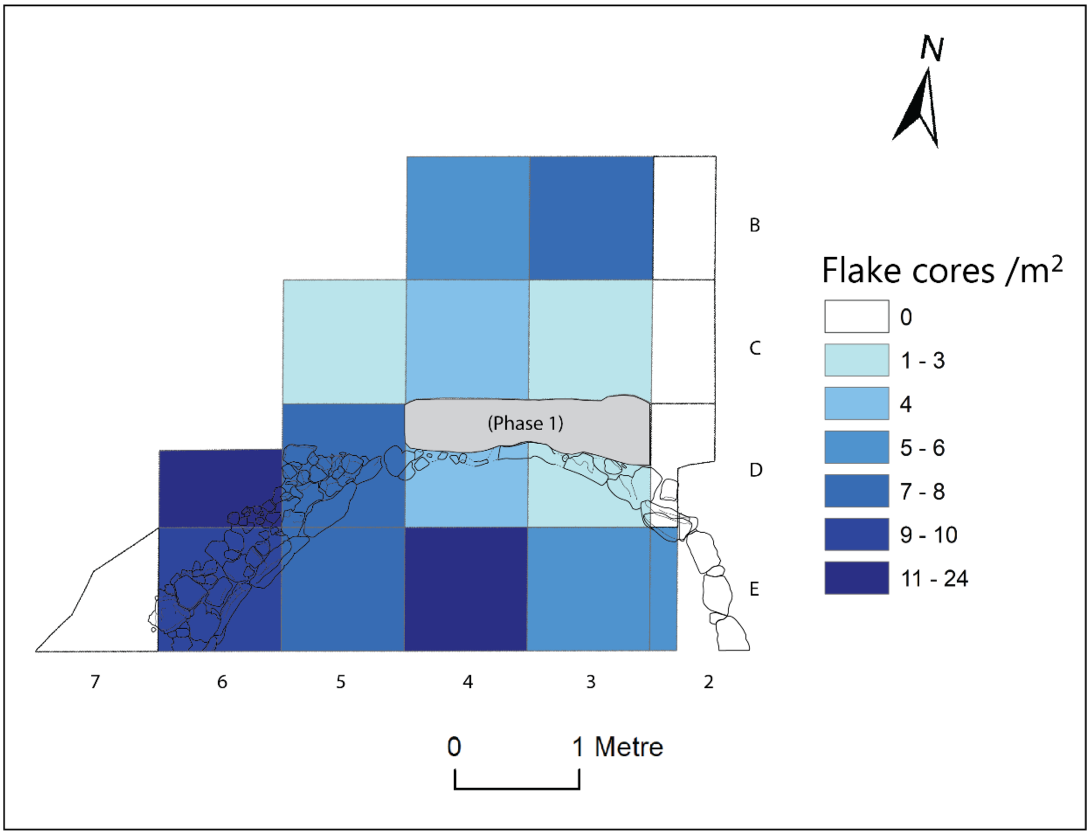


Figure 7.55: Distribution of Upper Phase 3 flake cores.

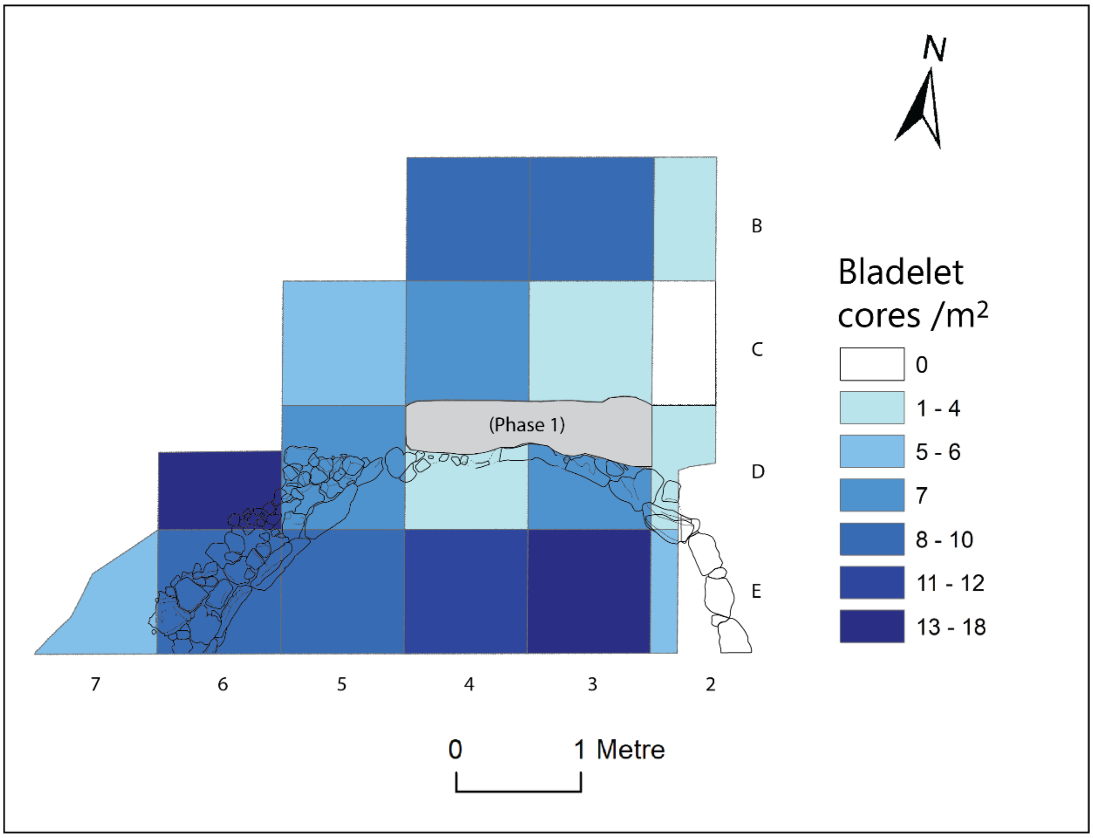


Figure 7.56: Distribution of Upper Phase 3 bladelet cores.

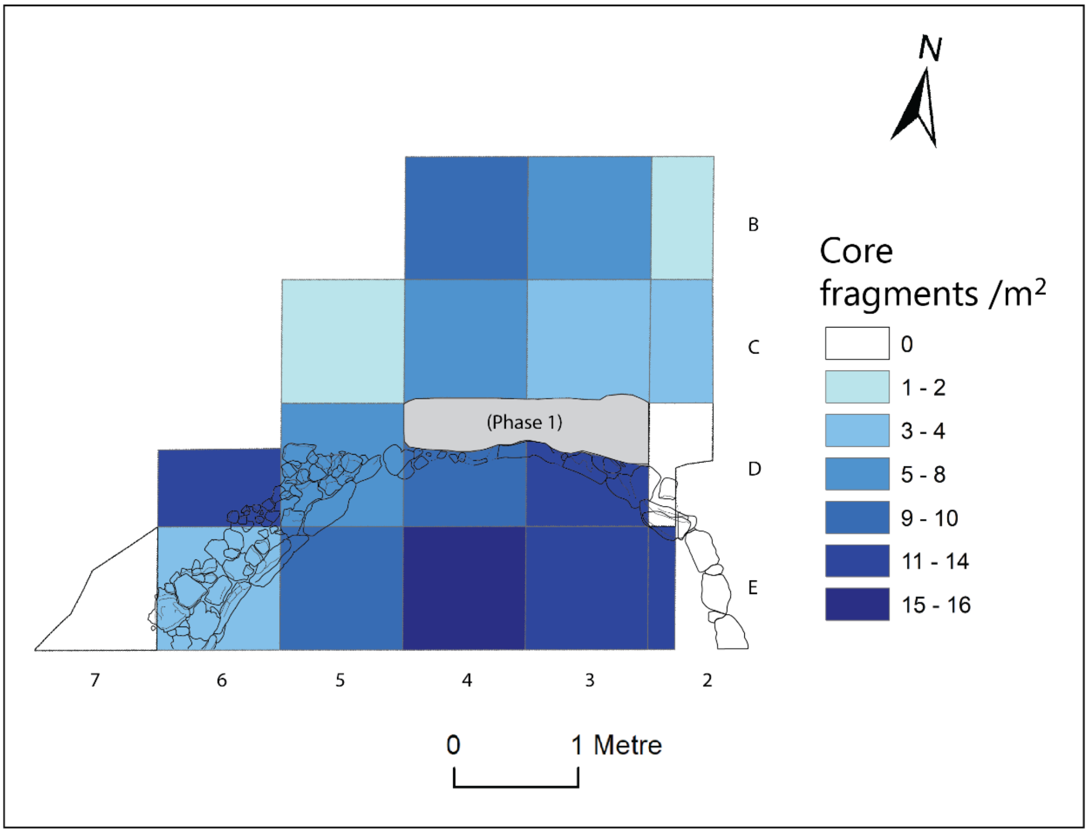


Figure 7.57: Distribution of Upper Phase 3 core fragments.

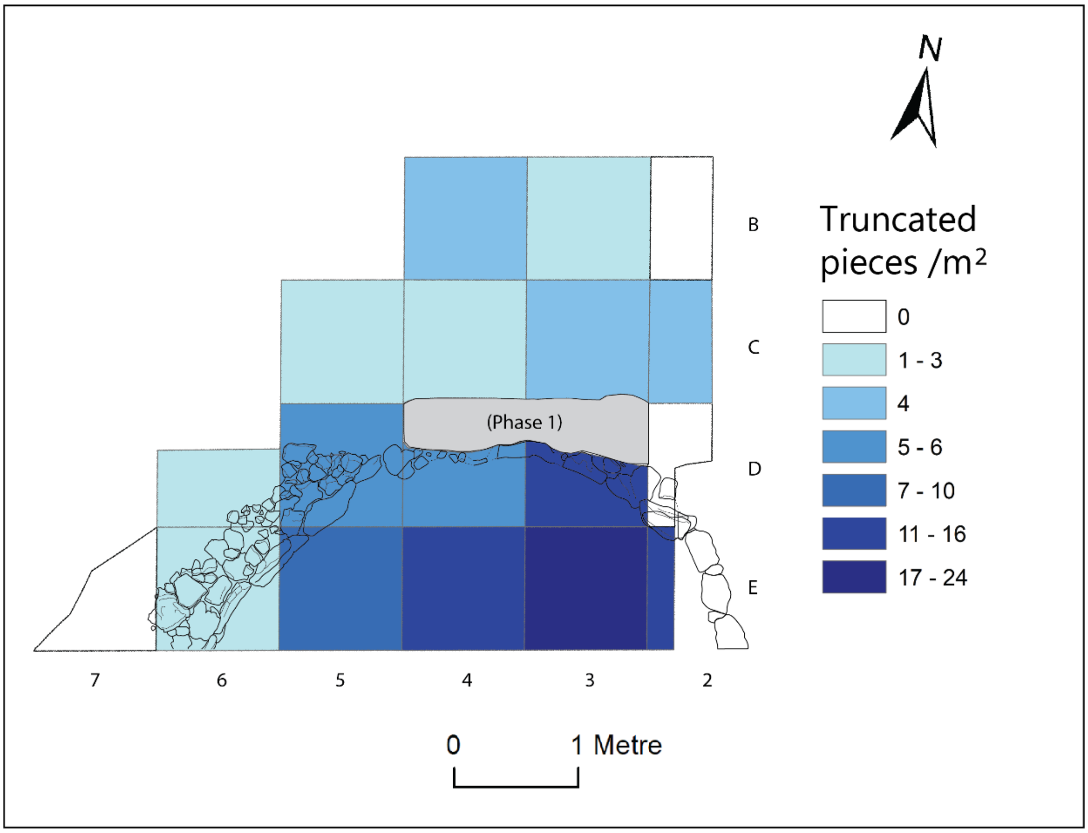


Figure 7.58: Distribution of Upper Phase 3 truncated pieces.

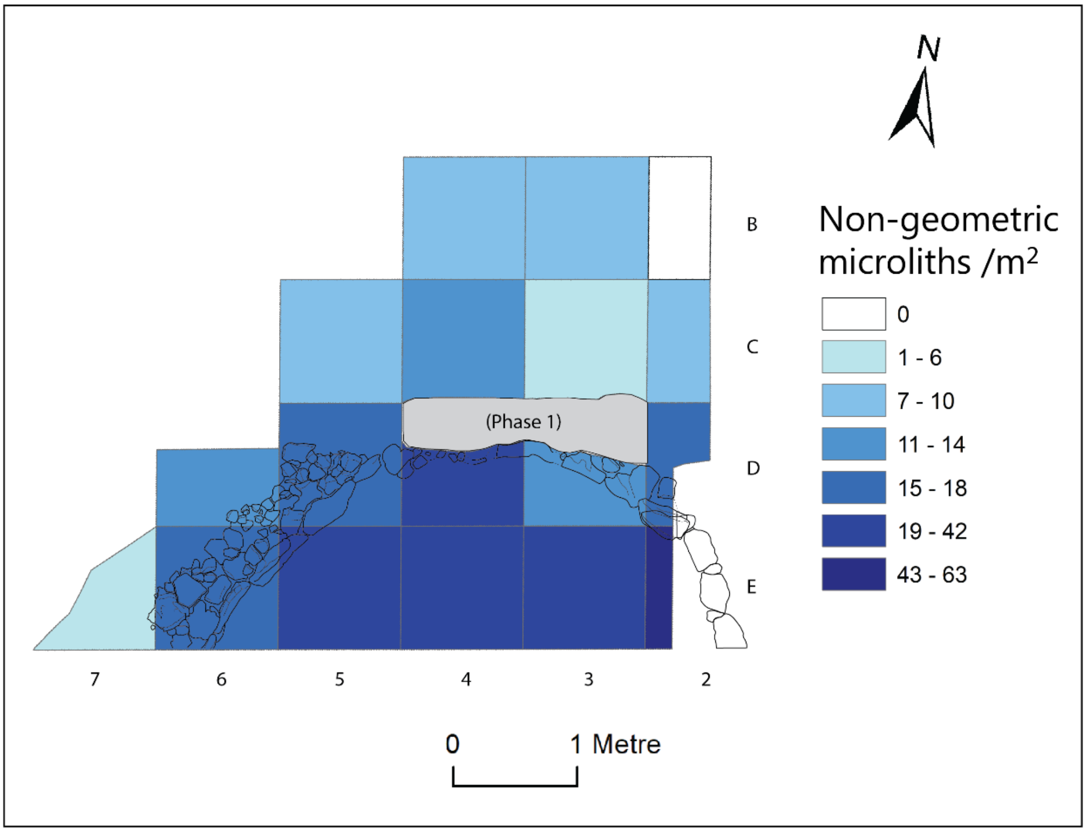


Figure 7.59: Distribution of Upper Phase 3 non-geometric microliths.

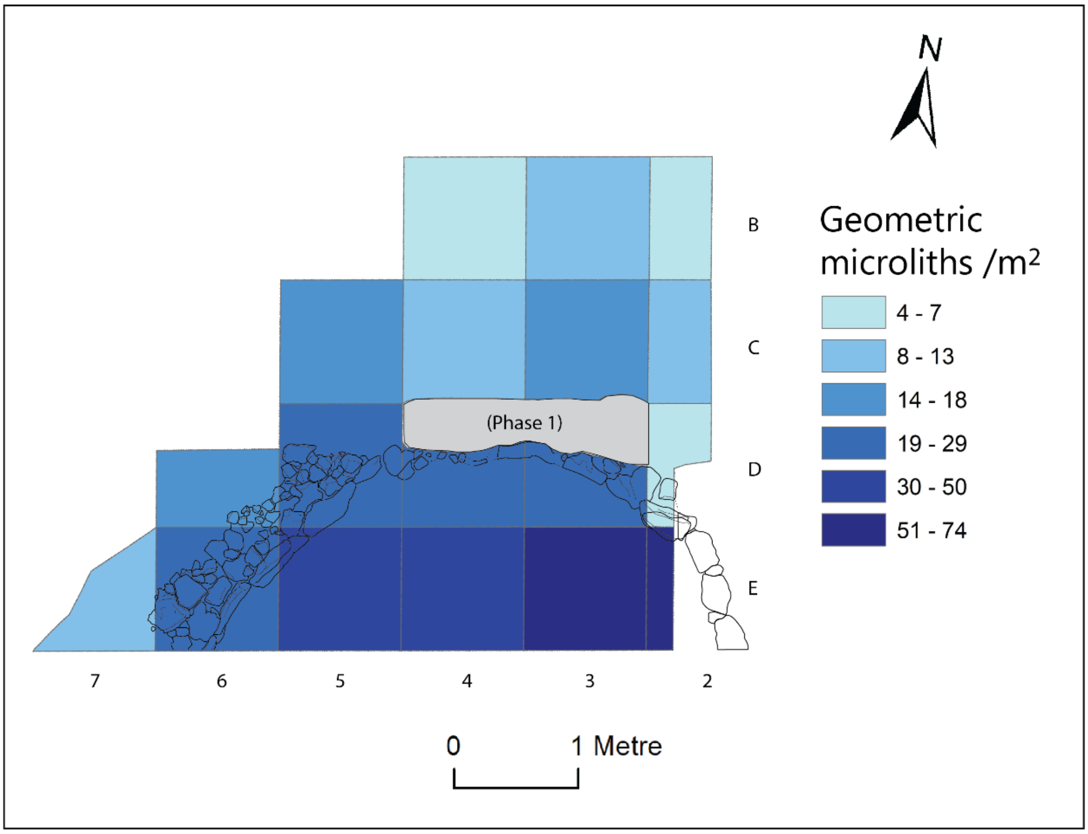


Figure 7.60: Distribution of Upper Phase 3 geometric microliths.

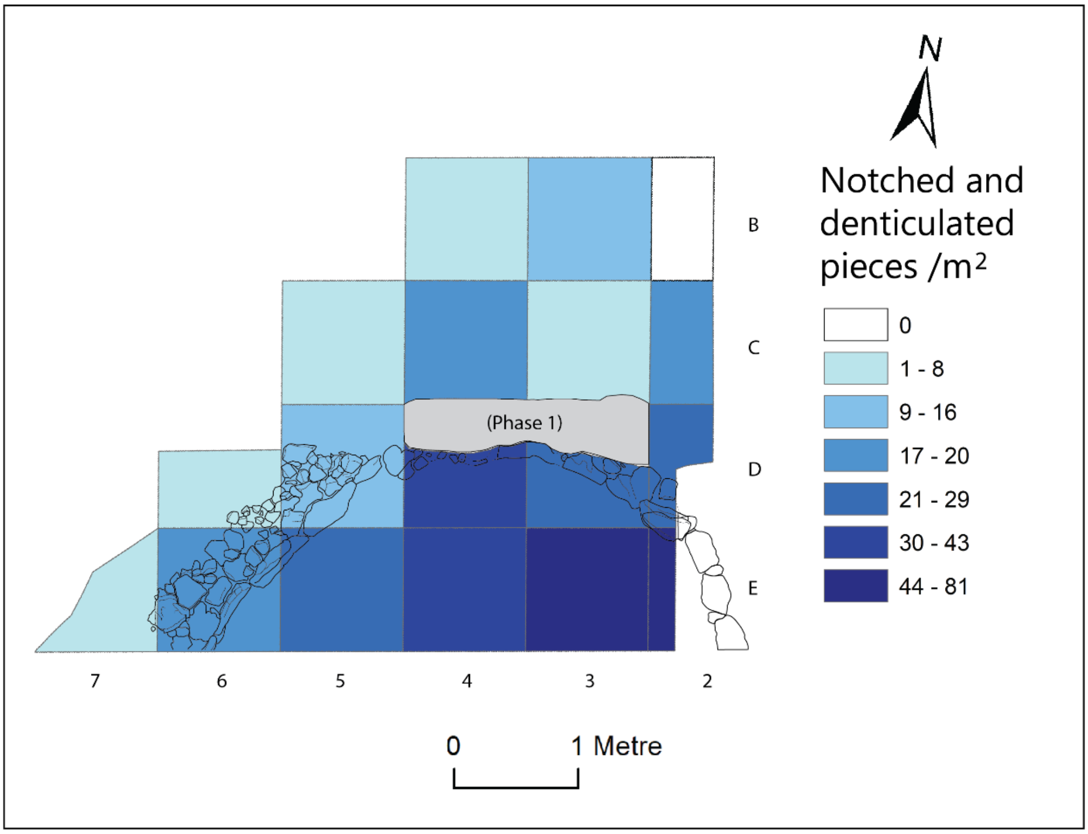


Figure 7.61: Distribution of Upper Phase 3 notched and denticulated pieces.

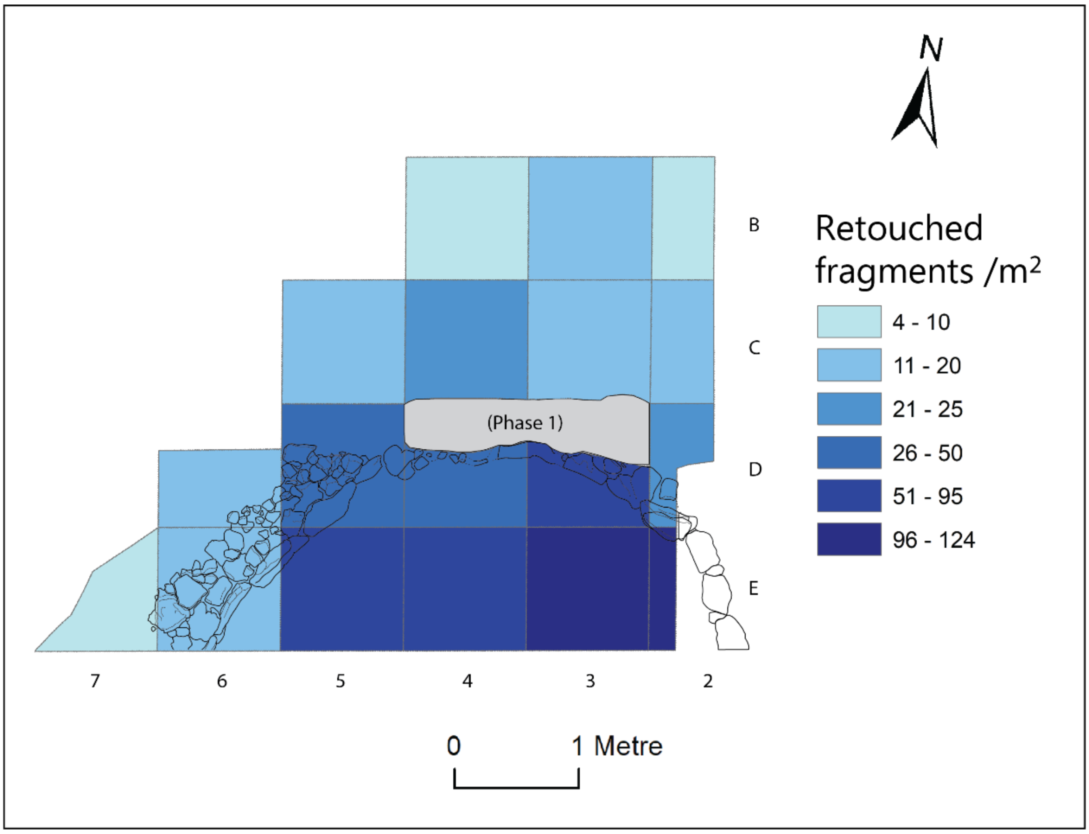


Figure 7.62: Distribution of Upper Phase 3 retouched fragments.

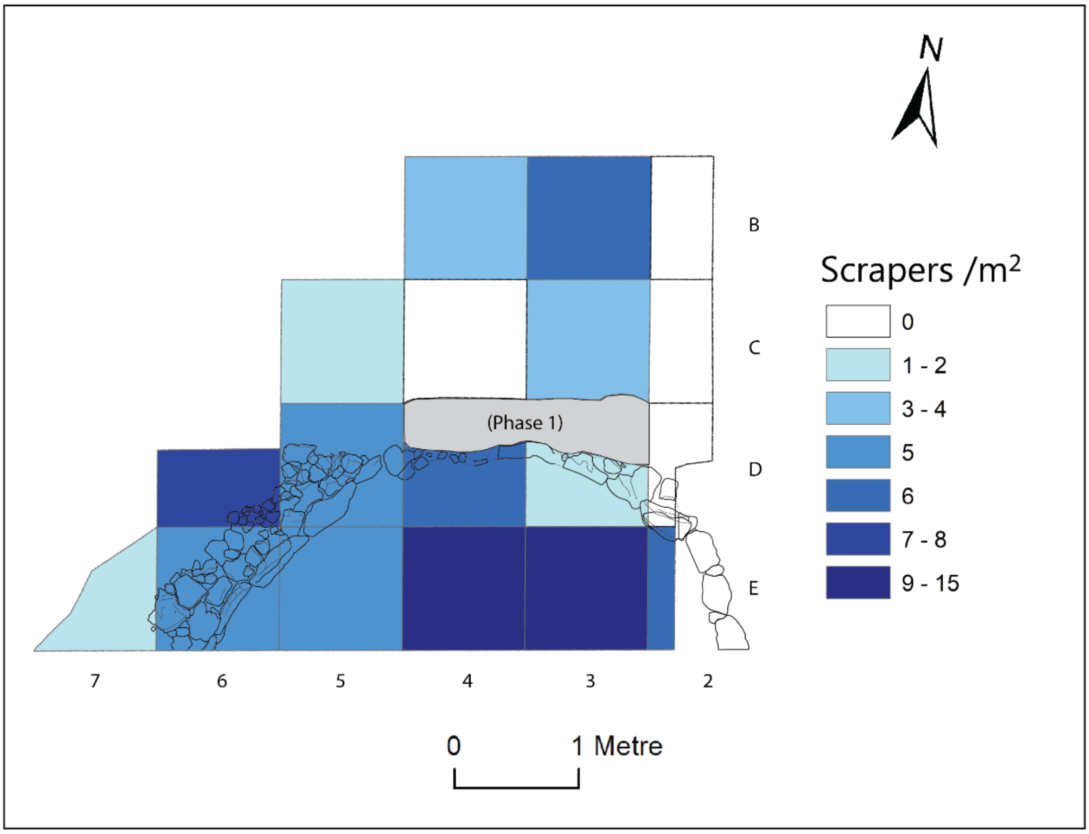


Figure 7.63: Distribution of Upper Phase 3 scrapers.

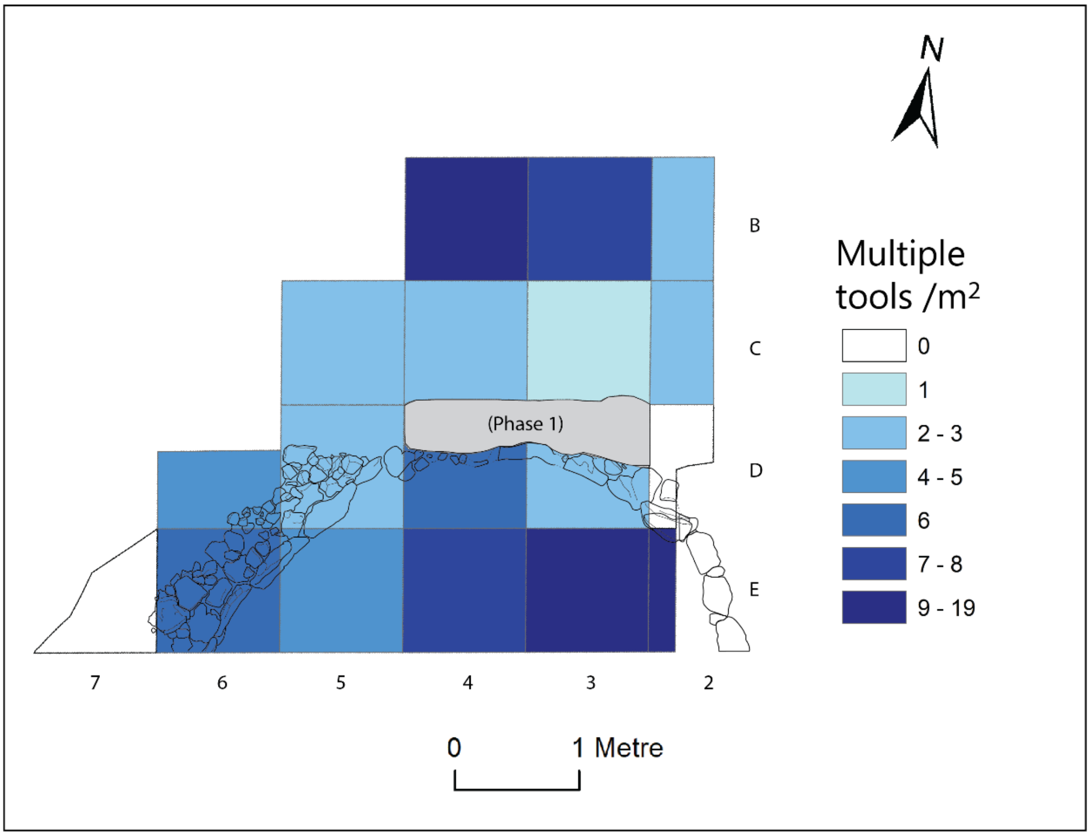


Figure 7.64: Distribution of Upper Phase 3 multiple tools.

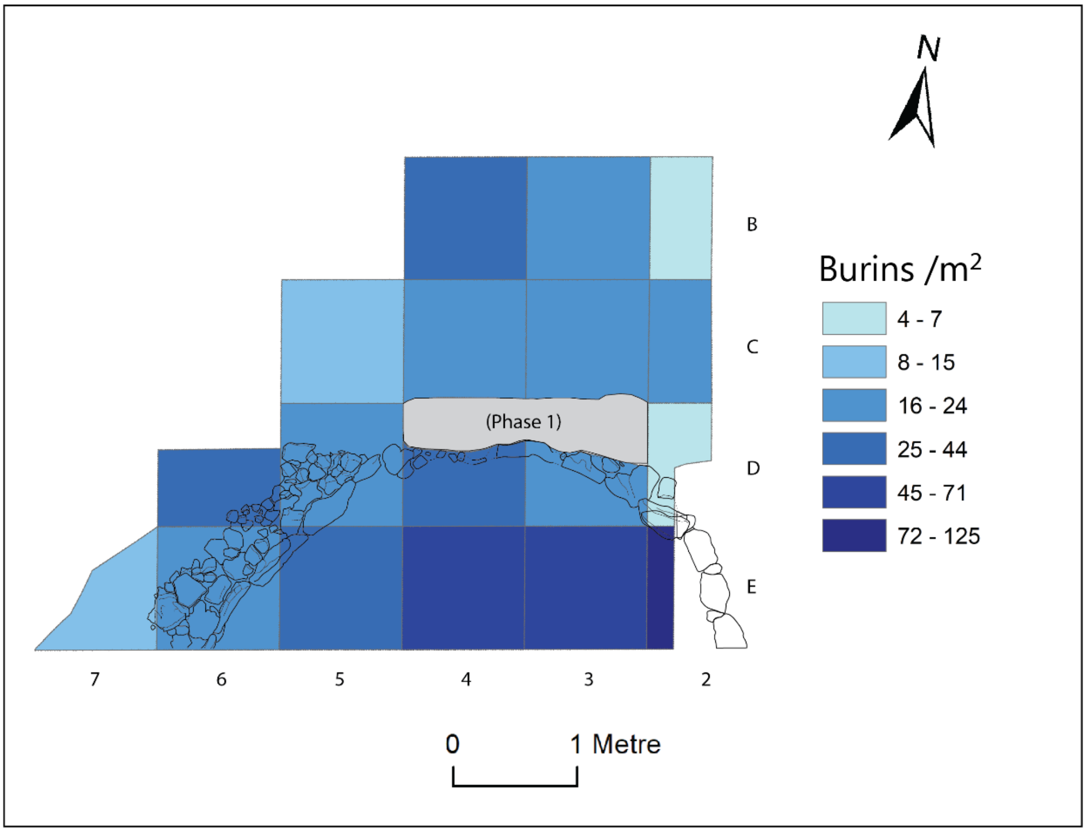


Figure 7.65: Distribution of Upper Phase 3 burins.

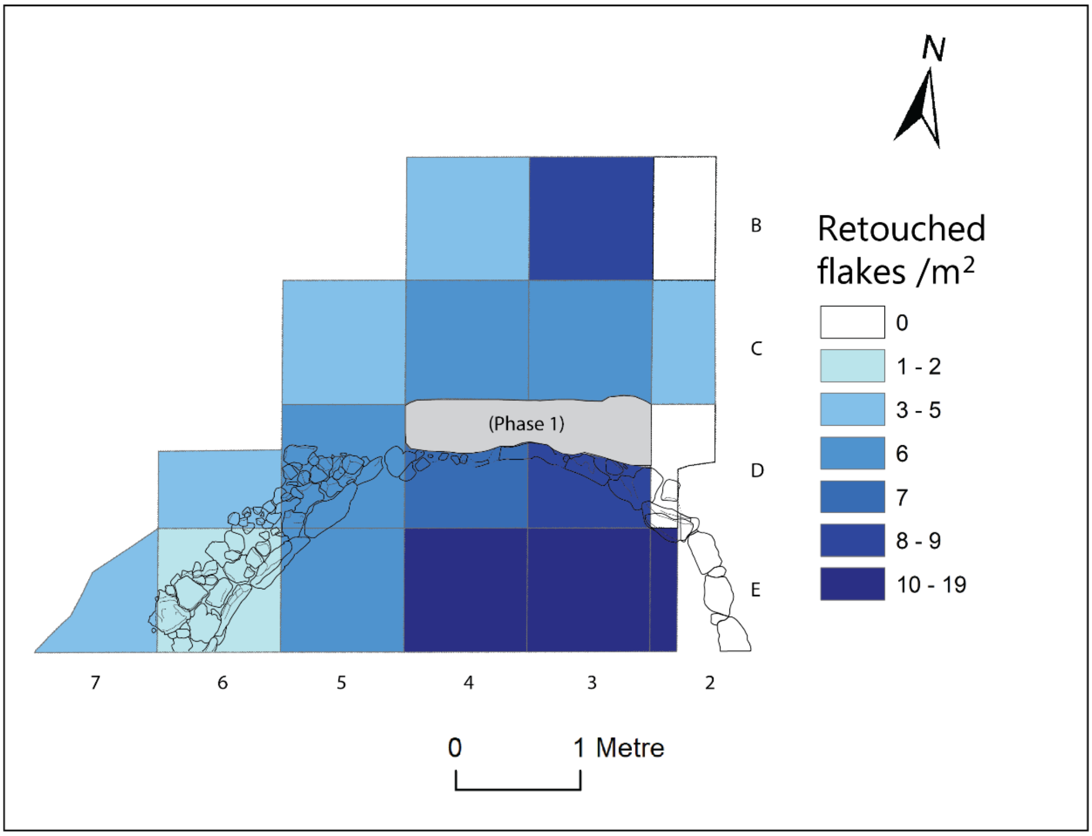


Figure 7.66: Distribution of Upper Phase 3 retouched flakes.

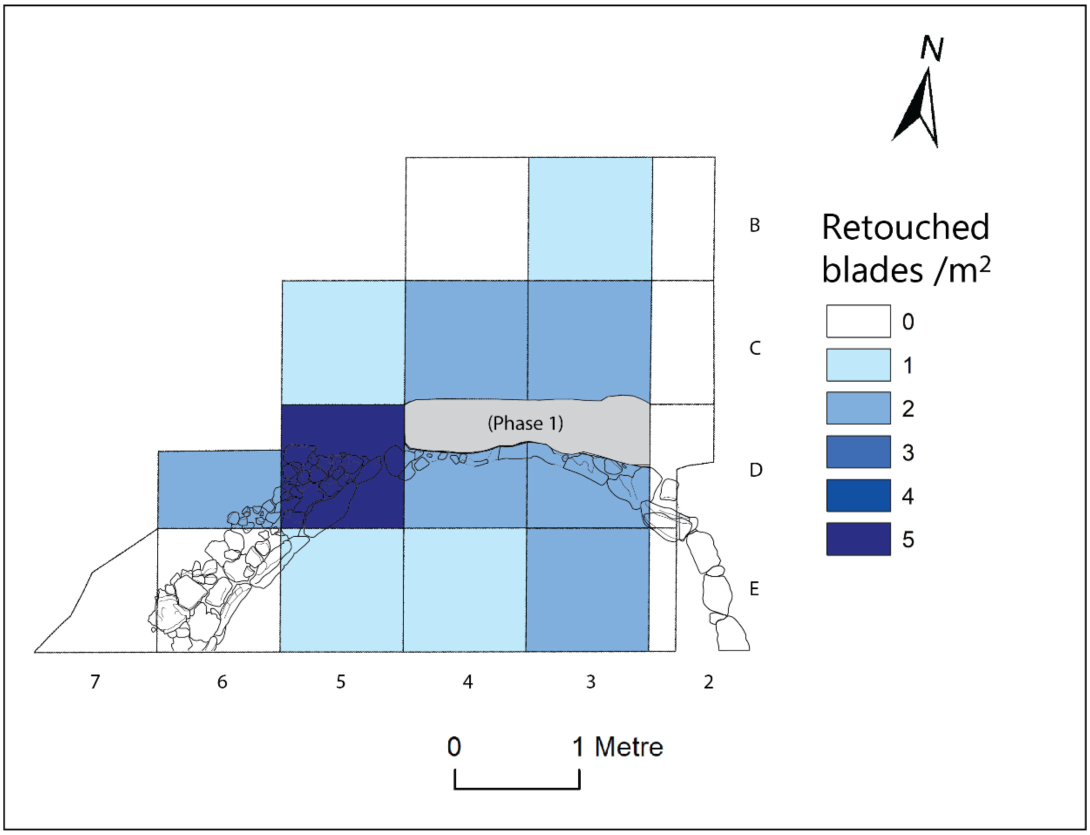


Figure 7.67: Distribution of Upper Phase 3 retouched blades.

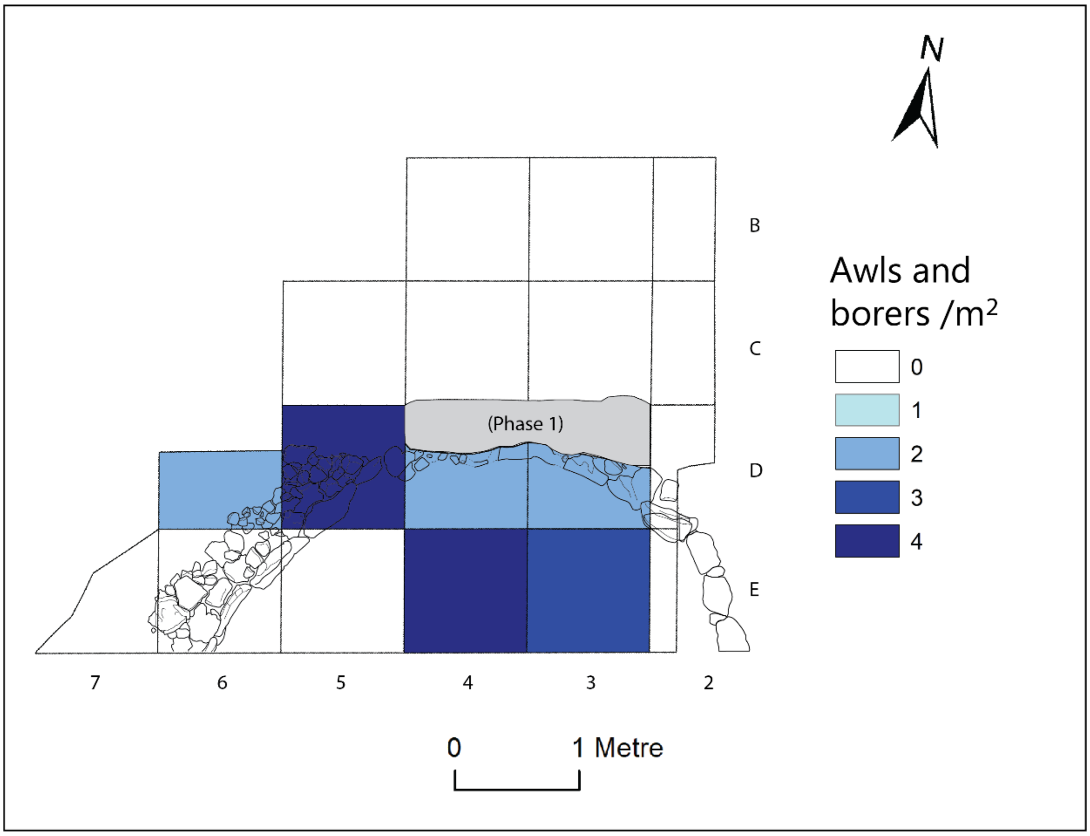


Figure 7.68: Distribution of Upper Phase 3 awls and borers.

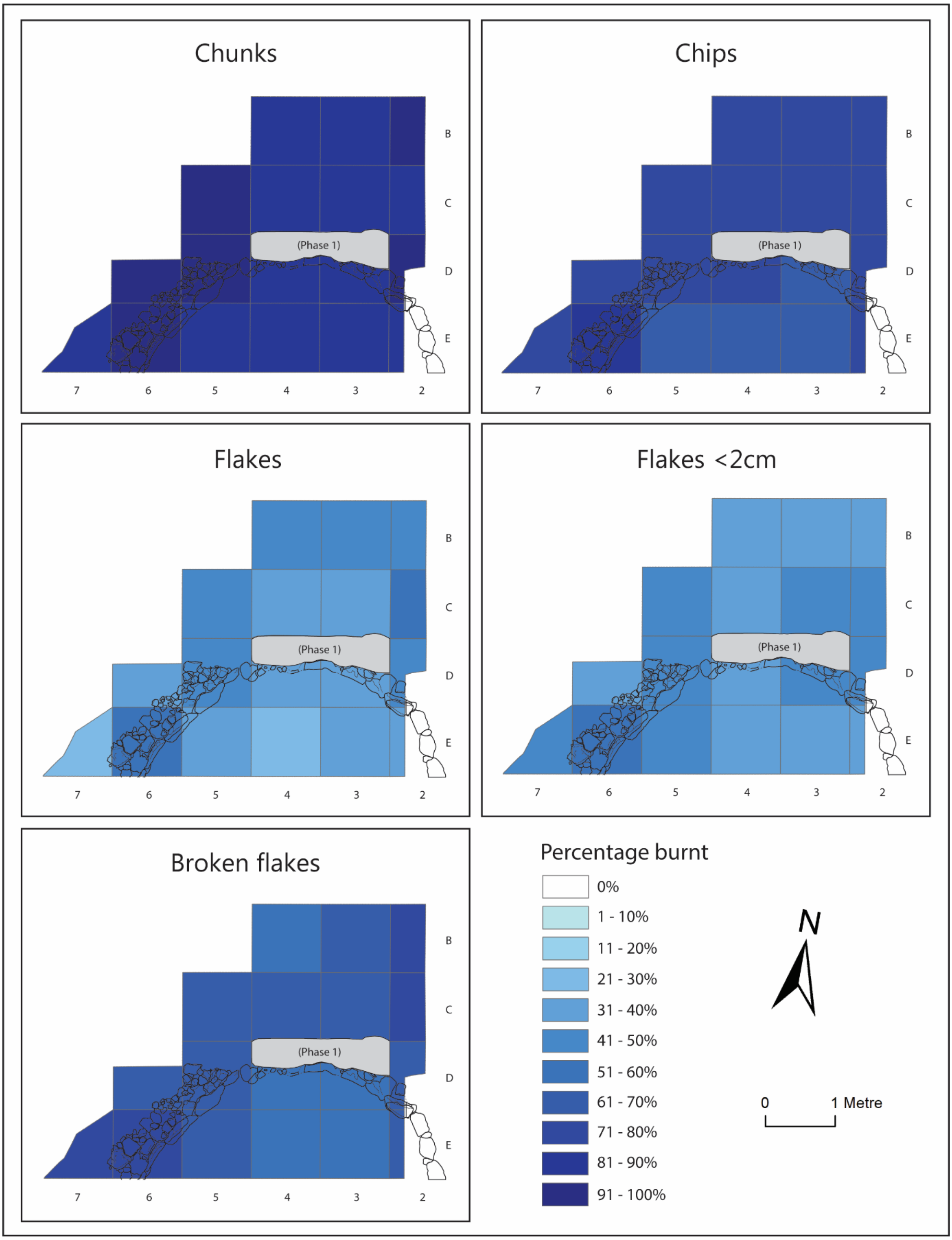


Figure 7.69: Distribution of burnt flaked stone artefacts in Upper Phase 3 (1/2).

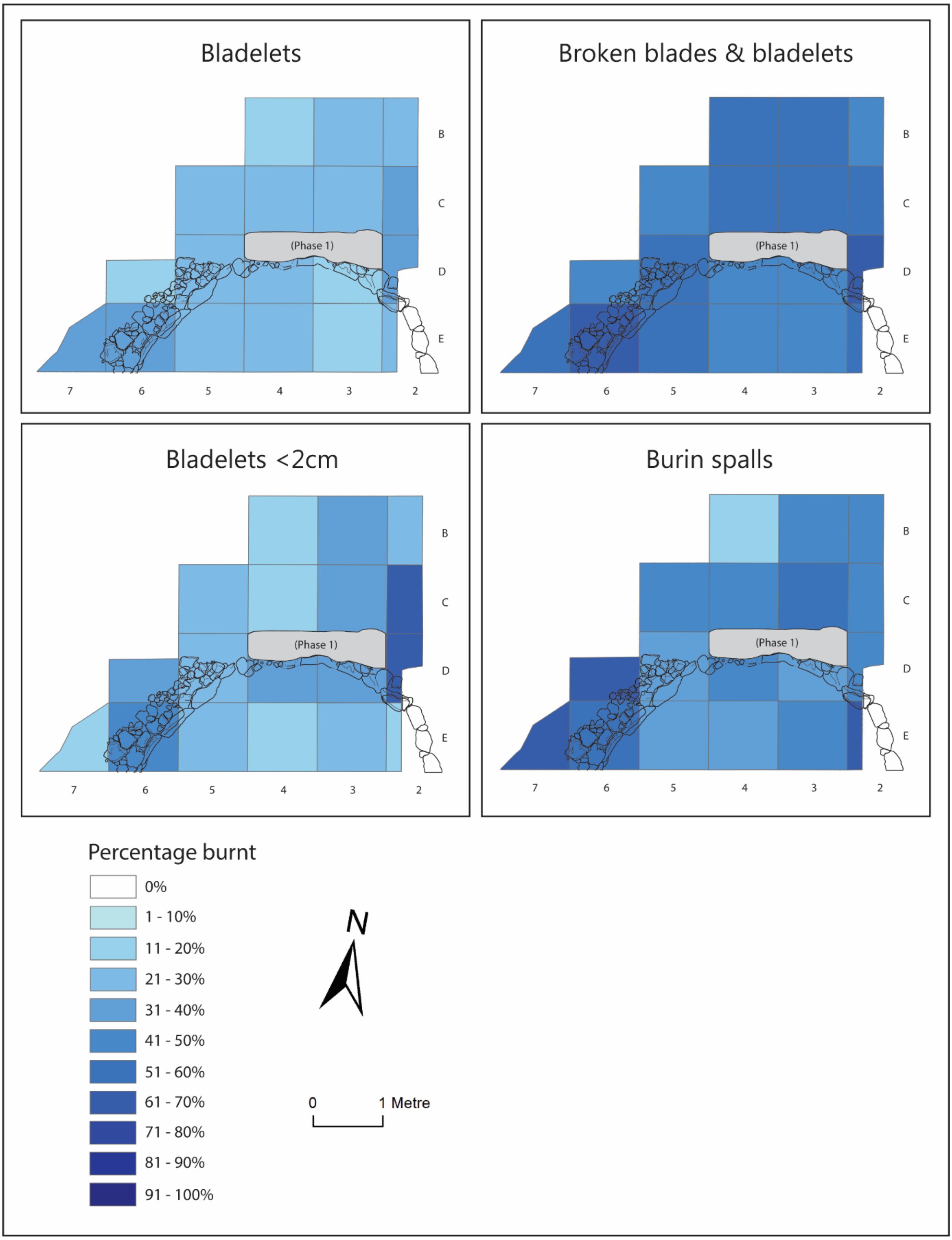


Figure 7.70: Distribution of burnt flaked stone artefacts in Upper Phase 3 (2/2).

high degree of burning in the area bordering the XX F sondage to the north of Wall 3 (**Fig. 7.70**).

7.3.2.2 *Faunal remains*

Unlike the lithic artefacts, the areal distribution of faunal material conversely remains closely tied to Structure 3 in terms of both artefact count and weights (**Figs. 7.71 - 7.72**), while the volumetric distribution of faunal remains is affected by similar influences in certain exterior squares as the lithic artefacts (**Figs. 7.73 – 7.74**).

7.3.2.3 *Groundstone artefacts*

The distribution of intact groundstone artefacts again diverges from the patterning of the lithics, being discontinuously distributed across the excavated area (**Fig. 7.75**). Unlike Phase 2, however, the distribution of fragmentary groundstone artefacts also exhibit little correspondence with the flaked stone artefacts, being concentrated in C3, with the majority of the remaining artefacts comprising a loose scatter along the north-western edge of the external area (**Fig. 7.76**). However, given that two of the three broken groundstone pieces in Square C3 were recycled as components of stone features in this area, it is apparent that no significant clustering of groundstone artefacts is evident in this phase.

7.3.2.4 *Bone artefacts*

The distribution of bone artefacts is also unlike any lithic artefact type, being concentrated around three clusters in C2, E2 and E6 (**Fig. 7.77**).

7.3.2.5 *Scaphopod artefacts*

The distribution of scaphopod artefacts follows a similar radial pattern around Structure 3 as the lithics and faunal material, albeit with the addition of a secondary cluster in Square C2 (**Fig. 7.78**).

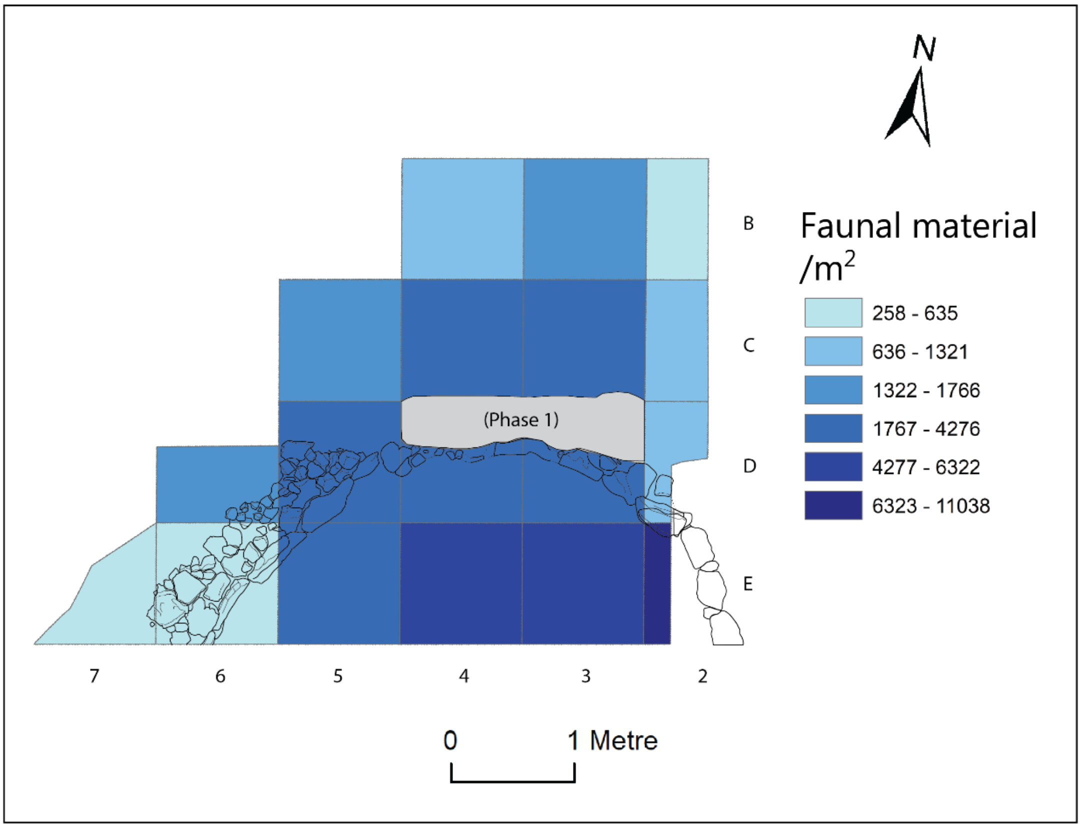


Figure 7.71: Distribution of Upper Phase 3 faunal material, by areal density.

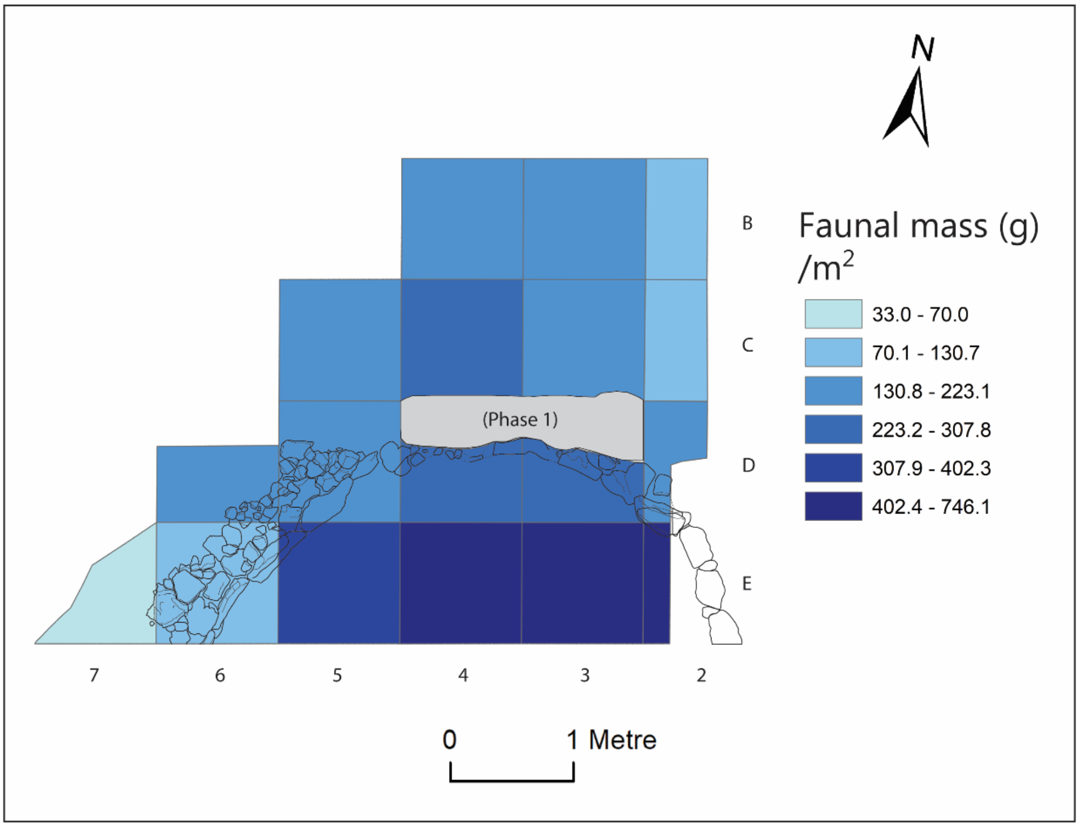


Figure 7.72: Distribution of Upper Phase 3 faunal weights, by areal density.

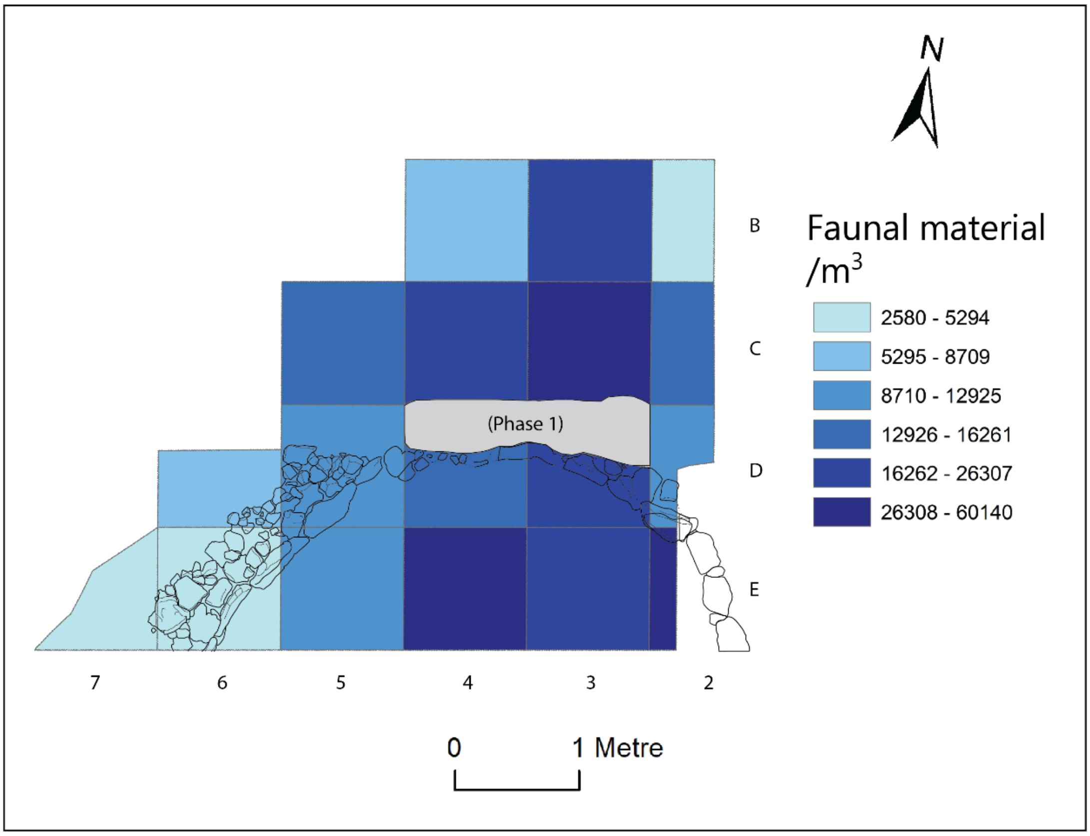


Figure 7.73: Distribution of Upper Phase 3 faunal material, by volumetric density.

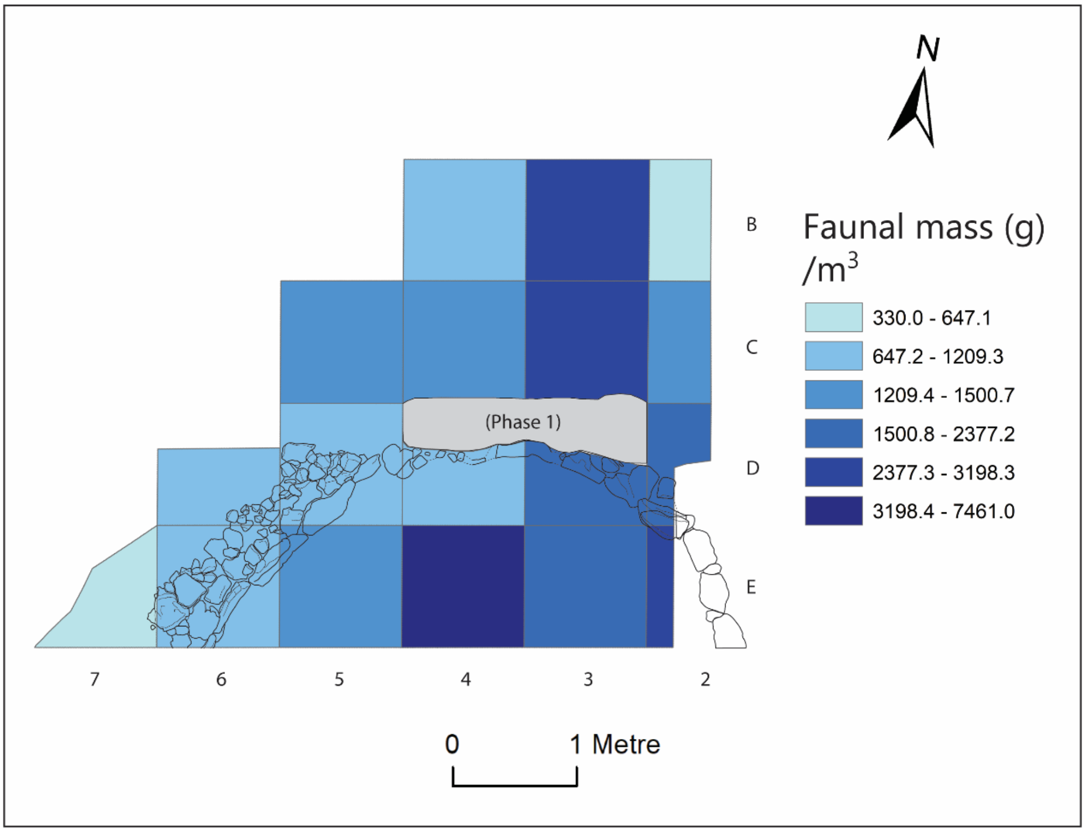


Figure 7.74: Distribution of Upper Phase 3 faunal weights, by volumetric density.

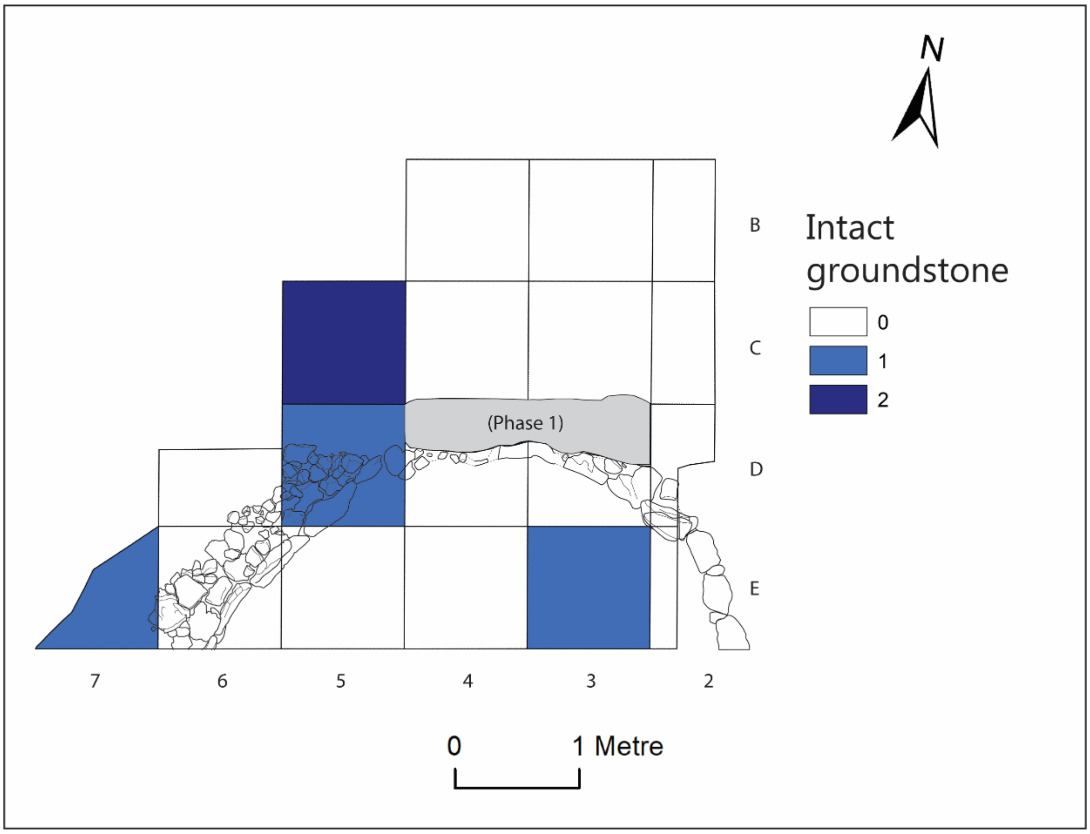


Figure 7.75: Distribution of Upper Phase 3 intact groundstone artefacts.

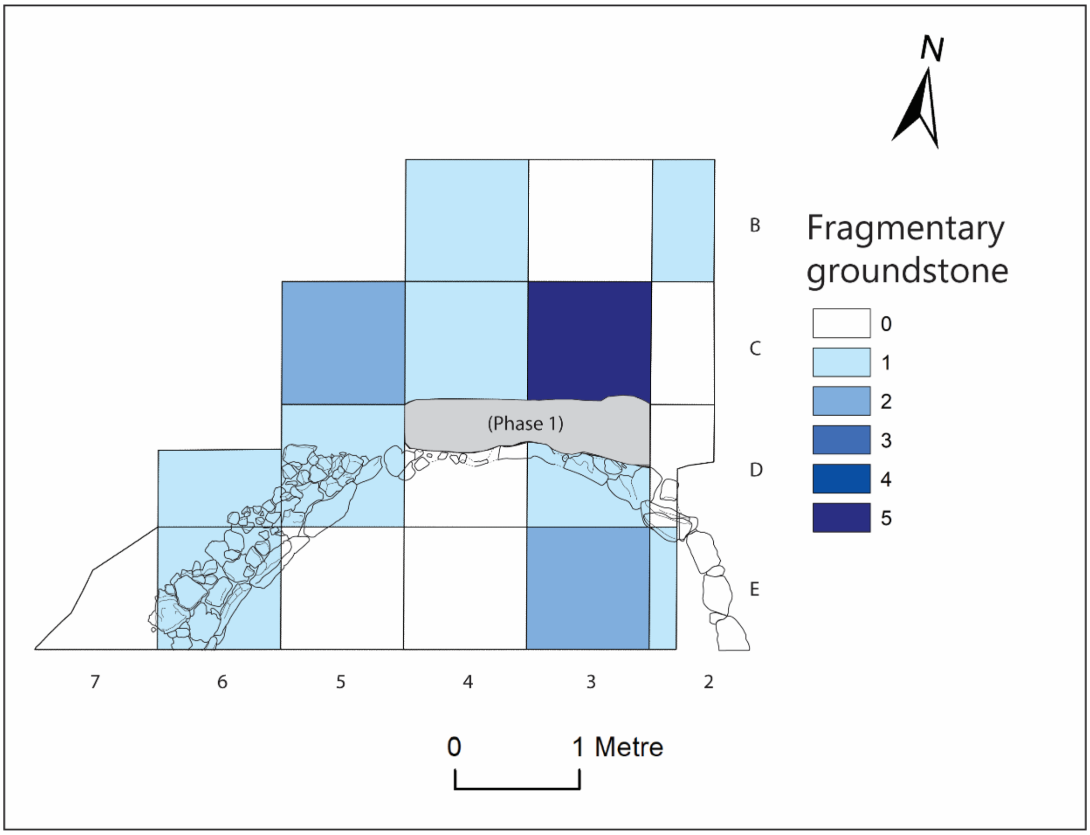


Figure 7.76: Distribution of Upper Phase 3 fragmentary groundstone artefacts.

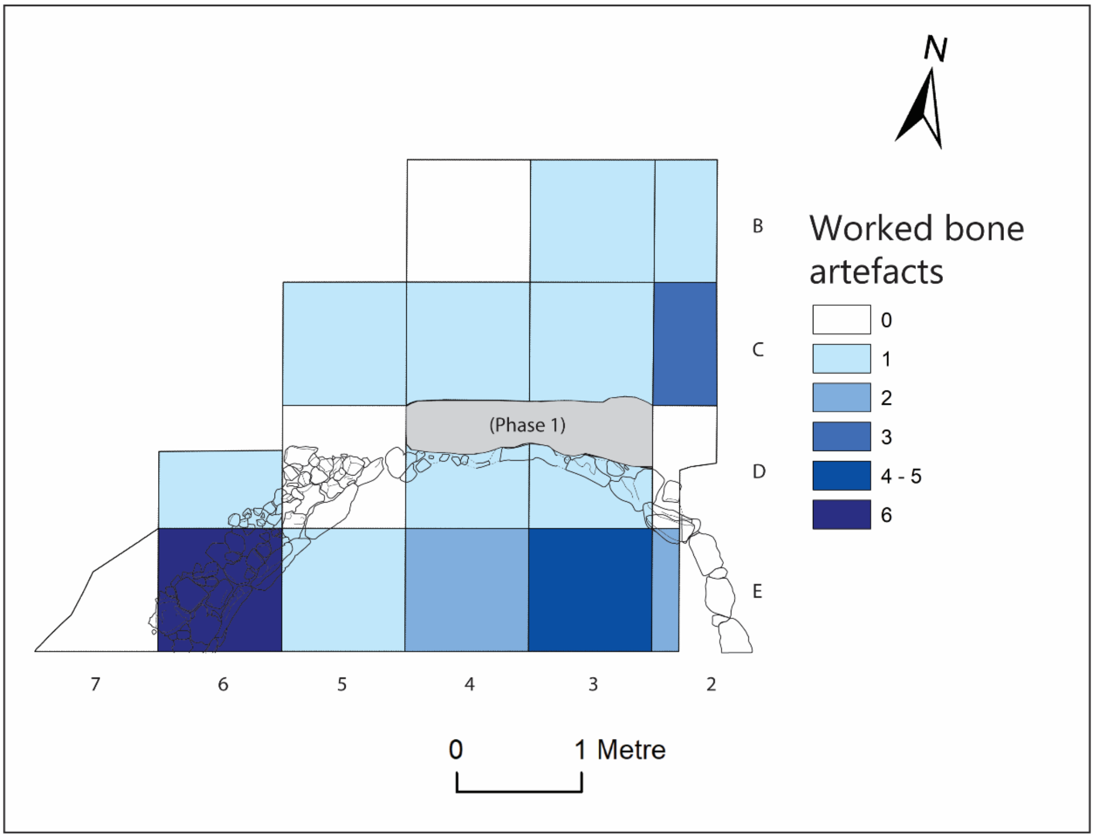


Figure 7.77: Distribution of Upper Phase 3 bone artefacts.

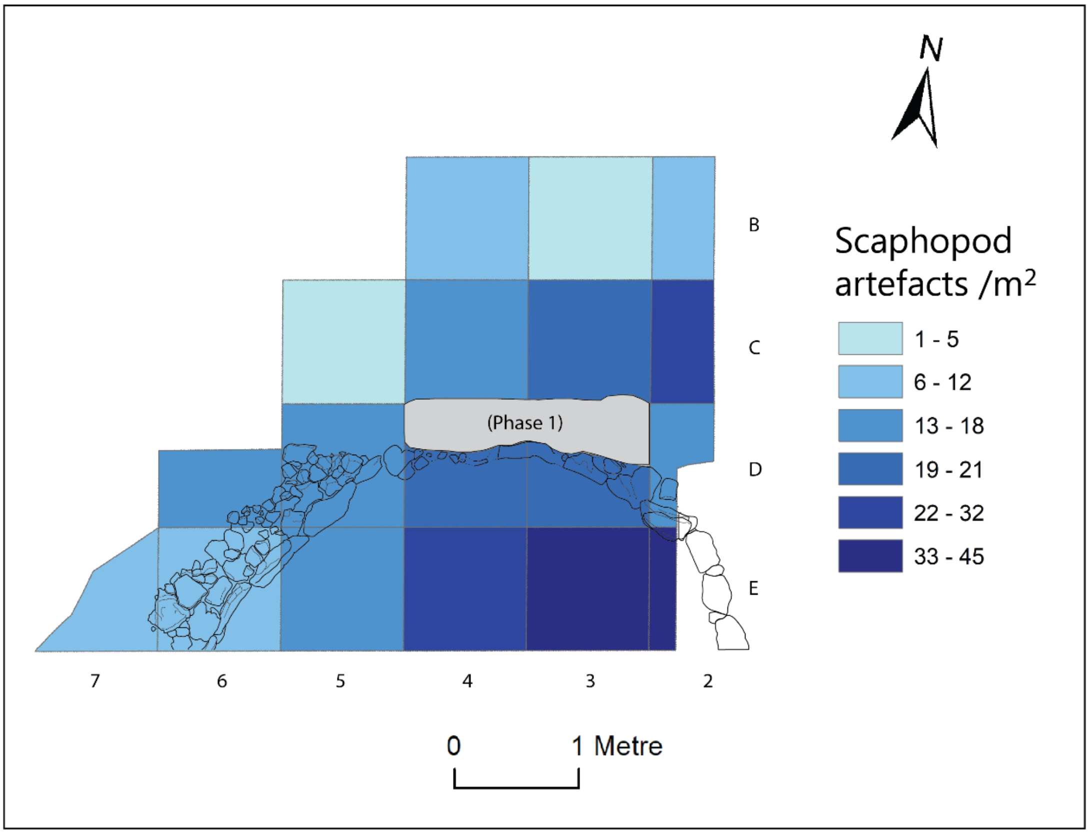


Figure 7.78: Distribution of Upper Phase 3 scaphopod (*Antalis sp.*) artefacts.

7.3.2.6 Statistical significance of Upper Phase 3 artefact distributions

Just as for Phase 2, the correlations between lithic artefacts and faunal remains are very pronounced in terms of both artefact number (r = 0.952) and weights (r = 0.949; **Table 7.4**). The correlation coefficients between these artefact classes and the scaphopod fragments are also notably stronger than the Phase 2 data, indicating common depositional pathways for these discarded pieces inside Structure 3. The intact and fragmentary groundstone artefacts again display the weakest correlations with other artefact classes, and the intact groundstone pieces even exhibit a slightly inverse correlation with the bone tools (r = -0.031). Interestingly, the correlation between flaked stone artefact weights and fragmentary groundstone artefacts is far less clear-cut than in Phase 2 (r = 0.041), indicating differential relationships between the disposal of these two artefact classes between the occupation of Structure 3 and Structure 1.

The correlations between most lithic debris and debitage categories are particularly strong in Upper Phase 3, reflecting the common deposition of these pieces inside Structure 3 (**Table 7.5**). These associations include some near absolute correlations, with the flakes <2cm and broken blades and bladelets producing a very high coefficient (r = 0.996). Consistent with the Phase 2 data, the flake and bladelet cores display relatively weaker correlations with most debris and debitage types, with the weakest being between the chips and flake cores (r = 0.416). Unlike Phase 2, however, the relationship between core fragments and the debris and debitage is notably stronger, suggesting an overall distribution more in line with the regular refuse deposits associated with Structure 3.

The Upper Phase 3 retouched tool groups share stronger correlations than seen in Phase 2, as does the debris and debitage, reflecting substantial associations with the interior of Structure 3 (**Table 7.6**). This association is pronounced for scrapers and truncations, with these tool groups exhibiting far stronger coefficients with other tool groups and debris and debitage than in Phase 2. The most substantially paired coefficients involve the truncated pieces and retouched fragments (r = 0.974), geometric microliths and retouched fragments (r = 0.966), and the truncated pieces and geometric microliths (r = 0.959). The irregular distributions of multiple tools and retouched blades in the density plots are reflected by these tools presenting the weakest coefficients with other tool groups, while any statistical relationship between these two tool groups themselves is absent (r = 0.000).

Table 7.4: Correlation coefficients (r) for the overall Upper Phase 3 artefact assemblage, by excavation square.

	Flaked-stone artefacts (no.)	Flaked-stone artefacts (mass)	Faunal material (no.)	Faunal material (mass)	Intact groundstone	Fragmentary groundstone	Worked-bone artefacts	Antalis fragments
Flaked-stone artefacts (no.)	XXXXX							
Flaked-stone artefacts (mass)	0.876	XXXXX						
Faunal material (no.)	0.952	0.862	XXXXX					
Faunal material (mass)	0.918	0.949	0.934	XXXXX				
Intact groundstone	0.176	0.154	0.119	0.081	XXXXX			
Fragmentary groundstone	0.226	0.041	0.164	0.046	0.193	XXXXX		
Worked-bone artefacts	0.425	0.406	0.295	0.337	-0.031	0.103	XXXXX	
Antalis fragments	0.909	0.783	0.868	0.836	0.100	0.282	0.491	XXXXX

Table 7.5: Correlation coefficients (r) for the Upper Phase 3 flaked stone artefact assemblage, by excavation square. BBaB = Broken blades and bladelets, RA = Retouched artefacts.

	Chunks	Chips	Flakes	Flakes <2cm	Broken flakes	Blades	Bladelets	BBaB	Bladelets <2cm	Burin spalls	Flake cores	Bladelet cores	Core fragments	RA
Chunks	XXXXX													
Chips	0.893	XXXXX												
Flakes	0.951	0.880	XXXXX											
Flakes <2cm	0.962	0.925	0.979	XXXXX										
Broken flakes	0.967	0.902	0.979	0.976	XXXXX									
Blades	0.676	0.613	0.748	0.723	0.725	XXXXX								
Bladelets	0.916	0.855	0.920	0.933	0.908	0.672	XXXXX							
BBaB	0.961	0.931	0.982	0.996	0.978	0.698	0.938	XXXXX						
Bladelets <2cm	0.946	0.948	0.960	0.979	0.957	0.656	0.931	0.984	XXXXX					
Burin spalls	0.947	0.939	0.949	0.971	0.954	0.659	0.956	0.975	0.989	XXXXX				
Flake cores	0.622	0.416	0.697	0.585	0.650	0.769	0.633	0.584	0.563	0.572	XXXXX			
Bladelet cores	0.643	0.551	0.770	0.675	0.662	0.518	0.658	0.694	0.705	0.676	0.735	XXXXX		
Core fragments	0.761	0.709	0.860	0.781	0.801	0.709	0.779	0.792	0.786	0.804	0.774	0.854	XXXXX	
RA	0.951	0.919	0.984	0.982	0.979	0.688	0.900	0.986	0.977	0.964	0.591	0.724	0.830	XXXXX

Table 7.6: Correlation coefficients (r) for Upper Phase 3 retouched artefact tool groups, by excavation square. NGM = Non-geometric microliths, NaD = Notched and denticulated pieces.

	Scrapers	Multiple tools	Burins	Retouched blades	Truncated pieces	NGM	Geometric microliths	NaD	Awls and borers	Retouched flakes	Retouched fragments	Debris and debitage	Cores
Scrapers	XXXXX												
Multiple tools	0.734	XXXXX											
Burins	0.915	0.788	XXXXX										
Retouched blades	0.316	0.000	0.301	XXXXX									
Truncated pieces	0.866	0.664	0.924	0.305	XXXXX								
NGM	0.844	0.618	0.933	0.348	0.887	XXXXX							
Geometric microliths	0.895	0.600	0.931	0.372	0.959	0.944	XXXXX						
NaD	0.812	0.605	0.895	0.296	0.916	0.923	0.931	XXXXX					
Awls and borers	0.723	0.332	0.639	0.648	0.673	0.635	0.681	0.630	XXXXX				
Retouched flakes	0.908	0.670	0.912	0.387	0.925	0.825	0.889	0.852	0.715	XXXXX			
Retouched fragments	0.850	0.572	0.917	0.403	0.974	0.938	0.966	0.933	0.740	0.909	XXXXX		
Debris and debitage	0.818	0.529	0.912	0.468	0.932	0.911	0.955	0.930	0.688	0.897	0.954	XXXXX	
Cores	0.856	0.681	0.814	0.314	0.689	0.759	0.718	0.633	0.663	0.778	0.711	0.658	XXXXX

The statistical relationship between retouched artefact groups and the Upper Phase 3 debris and debitage is almost identical to Phase 2, with the strongest paired coefficients existing between the combined debris and debitage and the geometric microliths ($r = 0.955$) and retouched fragments ($r = 0.954$). The correlations between unretouched lithic refuse and the scrapers ($r = 0.818$) and truncated pieces ($r = 0.932$) are more positive in Upper Phase 3 than in Phase 2, however, while the lowest correlations exist between this material and the retouched blades ($r = 0.468$) and multiple tools ($r = 0.529$).

7.3.2.7 Interpretation of Upper Phase 3 distributional data

The predominant deposition of Upper Phase 3 material inside Structure 3 is reminiscent of the Phase 1 distributions, indicating that the accumulation of massive amounts of primary refuse within interior spaces is a phenomenon common to the various domestic occupations of Wadi Hammeh 27 through time. In contrast, the exterior deposits become gradually less rich in artefactual material away from Structure 3 according to a radial pattern, with no clear candidates for specific knapping or activity areas discernible in this area. Larger debris and debitage artefacts, primarily chunks and flakes, are nonetheless overrepresented in the northern area, most likely in the context of having been thrown into an external toss-zone.

<u>7.3.3 Lower Phase 3</u>

7.3.3.1 Lithic artefacts

The spatial relationship between the Lower Phase 3 lithics and Structure 3 differs considerably from the situation in Upper Phase 3. In terms of the overall distribution of lithics by area, the interior deposits of Structure 3 remain densely packed with artefactual material (**Fig. 7.80**). However, a second cluster of flaked stone artefacts is also present around the north-east corner of the external area, while the area lining the exterior of Wall 3 is particularly rich in artefacts immediately to the east of the entrance to Structure 3. The quantity of flaked stone in the exterior space becomes even more pronounced when examining the areal distribution of lithic weights, although in this case artefacts are clustered along the entire northern baulk rather than in the north-east corner (**Fig. 7.81**). Likewise, both

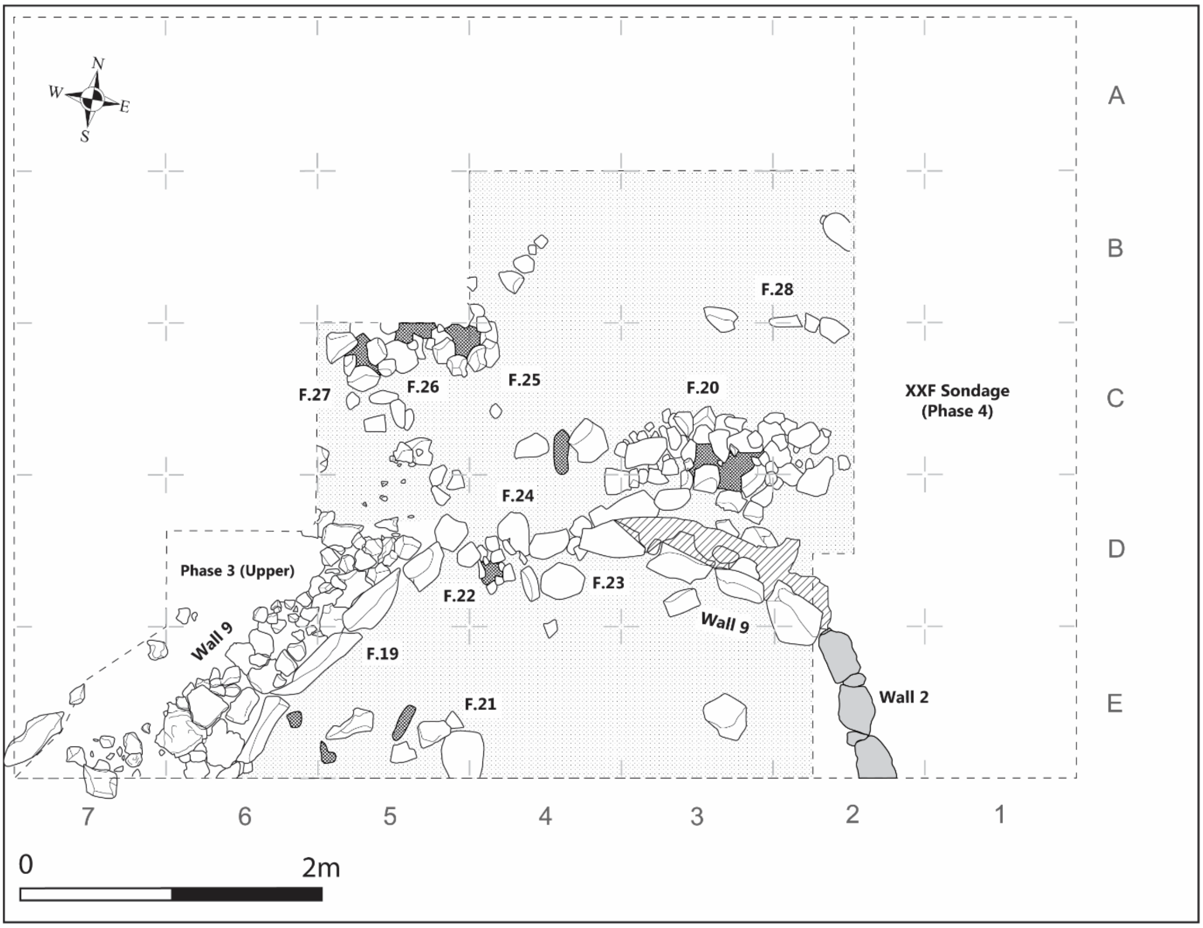


Figure 7.79: Plan of the Area XX F, Lower Phase 3 exposure.

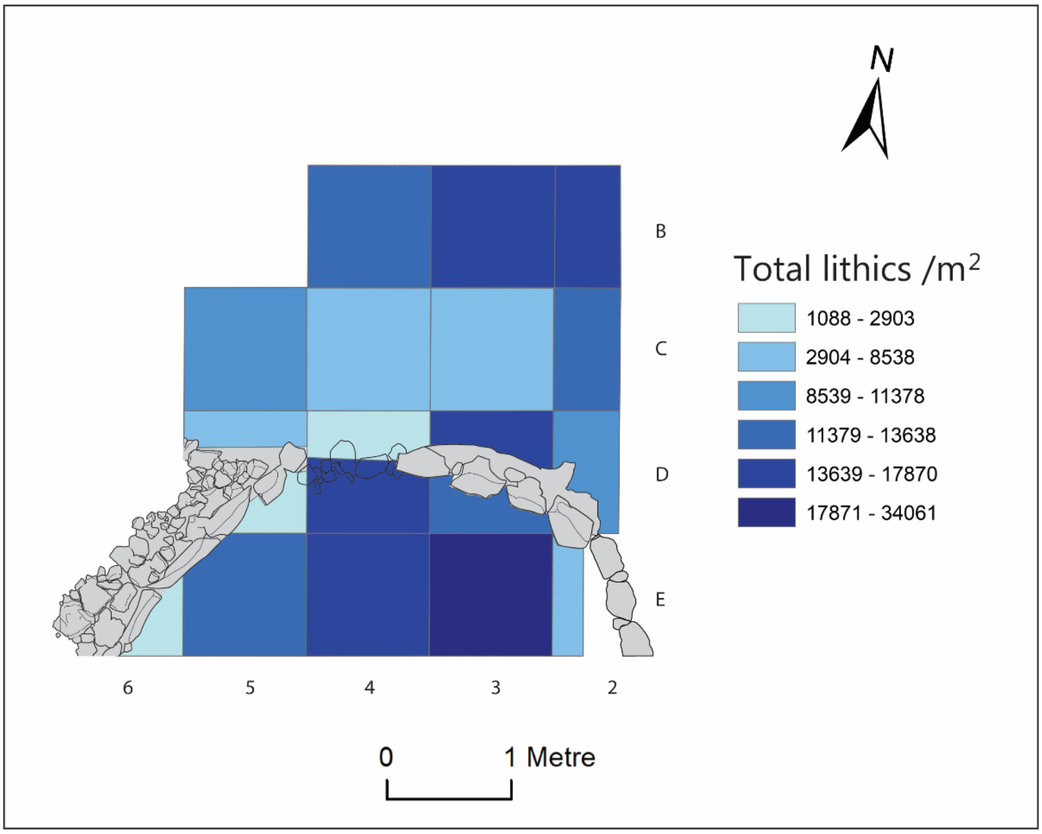


Figure 7.80: Distribution of Lower Phase 3 flaked stone artefacts, by areal density.

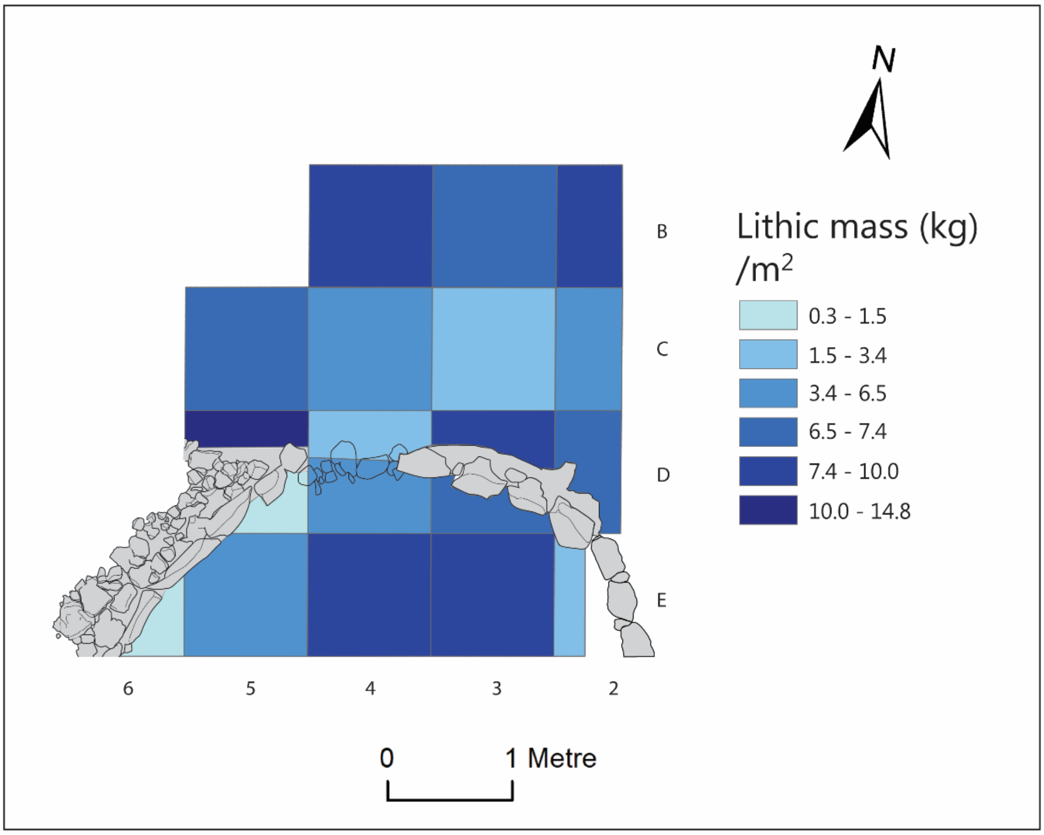


Figure 7.81: Distribution of Lower Phase 3 flaked stone artefact weights, by areal density.

areas bordering the entrance to Structure 3 feature high lithic weights, whereas the interior cluster is significantly lower.

By volume, the distribution of flaked stone artefact counts and weights are strongly associated with the interior deposits of Structure 3, particularly along the edge of the XX F sondage (**Figs. 7.82 - 7.83**). That said, the interior deposits are unusually patchy, being concentrated in Squares E3, E5 and the interior space of Square D4.

7.3.3.1.1 Lithic debris, debitage and cores

The distributions of Lower Phase 3 debris categories are once again almost identical to the overall lithic distribution, with twin clusters situated within Structure 3 and along the northern edge of the external area. Some variations in clustering patterns are nonetheless evident between the chips and chunks, with the former type being more tightly focused in Square E3 and the north-east corner of the exposure (**Figs 7.84**). Conversely, the chunks are distributed more broadly within Structure 3 and along the north-west edge of the exterior area (**Fig. 7.85**).

Amongst the debitage, the distributions of flakes <2cm (**Fig. 7.86**), broken flakes (**Fig. 7.87**), broken blades and bladelets (**Fig. 7.88**), bladelets <2cm (**Fig. 7.89**) and burin spalls (**Fig. 7.90**) all resemble the pattern exhibited by the chips, in that they present dual clusters centred on the Structure 3 interior and in the north-east corner of the exterior area. The distribution of blades also largely follows this pattern, albeit in a more disjointed fashion given their smaller population (**Fig. 7.91**). The distribution of whole flakes is less consistent with these patterns, instead mostly being centred on four marginal clusters (in Squares B2, B4, D2 and D4) in the exterior area (**Fig. 7.92**). The intact bladelets similarly exhibit an overall bias towards the exterior of Structure 3, with the squares bordering the northern and western edges of this area all displaying high areal densities (**Fig. 7.93**).

While the distributions of Lower Phase 3 cores also conform to dual clustering inside and outside Structure 3, these patterns once again vary considerably by group. The flake cores are mostly distributed within an arc surrounding the entrance to Structure 3, with a second, smaller cluster situated in the centre of Structure 3 (**Fig. 7.94**). The distribution of bladelet cores conversely bears a partial resemblance to that of the intact bladelet blanks, with the densest deposits in the north-west corner of the exterior area and a less conspicuous

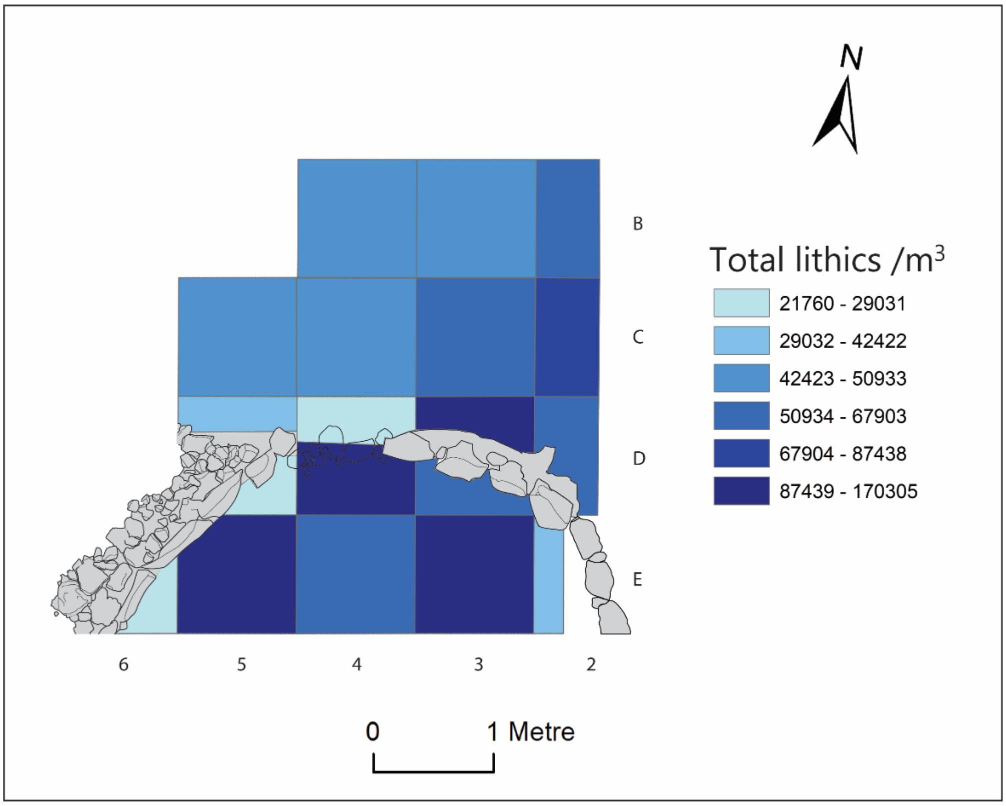


Figure 7.82: Distribution of Lower Phase 3 flaked stone artefacts, by volumetric density.

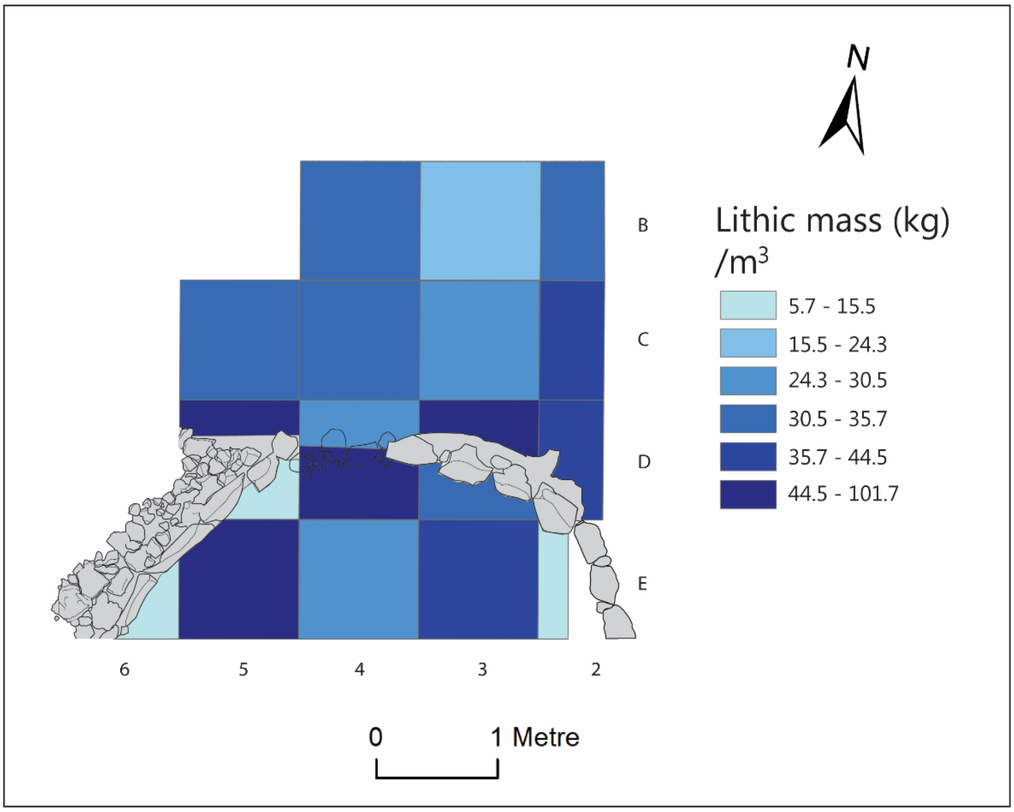


Figure 7.83: Distribution of Lower Phase 3 flaked stone artefact weights, by volumetric density.

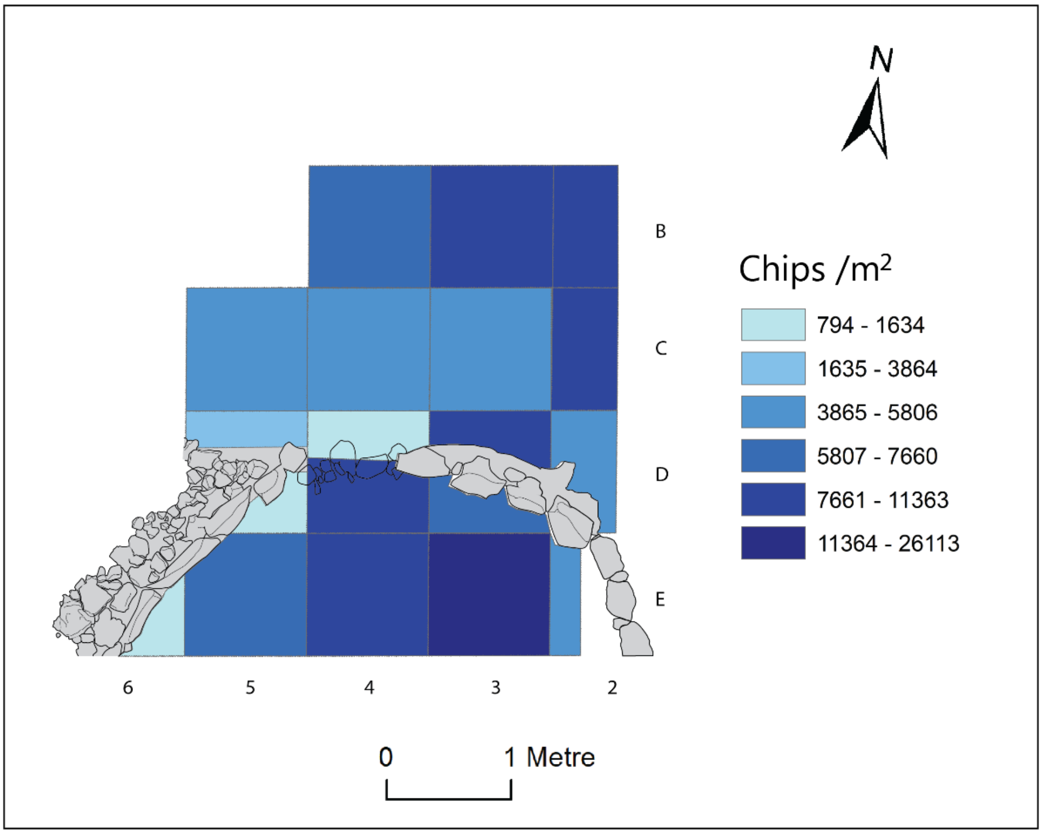


Figure 7.84: Distribution of Lower Phase 3 chips.

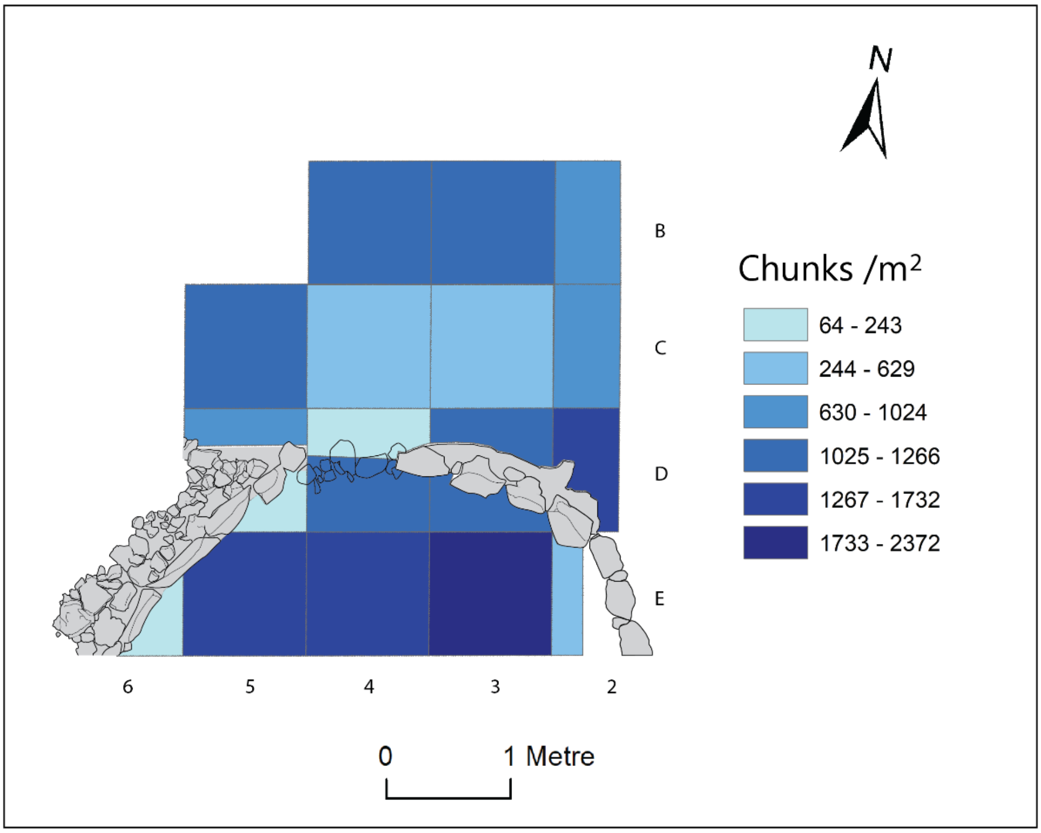


Figure 7.85: Distribution of Lower Phase 3 chunks.

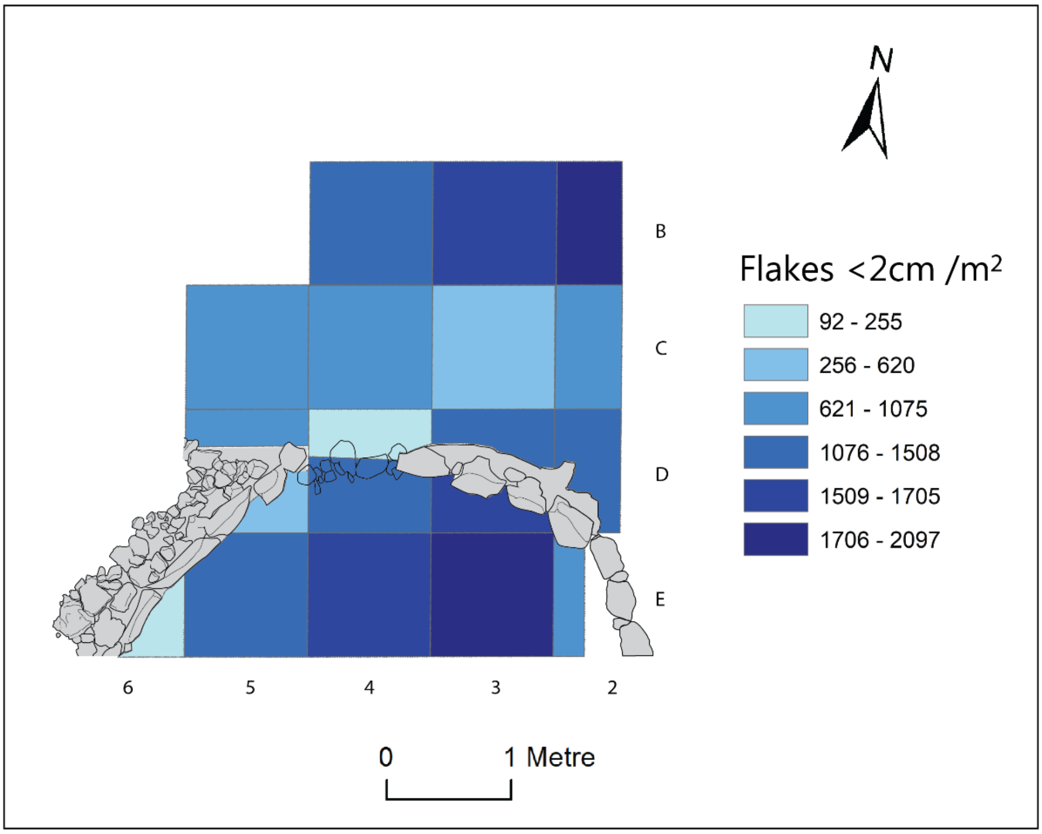


Figure 7.86: Distribution of Lower Phase 3 flakes <2cm.

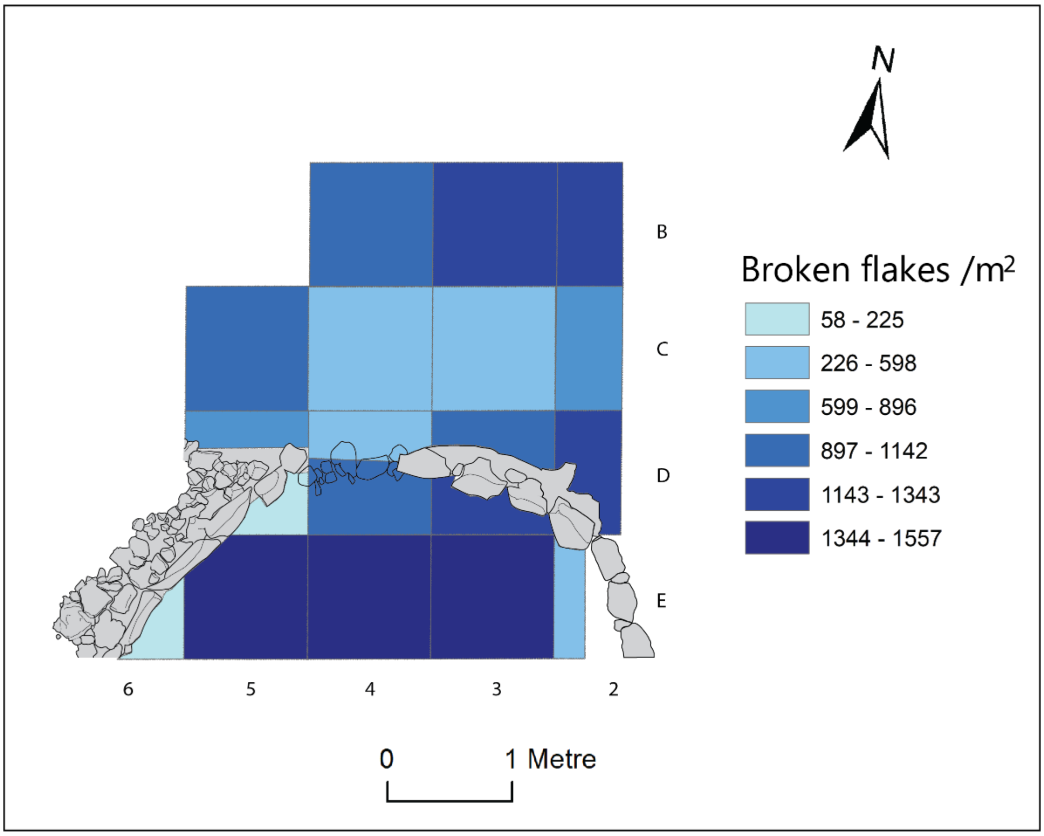


Figure 7.87: Distribution of Lower Phase 3 broken flakes.

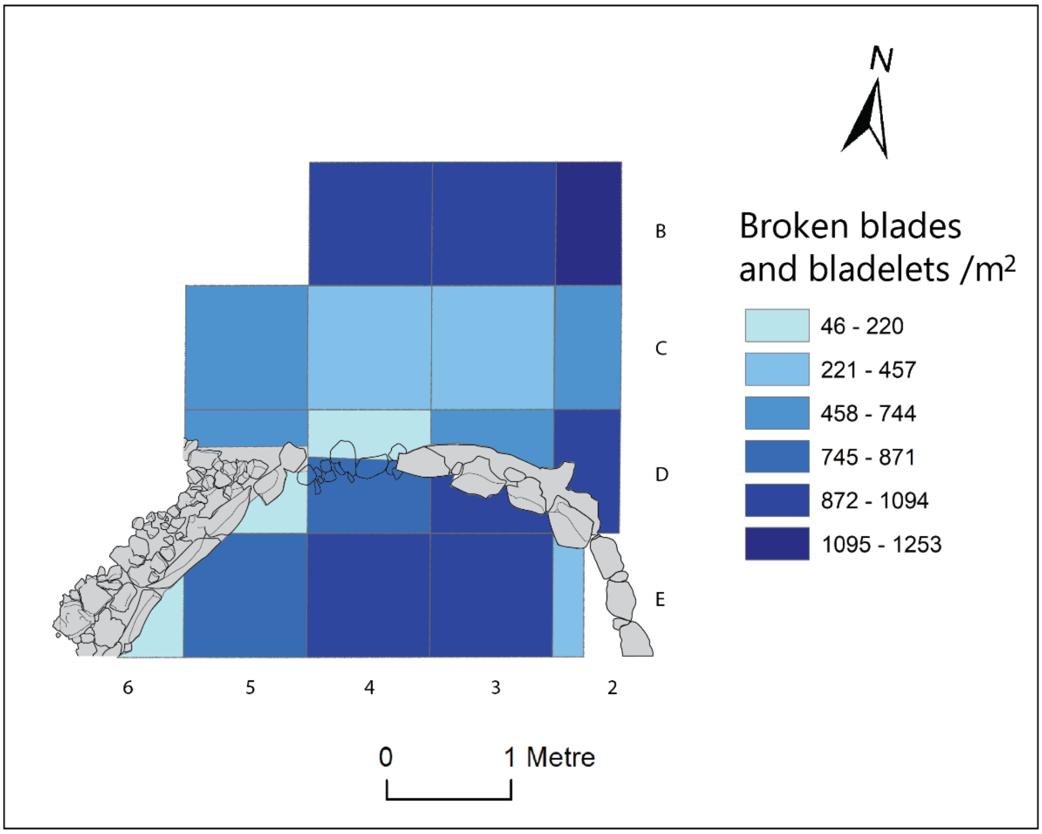


Figure 7.88: Distribution of Lower Phase 3 broken blades and bladelets.

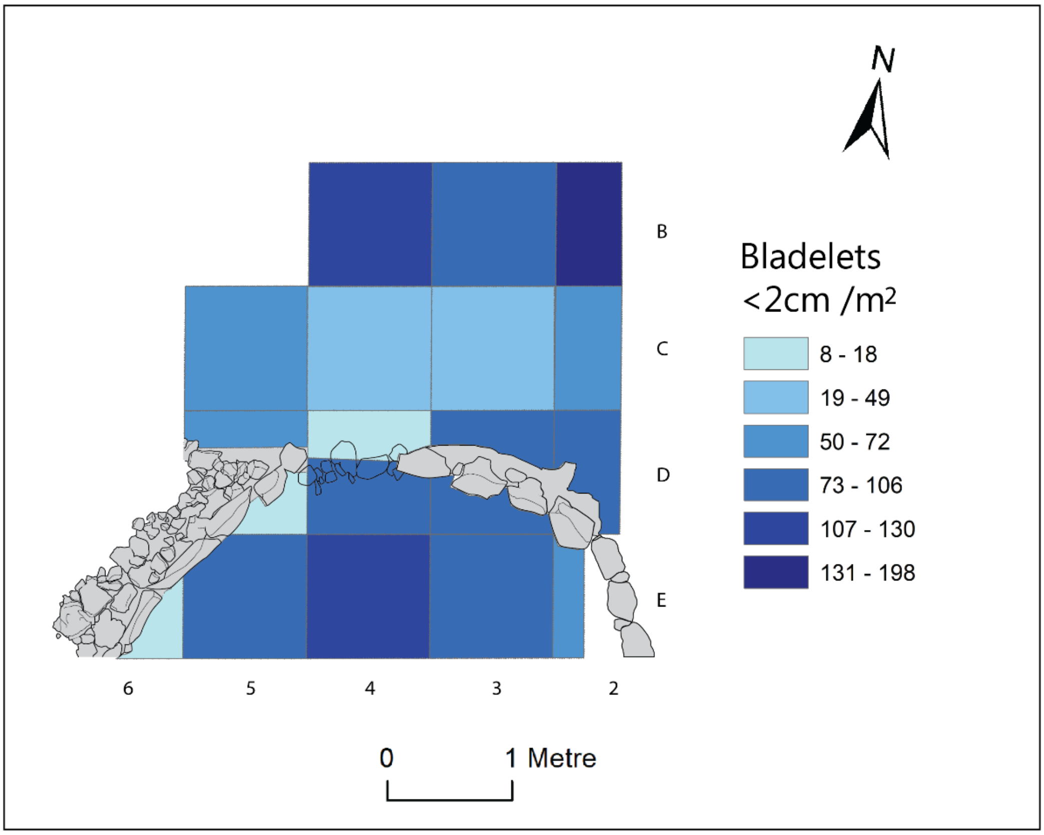


Figure 7.89: Distribution of Lower Phase 3 bladelets <2cm.

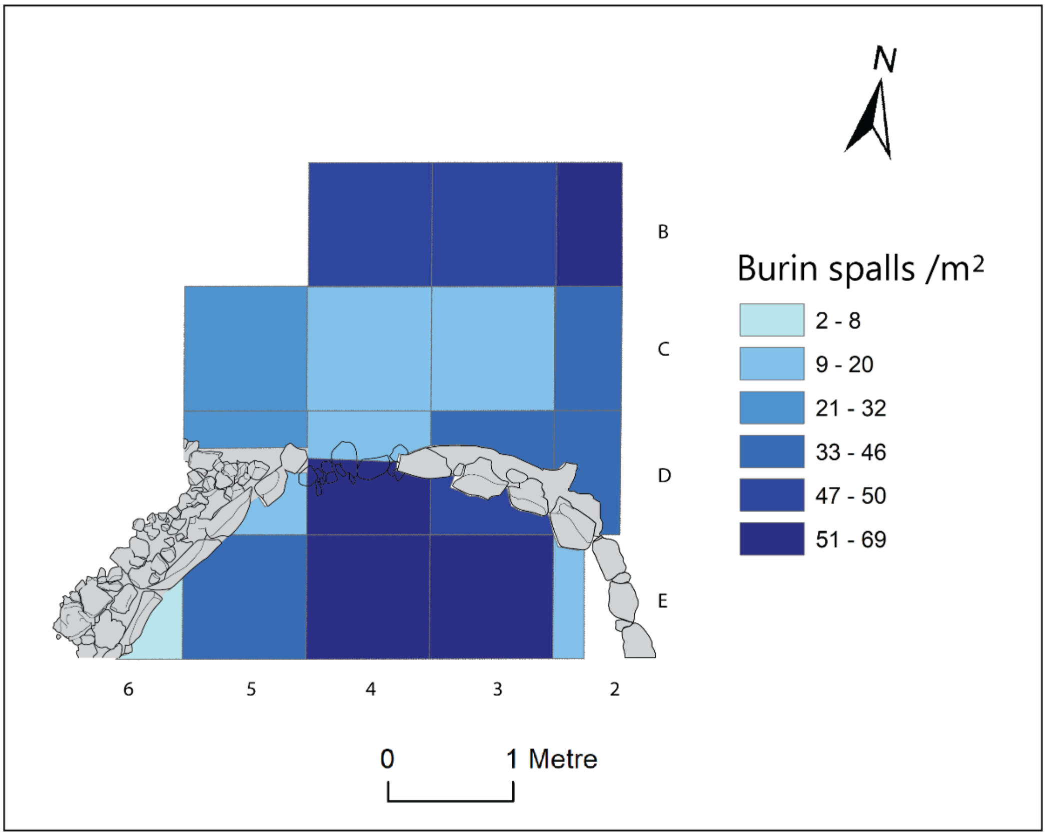


Figure 7.90: Distribution of Lower Phase 3 burin spalls

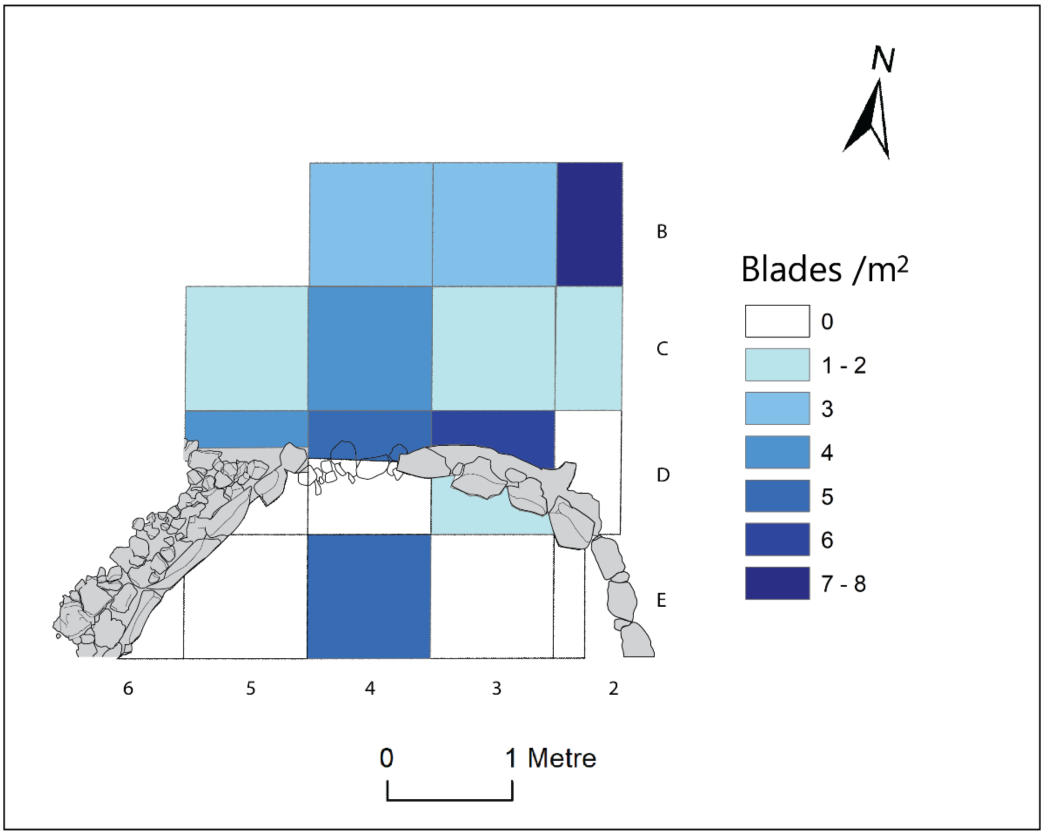


Figure 7.91: Distribution of Lower Phase 3 blades.

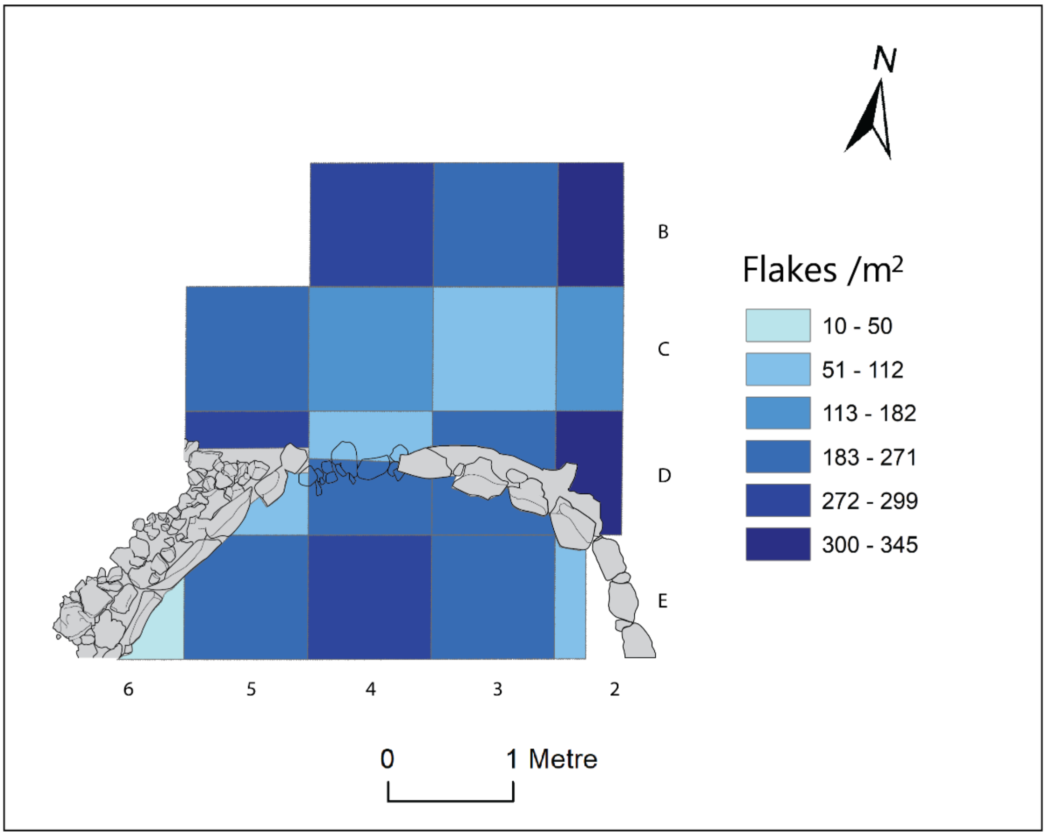


Figure 7.92: Distribution of Lower Phase 3 flakes.

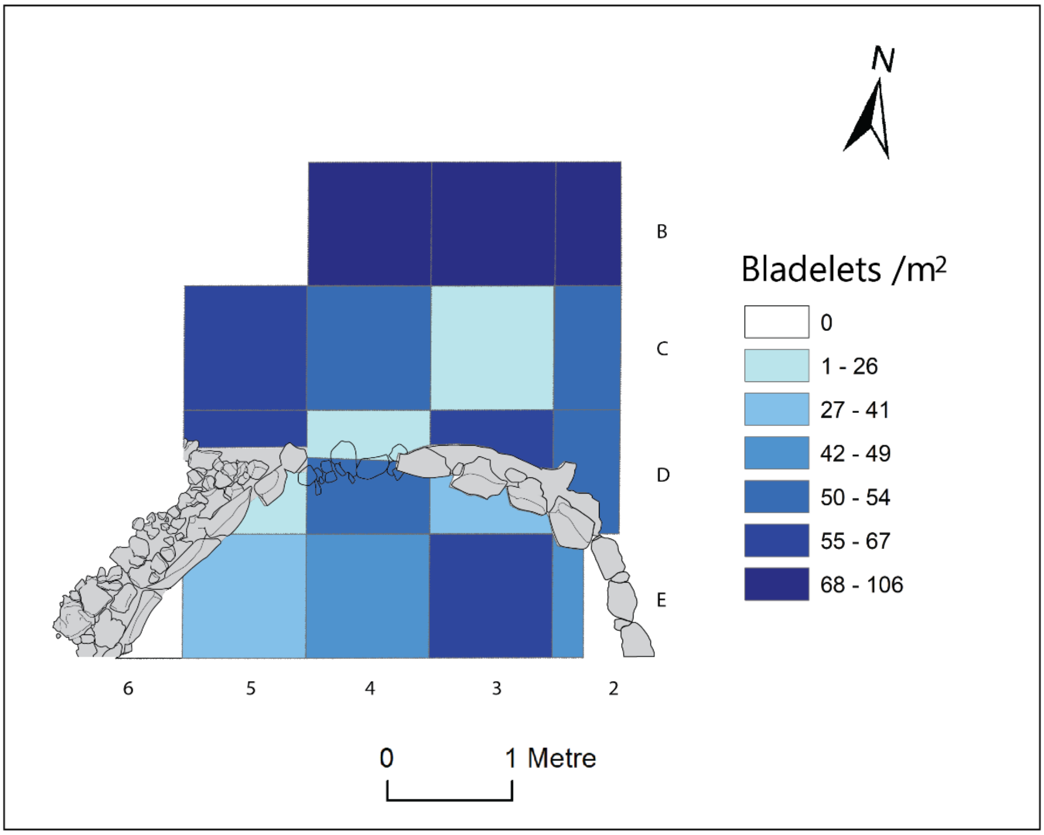


Figure 7.93: Distribution of Lower Phase 3 bladelets.

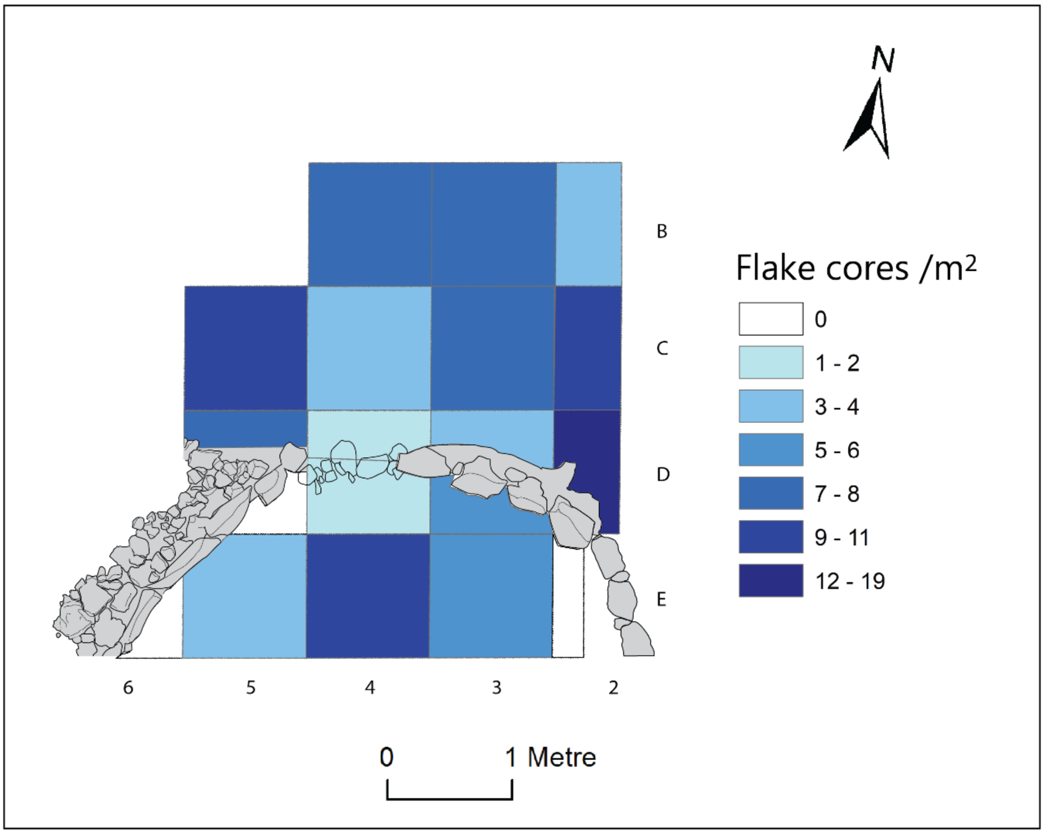


Figure 7.94: Distribution of Lower Phase 3 flake cores.

presence within Structure 3 (**Fig. 7.95**). Meanwhile, core fragments exhibit an exceptionally high degree of clustering in Square B3 on the north-east limit of the excavations, with a less pronounced continuation running along the north-west edge of the exterior area, along with a secondary cluster inside Structure 3 (**Fig. 7.96**).

7.3.3.1.2 Retouched artefacts

Most retouched tool groups in Lower Phase 3 are characterised by distributions with twin clusters centred on the Structure 3 interior and the northern exterior area respectively, with the main variations being in the placement of the exterior cluster. The external cluster is centred on the north-east corner of the external area in the case of the burins (**Fig. 7.97**), non-geometric microliths (**Fig. 7.98**), awls and borers (**Fig. 7.99**), retouched flakes (**Figure 7.100**) and retouched fragments (**Fig. 7.101**). Retouched blades are also common in the north-east corner, although in this case they also occur in significant quantities adjacent to the entrance to Structure 3, and are more common in the western half of its interior space rather than in its east (**Fig. 7.102**).

In contrast, the external cluster is centred more towards the middle of the northern edge in the case of the geometric microliths (**Fig. 7.103**) or the north-west corner for the truncated pieces (**Fig. 7.104**). The exterior multiple tools are conversely more widely distributed along the north-west edge of the exposure, with notably high areal density of these pieces in the space immediately west of the entrance to Structure 3 (**Fig. 7.105**).

The notched and denticulated pieces overall exhibit a pronounced bias towards the interior deposits of Structure 3, although secondary clusters are also present along the edge of the XX F sondage and in the north-west edge of the exposure (**Fig. 7.106**). In contrast, the distribution of scrapers is inclined towards the exterior deposits, being widespread across the excavated area, with a particularly high along the edge of the XX F sondage (**Fig. 7.107**). They are also entirely devoid from the western end of the interior Structure 3 deposits, although a tight secondary cluster of scrapers is also present immediately south of the entrance in Square E4.

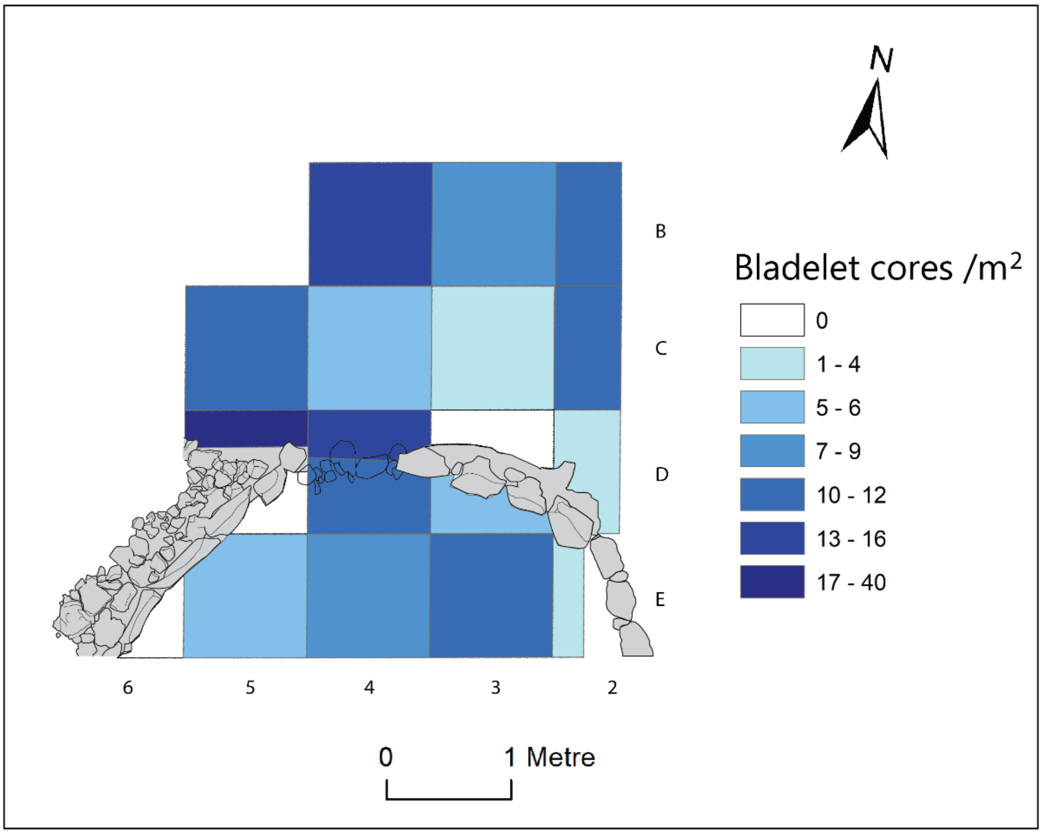


Figure 7.95: Distribution of Lower Phase 3 bladelet cores.

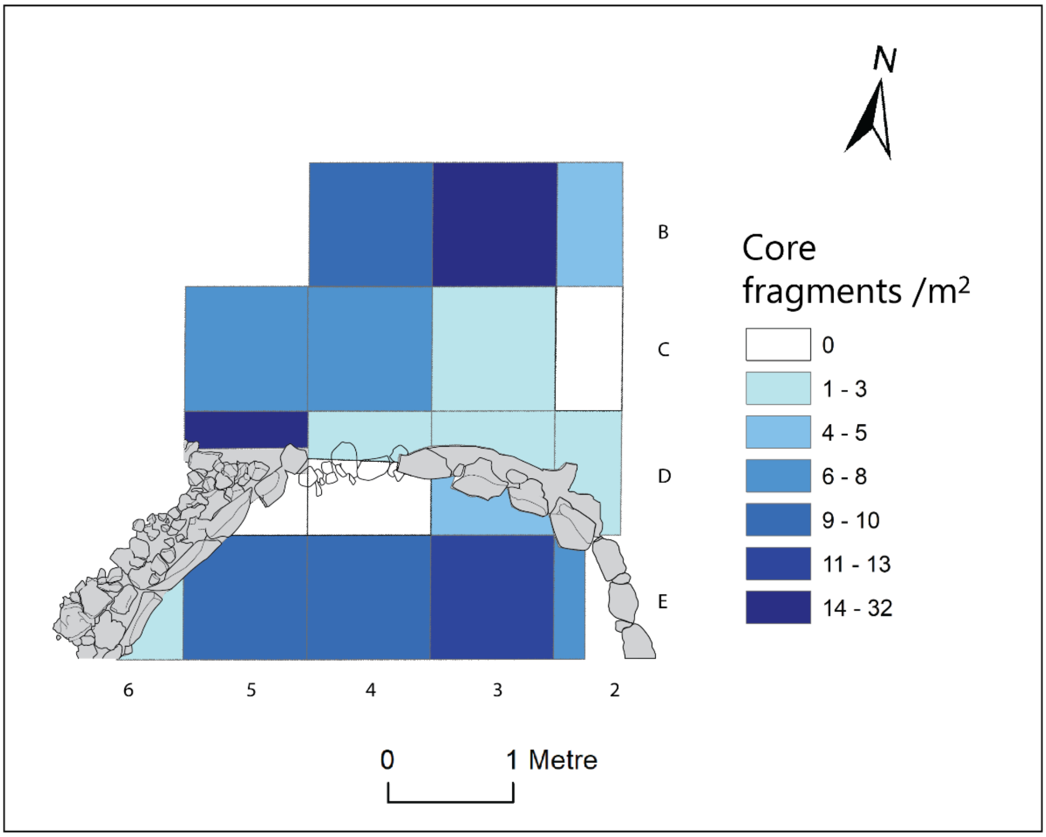


Figure 7.96: Distribution of Lower Phase 3 core fragments.

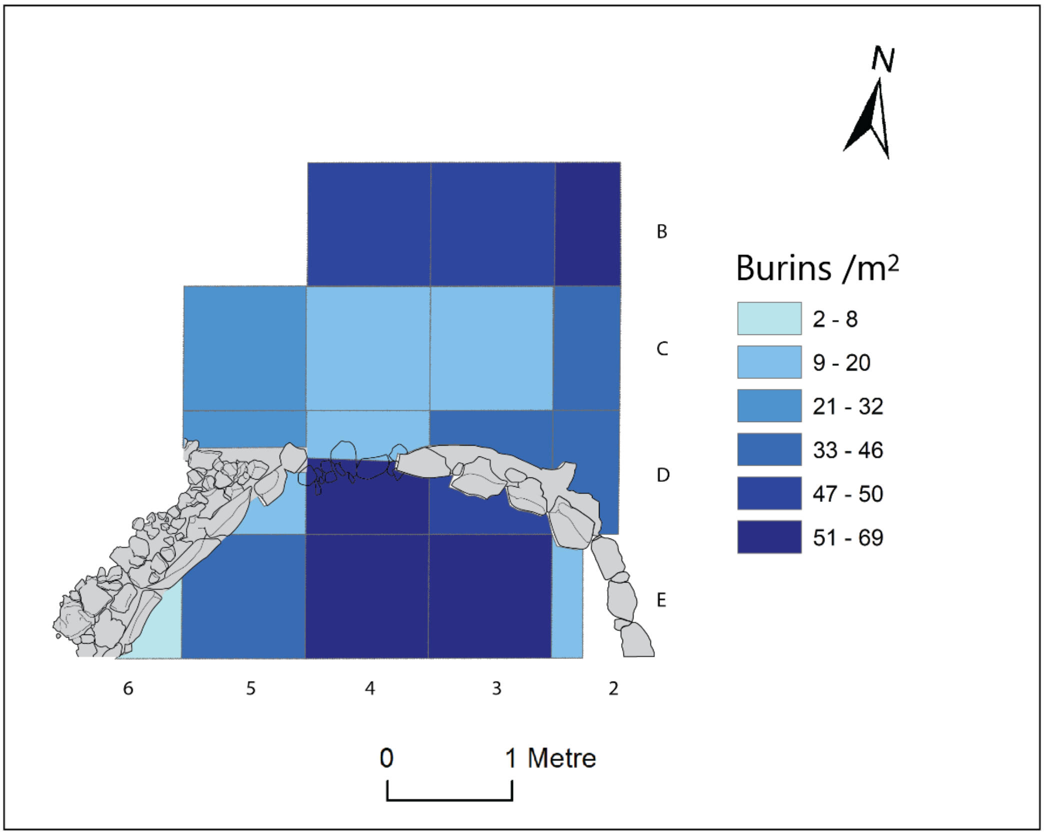


Figure 7.97: Distribution of Lower Phase 3 burins.

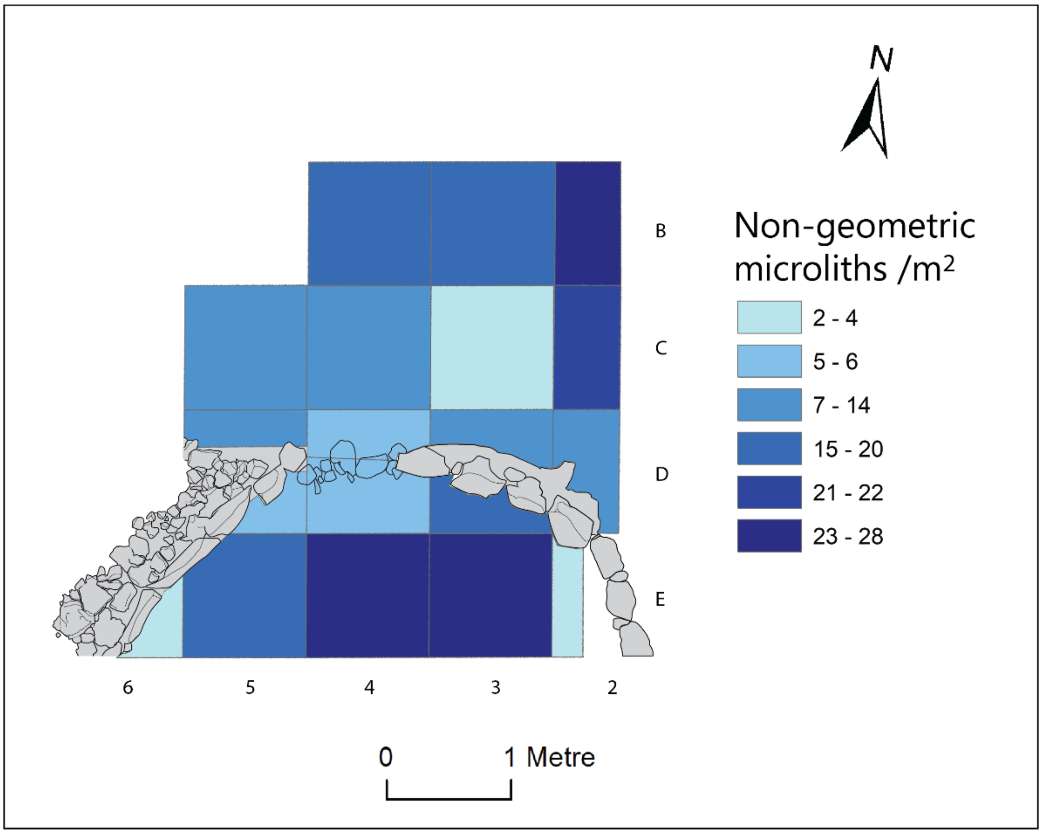


Figure 7.98: Distribution of Lower Phase 3 non-geometric microliths.

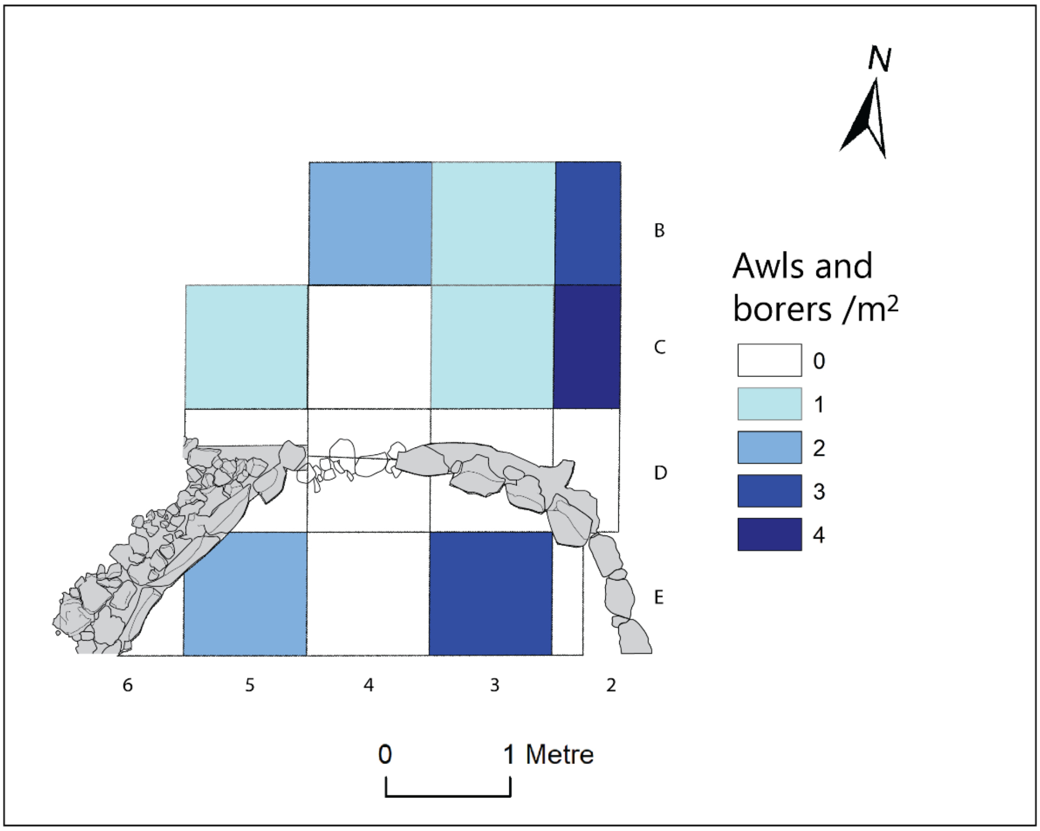


Figure 7.99: Distribution of Lower Phase 3 awls and borers.

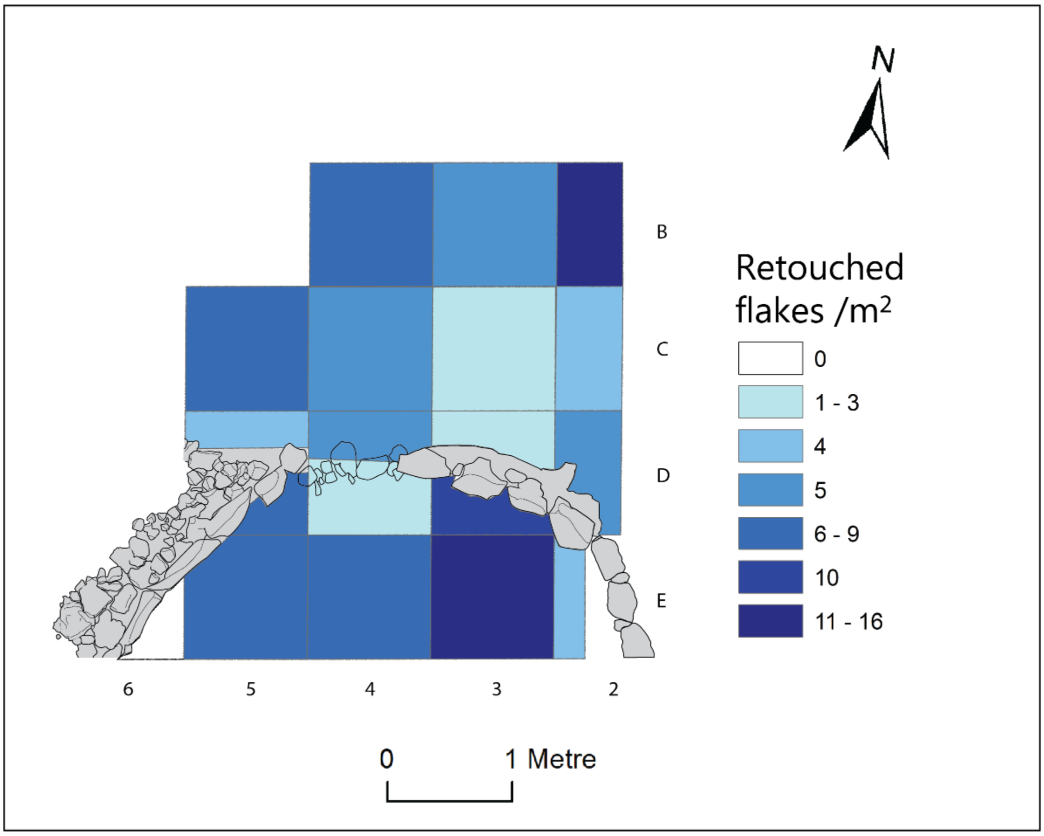


Figure 7.100: Distribution of Lower Phase 3 retouched flakes.

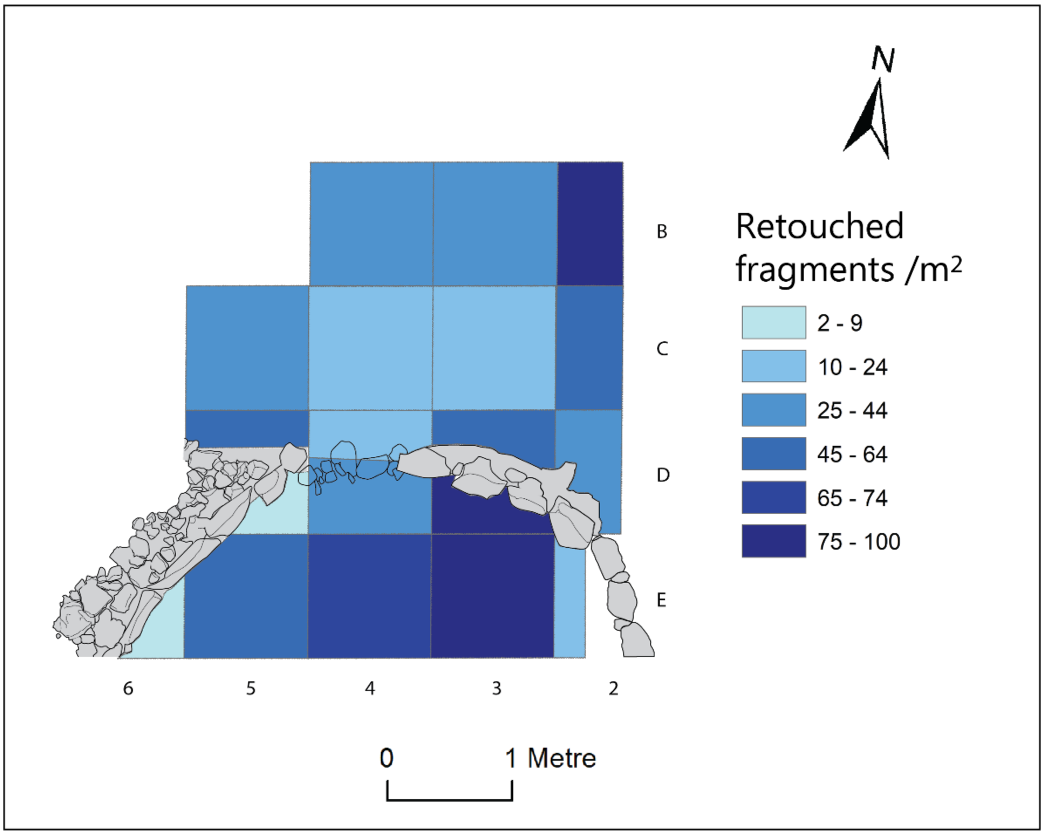


Figure 7.101: Distribution of Lower Phase 3 retouched fragments.

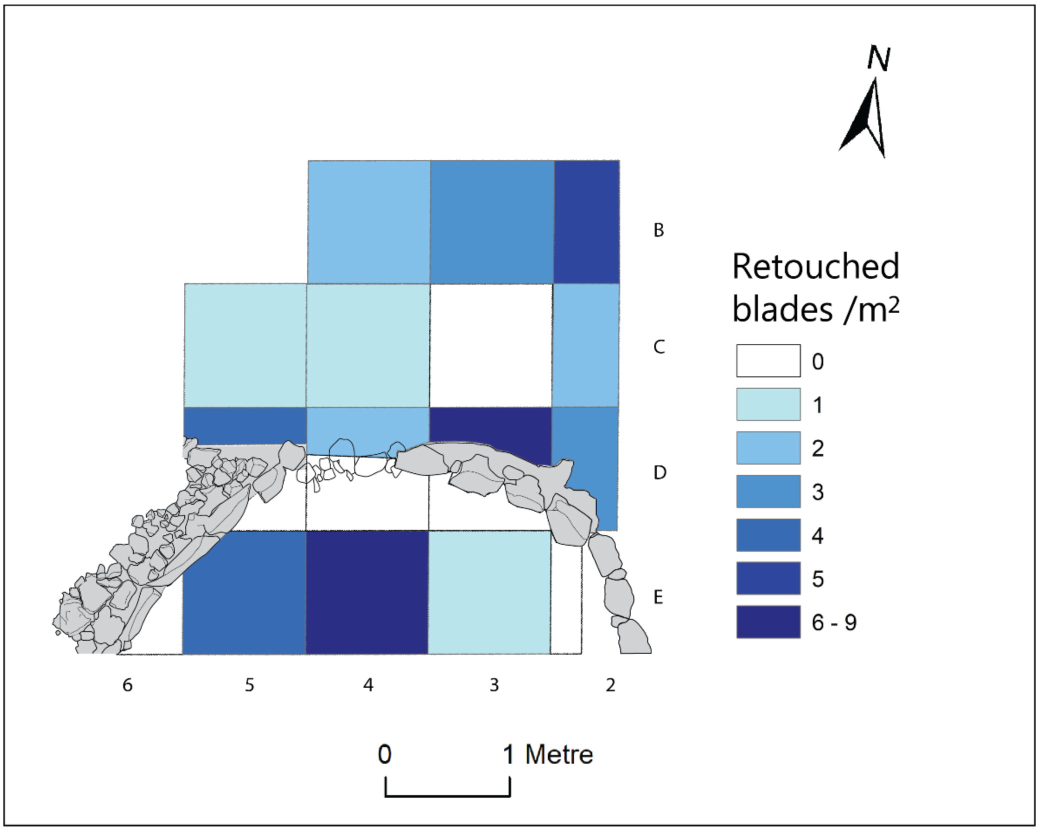


Figure 7.102: Distribution of Lower Phase 3 retouched blades.

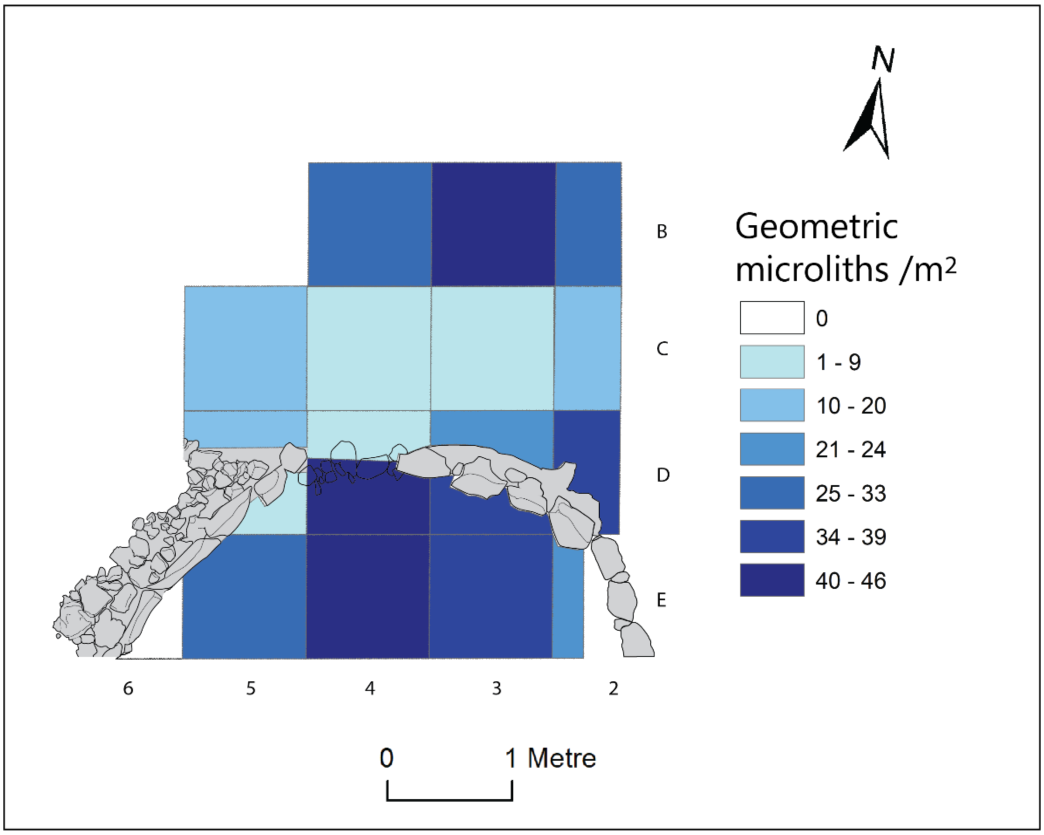


Figure 7.103: Distribution of Lower Phase 3 geometric microliths.

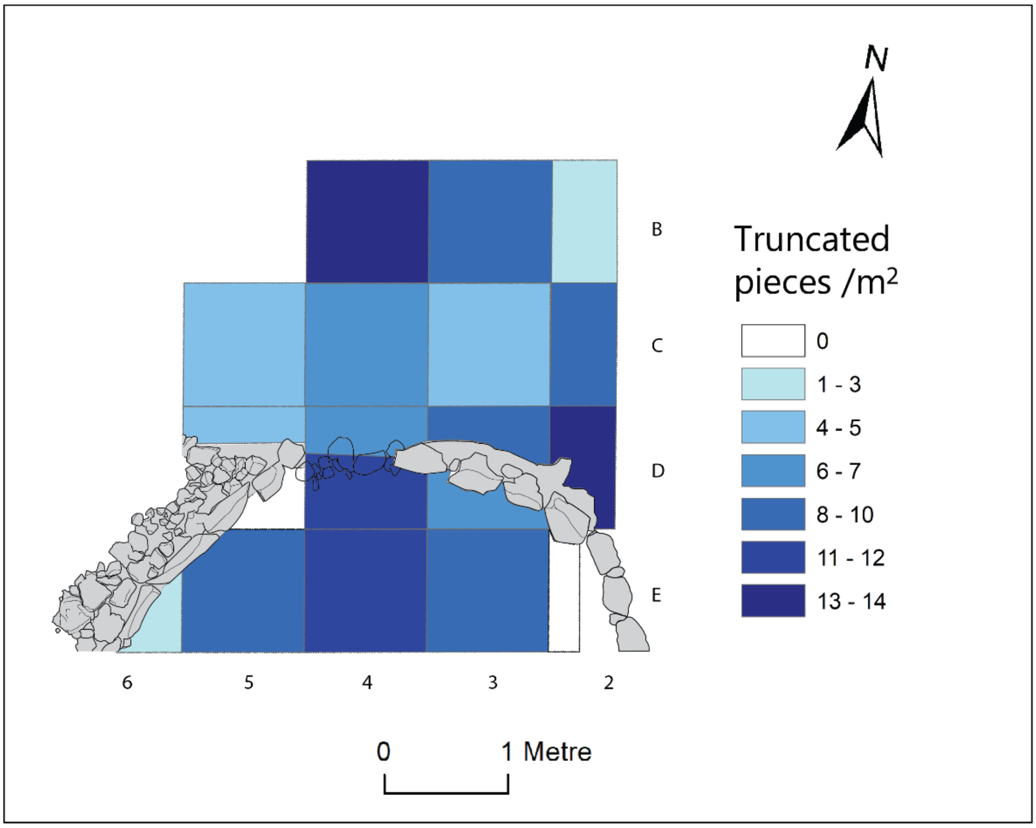


Figure 7.104: Distribution of Lower Phase 3 truncated pieces.

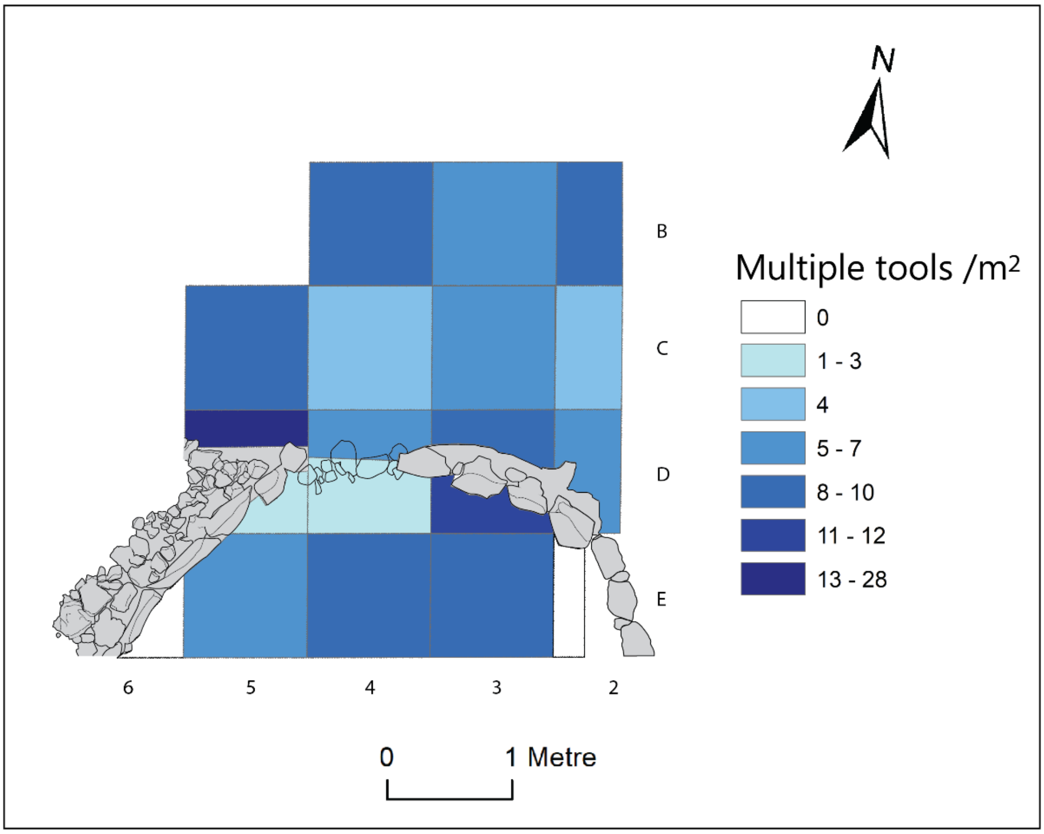


Figure 7.105: Distribution of Lower Phase 3 multiple tools.

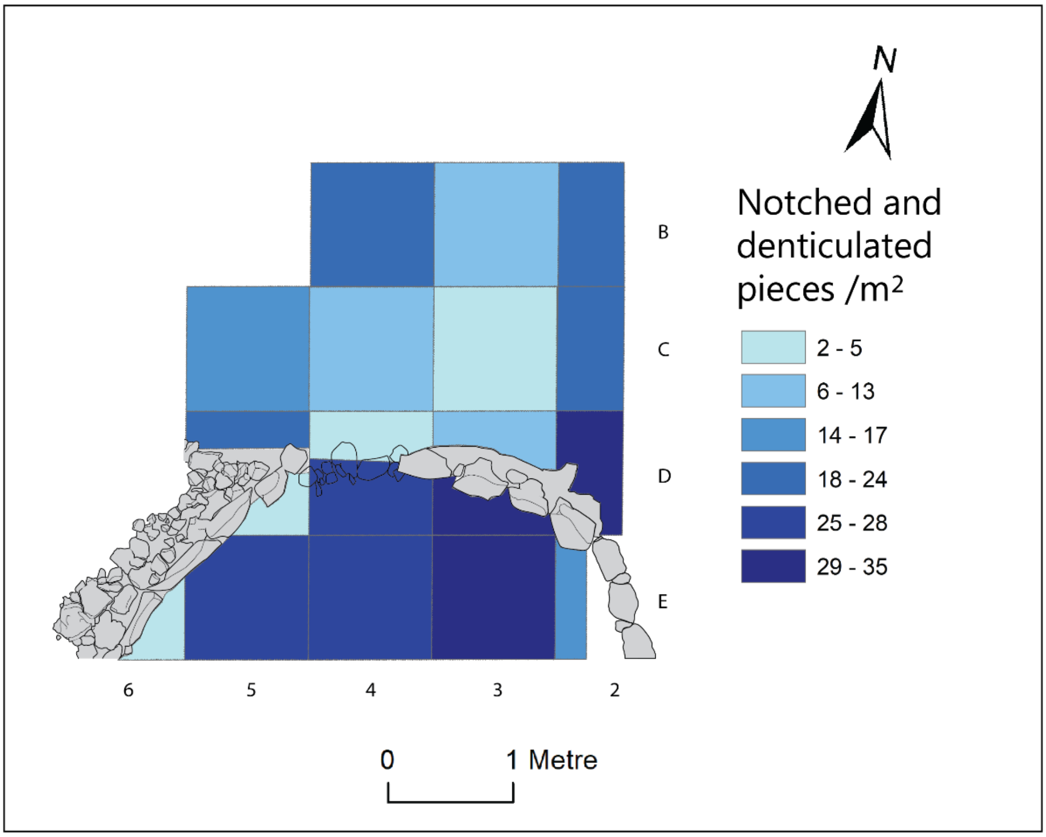


Figure 7.106: Distribution of Lower Phase 3 notched and denticulated pieces.

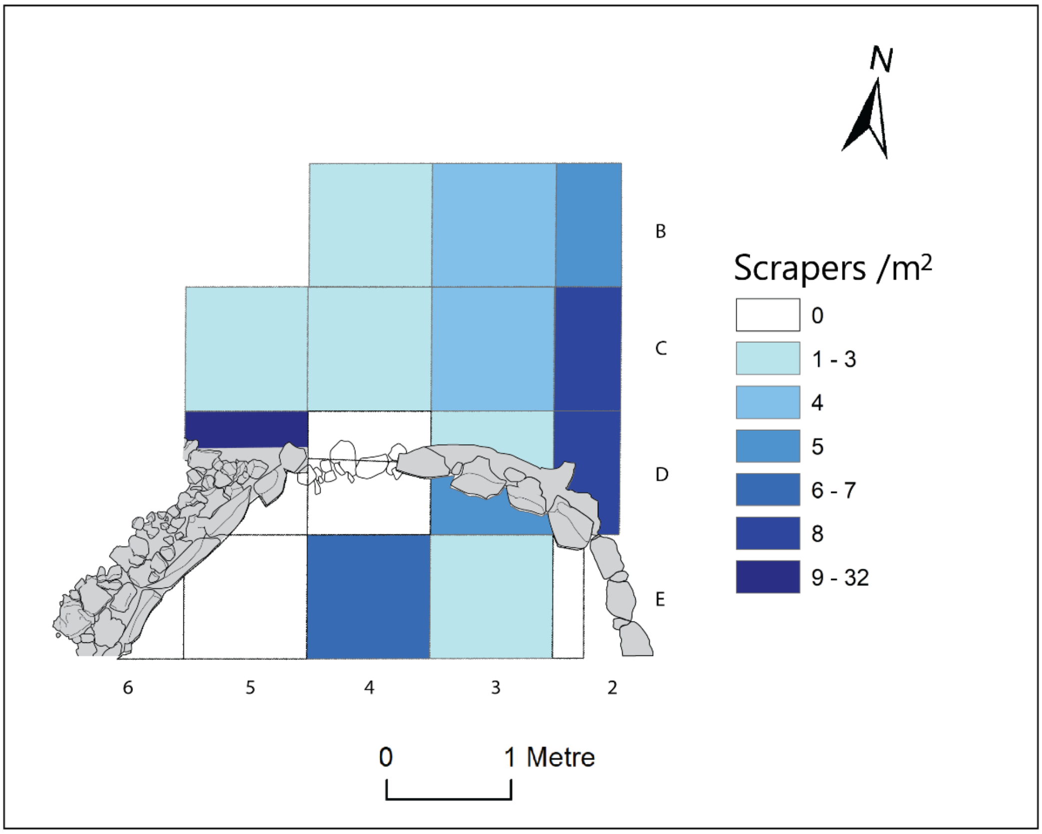


Figure 7.107: Distribution of Lower Phase 3 scrapers.

7.3.3.1.3 Burnt artefact distribution

In general, most debris and debitage types exhibit their lowest percentages of burnt artefacts in the Structure 3 interior deposits and in the space immediately outside its entrance. This pattern is most pronounced in the case of the whole flakes, flakes <2cm, broken flakes (**Fig. 7.108**), broken bladelets and bladelets and burin spalls (**Fig. 7.109**). In contrast, the chips (**Fig. 7.108**) and bladelets <2cm (**Fig. 7.109**) exhibit reduced rates of burning only in the interior deposits rather than also outside the entrance, while the percentage of burnt chunks remains exceedingly high (>80%) regardless of their place of deposition (**Fig. 7.108**).

7.3.3.2 Faunal remains

The areal numerical and weight distributions of the faunal material remain consistent with the numerical distribution of lithic artefacts, in each case retaining the division into two clusters in the Structure 3 and north-east corner, whereas the external areas bordering the Structure 3 entrance are largely free of faunal remains (**Figs. 7.110 - 7.111**). The volumetric distribution of faunal material mirrors that of the lithics, in this case also with clusters bordering the Structure 3 entrance in the case of the faunal weights (**Figs. 7.112 - 7.113**).

7.3.3.3 Groundstone artefacts

While no clustering is detectable in the case of the intact groundstone artefacts (**Fig. 7.114**), fragmentary groundstone pieces are present in large quantity in the north-west corner of the exterior area (**Fig. 7.115**).

7.3.3.4 Bone artefacts

The degree of bone artefact clustering differs considerably between the internal and external Lower Phase 3 deposits. The external bone artefacts are widely dispersed across the eastern half of the external deposits, whereas most pieces situated within Structure 3 are tightly clustered together towards its eastern side (**Fig. 7.116**).

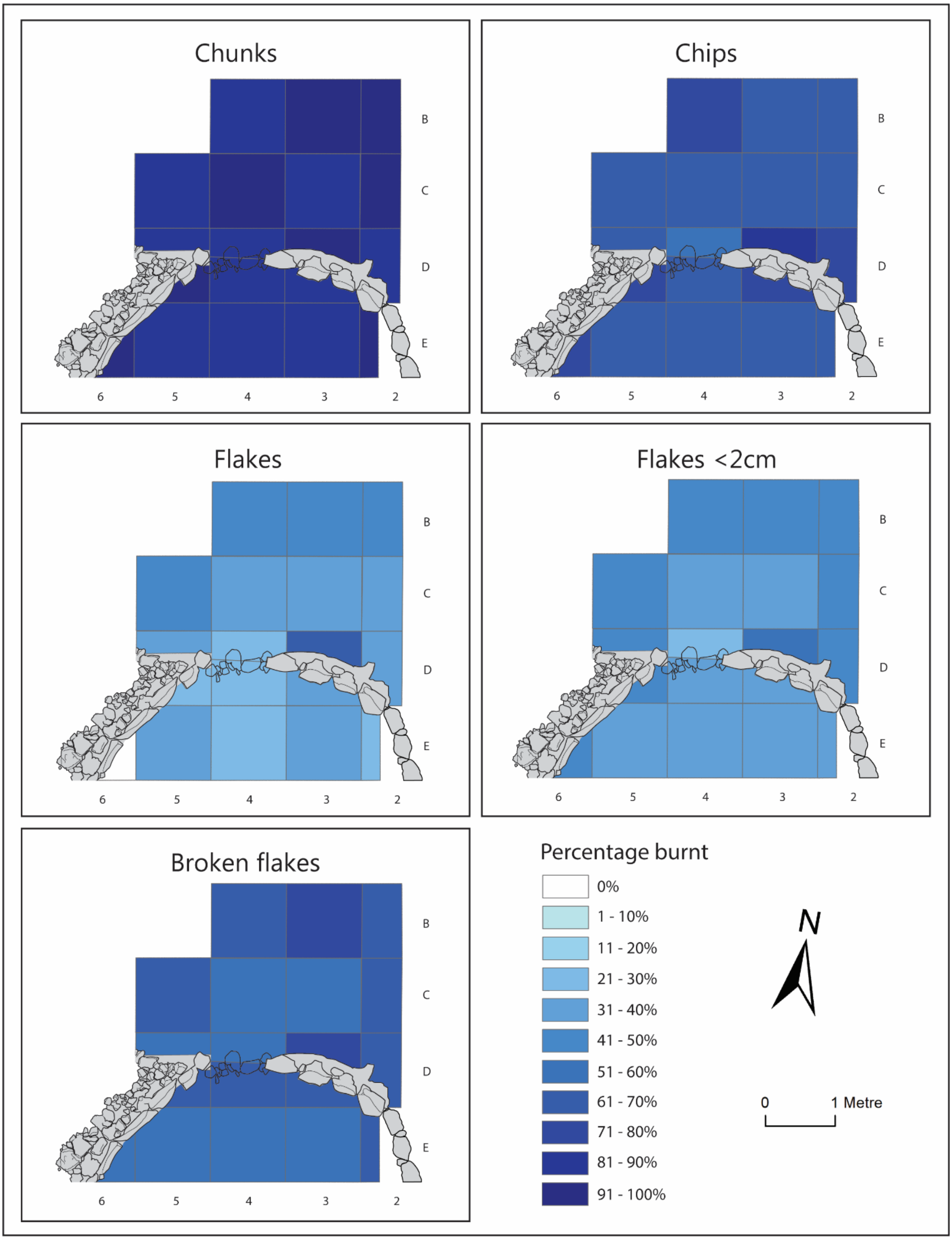


Figure 7.108: Distribution of burnt flaked stone artefacts in Lower Phase 3 (1/2).

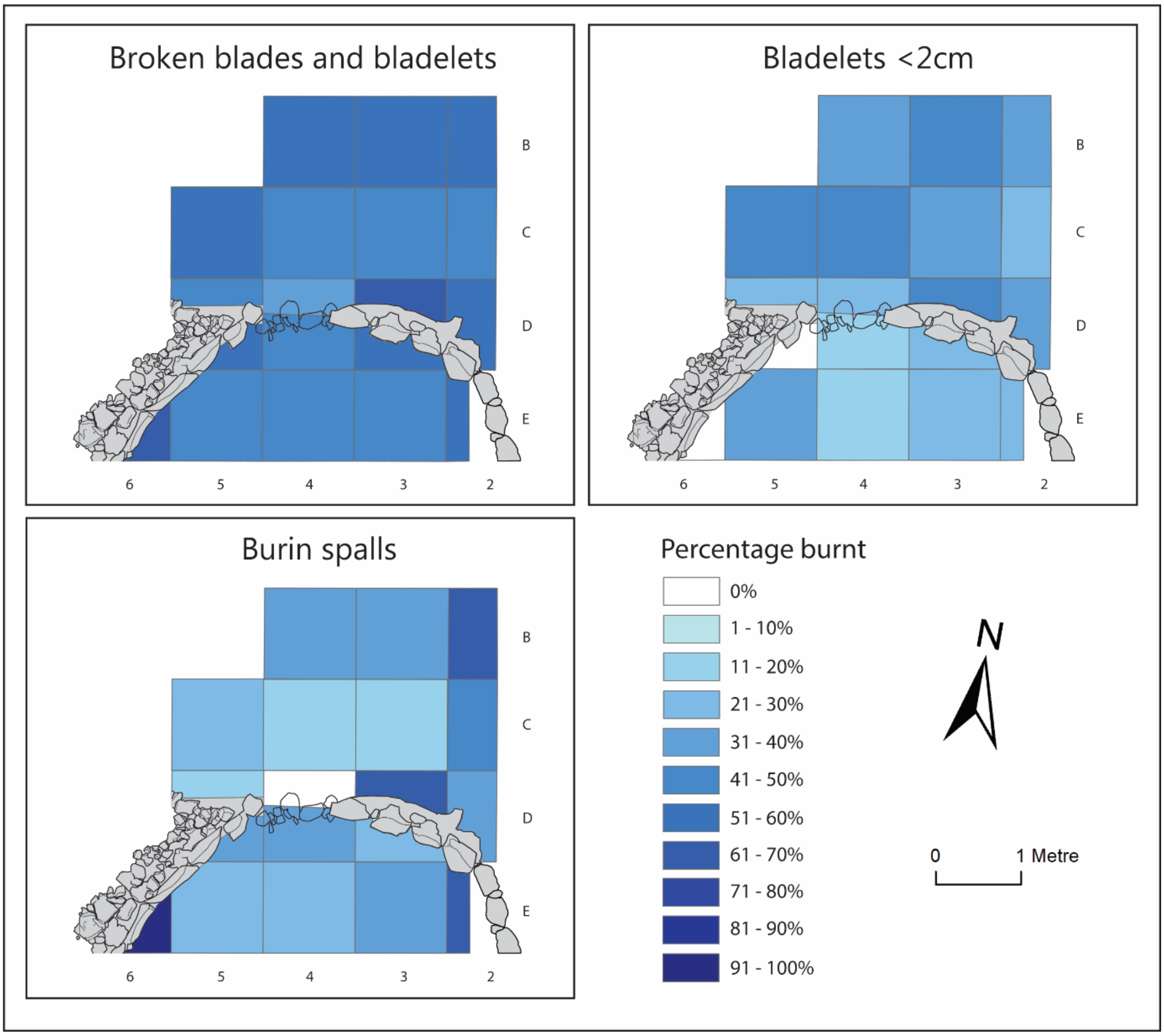


Figure 7.109: Distribution of burnt flaked stone artefacts in Lower Phase 3 (2/2).

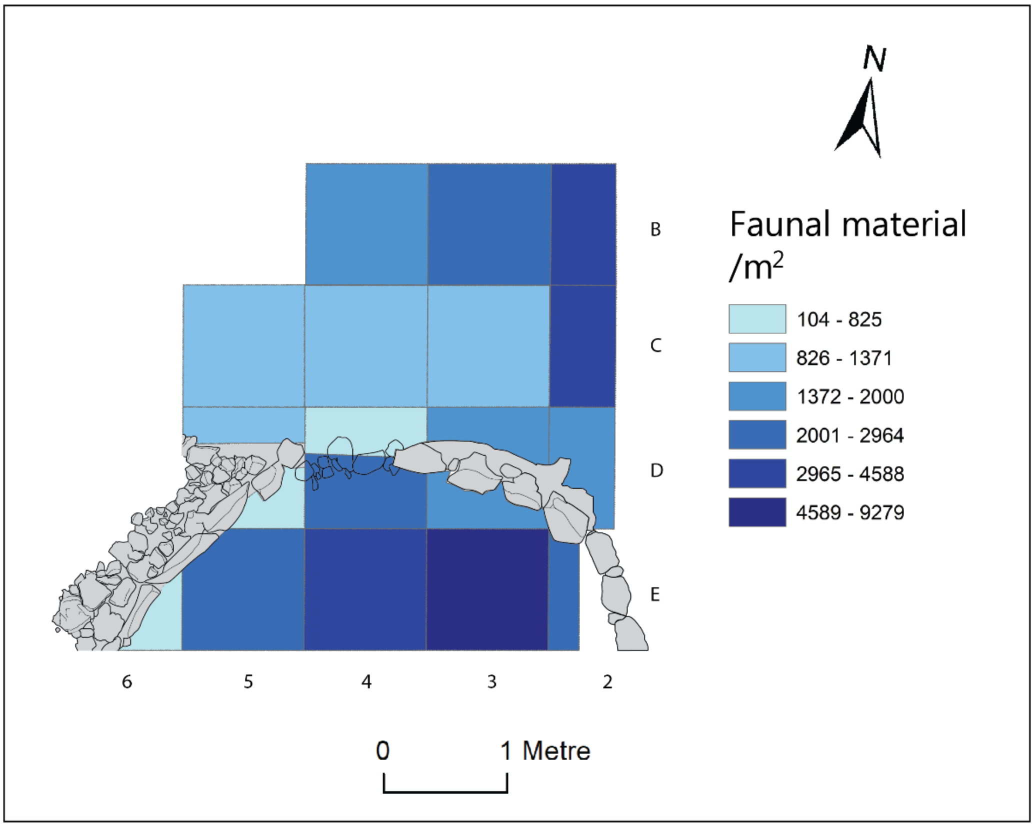


Figure 7.110: Distribution of Lower Phase 3 faunal material, by areal density.

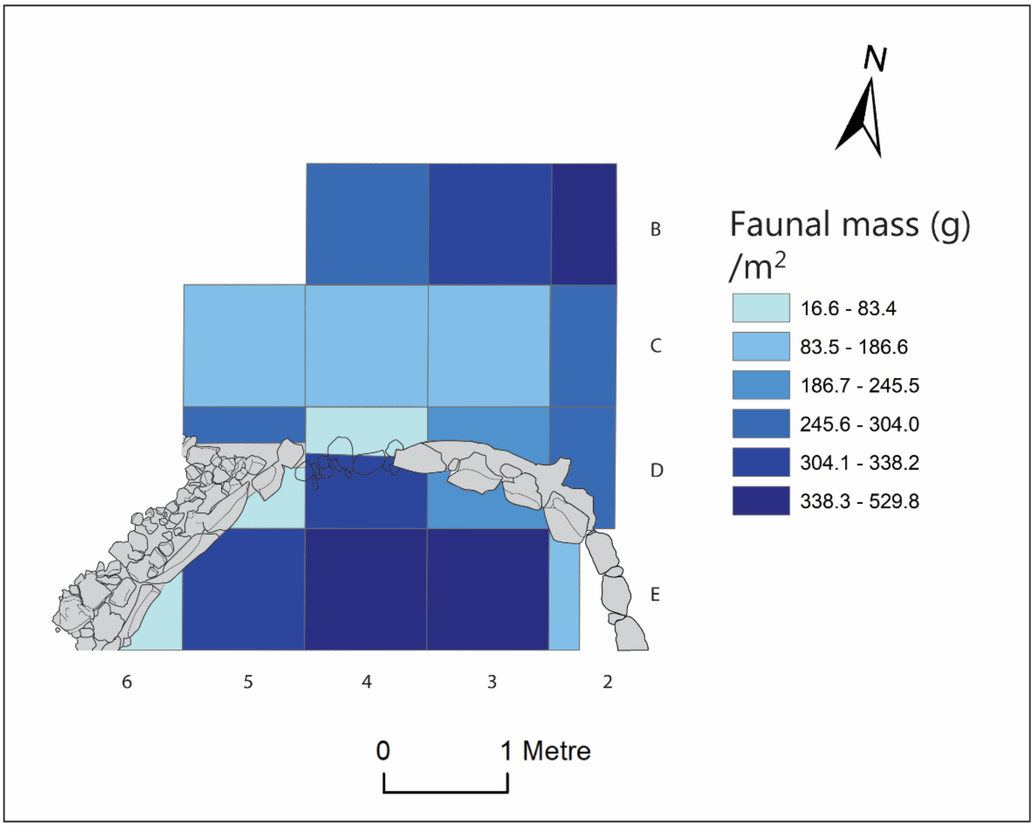


Figure 7.111: Distribution of Lower Phase 3 faunal weights, by areal density.

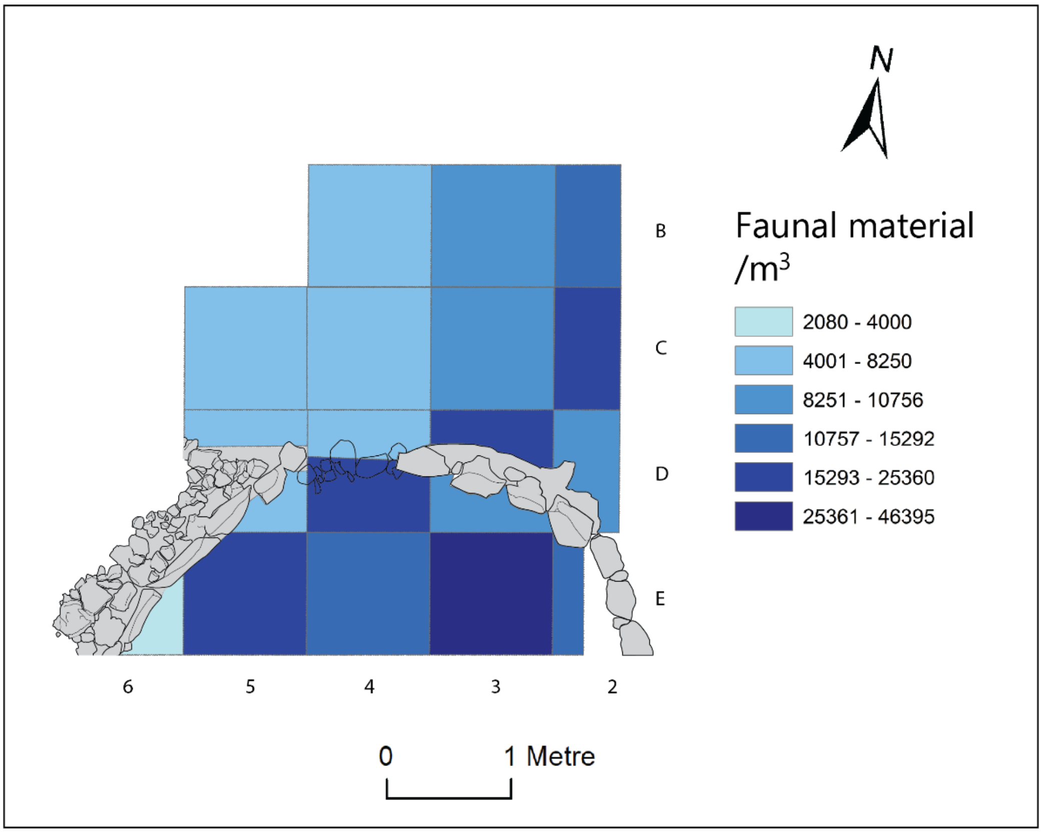


Figure 7.112: Distribution of Lower Phase 3 faunal material, by volumetric density.

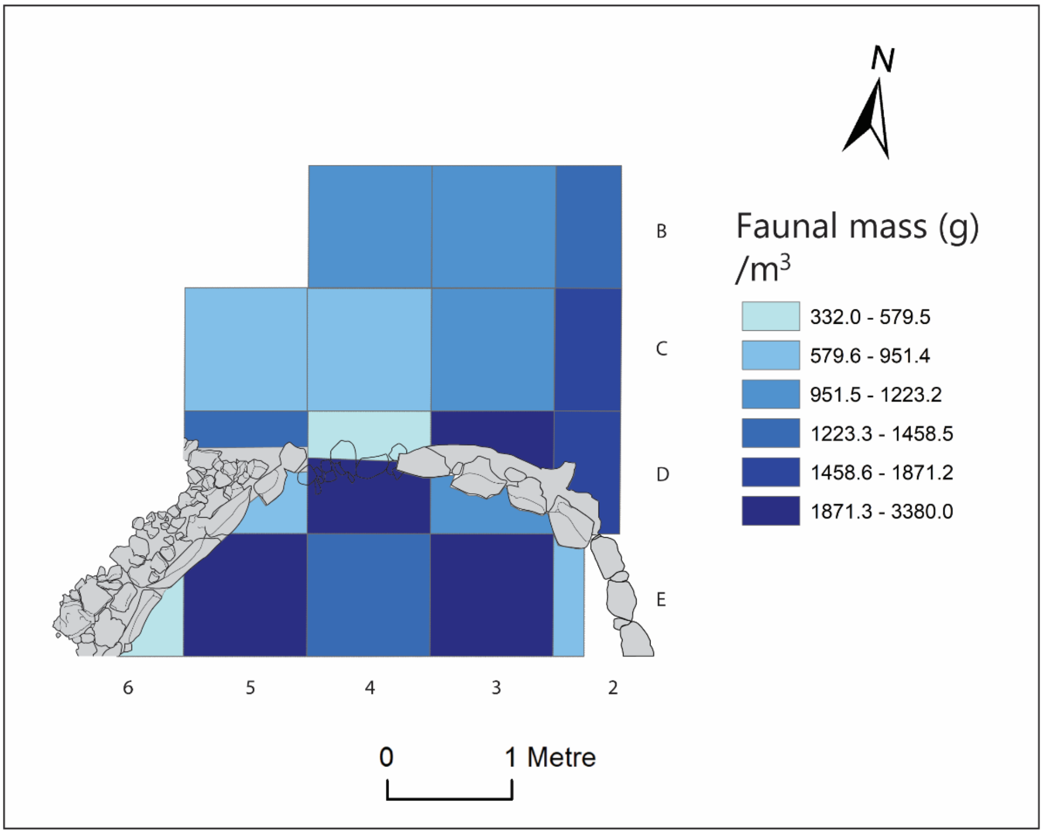


Figure 7.113: Distribution of Lower Phase 3 faunal weights, by volumetric density.

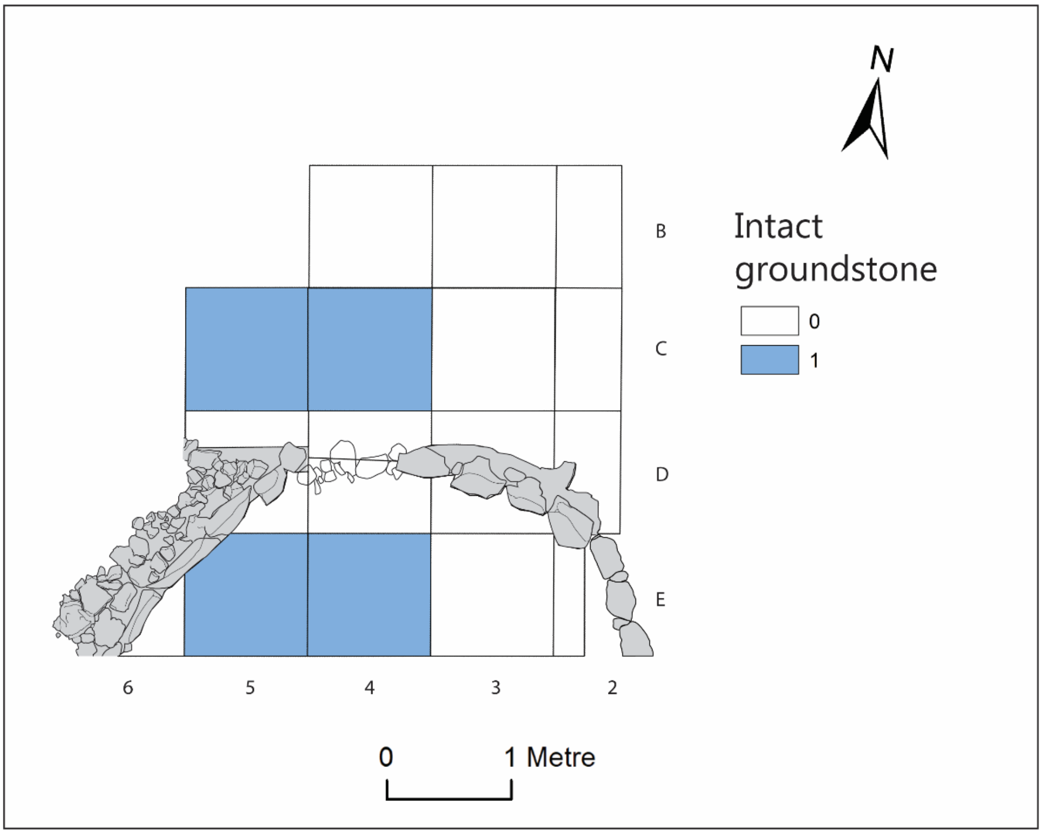


Figure 7.114: Distribution of Lower Phase 3 intact groundstone.

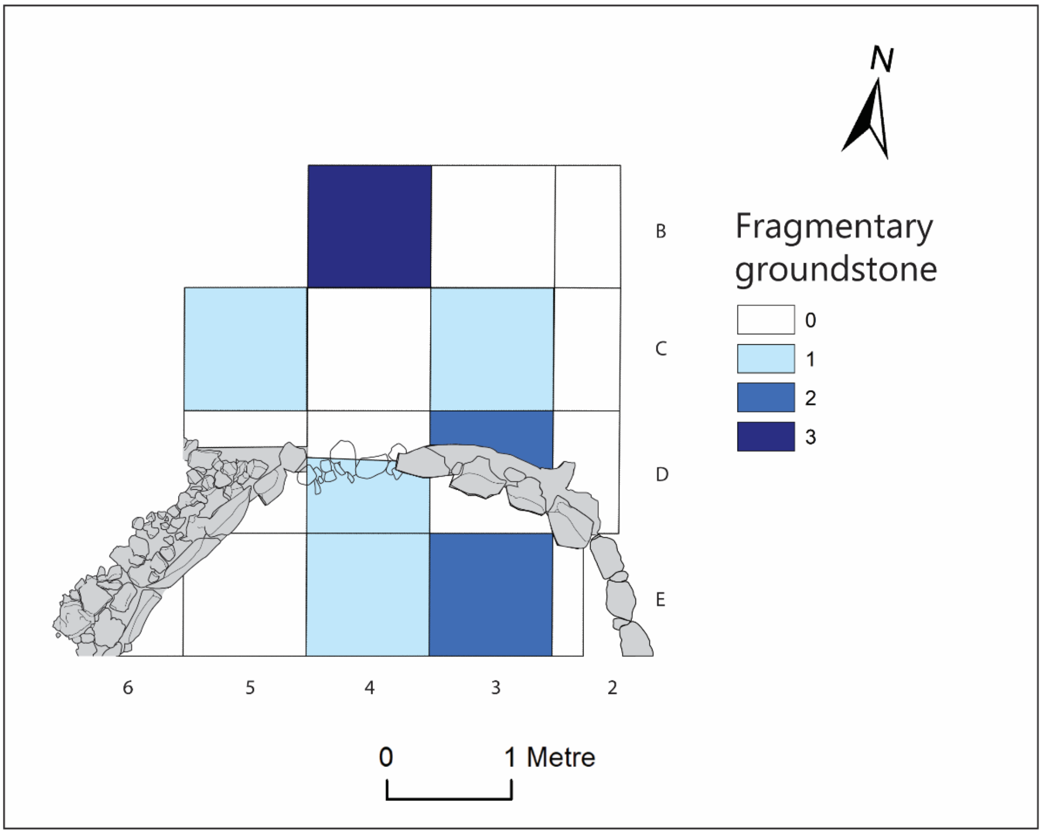


Figure 7.115: Distribution of Lower Phase 3 fragmentary groundstone.

7.3.3.5 Scaphopod artefacts

The distribution of scaphopod artefacts is more similar to the lithics, with twin clusters situated in the centre of Structure 3 and the eastern end of the exterior area respectively (**Fig. 7.117**).

7.3.3.6 Statistical significance of Lower Phase 3 artefact distributions

Comparable to Upper Phase 3, the Lower Phase 3 lithics, faunal material and scaphopod fragments all exhibit solid correlations with one another, while the intact groundstone artefacts present the least familiarity with other artefact types (**Table 7.7**). The strongest correlations between debris and debitage types are observed between the flakes <2cm and broken blades and bladelets (r = 0.981), flakes and broken blades and bladelets (r = 0.977) and the flakes <2cm and burin spalls (r = 0.974). Some of the coefficients relating to the blades are notably low compared to those of Phase 2 and Upper Phase 3, with their correlations with the chips (r = 0.053) and chunks (r = 0.140) being particularly weak.

The statistical relationships between different tool groups are similar to the Phase 2 and Upper Phase 3 assemblages, albeit with some variation (**Table 7.8**). The strongest coefficients all relate to the retouched fragments, with the distribution of these artefacts exhibiting the most similarity with the non-geometric microliths (r = 0.948), notched and denticulated pieces (r = 0.919) and retouched flakes (r = 0.914). The distribution of debris and debitage likewise display the strongest correlations with the retouched fragments (r = 0.913), retouched flakes (r = 0.904) and non-geometric microliths (r = 0.887). The correlations between geometric microliths and the retouched fragments (r = 0.874) and debris and debitage (r = 0.825), whilst still strong, show a notable decline when compared to the situations in Phase 2 and Upper Phase 3.

The relationship between scrapers and other tool groups is once again more akin to the Phase 2 data, diverging from the strong coefficients seen in Upper Phase 3 (**Table 7.9**). The correlation between Lower Phase 3 scrapers and awls and borers is particularly weak (r = 0.082), reflecting the spatial disassociation exhibit between these tool groups in the density plots. Likewise, the Lower Phase 3 debris and debitage present the weakest correlation with the scrapers (r = 0.248), followed by the retouched blades (r = 0.362).

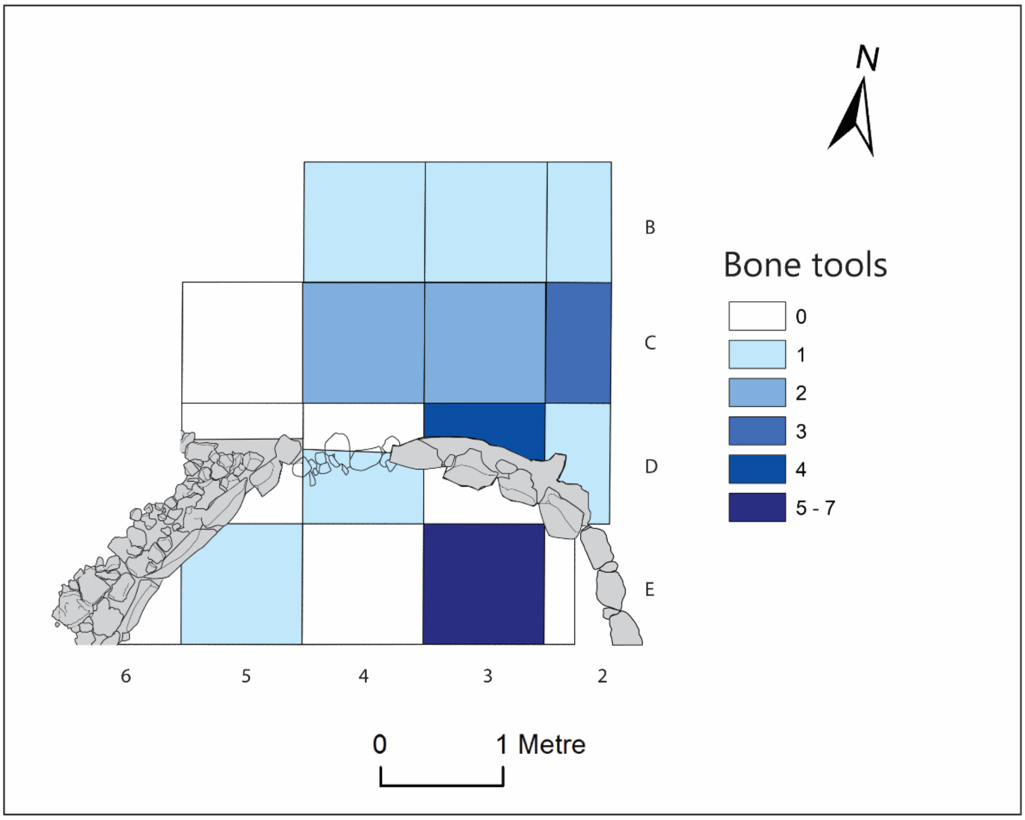


Figure 7.116: Distribution of Lower Phase 3 bone artefacts.

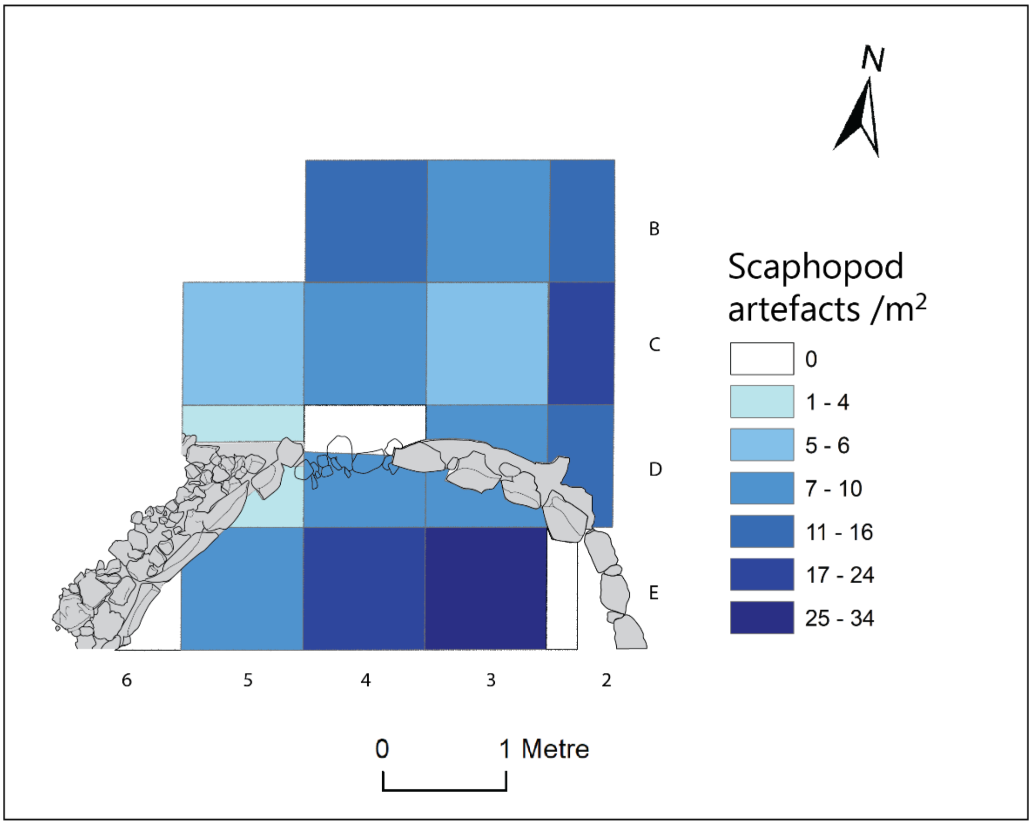


Figure 7.117: Distribution of Lower Phase 3 scaphopod (*Antalis sp.*) artefacts.

Table 7.7: Correlation coefficients (r) for the overall Lower Phase 3 artefact assemblage, by excavation square.

	Flaked-stone artefacts (no.)	Flaked-stone artefacts (mass)	Faunal material (no.)	Faunal material (mass)	Intact groundstone	Fragmentary groundstone	Bone artefacts	Antalis fragments
Flaked-stone artefacts (no.)	XXXXX							
Flaked-stone artefacts (mass)	0.832	XXXXX						
Faunal material (no.)	0.968	0.707	XXXXX					
Faunal material (mass)	0.959	0.912	0.897	XXXXX				
Intact groundstone	0.263	0.509	0.138	0.379	XXXXX			
Fragmentary groundstone	0.501	0.565	0.414	0.488	-0.046	XXXXX		
Bone artefacts	0.682	0.379	0.712	0.520	-0.152	0.489	XXXXX	
Antalis fragments	0.933	0.814	0.933	0.927	0.252	0.540	0.627	XXXXX

Table 7.8: Correlation coefficients (r) for the Lower Phase 3 flaked stone artefact assemblage, by excavation square. BBaB = Broken blades and bladelets, RA = Retouched artefacts.

	Chunks	Chips	Flakes	Flakes <2cm	Broken flakes	Blades	Bladelets	BBaB	Bladelets <2cm	Burin spalls	Flake cores	Bladelet cores	Core fragments	RA
Chunks	XXXXX													
Chips	0.894	XXXXX												
Flakes	0.882	0.661	XXXXX											
Flakes <2cm	0.954	0.863	0.937	XXXXX										
Broken flakes	0.963	0.775	0.957	0.962	XXXXX									
Blades	0.140	0.053	0.437	0.328	0.289	XXXXX								
Bladelets	0.682	0.578	0.862	0.813	0.727	0.496	XXXXX							
BBaB	0.927	0.777	0.977	0.981	0.965	0.353	0.859	XXXXX						
Bladelets <2cm	0.844	0.692	0.953	0.941	0.928	0.483	0.816	0.961	XXXXX					
Burin spalls	0.933	0.850	0.898	0.974	0.940	0.285	0.730	0.950	0.928	XXXXX				
Flake cores	0.636	0.431	0.729	0.650	0.653	0.462	0.652	0.674	0.609	0.624	XXXXX			
Bladelet cores	0.592	0.504	0.699	0.631	0.598	0.364	0.749	0.680	0.616	0.604	0.537	XXXXX		
Core fragments	0.708	0.617	0.733	0.770	0.719	0.299	0.729	0.761	0.696	0.674	0.497	0.621	XXXXX	
RA	0.954	0.836	0.931	0.974	0.967	0.329	0.748	0.965	0.931	0.969	0.642	0.675	0.704	XXXXX

Table 7.9: Correlation coefficients (r) for Lower Phase 3 retouched artefact tool groups, by excavation square. NGM = Non-geometric microliths, NaD = Notched and denticulated pieces.

	Scrapers	Multiple tools	Burins	Retouched blades	Truncated pieces	NGM	Geometric microliths	NaD	Awls and borers	Retouched flakes	Retouched fragments	Debris and debitage	Cores
Scrapers	XXXXX												
Multiple tools	0.636	XXXXX											
Burins	0.445	0.846	XXXXX										
Retouched blades	0.391	0.414	0.512	XXXXX									
Truncated pieces	0.253	0.628	0.860	0.579	XXXXX								
NGM	0.380	0.696	0.859	0.660	0.823	XXXXX							
Geometric microliths	0.299	0.634	0.800	0.613	0.800	0.882	XXXXX						
NaD	0.305	0.658	0.789	0.542	0.775	0.897	0.868	XXXXX					
Awls and borers	0.082	0.494	0.683	0.119	0.577	0.677	0.501	0.569	XXXXX				
Retouched flakes	0.215	0.742	0.838	0.429	0.686	0.898	0.771	0.866	0.702	XXXXX			
Retouched fragments	0.349	0.730	0.793	0.584	0.713	0.948	0.874	0.919	0.646	0.914	XXXXX		
Debris and debitage	0.248	0.689	0.778	0.362	0.698	0.887	0.825	0.837	0.728	0.904	0.913	XXXXX	
Cores	0.589	0.834	0.878	0.438	0.748	0.744	0.738	0.678	0.545	0.708	0.671	0.695	XXXXX

7.3.3.7 Interpretation of Lower Phase 3 distributional data

Both of the major artefact clusters in Lower Phase 3 appear to largely represent accumulations of primary refuse, as signified by the large volume of lithic and faunal microdebris in both accumulations. The two clusters appear to differ somewhat, however, in that the northern, exterior cluster features a significantly greater share of the lithic weights, reflecting the increased proportions of whole flakes in this area. Interestingly, the Lower Phase 3 chunks still present a clear leaning towards the interior deposits, indicating that, unlike in Upper Phase 3, the clustering of heavier lithic artefacts in the north does not incorporate the disposal of most chunks into a toss-zone. The relative scarcity of whole blades and bladelets within the interior deposits is also notable, and may partially reflect an increased degree of fragmentation due to foot traffic and other anthropomorphic influences in this area. Furthermore, the clustering of bladelet cores and bladelets together likely reflects the remnant of knapping activity areas.

All in all, the interior and exterior assemblages in this phase exhibit stronger continuities with one another compared to the situation in Upper Phase 3. Given that the interior deposits (Locus 8.1) are stratigraphically associated with Structure 3, they can be safely characterised as indoor domestic refuse. Likewise, the exterior cluster also presents high numbers of micro-refuse, indicating that it also represents a focal point for knapping activities and their associated primary refuse. Given the limited horizontal extent of the excavated sample area for this phase, however, any other spatial associations of this cluster with the broader settlement at this time remain unclear.

7.3.4 Upper Phase 4

7.3.4.1 Lithic artefacts

The areal distributions of Upper Phase 4 flaked stone artefacts exhibit an overall tendency towards the southern units overlying most of the Lower Phase 4 pit features, by both artefact count and weight (**Figs. 7.119 - 7.120**). The deposits above Feature 31 in the west are comparatively limited in each of these cases. The same spatial relationships are evident when examining the volumetric distribution of these artefacts, albeit with a stronger association with marginal units with lower volumes of sediment to the south of Feature 20 (**Figs. 7.121-7.122**).

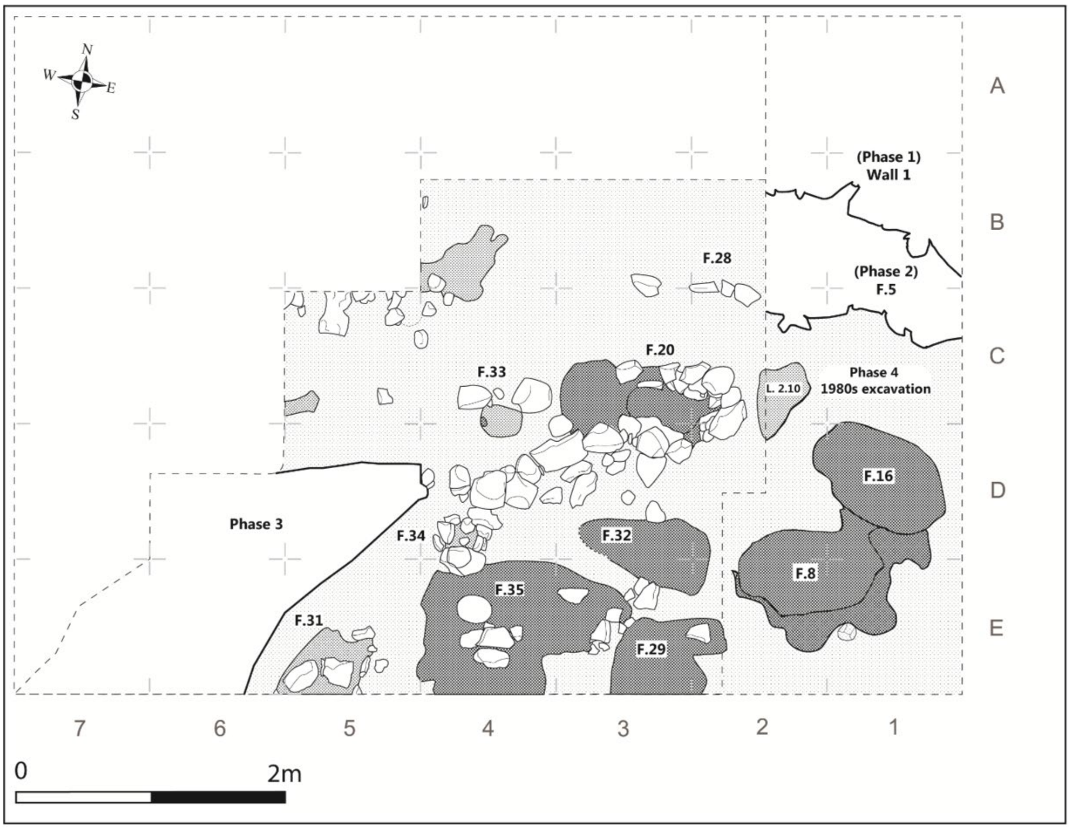


Fig 7.118: Plan of the Area XX F, Lower Phase 4 exposure.

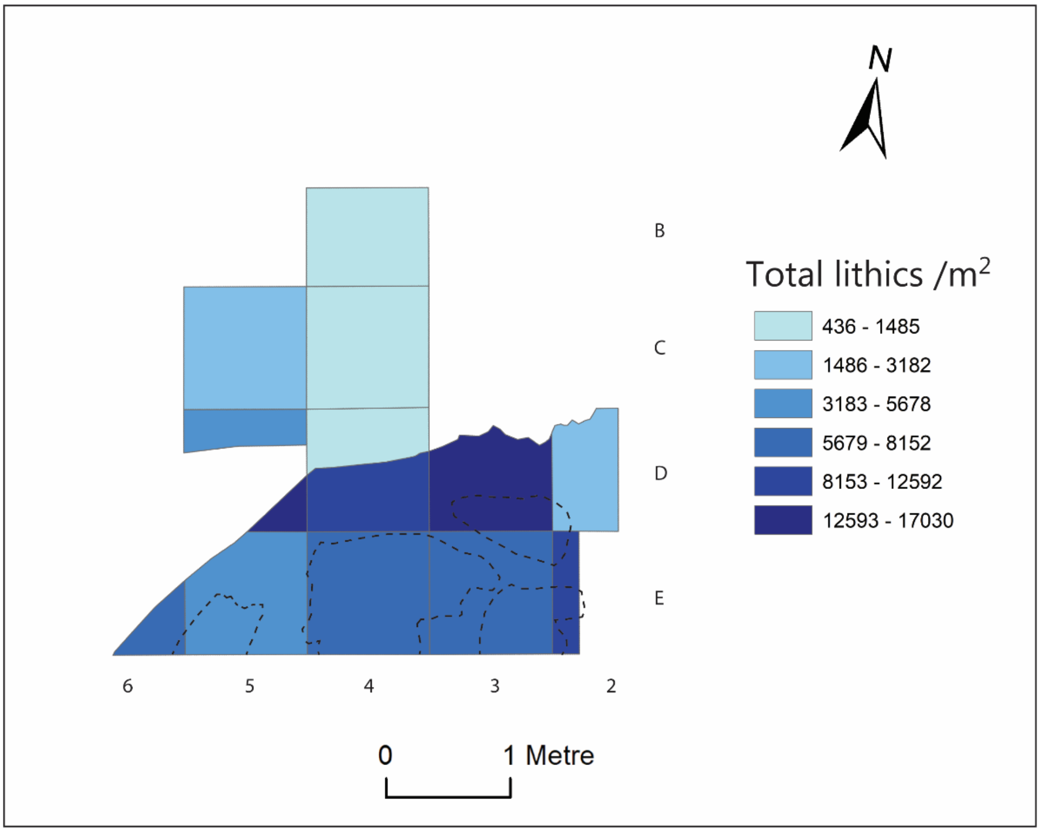


Figure 7.119: Distribution of Upper Phase 4 flaked stone artefacts, by areal density.

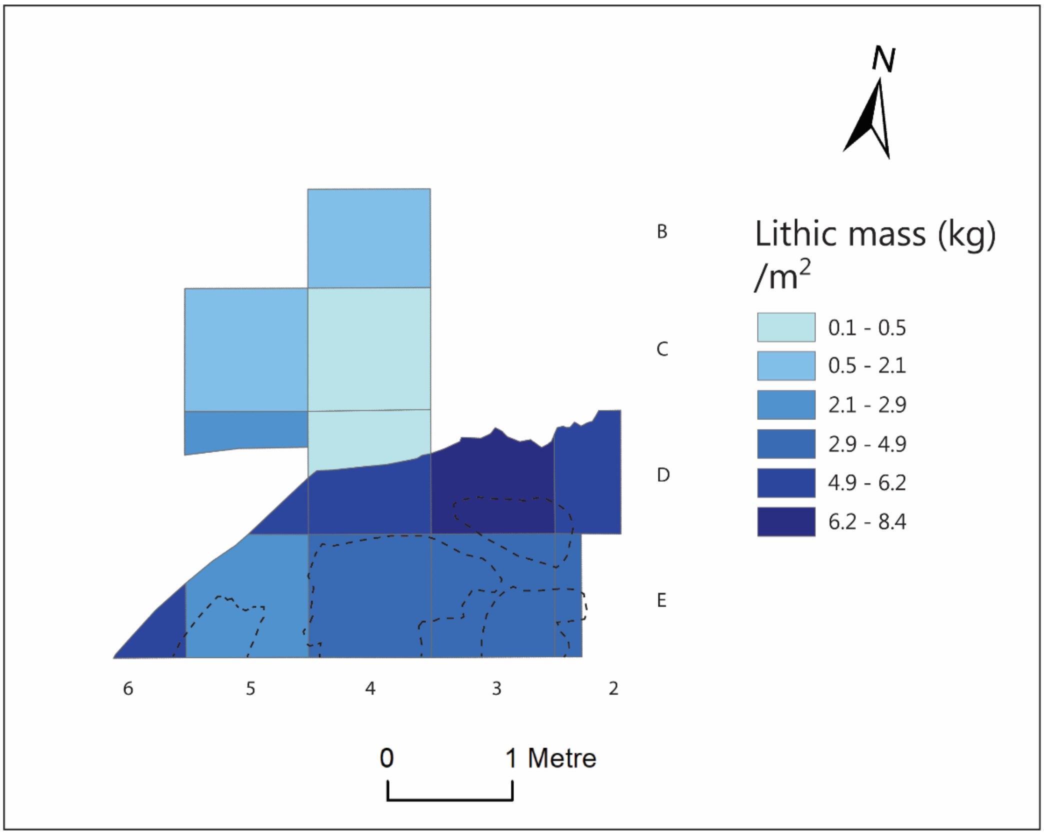


Figure 7.120: Distribution of Upper Phase 4 flaked stone artefact weights, by areal density.

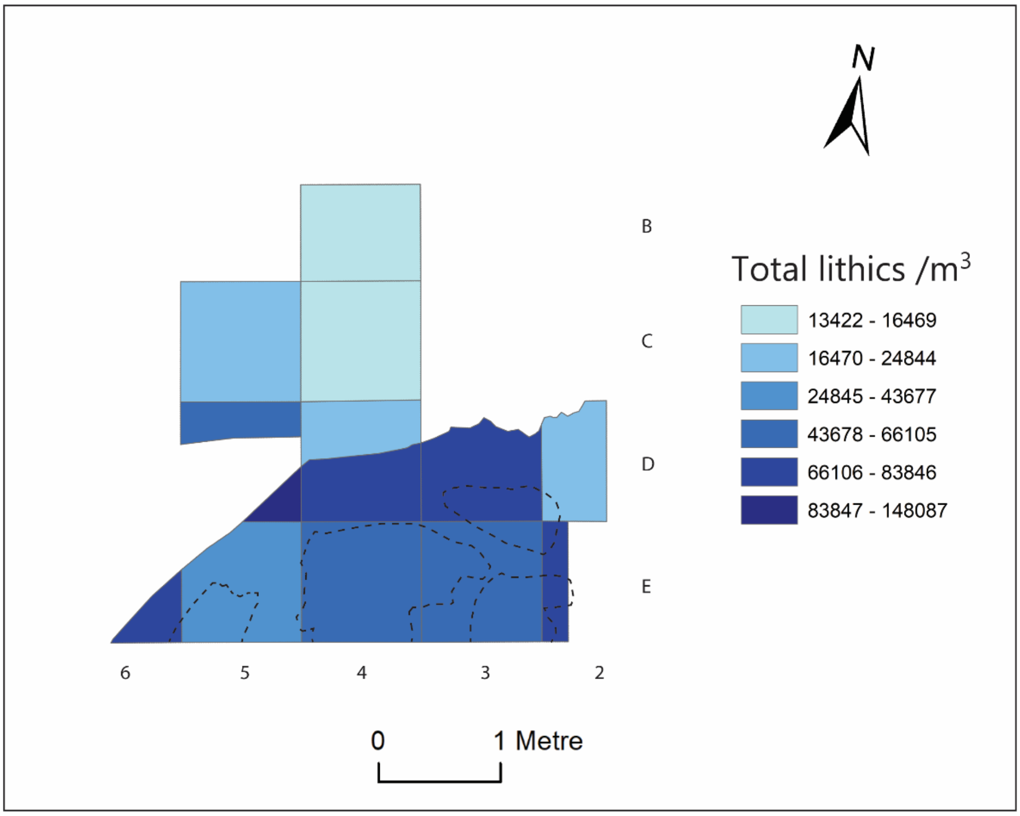


Figure 7.121: Distribution of Upper Phase 4 flaked stone artefacts, by volumetric density.

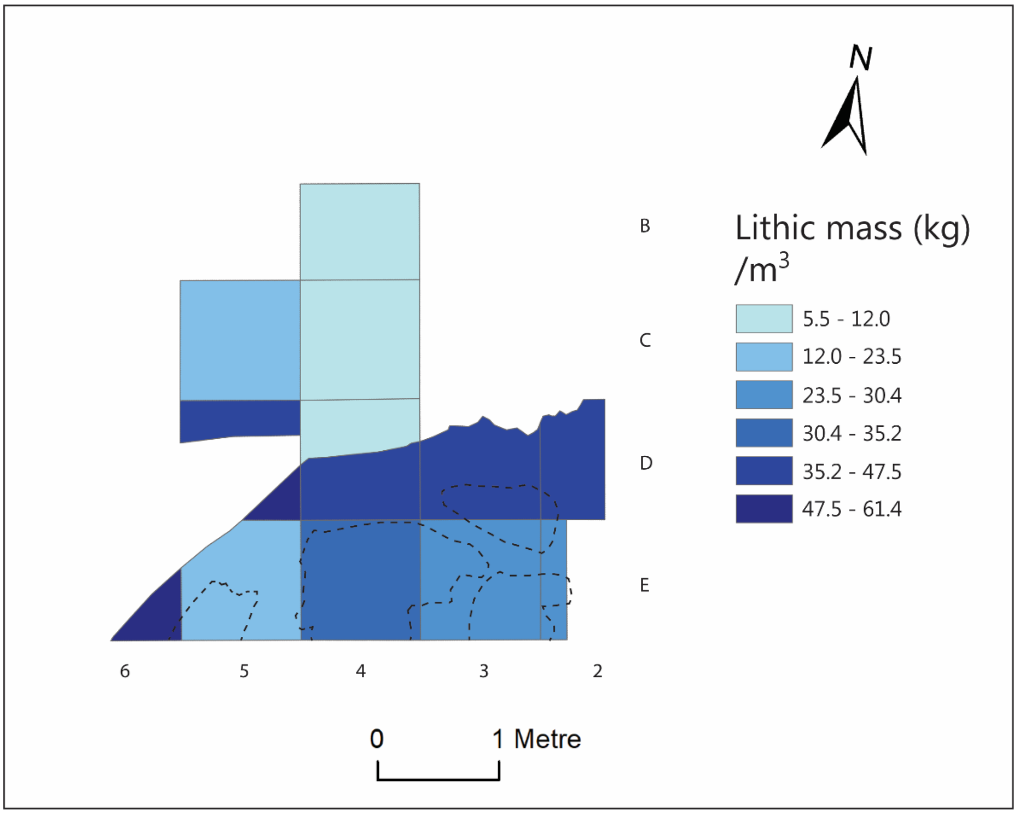


Figure 7.122: Distribution of Upper Phase 4 flaked stone artefact weights, by volumetric density.

7.3.4.1.1 Debris, debitage and cores

Given their numerical predominance, the chunks and chips unsurprisingly share a high degree of similarity with the overall distribution of lithic artefacts (**Figs. 7.123 - 7.124**). Likewise, the flakes (**Fig. 7.125**), flakes <2cm (**Fig. 7.126**), broken flakes (**Fig. 7.127**), bladelets (**Fig. 7.128**), broken blades and bladelets (**Fig 7.129**), bladelets <2cm (**Fig. 7.130**) and burin spalls (**Fig. 7.131**) all display a heavy degree of clustering in the southern Locus 8.3 deposits. Of these types, the broken flakes, whole bladelets and broken blades and bladelets also exhibit a degree of secondary clustering centred on the north-west corner of the Locus 9.5 deposits. The depositional leaning towards Locus 8.3 is less pronounced in the case of the blades (**Fig. 7.132**).

The distribution of cores in Upper Phase 4 once again varies considerably based on the types of blanks being produced. While displaying an overall association with the southern Locus 8.3 deposits, the flake cores also present a conspicuous degree of clustering in the space immediately north of the deposits overlying Feature 35 (**Fig. 7.133**). In contrast, the bladelet cores exhibit a greater affinity with the squares directly overlying Feature 35 and along the edge of the XX F sondage. In both cases, however, a secondary cluster is also present along the western edge of the Locus 9.5 deposits (**Fig. 7.134**). Finally, the core fragments are mostly clustered within the Squares overlying the junction between Features 29, 32 and 35, and in Squares D2 and E6 (**Fig. 7.135**). The core fragments further differ from the whole cores in that these artefacts are almost absent from the Locus 9.5 deposits.

7.3.4.1.2 Retouched artefacts

Of the retouched tool groups, the burins (**Fig. 7.136**), retouched blades (**Fig. 7.137**) non-geometric microliths (**Fig. 7.138**), geometric microliths (**Fig. 7.139**), retouched flakes (**Fig. 7.140**) and retouched fragments (**Fig. 7.141**) present strong associations with the deposits overlying Features 29, 32 and 35. Furthermore, each of these tool groups is all but absent from the Locus 9.5 deposits to the north. The scrapers (**Fig. 7.142**) and multiple tools (**Fig. 7.143**) likewise exhibit clear depositional biases towards the south, although in these cases they also appear in considerable quantities along the north-west edge of Locus 9.5. The truncated pieces (**Fig. 7.144**) and notched and denticulated pieces (**Fig. 7.145**) reach their greatest areal densities in the deposits north of Feature 35, although high quantities of notched and denticulated pieces are also present in Square E3. Finally, the only two awls and

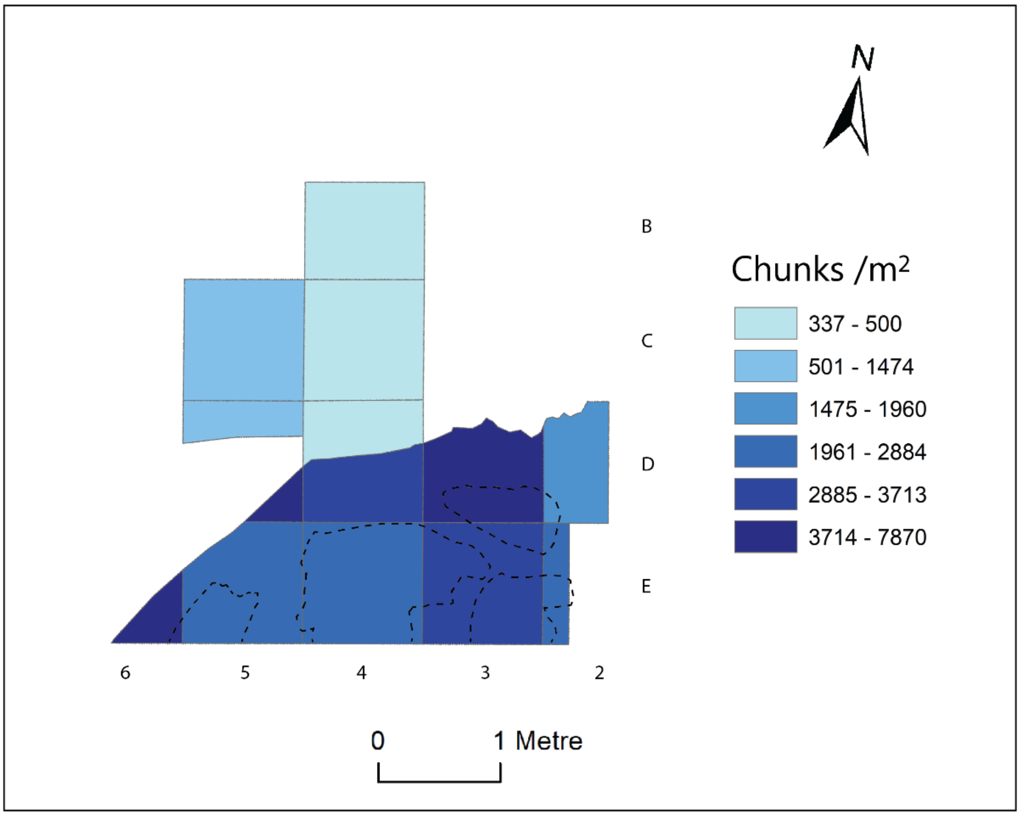


Figure 7.123: Distribution of Upper Phase 4 chunks.

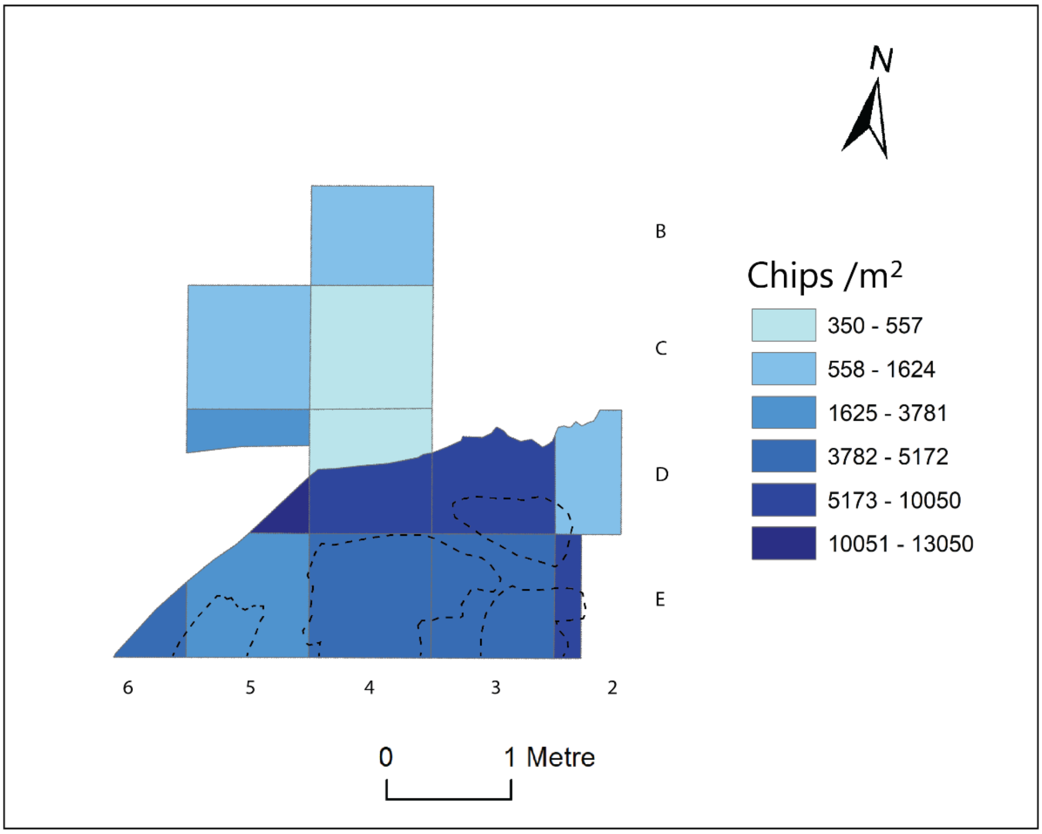


Figure 7.124: Distribution of Upper Phase 4 chips.

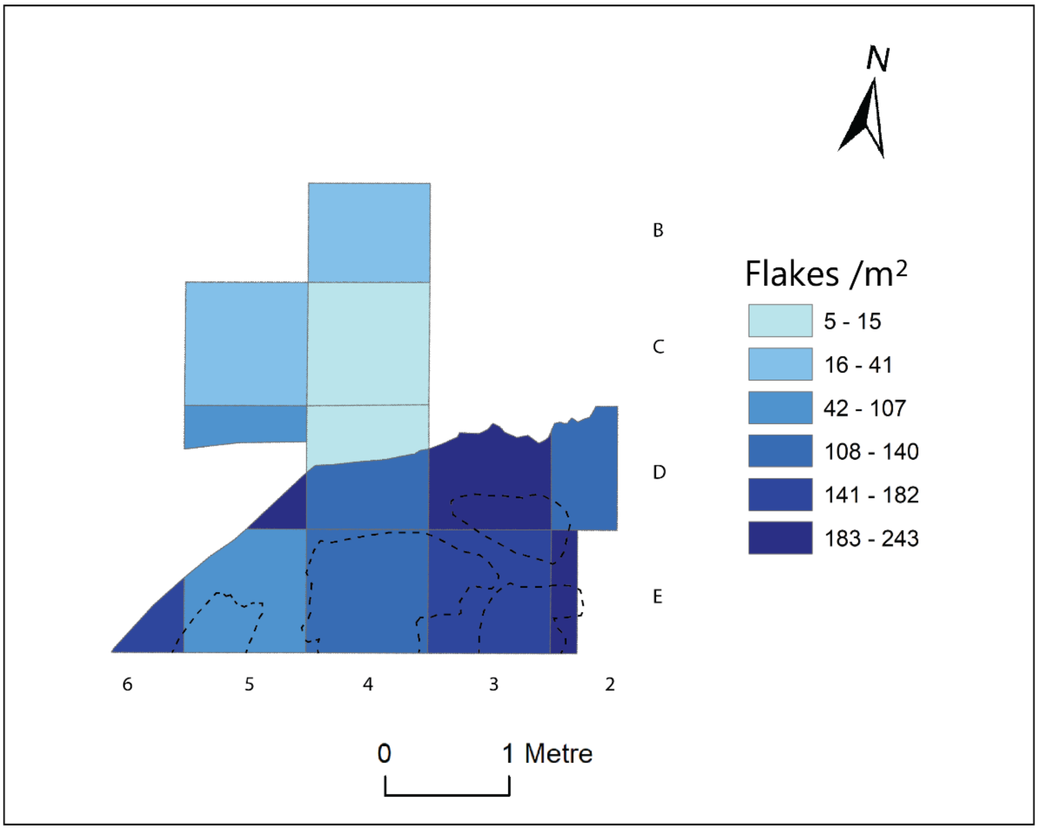


Figure 7.125: Distribution of Upper Phase 4 flakes.

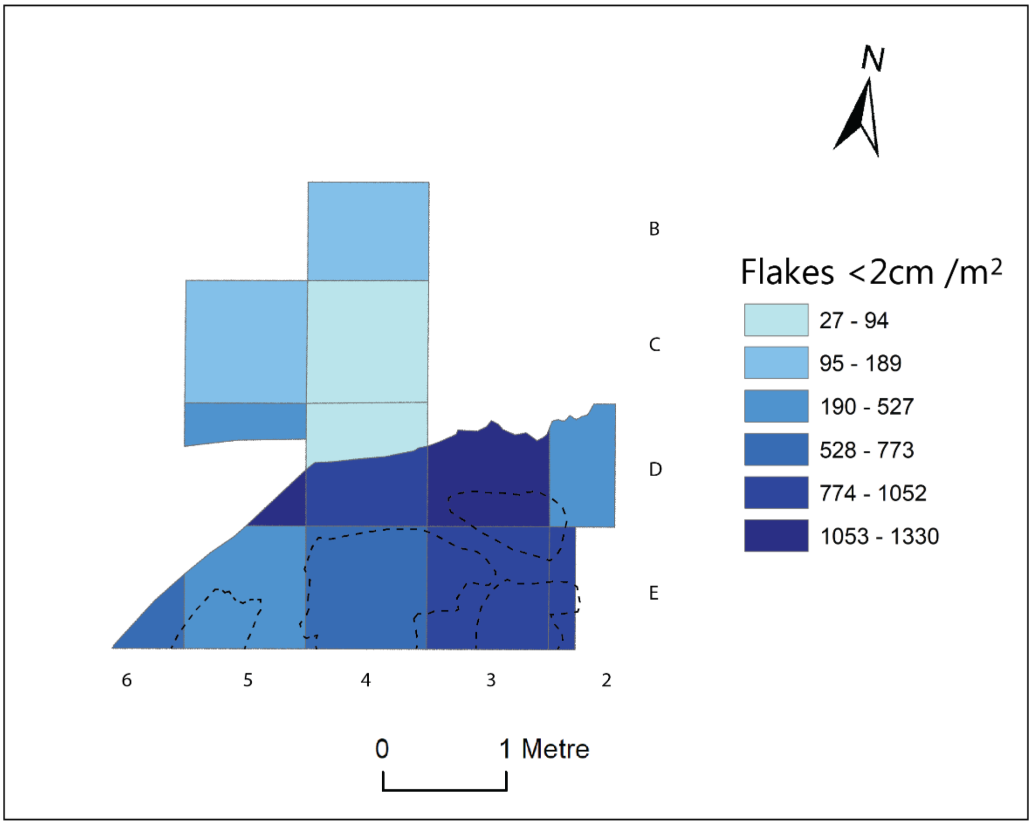


Figure 7.126: Distribution of Upper Phase 4 flakes <2cm.

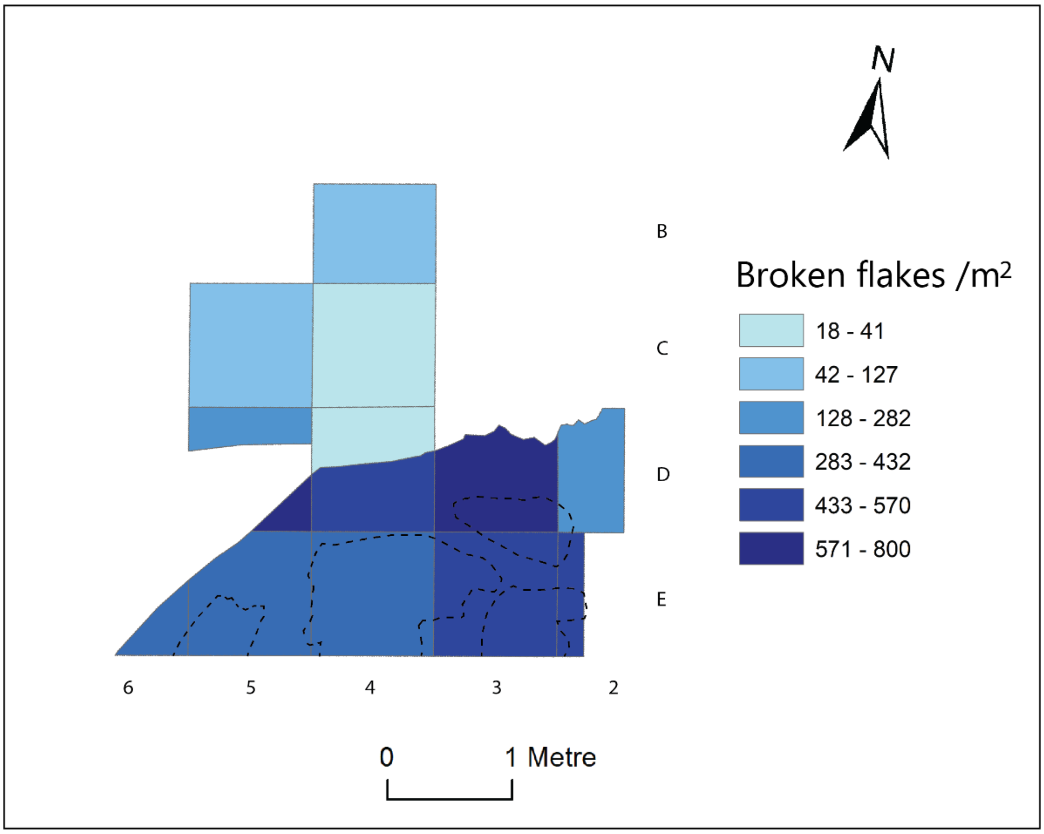


Figure 7.127: Distribution of Upper Phase 4 broken flakes.

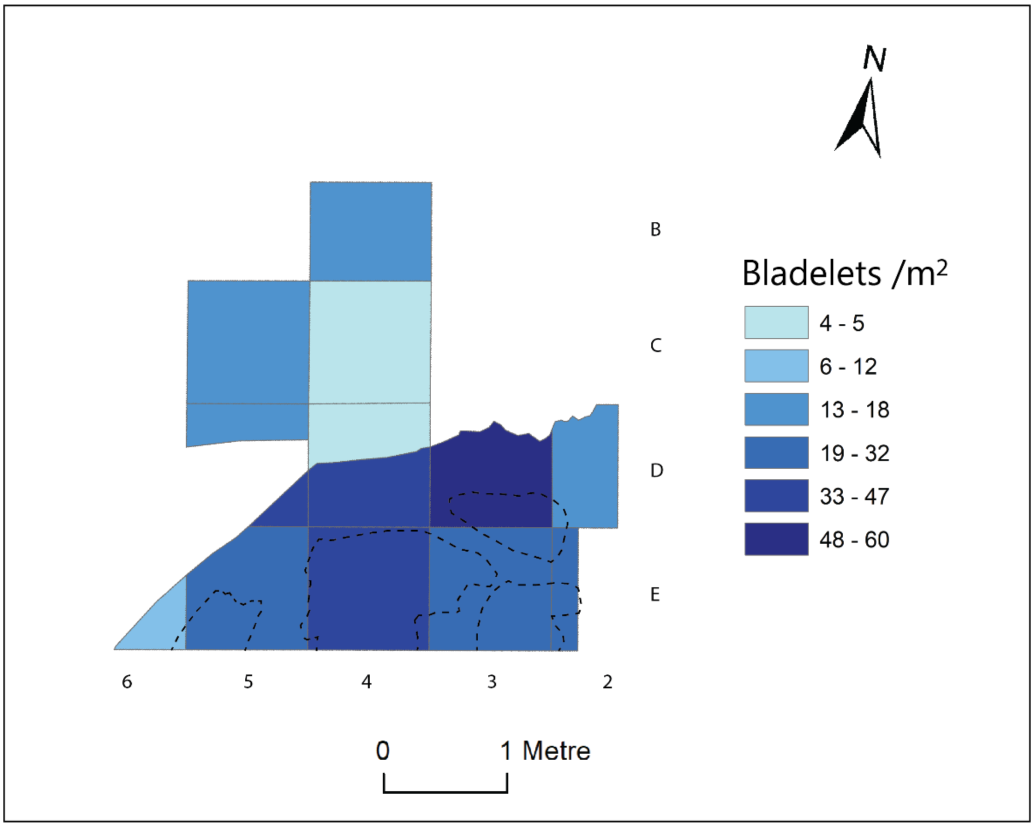


Figure 7.128: Distribution of Upper Phase 4 bladelets.

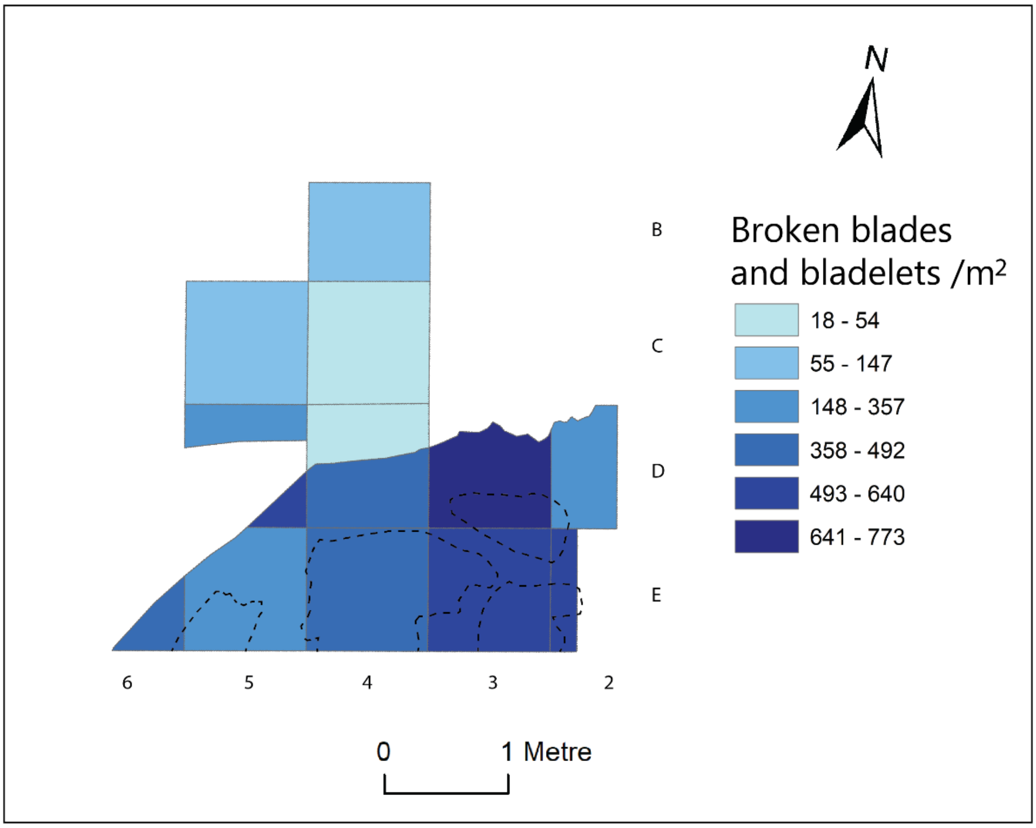


Figure 7.129: Distribution of Upper Phase 4 broken blades and bladelets.

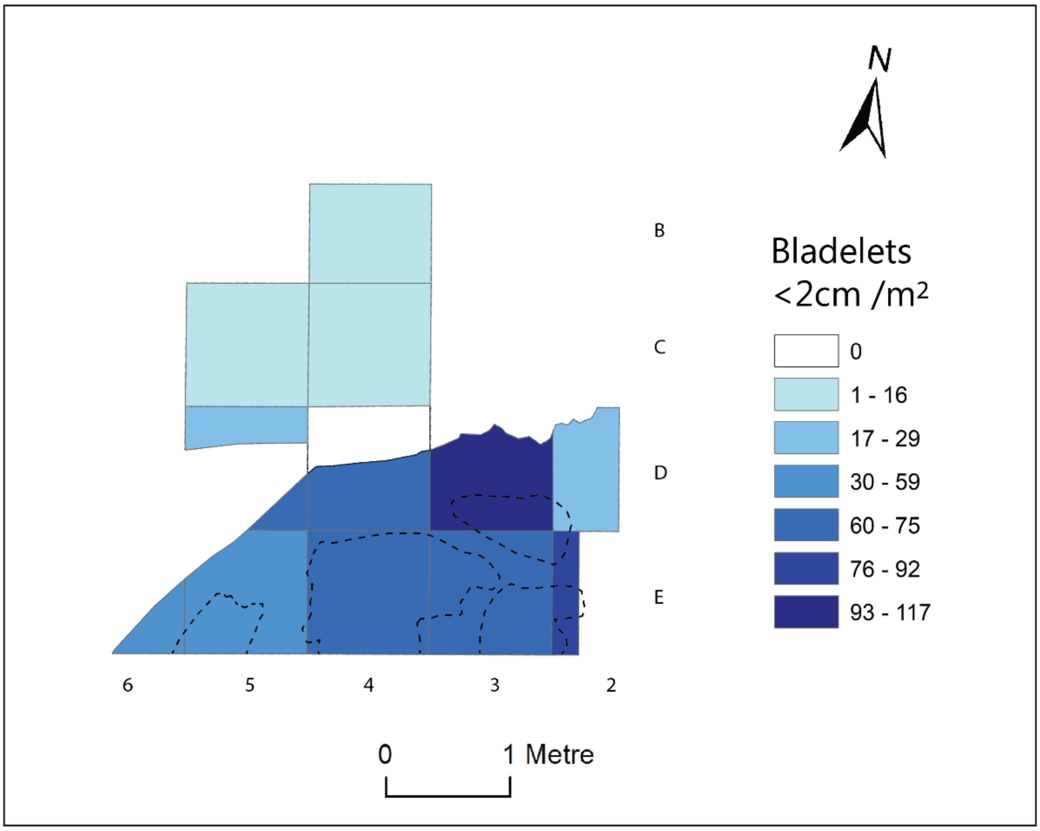


Figure 7.130: Distribution of Upper Phase 4 bladelets <2cm.

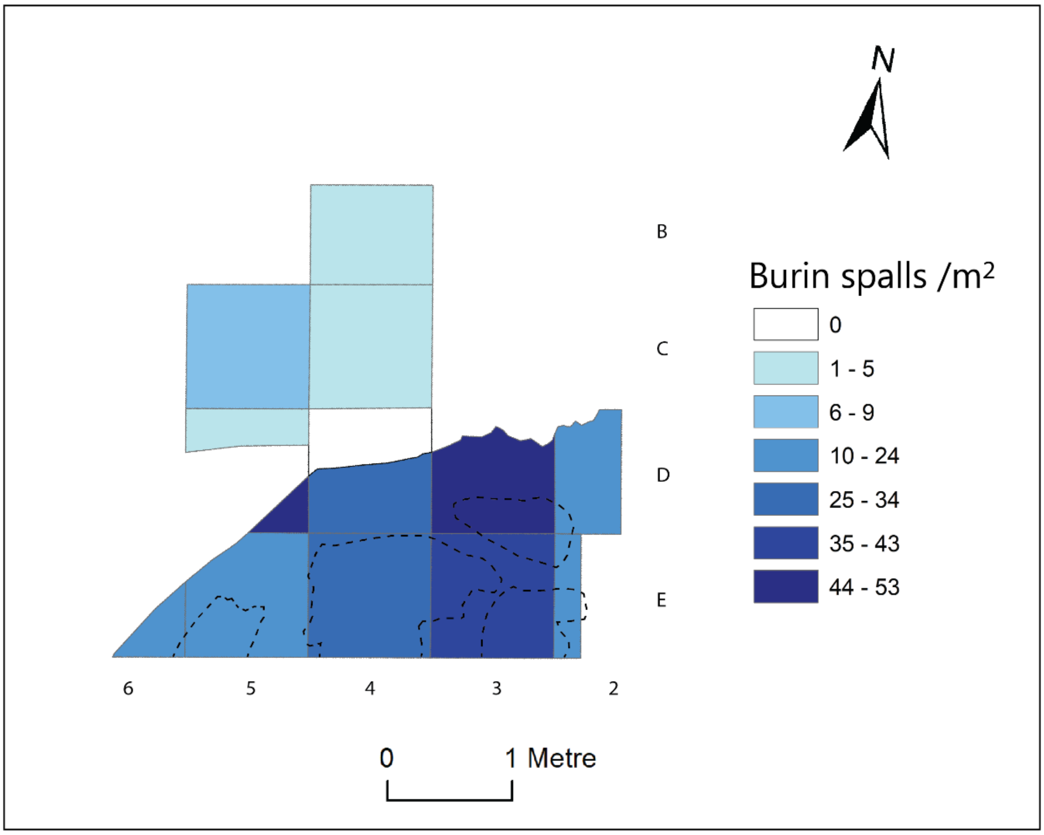


Figure 7.131: Distribution of Upper Phase 4 burin spalls.

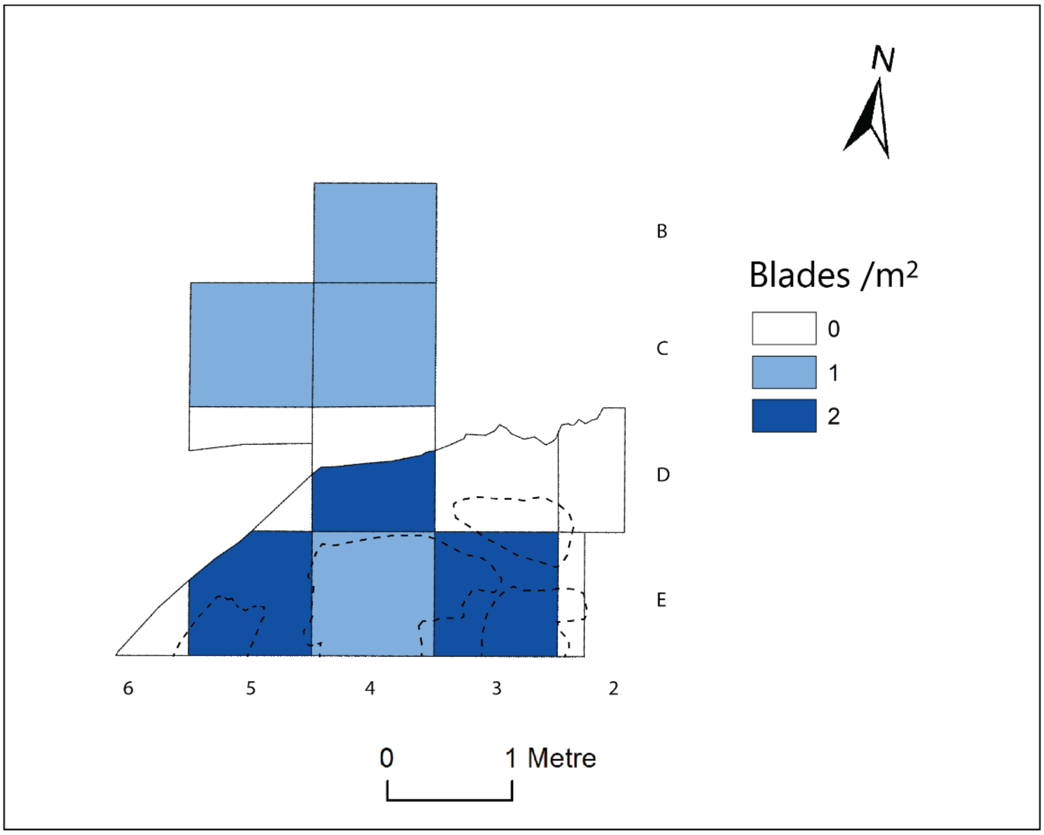


Figure 7.132: Distribution of Upper Phase 4 blades.

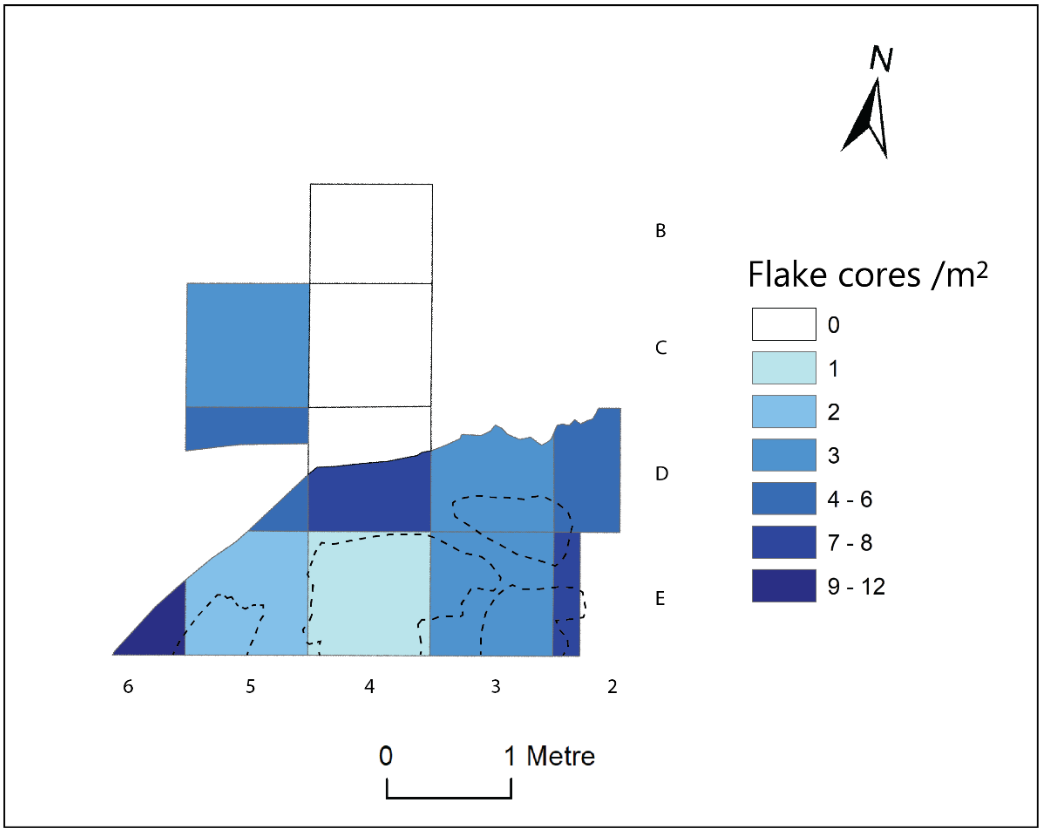


Figure 7.133: Distribution of Upper Phase 4 flake cores.

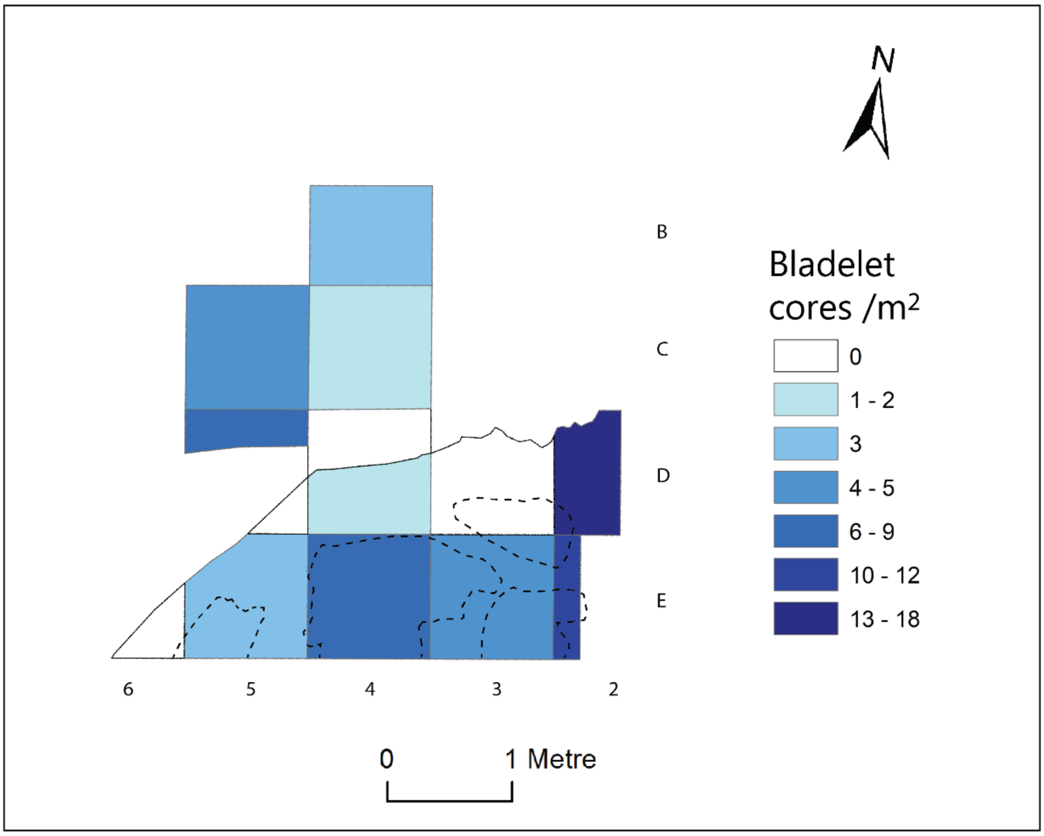


Figure 7.134: Distribution of Upper Phase 4 bladelet cores.

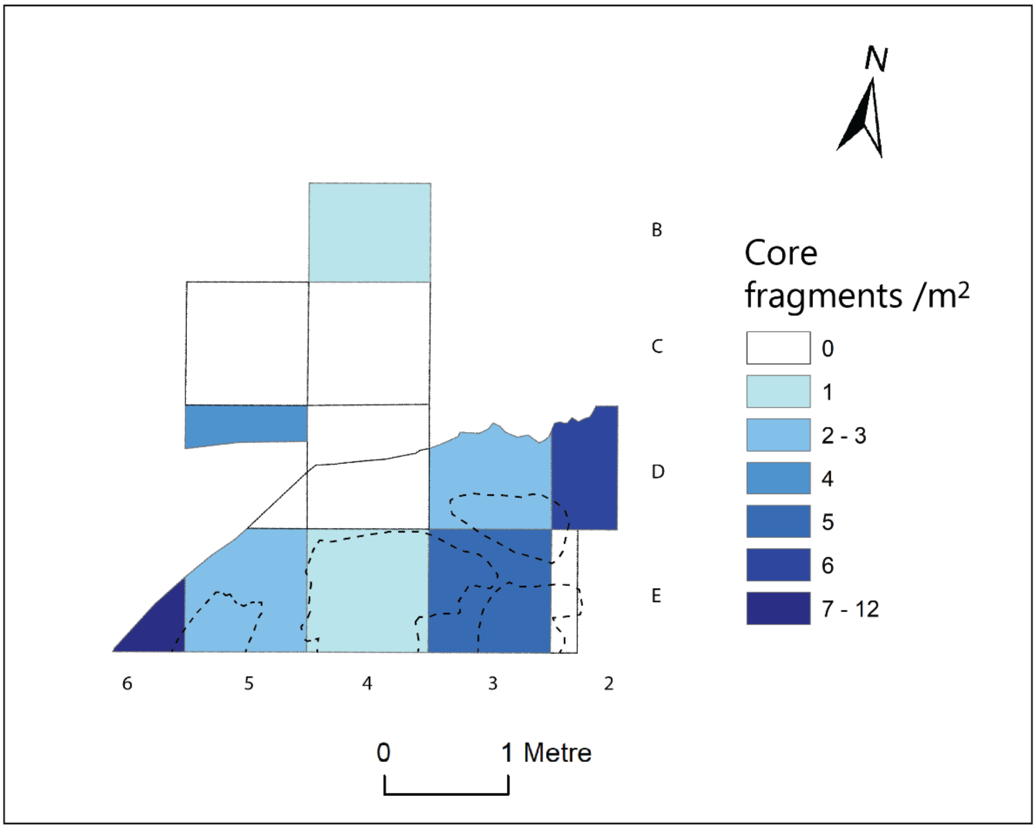


Figure 7.135: Distribution of Upper Phase 4 core fragments.

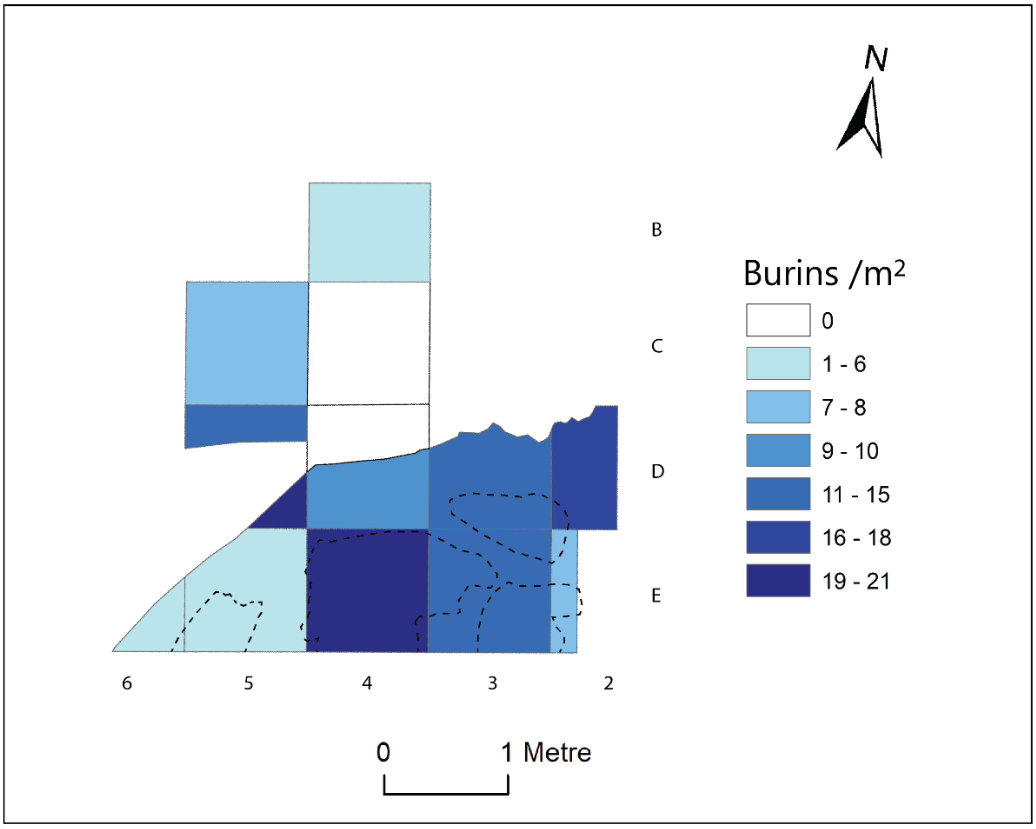


Figure 7.136: Distribution of Upper Phase 4 burins.

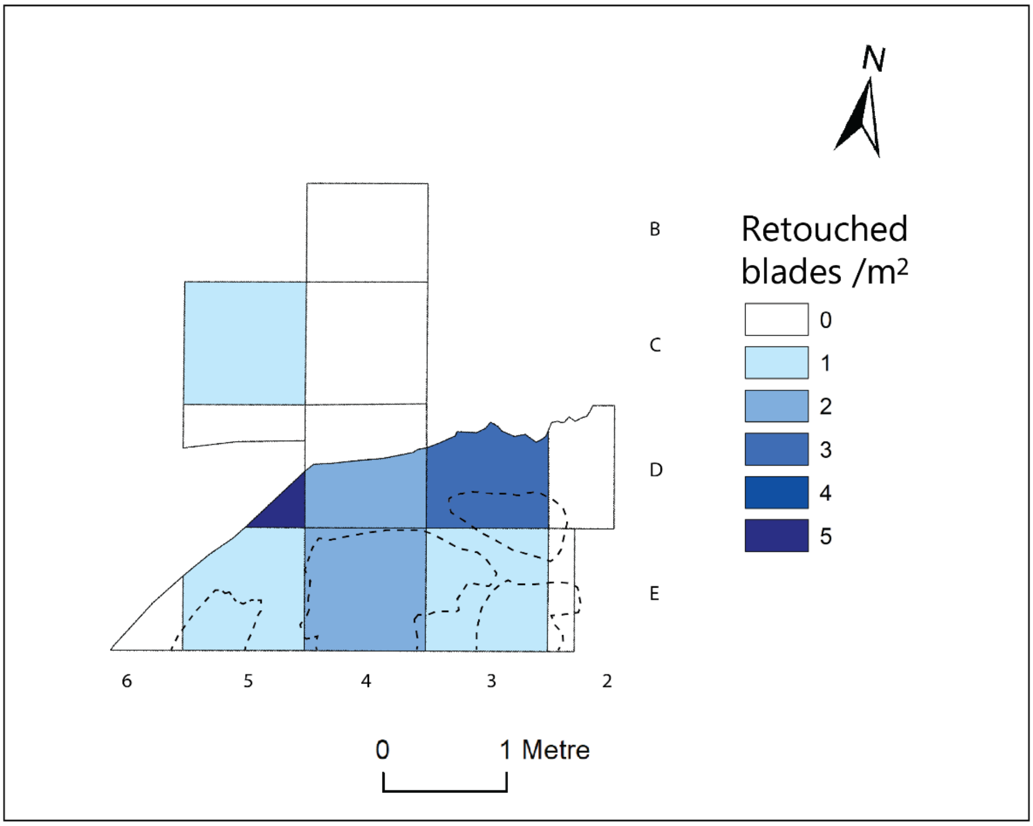


Figure 7.137: Distribution of Upper Phase 4 retouched blades.

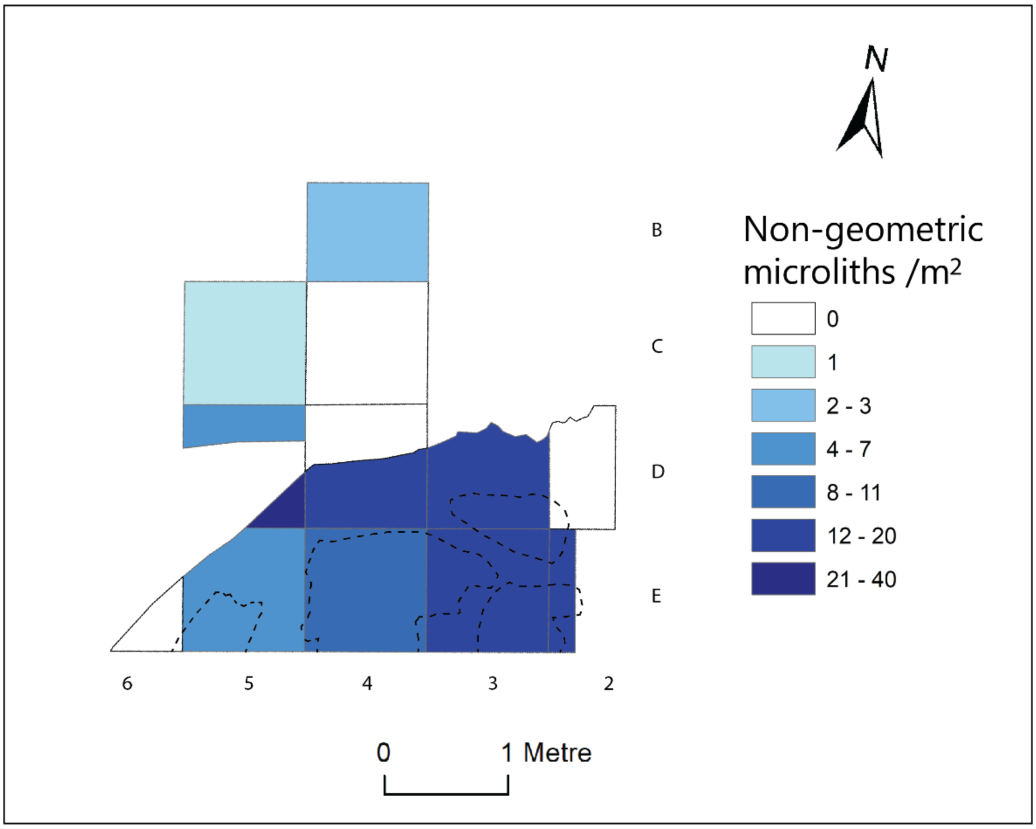


Figure 7.138: Distribution of Upper Phase 4 non-geometric microliths.

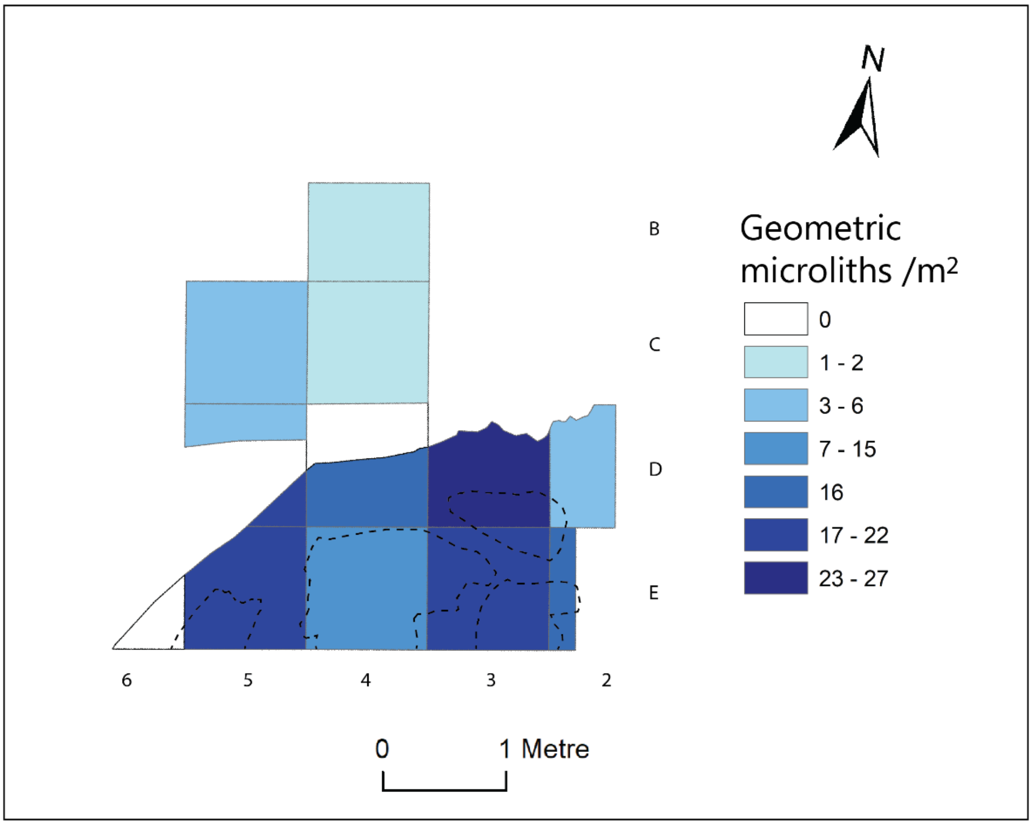


Figure 7.139: Distribution of Upper Phase 4 geometric microliths.

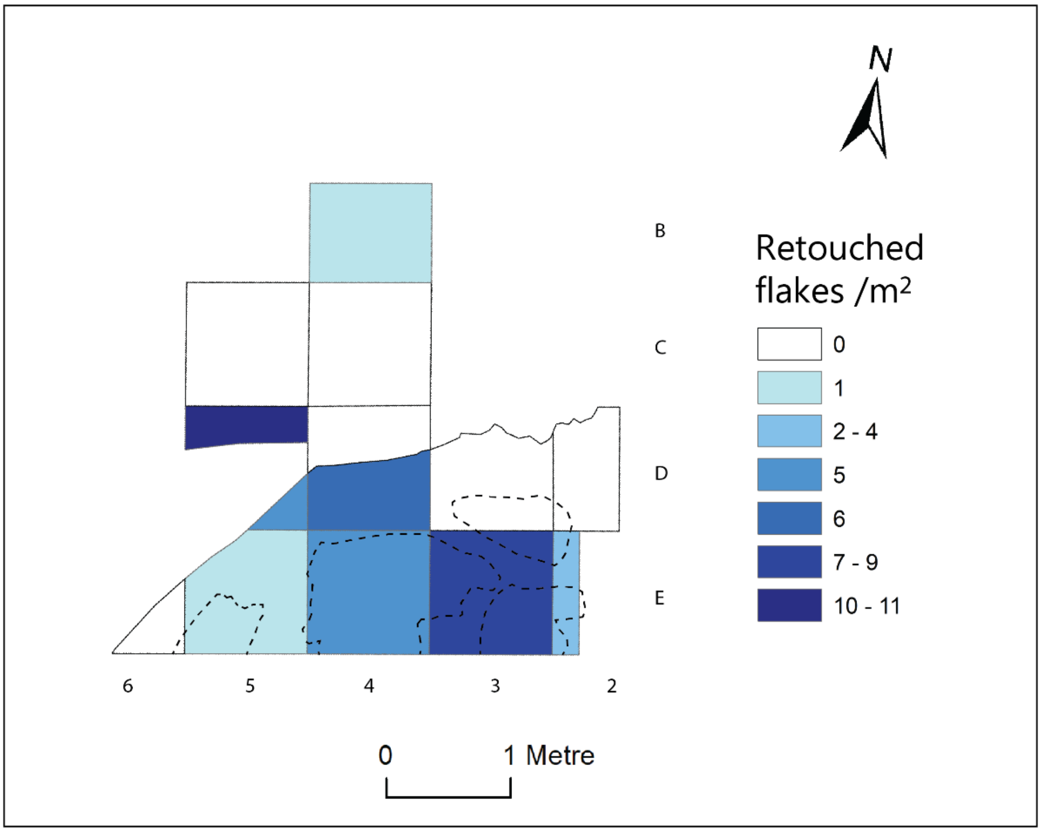


Figure 7.140: Distribution of Upper Phase 4 retouched flakes.

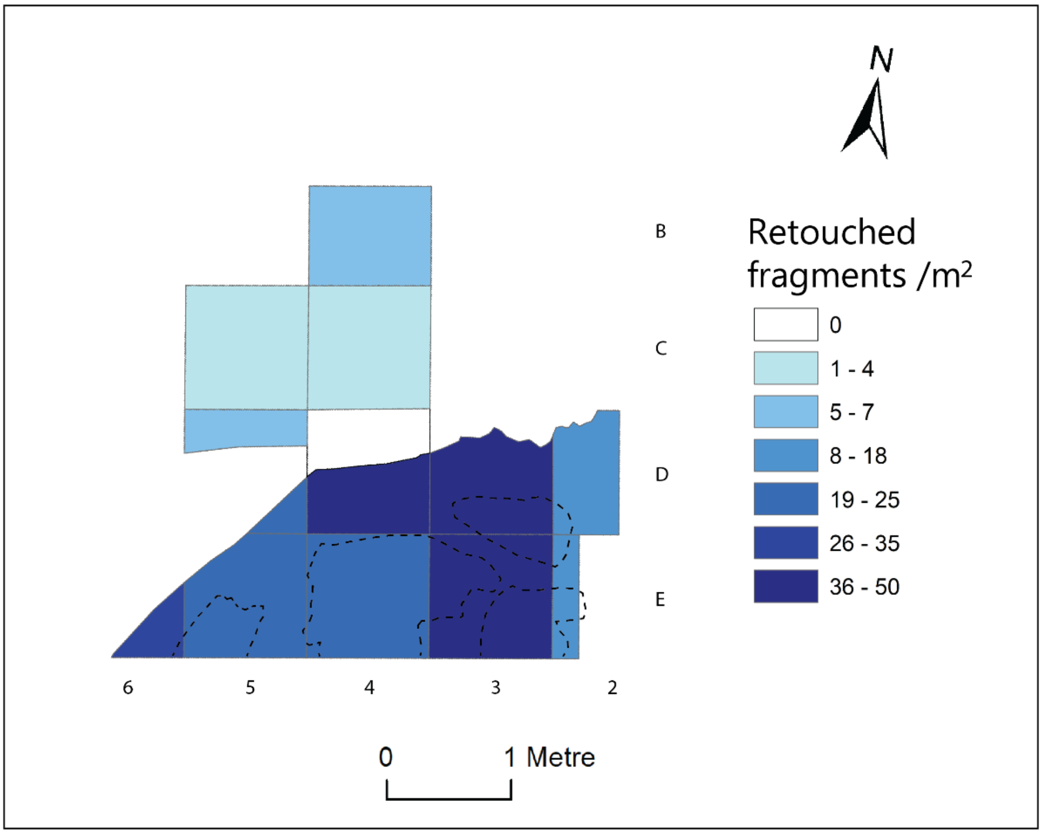


Figure 7.141: Distribution of Upper Phase 4 retouched fragments.

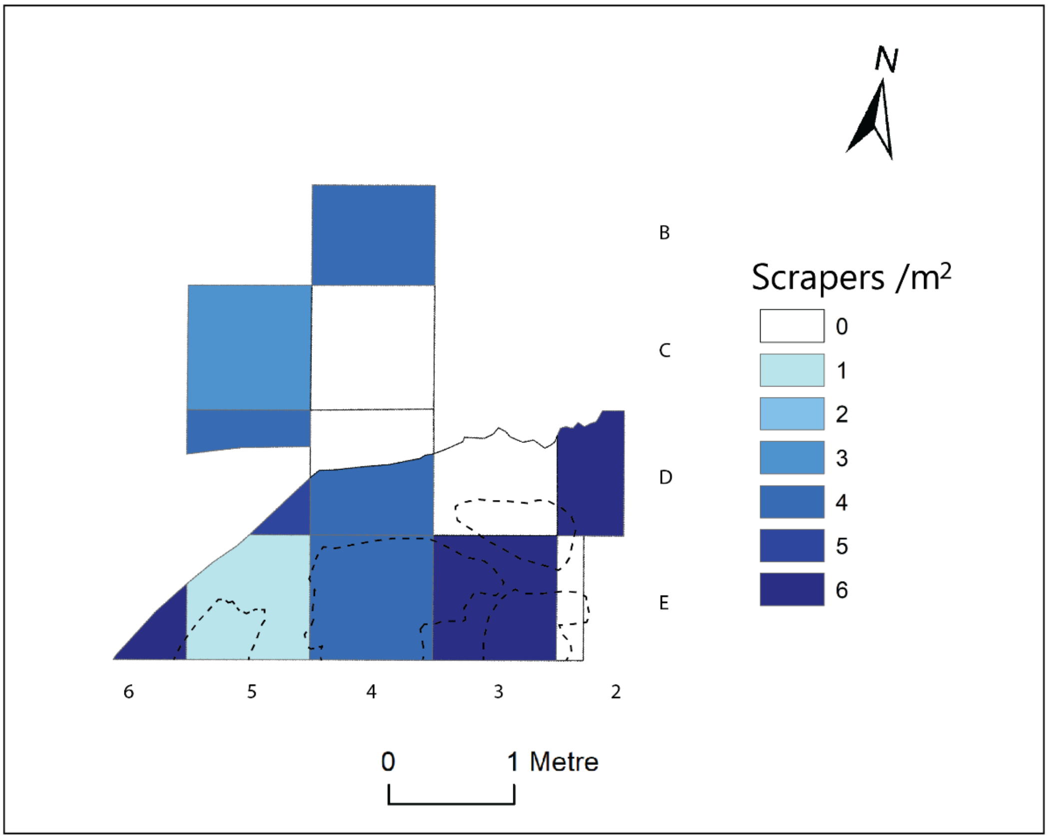


Figure 7.142: Distribution of Upper Phase 4 scrapers.

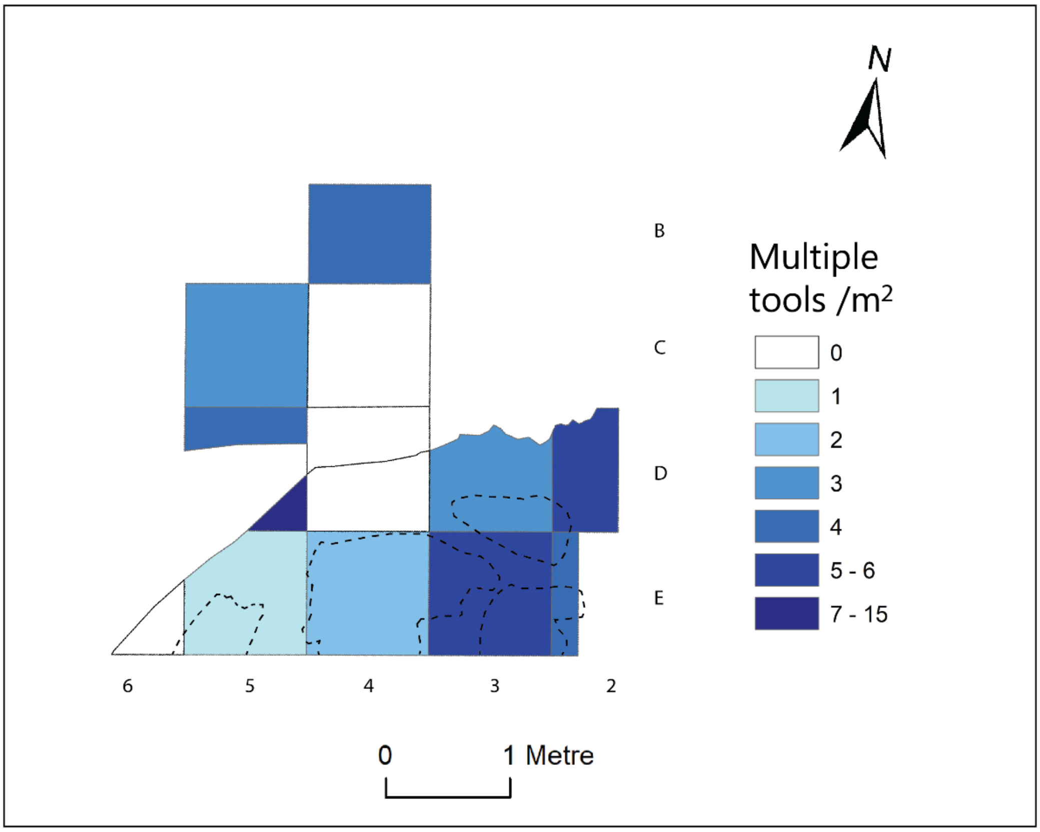


Figure 7.143: Distribution of Upper Phase 4 multiple tools.

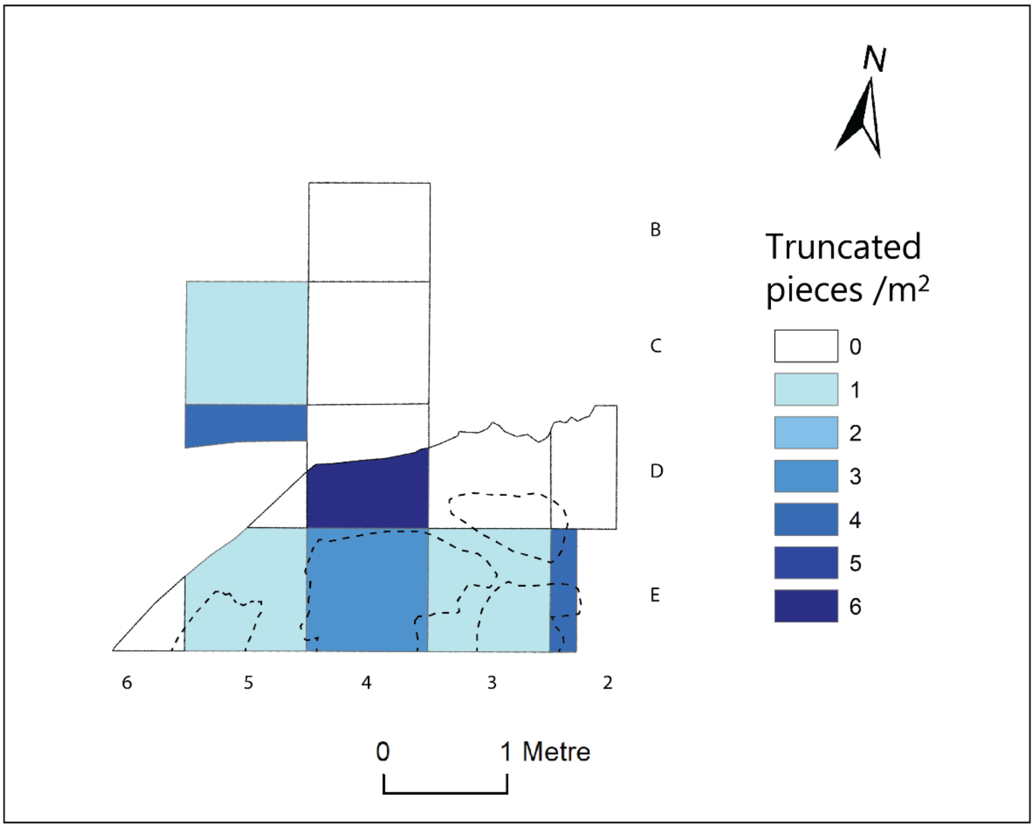


Figure 7.144: Distribution of Upper Phase 4 truncated pieces.

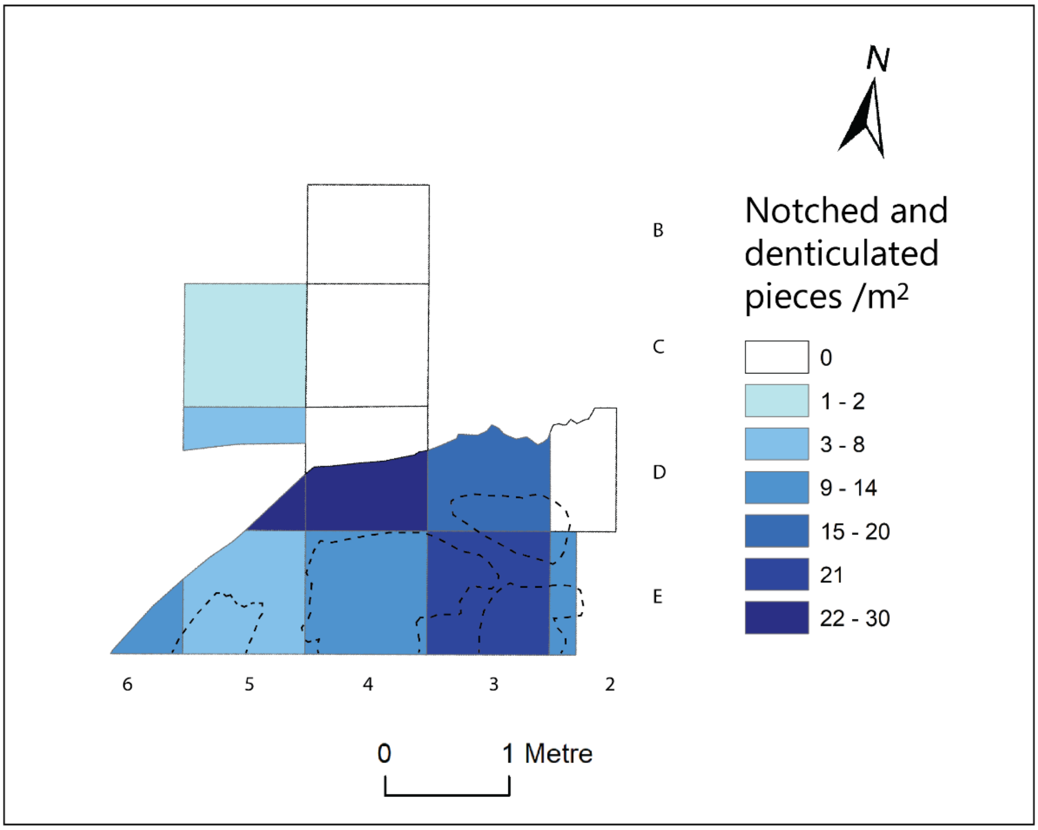


Figure 7.145: Distribution of Upper Phase 4 notched and denticulated pieces.

borers from the Upper Phase 4 deposits are deposited in separate squares in the southern Locus 8.3 deposits (**Fig. 7.146**).

7.3.4.1.3 Burnt artefact distribution

Aside from the chips, flakes <2cm (**Fig. 7.147**), broken flakes and broken blades and bladelets (**Fig. 7.148**) exhibiting slightly higher percentages of burnt artefacts towards the eastern end of Locus 8.3, little spatial patterning is evident for the Upper Phase 4 burnt artefacts, other than that the presence of burning is ubiquitous.

7.3.4.2 Faunal remains

The distributions of faunal remains by area and volume are identical to those of the lithics, being most common in the deposits overlying the Lower Phase 3 pit features (**Figs 7.149 - 7.152**).

7.3.4.3 Groundstone artefacts

The five intact groundstone artefacts are widely distributed across the Upper Phase 4 deposits, without any obvious spatial association with any of the underlying pit features (**Fig. 7.153**). In contrast, the fragmentary groundstone artefacts are largely divided between two pronounced clusters (**Fig. 7.154**). The first of these concentrations is closely associated with the deposits overlying the Feature 35 pit, whereas the second collection is situated in the north-west corner of the Locus 9.5 deposits.

7.3.4.4 Bone artefacts

The Upper Phase 4 bone artefacts are exclusively found in the southern Locus 8.3 deposits, particularly in the space situated between Features 29, 32 and 35 (**Fig. 7.155**).

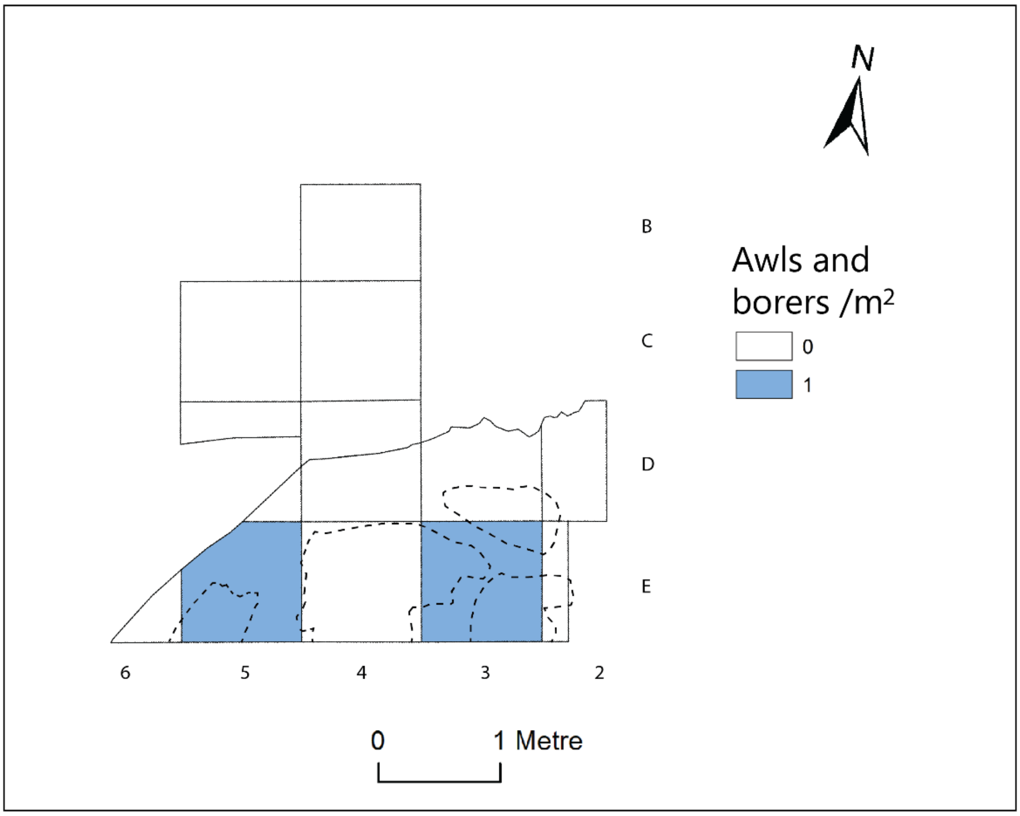


Figure 7.146: Distribution of Upper Phase 4 awls and borers.

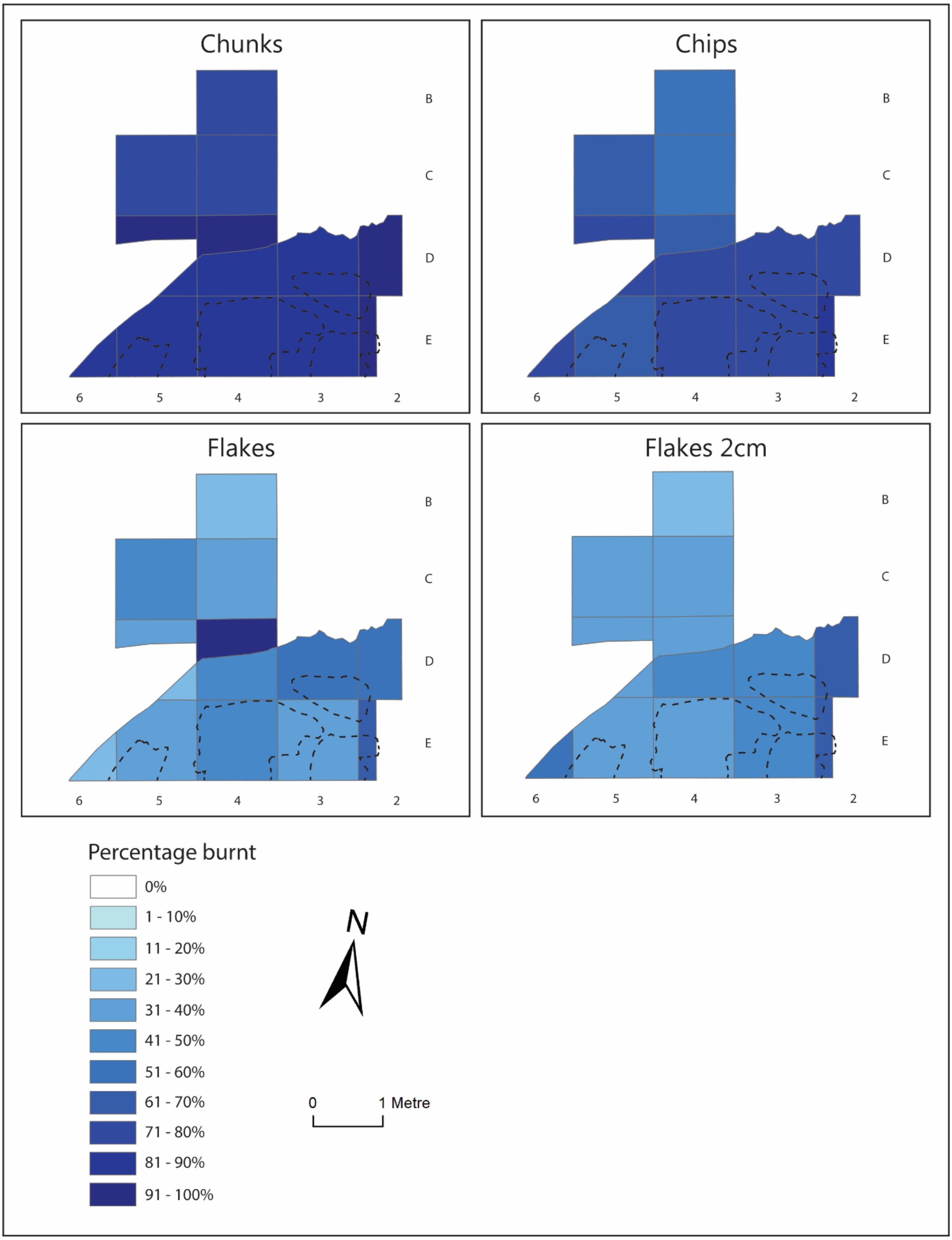


Figure 7.147: Distribution of burnt flaked stone artefacts in Upper Phase 4 (1/2).

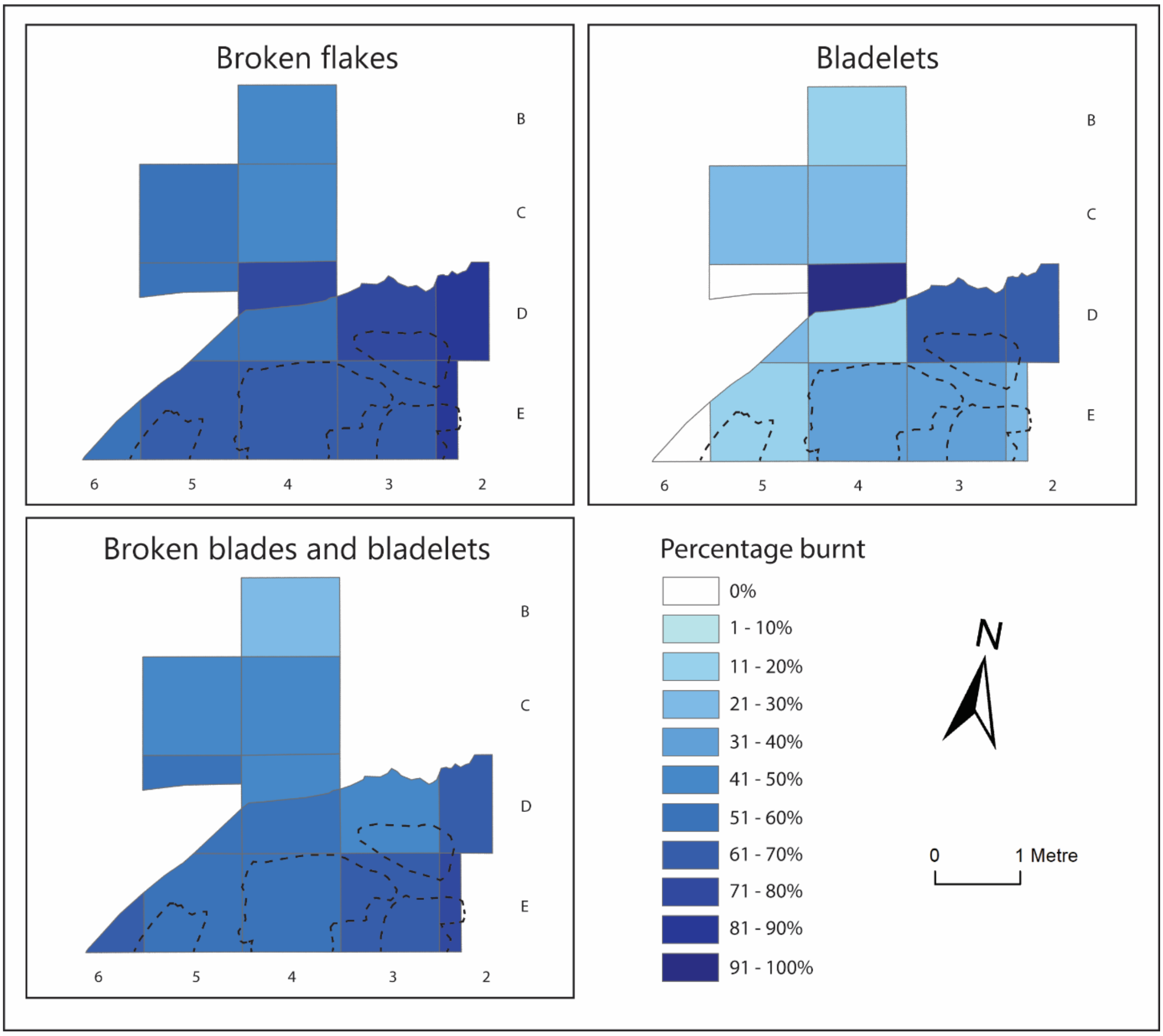


Figure 7.148: Distribution of burnt flaked stone artefacts in Upper Phase 4 (2/2).

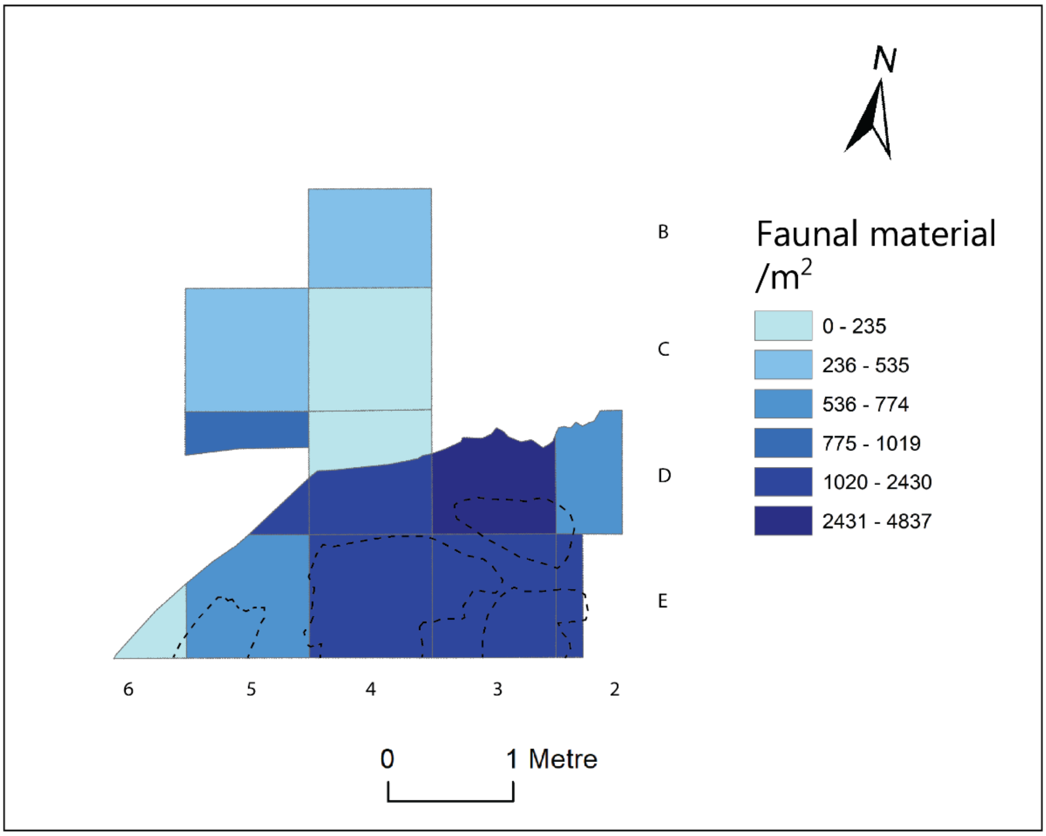


Figure 7.149: Distribution of Upper Phase 4 faunal material, by areal density.

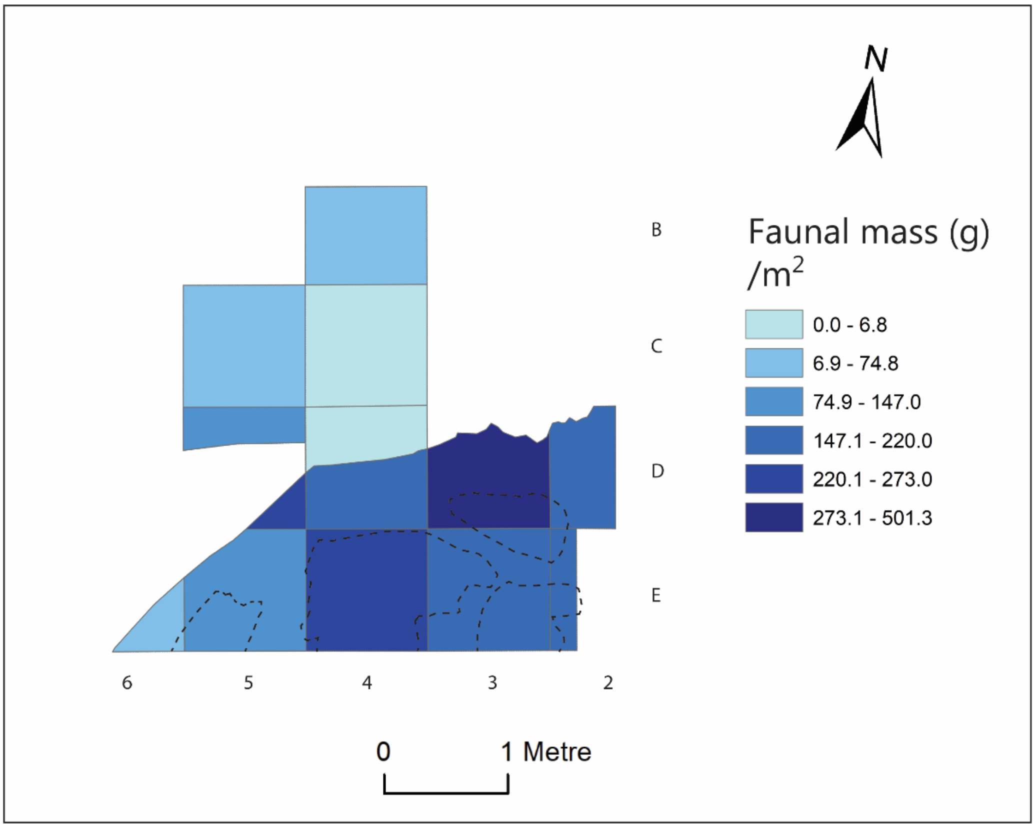


Figure 7.150: Distribution of Upper Phase 4 faunal weights, by areal density.

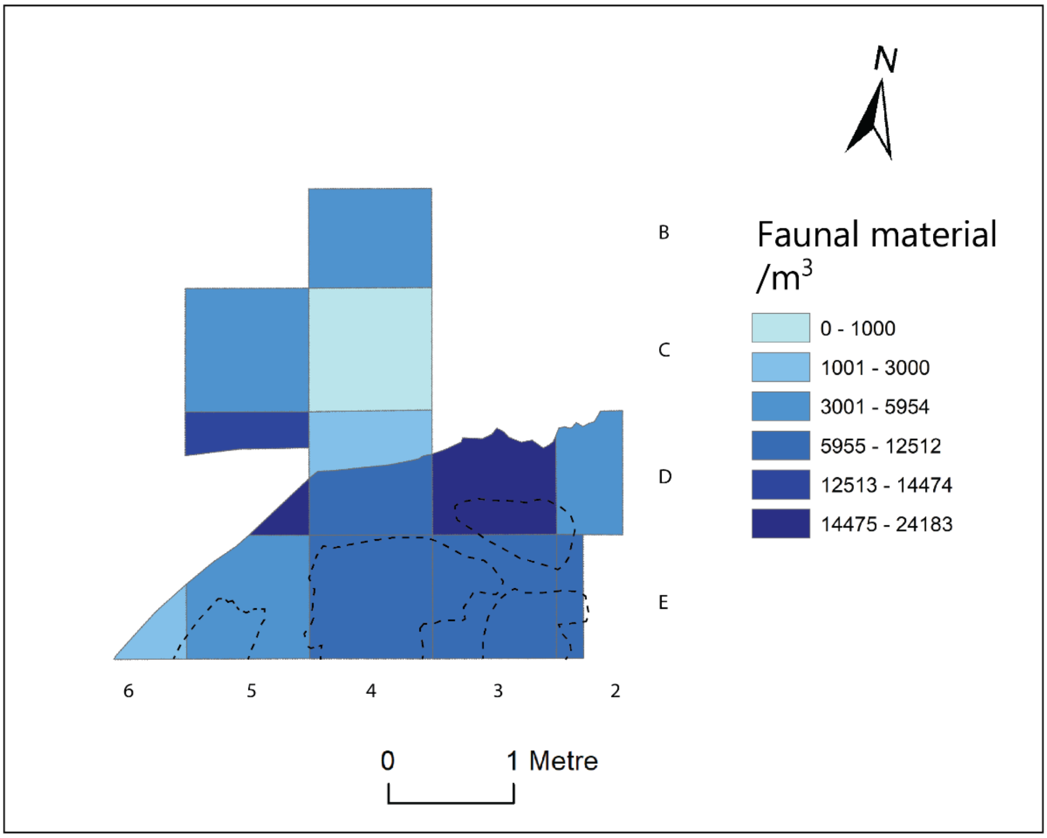


Figure 7.151: Distribution of Upper Phase 4 faunal material, by volumetric density.

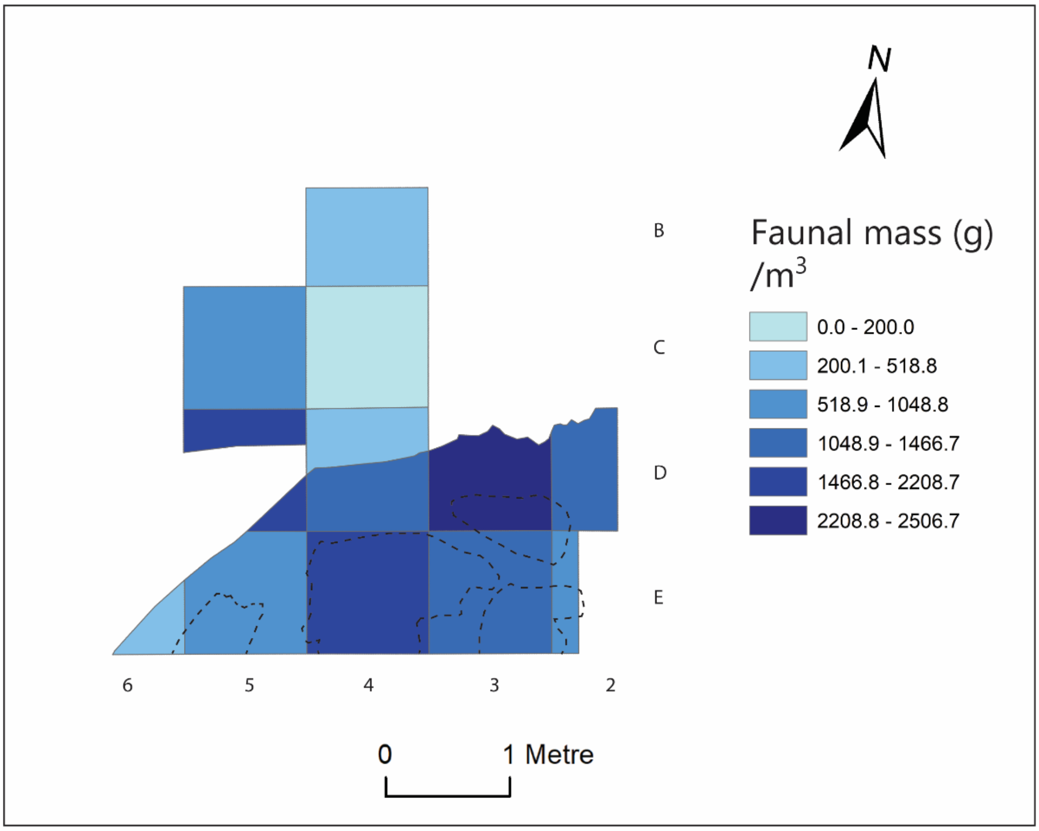


Figure 7.152: Distribution of Upper Phase 4 faunal weights, by volumetric density.

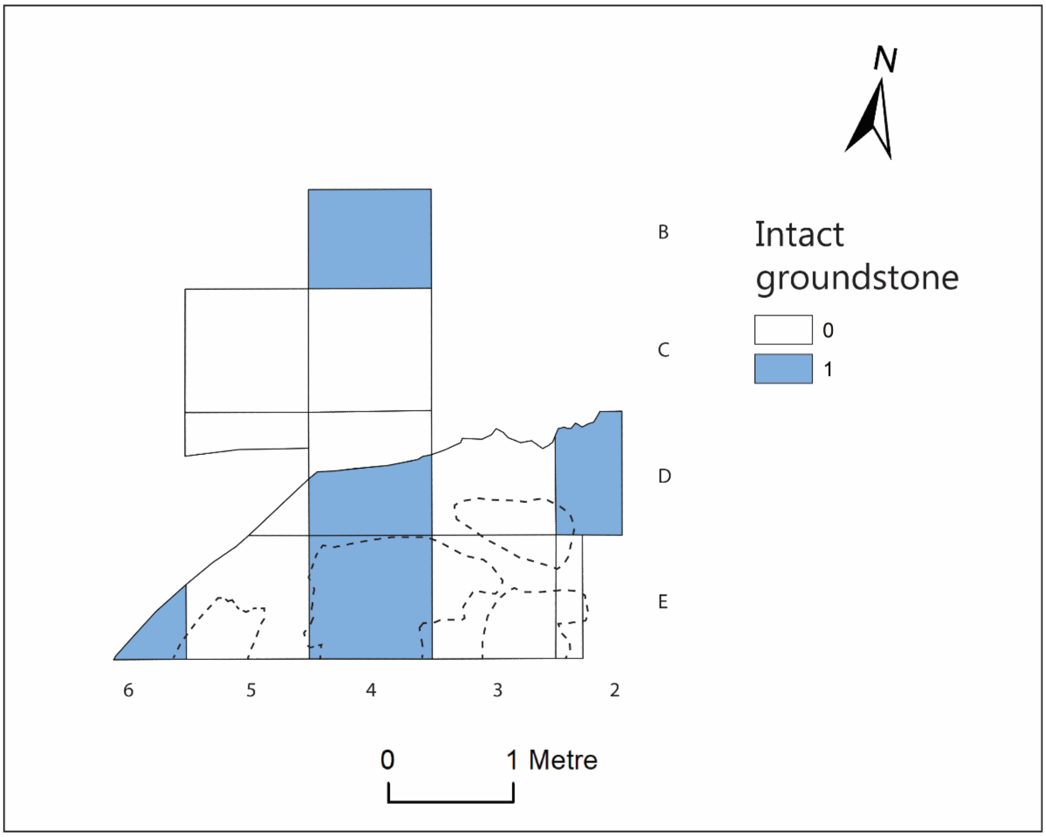


Figure 7.153: Distribution of Upper Phase 4 intact groundstone artefacts.

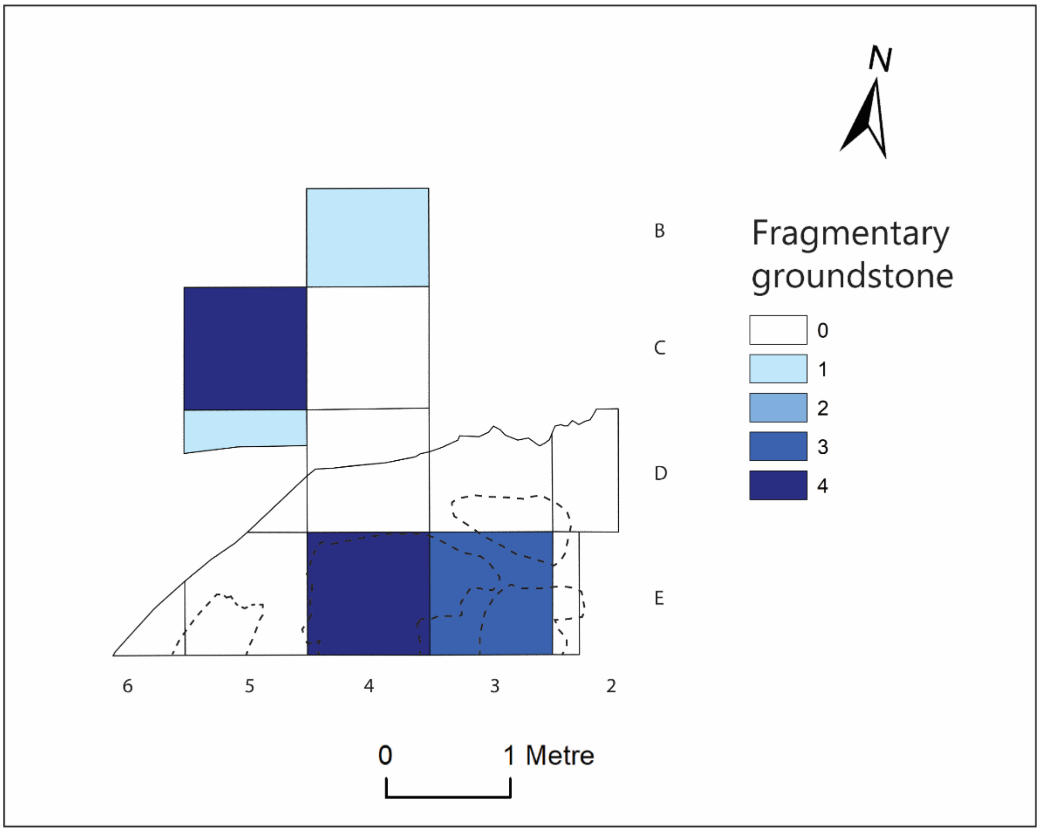


Figure 7.154: Distribution of Upper Phase 4 fragmentary groundstone artefacts.

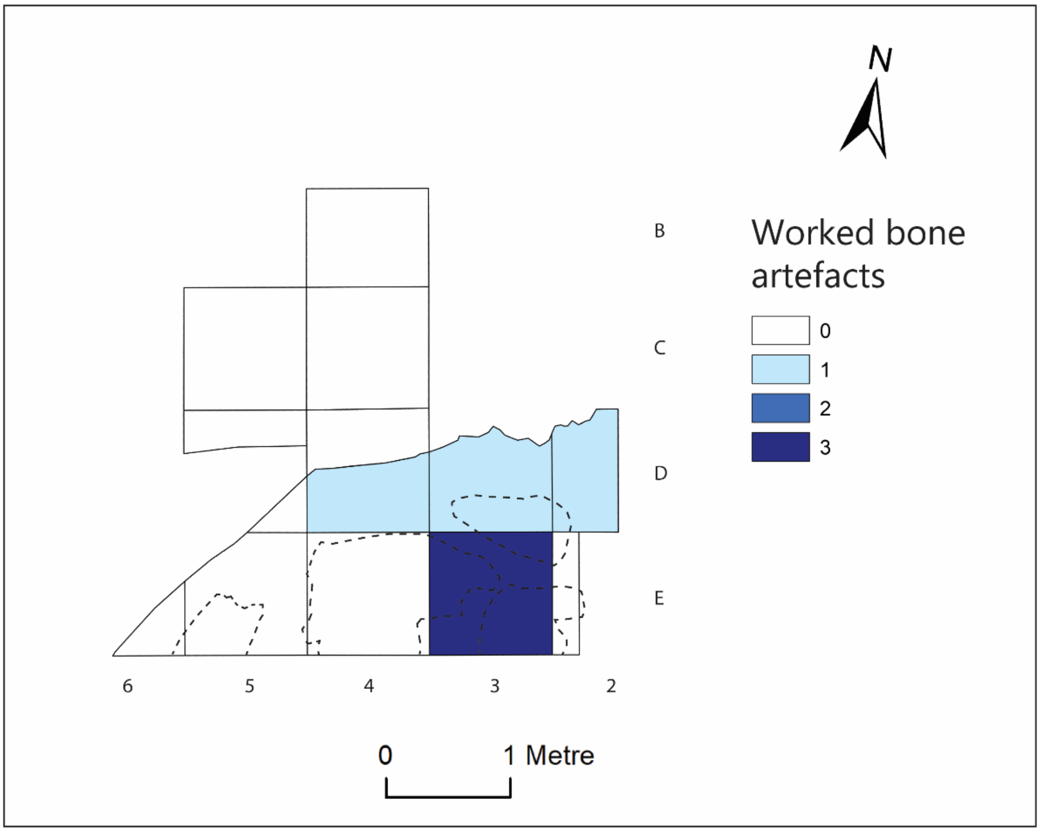


Figure 7.155: Distribution of Upper Phase 4 bone artefacts.

7.3.4.5 Scaphopod artefacts

The areal distribution of scaphopod artefacts is similar to the broken groundstone artefacts, albeit with the southern cluster extending westwards towards the edge of the XX F sondage in Square D2 (**Fig. 7.156**).

7.3.4.6 Statistical significance of Upper Phase 4 artefact distributions

An application of Pearson's r test confirmed the spatial observations made for the Upper Phase 4 assemblage. The statistical relationships between major artefacts groups remains much the same as in the Phase 2 and 3 assemblages, with the strongest correlations existing between the lithic and faunal artefacts, and the weakest relating to the groundstone artefacts (**Table 7.10**). Likewise, the core types display a high degree of disconnect with the debris and debitage, with a notable exception to this pattern being the relatively significant coefficient between bladelet cores and bladelets ($r = 0.747$; **Table 7.11**). The strongest coefficient for the Upper Phase 4 debitage types is between the broken flakes and broken bladelets ($r = 0.994$), and the weakest between the flake and bladelet cores ($r = 0.189$).

The retouched tool groups with the most pronounced statistical relationships are unsurprisingly those clustered in the southern area overlying the Lower Phase 4 pit features, with the strongest coefficients existing between the non-geometric microliths and notched and denticulated pieces ($r = 0.960$) and between the notched and denticulated pieces and retouched fragments ($r = 0.952$; **Table 7.12**). Similarly, the overall distribution of debris and debitage artefacts present the strongest coefficients with the notched and denticulated pieces ($r = 0.943$), geometric microliths ($r = 0.925$) and non-geometric microliths ($r = 0.924$). The weakest coefficients are exhibited between the artefact groups with low numbers and which deviate from overall patterns for this phase, particularly between the multiple tools and truncated pieces ($r = 0.024$).

7.3.4.7 Interpretation of Upper Phase 4 distributional data

A couple of exceptions aside, the Upper Phase 4 cultural material displays clear depositional associations with the area overlying the earlier pit features, particularly Feature 35. The lithic artefacts deposited in this space represent the same range of artefacts as exhibited in the main

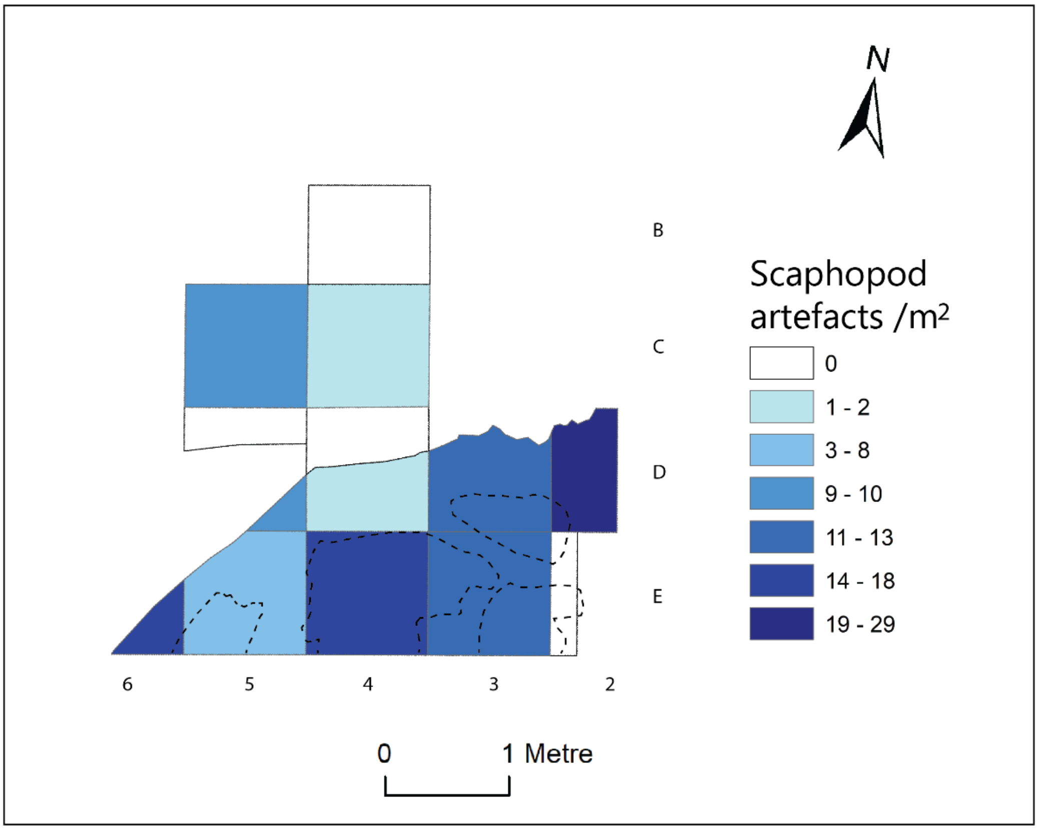


Figure 7.156: Distribution of Upper Phase 4 scaphopod (*Antalis sp.*) artefacts.

Table 7.10: Correlation coefficients (r) for the overall Upper Phase 4 (Loci 8.3 & 9.5) artefact assemblage, by excavation square.

	Flaked-stone artefacts (no)	Flaked-stone artefacts (mass)	Faunal material (no.)	Faunal material (mass)	Intact groundstone	Fragmentary groundstone	Worked-bone artefacts	Antalis fragments
Flaked-stone artefacts (no)	XXXXX							
Flaked-stone artefacts (mass)	0.954	XXXXX						
Faunal material (no.)	0.917	0.914	XXXXX					
Faunal material (mass)	0.915	0.958	0.957	XXXXX				
Intact groundstone	-0.012	0.153	-0.034	0.064	XXXXX			
Fragmentary groundstone	0.455	0.627	0.517	0.643	0.036	XXXXX		
Worked-bone artefacts	0.526	0.537	0.556	0.482	-0.026	0.201	XXXXX	
Antalis fragments	0.726	0.845	0.713	0.857	0.085	0.781	0.390	XXXXX

Table 7.11: Correlation coefficients (r) for the Upper Phase 4 flaked stone artefact assemblage, by excavation square. BBaB = Broken blades and bladelets, RA = Retouched artefacts.

	Chunks	Chips	Flakes	Flakes <2cm	Broken flakes	Blades	Bladelets	BBaB	Bladelets <2cm	Burin spalls	Flake cores	Bladelet cores	Core fragments	RA
Chunks	XXXXX													
Chips	0.930	XXXXX												
Flakes	0.965	0.943	XXXXX											
Flakes <2cm	0.963	0.963	0.989	XXXXX										
Broken flakes	0.977	0.948	0.990	0.993	XXXXX									
Blades	0.612	0.570	0.656	0.657	0.703	XXXXX								
Bladelets	0.835	0.899	0.897	0.919	0.895	0.636	XXXXX							
BBaB	0.961	0.936	0.991	0.993	0.994	0.698	0.922	XXXXX						
Bladelets <2cm	0.964	0.958	0.989	0.990	0.991	0.676	0.926	0.989	XXXXX					
Burin spalls	0.950	0.904	0.955	0.973	0.968	0.664	0.886	0.975	0.945	XXXXX				
Flake cores	0.486	0.540	0.492	0.489	0.512	0.379	0.344	0.466	0.478	0.451	XXXXX			
Bladelet cores	0.412	0.495	0.580	0.570	0.536	0.446	0.747	0.611	0.576	0.541	0.189	XXXXX		
Core fragments	0.693	0.458	0.685	0.623	0.686	0.600	0.423	0.673	0.637	0.654	0.284	0.206	XXXXX	
RA	0.940	0.919	0.967	0.977	0.978	0.696	0.876	0.977	0.952	0.980	0.518	0.540	0.682	XXXXX

Table 7.12: Correlation coefficients (r) for Upper Phase 4 retouched artefact tool groups, by excavation square. NGM = Non-geometric microliths, NaD = Notched and denticulated pieces.

	Scrapers	Multiple tools	Burins	Retouched blades	Truncated pieces	NGM	Geometric microliths	NaD	Awls and borers	Retouched flakes	Retouched fragments	Debris and debitage	Cores
Scrapers	XXXXX												
Multiple tools	0.789	XXXXX											
Burins	0.772	0.537	XXXXX										
Retouched blades	0.525	0.395	0.828	XXXXX									
Truncated pieces	0.449	0.024	0.674	0.647	XXXXX								
NGM	0.693	0.603	0.763	0.691	0.544	XXXXX							
Geometric microliths	0.605	0.467	0.761	0.723	0.494	0.842	XXXXX						
NaD	0.700	0.461	0.789	0.736	0.658	0.960	0.865	XXXXX					
Awls and borers	0.442	0.422	0.377	0.281	0.086	0.577	0.824	0.579	XXXXX				
Retouched flakes	0.812	0.593	0.776	0.474	0.542	0.878	0.718	0.866	0.539	XXXXX			
Retouched fragments	0.728	0.501	0.735	0.637	0.500	0.907	0.917	0.952	0.732	0.846	XXXXX		
Debris and debitage	0.615	0.448	0.828	0.842	0.665	0.924	0.925	0.943	0.582	0.750	0.904	XXXXX	
Cores	0.795	0.524	0.872	0.626	0.635	0.653	0.771	0.709	0.557	0.720	0.735	0.746	XXXXX

Phase 3 and 2 primary refuse clusters, suggesting that a similar range of domestic activities was carried out in this relatively limited space as in the later occupations associated with Structures 3 and 1.

At the same time, some artefacts show relatively high rates of deposition along the northern edge of Locus 9.5, particularly macrolithic tools such as scrapers, burins and multiple tools. Whilst highly reminiscent of similar clusters of bulky artefacts seen in the subsequent Lower and Upper Phase 3 deposits, it is much more difficult to rationalise this pattern as toss-zone refuse for Upper Phase 4 due to the absence of obvious domestic architecture.

7.3.5 Lower Phase 4

The various Lower Phase 4 pit deposits are all too isolated and horizontally restricted for the density plots utilised in the overlying deposits to be of much value in identifying distributional patterns. This issue is further complicated by the fact that Features 20, 29, 31 and 32 were each excavated in spits as single units, disregarding the square metre plots utilised in the overlying phases. As such, investigations into the spatial distribution of the Lower Phase 4 flaked stone artefact assemblages have been conducted solely on an inter-locus basis presented in tabular fashion.

7.3.5.1 Lithic debris, debitage and cores

Aside from the few notable variations, the overall compositions of the various Lower Phase 4 assemblages are consistent with the successive phases, indicating that these deposits are reflective of a similar domestic occupation predating the establishment of Structure 3 (**Table 7.13**). Some variations between these pit deposits are worth noting, however. While still comprising over half of the assemblage numerically (58.2%), the proportion of chips in the Locus 9.4 deposits associated with Feature 20 are notably low, both in comparison to the other Lower Phase 4 loci and the successive occupational phases. In contrast, the deposits inside the Feature 29 double burial feature the highest proportion of chips (75.7%) out of any of the loci sampled during the 2014-16 excavations at Wadi Hammeh 27. The proportions of debitage types in both loci are nonetheless relatively consistent with the rest of the strata at the site. Finally, the Locus 8.6 fill within Feature 32 exhibits the highest percentage of retouched artefacts (2.8%) from Wadi Hammeh 27.

Table 7.13: Proportions of flaked stone artefact types between major Lower Phase 4 loci.

	Locus 8.5 (F .29)		Locus 8.6 (F. 32)		Locus 8.8 (F. 31)		Locus 8.9 (F. 35)		Locus 9.4 (F. 20)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Debris										
Chunks	213	3.2	116	4.3	38	4.6	635	5.1	158	7.2
Chips	5,069	75.7	1,763	64.8	533	64.3	8,517	68.0	1,279	58.2
Sub-total	**5,282**	**78.8**	**1,879**	**69.0**	**571**	**68.9**	**9,152**	**73.1**	**1,437**	**65.3**
Debitage										
Flakes	73	1.1	64	2.4	18	2.2	229	1.8	52	2.4
Flakes (<2cm)	585	8.7	257	9.4	78	9.4	1,233	9.9	257	11.7
Broken flakes	282	4.2	162	6.0	61	7.4	724	5.8	157	7.1
Blades	0	0.0	2	0.1	2	0.2	2	0.0	0	0.0
Bladelets	16	0.2	28	1.0	8	1.0	63	0.5	19	0.9
Broken blades & bladelets	287	4.3	182	6.7	50	6.0	713	5.7	189	8.6
Bladelets (<2cm)	48	0.7	25	0.9	9	1.1	118	0.9	28	1.3
Core trimming elements	11	0.2	18	0.7	5	0.6	42	0.3	6	0.3
Burin spalls	15	0.2	21	0.8	4	0.5	49	0.3	13	0.6
Microburin byproducts	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0
Sub-total	**1,317**	**19.7**	**759**	**27.9**	**235**	**28.3**	**3,174**	**25.4**	**721**	**32.8**
Cores	6	0.1	7	0.3	8	1.0	23	0.2	6	0.3
Tools	64	1.0	77	2.8	15	1.8	167	1.3	35	1.6
No. of artefacts	**6,669**		**2,722**		**829**		**15,516**		**2,199**	

Table 7.14: Proportions of cores between major Lower Phase 4 loci.

	Locus 8.5 (F .29)		Locus 8.6 (F. 32)		Locus 8.8 (F. 31)		Locus 8.9 (F. 35)		Locus 9.4 (F. 20)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Flake cores	2	33.3	1	14.3	3	37.5	10	43.5	2	33.3
Blade cores	0	0.0	0	0.0	0	0.0	1	4.3	0	0.0
Bladelet cores	3	50.0	6	85.7	2	25.0	6	26.1	0	0.0
Core fragments	1	16.7	0	0.0	3	37.5	6	26.1	4	66.7
No. of artefacts	**6**		**7**		**8**		**23**		**6**	

The proportions of cores in each pit are low, although they once nevertheless again display a high degree of typological variation (**Table 7.14**). Locus 8.5 contains a relatively even mixture between flake and bladelet cores, whereas the neighbouring Locus 8.6 deposits demonstrate a clear preference towards bladelet cores. Conversely, the Locus 8.9 deposits associated with Feature 35 contain a higher number of flake cores, while the Locus 9.4 fill within Feature 20 presents an unusually high proportion of core fragments.

7.3.5.2 Retouched artefacts

The tool group proportions notably vary between different Lower Phase 4 loci (**Table 7.15**). The Feature 29 double burial is accompanied by a broad range of retouched pieces, with relatively high proportions of multiple tools, awls and borers and retouched fragments compared to the other Phase 4 loci, and fewer scrapers and notched and denticulated pieces. The neighbouring Feature 32 pit is conversely represented by above-average proportions of burins, geometric microliths and awls and borers, whereas scrapers, non-geometric microliths and retouched fragments are less common. The Feature 20 tool assemblage is mostly characterised by geometric and non-geometric microliths, as well as notched and denticulated pieces, while burins are scarce. Finally, the Locus 8.9 tool assemblage is similar in composition to the overlying domestic deposits.

7.3.5.3 Burnt artefact distribution

The percentage of burnt artefacts remains largely consistent across the Lower Phase 4 deposits (**Table 7.16**). While the Locus 9.4 fill exhibits the highest percentages of burnt debris, the proportions remain consistent of burnt debitage types remained consistent with the other loci. The Feature 32 fill contains the lowest overall percentage of burnt artefacts out the assemblages catalogued from the 2014-16 excavations.

7.3.5.4 Interpretation of Lower Phase 4 distributional data

While some minor discrepancies are evident, the various Lower Phase 4 pit features are all accompanied by flaked stone assemblages reminiscent of a similar range of activities as the subsequent Upper Phase 4 deposits and those associated with the occupation of Structure 3.

Table 7.15: Proportions of retouched artefacts between major Lower Phase 4 loci.

	Locus 8.5 (F. 29)		Locus 8.6 (F. 32)		Locus 8.8 (F. 31)		Locus 8.9 (F. 35)		Locus 9.4 (F. 20)	
	No.	%	No.	%	No.	%	No.	%	No.	%
Scrapers	1	1.6	1	1.3	2	13.3	10	6.0	1	2.9
Multiple tools	6	9.4	5	6.5	2	13.3	8	4.8	1	2.9
Burins	10	15.6	15	19.5	2	13.3	23	13.8	3	8.6
Retouched blades	0	0.0	2	2.6	1	6.7	2	1.2	0	0.0
Truncations	2	3.1	3	3.9	0	0.0	4	2.4	1	2.9
Non-geometric microliths	7	10.9	6	7.8	0	0.0	18	10.8	6	17.1
Geometric microliths	7	10.9	15	19.5	2	13.3	24	14.4	7	20.0
Notches & denticulates	5	7.8	10	13.0	0	0.0	16	9.6	6	17.1
Awls and borers	2	3.1	3	3.9	0	0.0	3	1.8	1	2.9
Bifacial tools	1	1.6	0	0.0	0	0.0	1	0.6	0	0.0
Retouched flakes	3	4.7	2	2.6	3	20.0	9	5.4	1	2.9
Fragments	20	31.3	13	16.9	2	13.3	48	28.7	8	22.9
Informal tools	0	0.0	2	2.6	1	6.7	1	0.6	0	0.0
No. of artefacts	**64**		**77**		**15**		**167**		**35**	

Table 7.16: Percentages of burnt flaked stone artefacts between major Lower Phase 4 loci.

	Locus 8.5 (F .29)	Locus 8.6 (F. 32)	Locus 8.8 (F. 31)	Locus 8.9 (F. 35)	Locus 9.4 (F. 20)
Debris					
Chunks	85.0	83.6	78.9	89.8	88.6
Chips	70.0	63.5	60.4	68.4	72.2
Sub-total	**70.6**	**64.7**	**61.6**	**69.8**	**83.1**
Debitage					
Flakes	38.4	14.1	27.8	37.1	28.8
Flakes (<2cm)	43.1	32.3	26.9	41.0	41.2
Broken flakes	64.2	51.2	42.6	58.4	56.1
Blades	-	0.0	0.0	50.0	-
Bladelets	18.8	28.6	25.0	28.6	15.8
Broken blades & bladelets	52.3	42.9	54.0	52.5	52.4
Bladelets (<2cm)	35.4	28.0	11.1	24.6	21.4
Core rotation elements	54.5	33.3	0.0	42.9	40.8
Burin spalls	33.3	42.9	25.0	40.8	7.7
Microburin byproducts	-	-	-	0.0	-
Sub-total	**48.7**	**37.3**	**35.3**	**46.4**	**44.4**
Cores	0.0	0.0	37.5	26.1	33.3
Tools	28.1	33.8	33.3	40.7	31.4
Total	**65.8**	**56.0**	**53.4**	**63.4**	**63.5**

This situation is most notable in the case of the Feature 29 double burial, lending further evidence towards the idea that a significant domestic occupation already existed at the site when this grave was originally backfilled.

The overall percentage of lithics displaying evidence of burning in Feature 20 is not particularly high when compared elsewhere onsite, an interesting find given the large amount of burnt sediment present in this pit. This being said, the percentage of burnt debris is notably high compared with the other Phase 4 loci, suggesting that a relatively greater proportion of the debitage and retouched tools were deposited within this pit after it ceased being utilised for its original combustive function.

7.4 Conclusions

Each phase at Wadi Hammeh 27 is accompanied by dense primary refuse deposits. The application of a combination of spatial analytical methods at Wadi Hammeh 27 has proven effective, with the visual distributions being consistently confirmed through statistical means. While Rosen (2000) may indeed be correct that activity areas will overlap within core areas of domestic settlements, the differentiation in certain artefact types at Wadi Hammeh 27 nonetheless indicates that a degree of spatial segregation in artefact deposition nonetheless remains detectable, even in the dense, midden-like deposits of an Early Natufian architectural site. This aspect is most prominent in the varying distributions of different core types, along with that of certain tool groups such as scrapers, indicating that the relocation of tools and exhausted cores is detectable against the backdrop of debris and debitage waste. Furthermore, the consistent clustering of certain artefact types together suggests a degree of permanence not only in how architecture built at Wadi Hammeh 27, but how activities were carried out spatially in relation to it.

Having thus completed the data analysis portion of this thesis, the discussion may now turn to the application of broader theoretical considerations explain to the archaeological sequence at Wadi Hammeh 27. To begin with, the various diachronic patterns that have been identified are summarised more concisely in the following chapter, before being measured against existing models of technological and cultural change.

Chapter 8: Elucidating the nature of change at Wadi Hammeh 27: statistical and theoretical applications

8.1 Introduction

The flaked stone artefact data detailed between Chapters 4 and 6 have revealed a complex series of changes over time in many variables. This chapter aims to present these patterns in a more concise fashion, in order to interpret their nature and significance through a combination of statistical and theoretical means, in the latter case utilising the models of cultural change discussed in Chapter 2. The statistical significance of the changes of each attribute were tested in Microsoft Excel using a basic one-way Analysis of Variance (ANOVA) model with an alpha level of 0.05.

8.2 Patterns of typological and attribute change at Wadi Hammeh 27

The patterns of technological change exhibited at Wadi Hammeh 27 take numerous trajectories and can be categorised within the following seven categories: progressive increase, punctuated increase, progressive decline, punctuated decline, lenticular, sinuous and stochastic/unpatterned.

8.2.1 Patterns of gradual increase

Mean bladelet thickness and mass increase between Phase 4 and Phase 2 to an such an extent that both changes are statistically significant (**Table 8.1**). The proportions of flakes featuring acute platform angles also decline between Phase 4 and 2, being replaced by flakes with 90˚ platform angles. This escalation in flake platform angles is also statistically significant (P = 0.002839). The average bladelet platform angle similarly rises enough in the later assemblages for the overall change in platform angle between Phase 4 and 2 to be statistically significant (P = 0.002752).

Instances of artefact types gradually increasing over time in a more-or-less incremental fashion are uncommon at Wadi Hammeh 27. The only examples of debitage types exemplifying this pattern are the microburin by-products (**Fig 8.1**), the proportions of which

Table 8.1: Table of single factor Anova p-values for debitage artefacts between Phase 4 and 2.

	Flakes		Blades		Bladelets	
	P-value	H_1	*P-value*	H_1	*P-value*	H_1
Length	0.243425	No	0.157290	No	0.189186	No
Width	0.094554	No	0.485909	No	0.446016	No
Thickness	0.809416	No	0.100247	No	0.039818	**Yes**
Weight	0.407689	No	0.032228	**Yes**	0.021034	**Yes**
Platform angle	0.002839	**Yes**	0.488677	No	0.002752	**Yes**
Cortex %	0.416955	No	0.671690	No	0.362537	No
Dorsal scar no.	0.028506	**Yes**	0.734180	No	0.385271	No

remain marginal in any case. Likewise, burins are the only tool group to exhibit this pattern, while the bladelet cores present a similar pattern only after Upper Phase 3 (**Fig. 8.2**). The shares of the multiple platform type likewise increase amongst the flake cores between Phases 4 and 2, with the final Phase 1 flake core sample being too small to be compatible (N = 5).

In contrast with the limited incremental typological shifts, comparatively high numbers of artefact attributes display a steady increase over time. Amongst the debitage attributes, the fractions of rectangular flakes evidence a gradual upturn over time, as do the bladelets with hinged terminations and triangular cross-sections (**Fig. 8.1**). Several tool attributes likewise demonstrate a progressive increase between Phases 4 and 2, as exemplified by the proportions of scrapers with unidirectional scar orientations (**Fig. 8.2**), multiple tools with change of orientation scar layouts, burins on bladelet blanks, unidirectional burin orientations and unidirectional geometric microlith scar orientations (**Fig. 8.3**).

Several possible correlations may be drawn between the types and attributes within this group alone. Firstly, the marginal rise in microburin by-products occurs alongside the increasing emphasis on bladelet cores in later phases, an unsurprising find given that the microburin technique is generally associated with bladelet blanks in a Natufian context (Henry 1974: 391). The increase in rectangular flakes may likewise be correlated with the rise in bladelet cores, with the majority of flakes falling into this category likely being gracile, bladelet-like pieces produced alongside the targeted bladelet blanks. Finally, the rise in small burins on bladelet blanks can also be correlated with the increased significance in bladelet production.

Even though the majority of scrapers, burins and multiple tools were manufactured from flake blanks, the surge of multiple platform flake cores seemingly had no effect on the composition of blank attributes for these tools. This aspect is telling, indicating that the majority of pieces belonging to these tool groups were consistently being removed earlier in the reduction sequence before their corresponding cores were recycled, rather than from the heavily rotated micro-flake cores found in the earlier deposits of Wadi Hammeh 27.

8.2.2 Patterns of abrupt increase

Other artefact types and attributes increase over time, albeit in an abrupt, episodic fashion. This mode of change tends to be more prevalent with numbers of tools per se, rather than

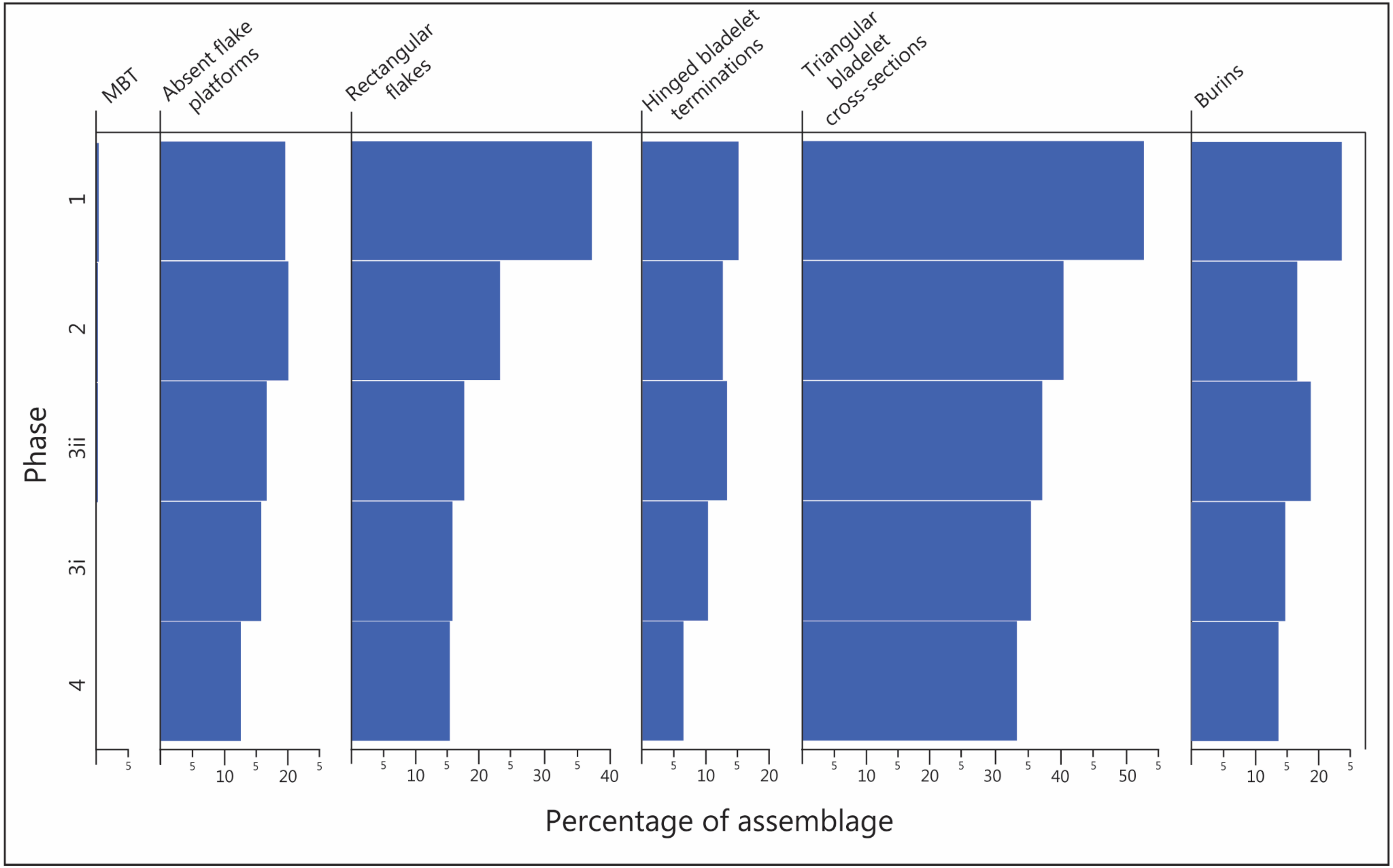


Figure 8.1: Types and technological attributes exhibiting a gradual increase over time (1/3). MBT = microburin byproducts.

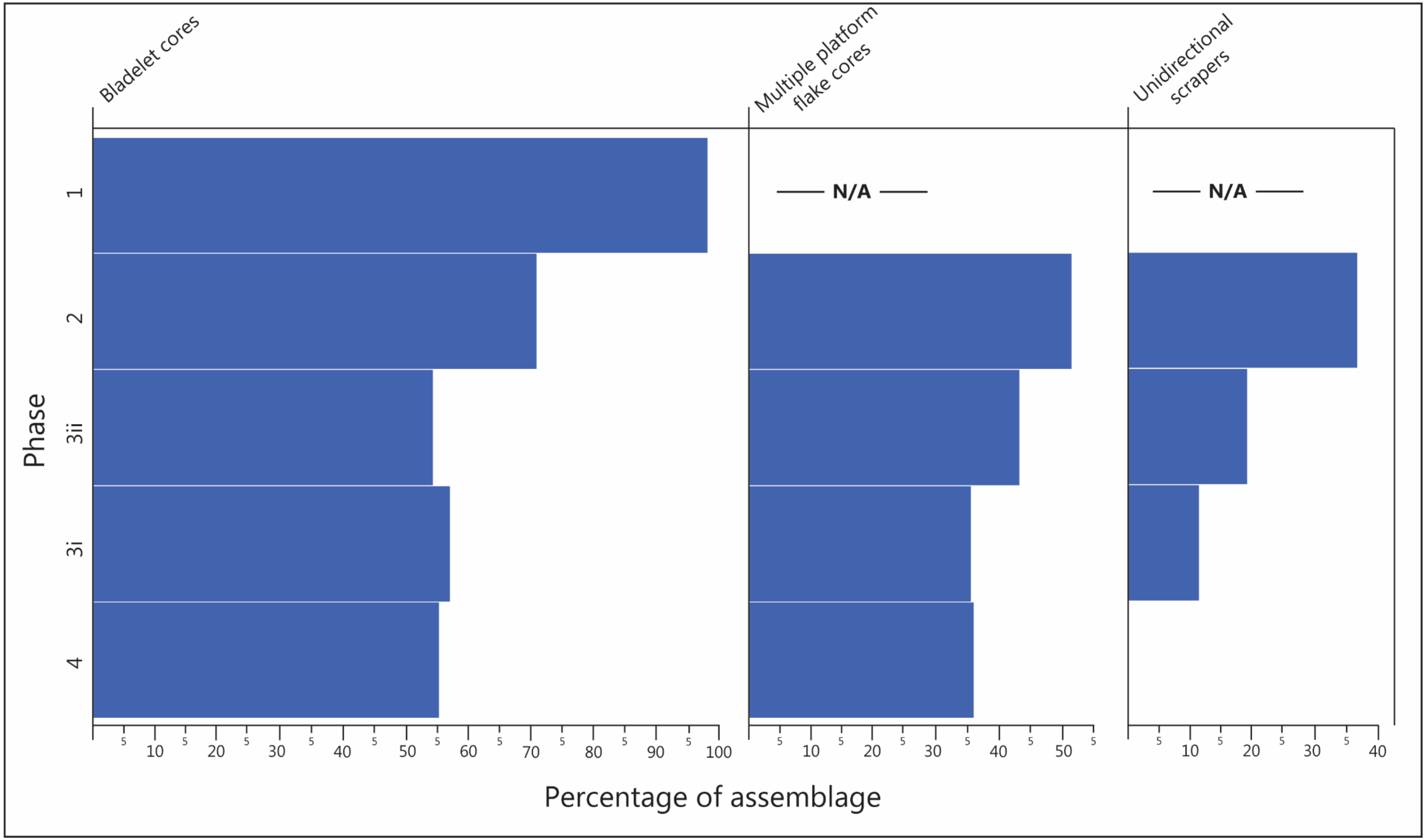


Figure 8.2: Types and technological attributes exhibiting a gradual increase over time (2/3). GMs = geometric microliths.

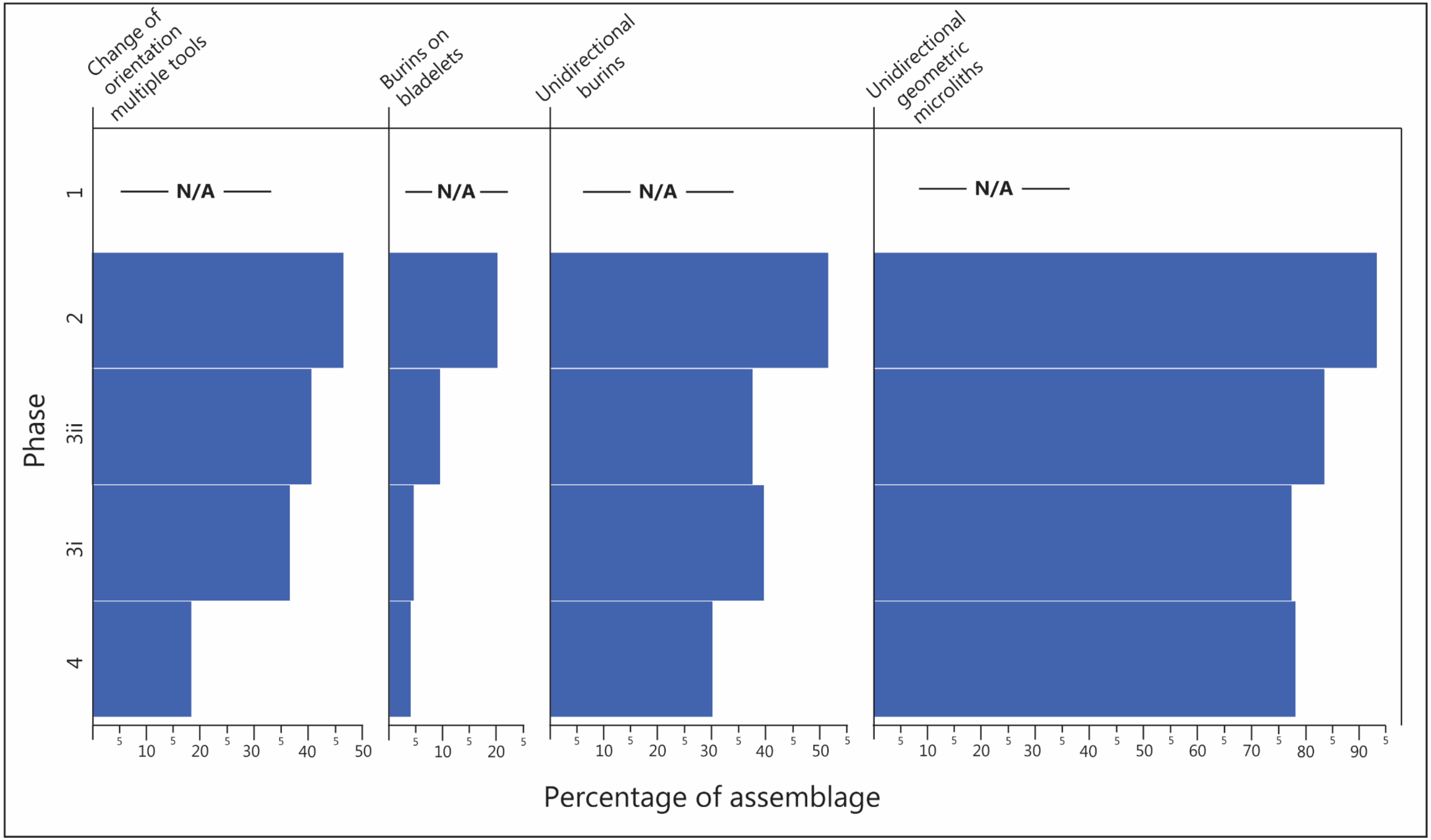


Figure 8.3: Types and technological attributes exhibiting a gradual increase over time (3/3).

among artefact attributes. The abrupt typological upturns mainly occur across the transition from Phase 2 to Phase 1, including the total proportions of debitage, cores and retouched artefacts within each assemblage (**Fig. 8.4**). The fractions of whole flakes also exhibit this pattern (**Fig. 8.4**), as do the total shares of retouched blades, non-geometric microliths and bifacial tools (**Fig. 8.5**). The proportions of lunates with abrupt retouch similarly double in Phase 1 compared to the four preceding assemblages (**Fig. 8.6**). Other types show a jump between Upper Phase 3 and Phase 2, with their percentages remaining relatively stable in the subsequent Phase 1 assemblage. This pattern is represented by the chunks amongst the total assemblage (**Fig. 8.4**), the Helwan bladelets amongst other sickle element types (**Fig. 8.5**) and the Helwan lunates among the lunates (**Fig. 8.6**).

Several debitage attributes likewise remain largely static between Phases 4 and 2, before undergoing a substantial surge in Phase 1. This pattern is exemplified by the fractions of flakes with plain platforms and triangular cross-sections (**Fig. 8.4**), as well as by the bladelets with plain platforms and ovoid or irregular shapes (**Fig. 8.5**). The proportions of non-geometric microliths with a unidirectional scar layout also notably increase between Upper Phase 3 and Phase 2 (**Fig. 8.6**).

Some of the typological breaks between Phase 2 and 1 almost certainly relate to the identification of the Phase 1 occupational surface as a probable abandonment phase, namely the whole flakes, retouched blades and non-geometric microliths. This causal relationship is detailed in Chapter 10. Other alterations between these two phases likely relate to differing states of preservation between Phase 1 and the underlying deposits. This explanation is most applicable to the increased proportions of debitage, cores and retouched tools at the expense of chips, which are notably underrepresented in Phase 1.

The jump in abrupt lunates is the only typological shift in Phase 1 for which an obvious taphonomic explanation may not be drawn. It is instead possible that this rise may herald a broader technological trend, namely the widespread adoption of backed lunates in the Late Natufian period, although it is of course premature to conclusively make such an identification based on what may otherwise have been an anomaly restricted to a single assemblage. In any case, while abruptly retouched lunates became the dominant mode with the Late Natufian period, this was relatively late, given that abruptly backed lunates had already become the dominant lunate type at Shubayqa 1 during the Early Natufian (Richter et

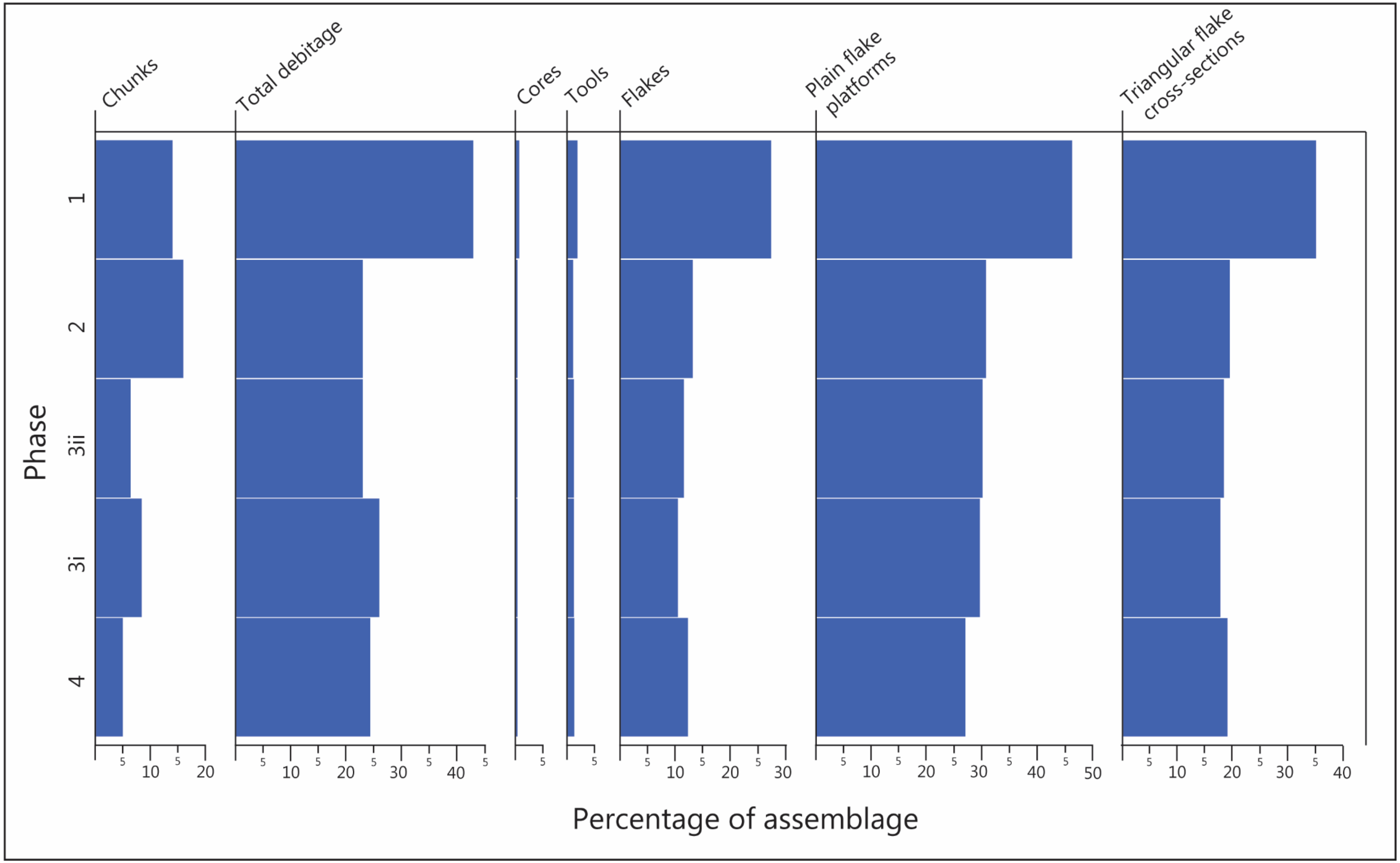


Figure 8.4: Types and technological attributes exhibiting an abrupt increase over time (1/3).

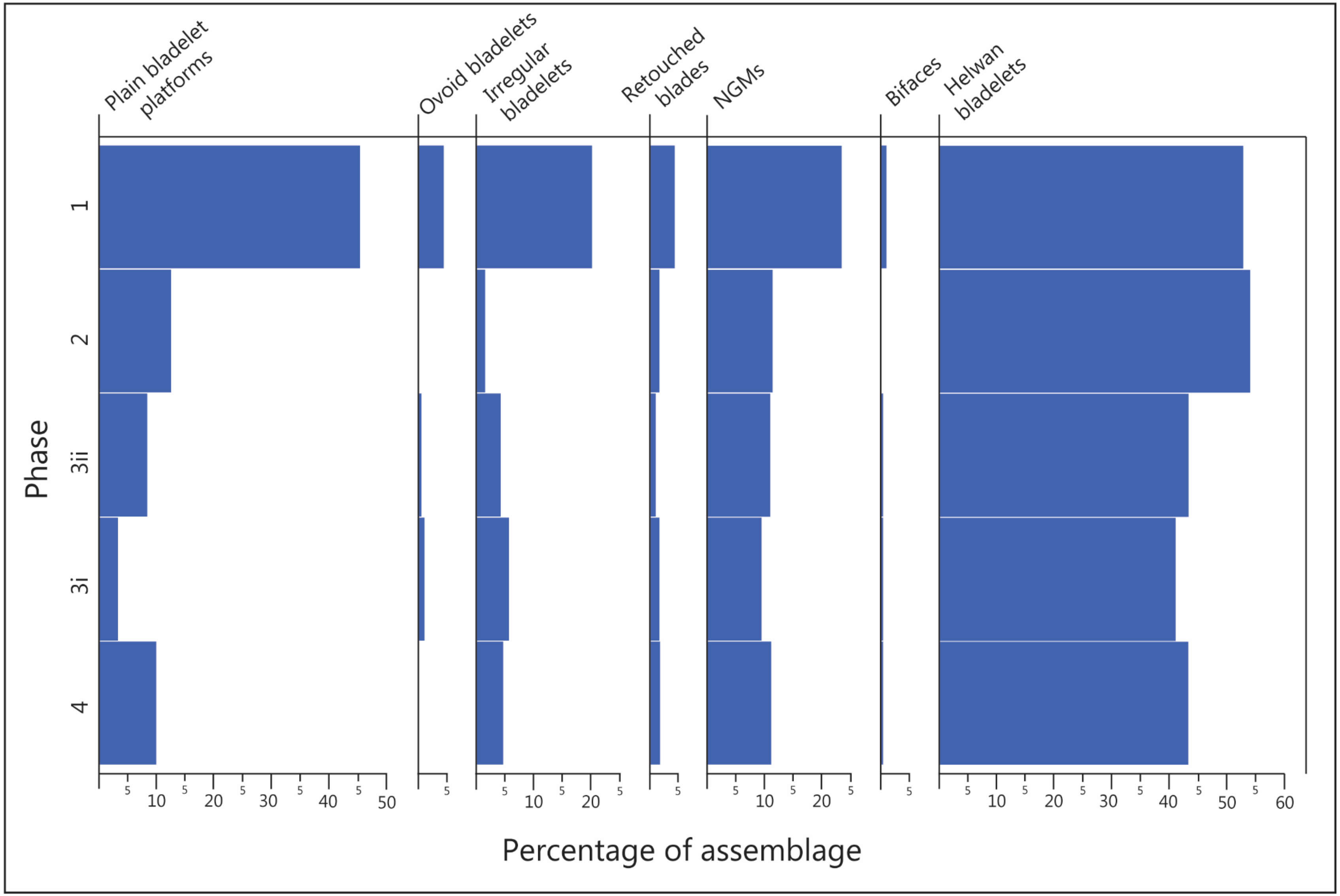


Figure 8.5: Types and technological attributes exhibiting an abrupt increase over time (2/3). NGMs = non-geometric microliths.

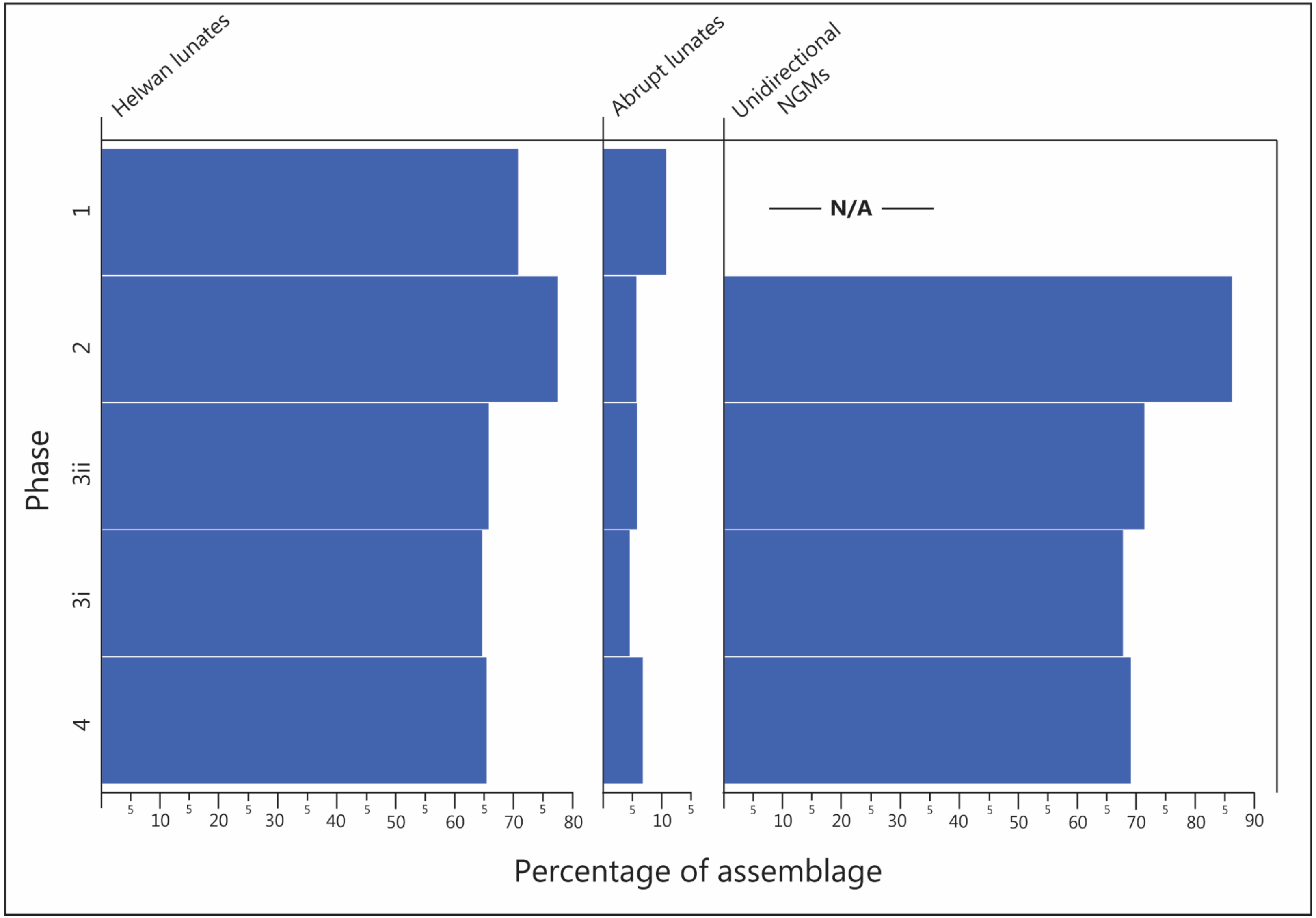


Figure 8.6: Types and technological attributes exhibiting an abrupt increase over time (3/3). NGMs = non-geometric microliths.

al. 2017: 5-6). These examples lend further credence to Olzewski's (1986) argument that the shift towards manufacturing lunates with abrupt retouch was not a uniform process, instead occurring at different rates on a regional basis.

The deviations between the Upper Phase 3 and Phase 2 assemblages are notable, given that this break serves as the dividing line between the abandonment of Structure 3 and the establishment of Structure 1. The fact that both sickle elements and lunates exhibit a jump in the proportions of pieces featuring Helwan retouch (albeit to a lesser extent in the latter case) is significant, as is the corresponding jump in sickle elements manufactured from unidirectional bladelets. Given that the transition between these two phases also marks the onset of rising proportions of specialised bladelet cores (see Chapter 8.2.1), these changes together suggest a trend to increasing standardization of microlithic manufacture between the occupations of Structures 3 and 1.

The significance of such an identification is nonetheless obfuscated by ambiguities as to the exact nature and length of this inter-occupational break. While reliable radiocarbon dates are available for both structures (from Phase 1 and Lower Phase 3 respectively), the lack of dates from Phase 2 and Upper Phase 3 renders it impossible at the present time to estimate exactly how long the intermediate period between the occupation of the two structures lasted, if one existed to any extent at all. The lack of any comparatively sterile deposits dividing the Upper Phase 3 and Phase 2 occupations points to a limited timeframe between inhabitation of the two structures, although the possibility this situation instead reflects an unconformity in the rate of sedimentation (Eicher 1976: 34) also cannot be discounted. In any case, the drive towards the standardised production of uniform sickle elements from bladelet cores most likely represents a response to shifting functional requirements over time, as discussed in Chapter 9.4.

At the same time, the jumps in ovoid and irregular-shaped bladelets in Phase 1, along with the overall increase in bladelets with hinged terminations over time (see Chapter 8.2.1) must also be taken into account. A bladelet possessing any of these qualities would make an unlikely candidate to be manufactured into straight, geometric sickle elements, suggesting that other factors must also be considered, including a decline in knapping proficiency.

8.2.3 Patterns of gradual decline

Instances of gradual decline over time are uncommon at Wadi Hammeh 27, and tend to concern attributes rather than artefact types, thus mirroring the patterns of gradual increase at the site. The thickness and mass of the blades undergo a substantial decline between Lower Phase 3 and Phase 2, although only the latter case is statistically significant (**Table 8.1**). The mean numbers of dorsal scars on flakes also diminish between Phases 4 and 2, with this drop additionally being statistically significant (P = 0.028506).

The smaller flake core dimensions (P = 0.010860), mass (P = 0.000952) and scar length (P = 0.031958) are all statistically significant (**Table 8.2**). The mean percentage of cortex coverage on flake cores also declines between Phase 4 and 2, in spite of the percentage of cortex-free specimens remaining consistent across time. That being said, this analysis does not include the three large flake cores comprising Feature 20, from which only the dimensions were available. Indeed, when the values for these three artefacts are included in the 'length/maximum dimension' field for Phase 2, the P-value for this attribute rises to 0.05912, suggesting that the other attributes would similarly be statistically insignificant if the relevant values for these three cores were available.

Despite exhibiting generally static dimensions over time, the bladelet cores display a slight decline in their mean number of negative scars, as well as a fall in their mean maximum scar length (**Table 8.2**). These changes are due primarily to the steady rise in bladelet cores with convergent scar patterns between Phases 4 and 2 at the expense of pieces with a parallel layout. A continuous descent in the mean cortex coverage on bladelet cores also occurs, with this shift being especially pronounced between the Phase 4 and Lower Phase 3 assemblages.

The only debitage type to exhibit a progressive decrease over time are the core trimming elements, which incrementally drop between Phase 4 and 1 (**Fig. 8.7**). The flake cores trend in the opposite direction to the bladelet cores, with a substantial drop in their proportions occurring between Upper Phase 3 and Phase 1 (**Fig. 8.7**). The change of orientation flake cores similarly decline over time (**Fig. 8.8**). The multiple tools are the only tool group to present a steady, unidirectional downtrend over time, while the alternating lunates and pieces with a single small notch decrease over time within their respective tool groups (**Fig. 8.8**).

This pattern of change is particularly common among the flake debitage attributes, with the shares of flakes with radial scar layouts, dihedral and multifaceted platforms, feathered

Table 8.2: Table of single factor Anova p-values for cores between Phase 4 and 2.

	Flake cores		Bladelet cores	
	P-value	H_1	*P-value*	H_1
Length/maximum dimension	0.010860	**Yes**	0.390554	No
Weight	0.000952	**Yes**	0.256645	No
Scar no.	0.123143	No	0.054109	No
Maximum scar length	0.031958	**Yes**	0.184902	No
Cortex %	0.124139	No	0.381669	No

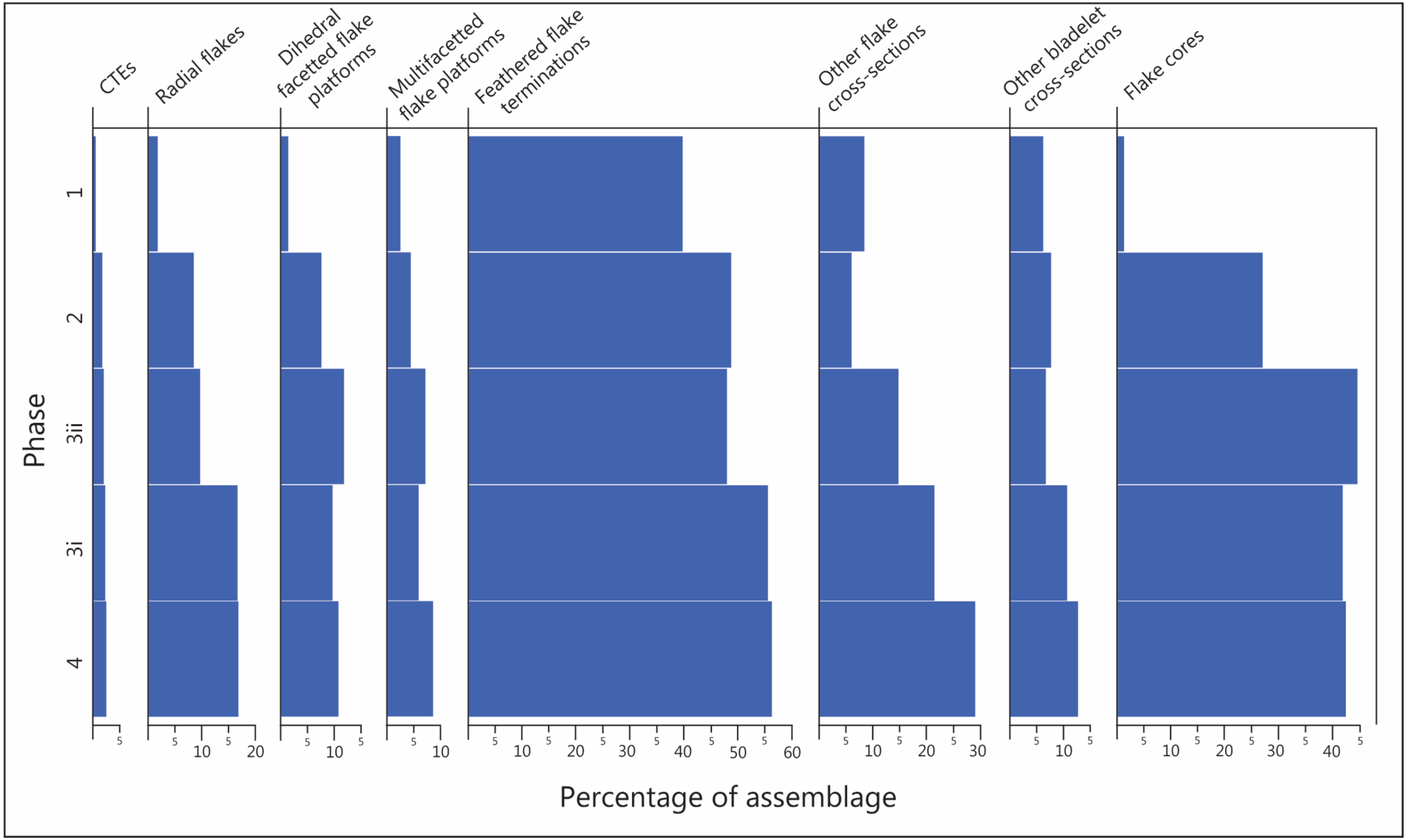


Figure 8.7: Types and technological attributes exhibiting a gradual decline over time (1/2). CTEs = core trimming elements.

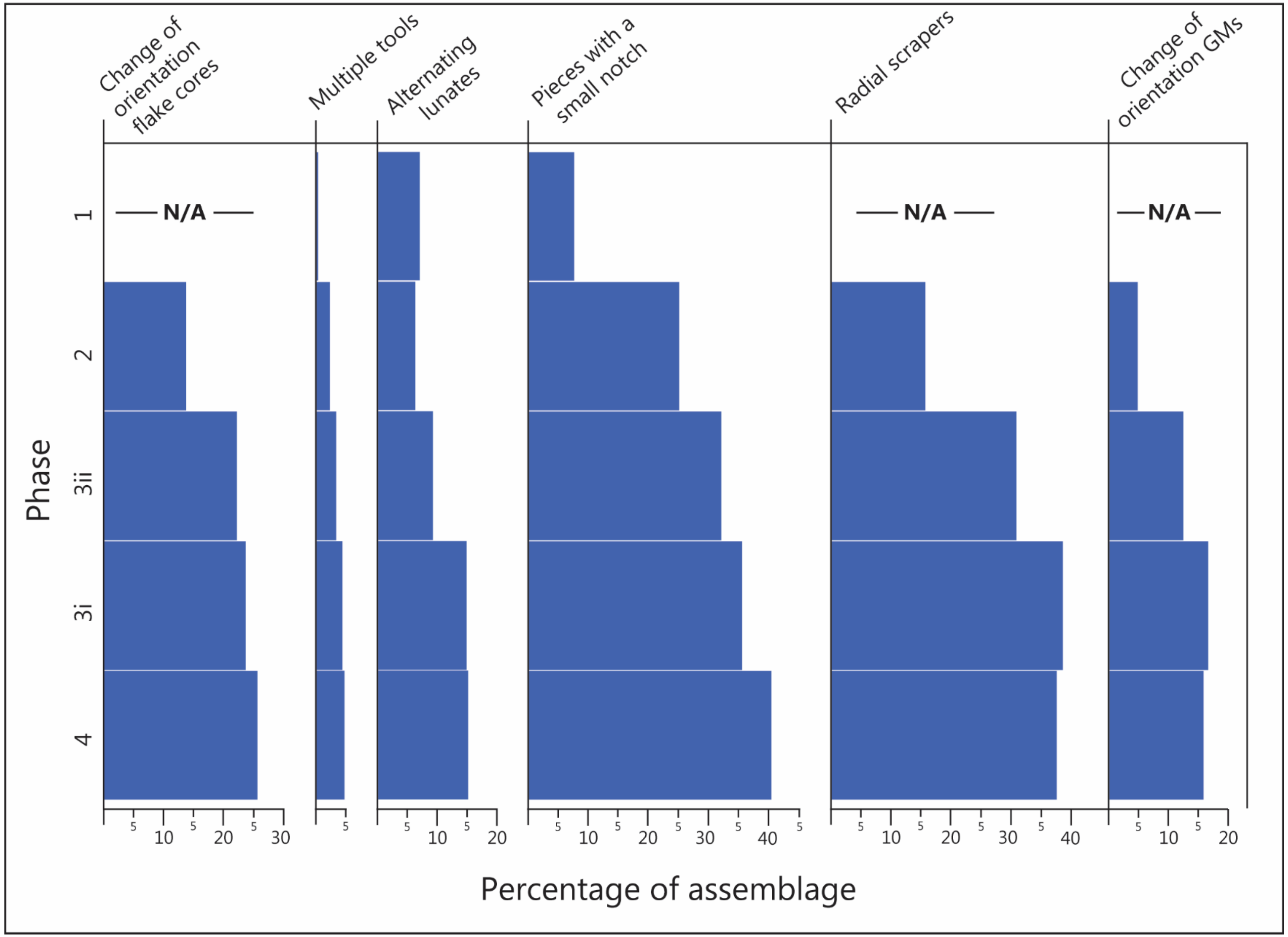


Figure 8.8: Types and technological attributes exhibiting a gradual decline over time (2/2). GMs = geometric microliths.

terminations and miscellaneous cross-sections all gradually declining over time (**Fig. 8.7**). In contrast, the only bladelet attribute to exhibit this pattern are the 'other' cross-sections, which drop between Phases 4 and Upper Phase 3, after which they remain static. Examples of gradual decline among the tool attributes are likewise rare, with the only instances being the scrapers with radial scar layouts and geometric microliths with change of orientation layouts (**Fig. 8.8**).

The fall in core-trimming elements and the rise in specialised bladelet cores in the later phases of Wadi Hammeh 27 may initially appear anomalous, given that bladelet cores in earlier Epipalaeolithic assemblages are associated with high rates of core maintenance (Delage 2005). The seemingly inverse relationship between the two types at Wadi Hammeh 27 is thus telling, suggesting that while specialised bladelet cores indeed dominate the later assemblages, less care was taken in maintaining their form. Such an approach also serves to explain the higher numbers of bladelet blanks with undesirable shapes and hinged terminations in the later phases.

The fact that the decline in extant flake cores has no effect on the proportions of most macro-tool groups is intriguing, indicating that enough suitably-sized flakes were still being produced as part of a two-stage reduction sequence in the later phases to compensate for the lack of dedicated flake cores. This model also serves to explain why the fractions of flakes and scrapers with radial scar orientations decrease while the percentages of multiple platform flake cores increase, with these pieces instead being knapped in a unidirectional fashion prior to the recycling of the nodule (see Chapter 9.2). Conversely, the fact that multiple tools decline over time in favour of burins may represent one of two explanations: either that burins were being designed for hafting to a lesser extent (as discussed in Chapter 9.3.3), or that burins gradually became functionally disassociated from scrapers and other macro-tool varieties.

8.2.4 Patterns of abrupt decline

Unlike the aforementioned instances of abrupt increase, all typological examples of abrupt decline mark a break between Phase 1 and the four preceding assemblages. Among the debitage, this pattern occurs only for the broken blades and blades, which exhibit a proportion in Phase 1 half that of the preceding assemblages (**Fig. 8.9**). A similarly pronounced drop in the percentages of chips is also evident. The only tool type to demonstrate this pattern is the

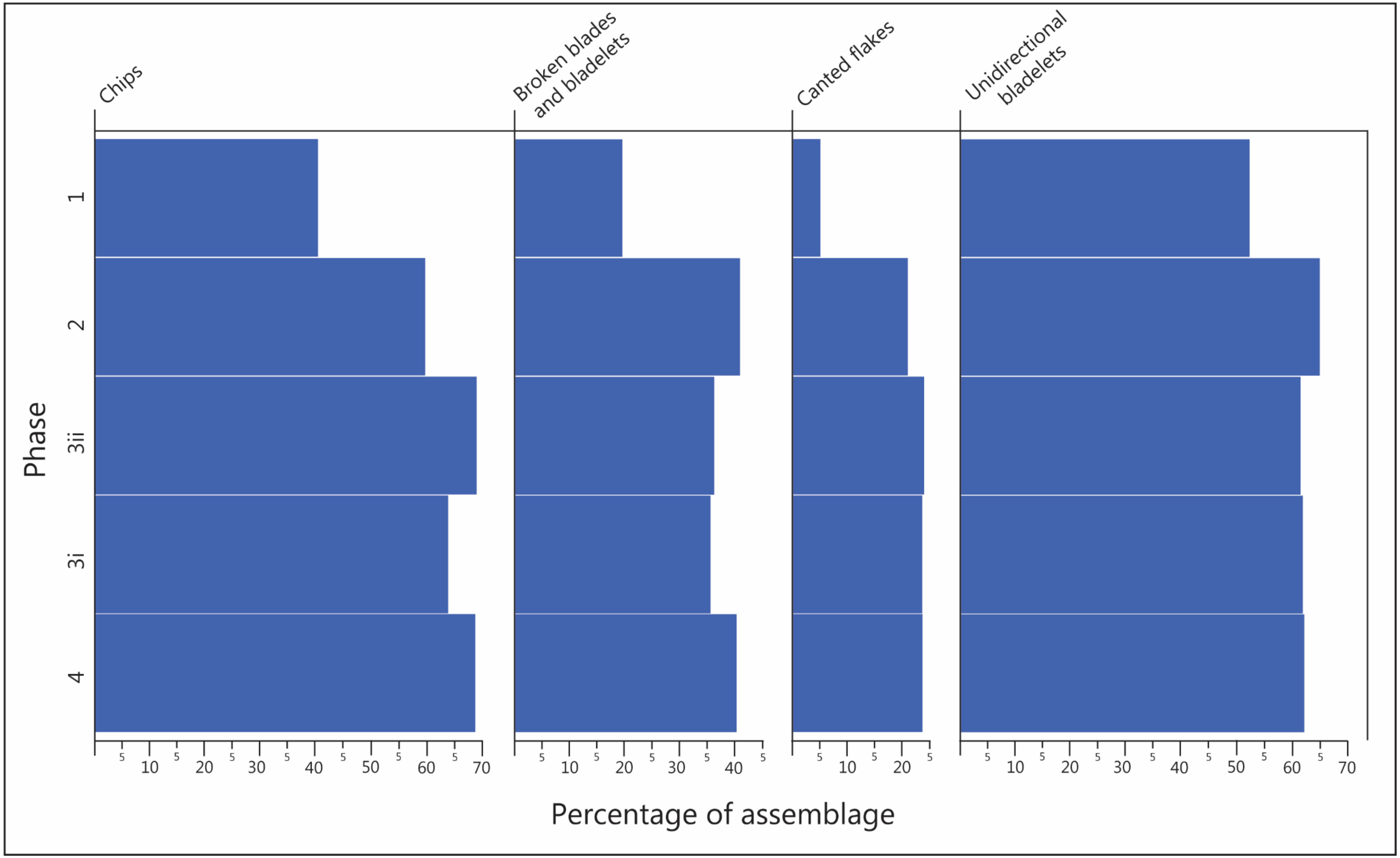


Figure 8.9: Types and technological attributes exhibiting an abrupt decline over time (1/2).

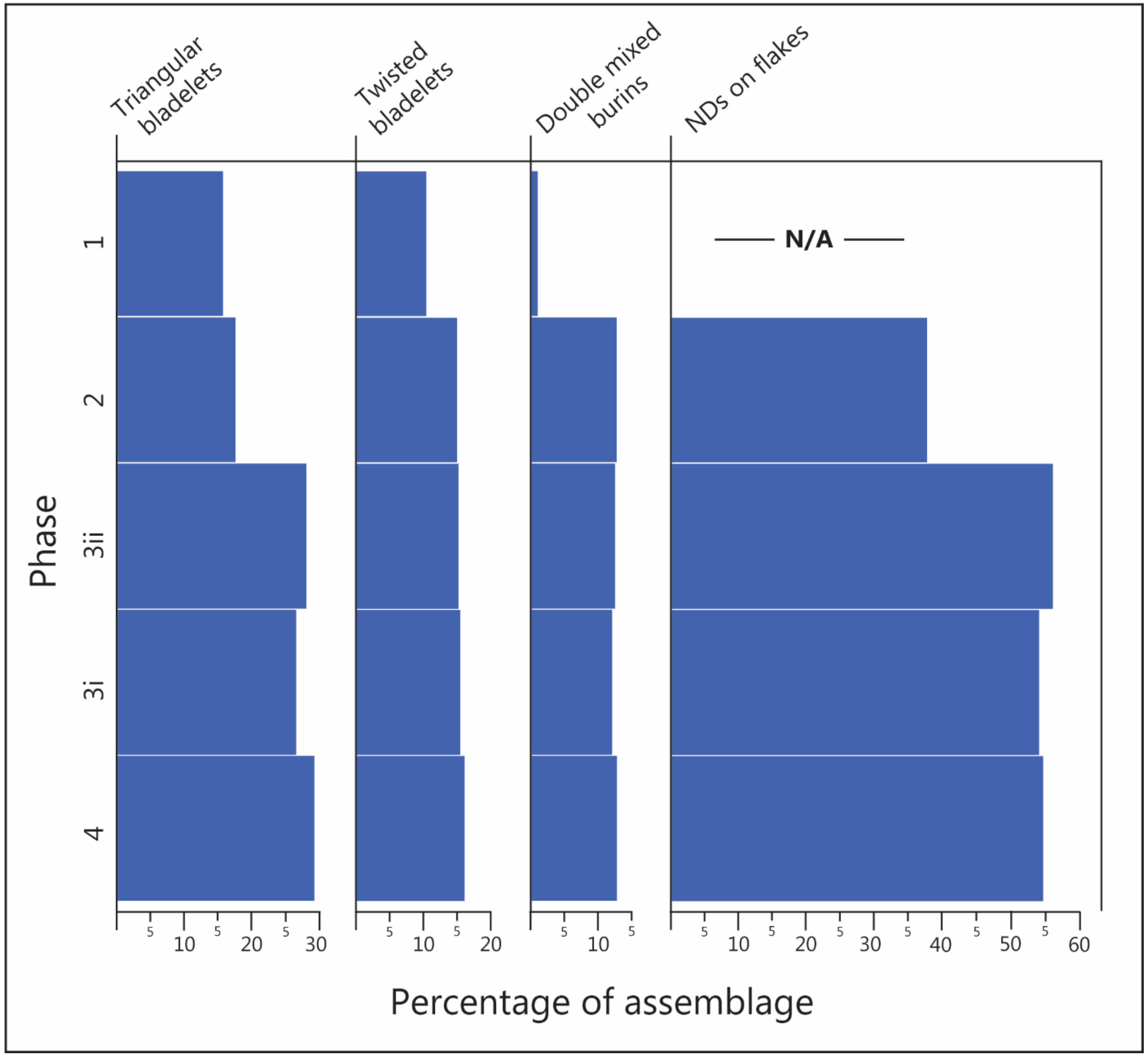


Figure 8.10: Types and technological attributes exhibiting an abrupt decline over time (2/2). NDs = notched and denticulated pieces.

double mixed burin, which plummets in Phase 1 after a period of remarkable stability between Phases 4 and 2 (**Fig. 8.10**).

Among the debitage attributes, the proportions of canted flakes, unidirectional bladelets (**Fig. 8.9**) and twisted bladelets (**Fig. 8.10**) all decrease noticeably in Phase 1. The only attribute to deviate from this pattern are the triangular-shaped bladelets, which instead drop between Upper Phase 3 and Phase 2, after which their proportions remain relatively stable into Phase 1 (**Fig. 8.10**). The percentages of notched and denticulated pieces manufactured from flake blanks also plummet between Upper Phase 3 and Phase 2. The plunge in broken blades and bladelets correlates neatly with the surge in the proportions of intact blades and bladelets in Phase 1, suggesting that aspects relating to the final abandonment of the site are responsible, as discussed in Chapter 10. Similar influences may explain the lack of double mixed burins, suggesting that the inhabitants of Wadi Hammeh 27 had less need to recycle existing burins through the manufacture of a second working edge due to the restricted timeframe of the Phase 1 occupation.

On the other hand, the lack of chips in the Phase 1 assemblage is most likely reflective of the winnowing of exceptionally small artefacts due to the comparatively poor preservation of the associated deposits. Such an explanation is supported by the comparative scarcity of flakes and bladelets measuring less than 2cm in length in this phase (see Chapter 4.4.5), along with the relative lack of tusk shell bead fragments compared to the earlier assemblages. These aspects are also addressed further in Chapter 10.

Some of the attributional shifts are consistent with contemporaneous trends, while others appear anomalous. As an example of the former case, the decline in flake blanks used for notched and denticulated pieces corresponds neatly with the reduced emphasis on micro-flake core reduction in Phase 2. In contrast, the reduced proportion of bladelets with unidirectional scar orientations in Phase 1 is difficult to relate with the jump in single platform bladelet cores in this phase.

<u>8.2.5</u> <u>Lenticular (bell-curve) frequency shifts</u>

This group represents types or attributes that develop a unimodal peak in popularity which declines in subsequent assemblages. This mode of change is notable in that it is entirely unrepresented when it comes to debitage types. Curiously though, debitage attribute states with lenticular distributions over time are common. Amongst the flakes, unidirectional scar orientations, stepped terminations, triangular shapes, flat profiles and trapezoidal cross-sections all crest in Phase 2, while flakes with lenticular cross-sections are most common in Upper Phase 3 (**Fig. 8.11**). Numerous bladelet attributes likewise exhibit a lenticular pattern, albeit with a greater degree of variation regarding the location of their peak. The proportions of bladelets with punctiform platforms and feathered terminations are highest in Lower Phase 3 (**Fig. 8.12**), lending further evidence that while the overall emphasis on bladelet production occurs in later phases, this shift does not correspond with an increase in the knapping expertise involved in their manufacture. Bladelets with expanding shapes and flat profiles culminate in Upper Phase 3 (**Fig. 8.13**), while those with dihedral facetted platforms and rectangular shapes subsequently reach their maximum extent in Phase 2 (**Fig. 8.12**). Finally, the peak proportions of bladelets with crushed platforms extends across Lower and Upper Phase 3 (**Fig 8.12**).

Single platform flake cores and change of orientation bladelet cores are the only core types to display a lenticular pattern over time, peaking in Upper and Lower Phase 3 respectively (**Fig. 8.13**). The fact that these patterns do not align is interesting, suggesting that the micro-flake and bladelet cores were never linked in terms of the knapping strategies applied. The proportions of flake cores with convergent scar layouts and bladelet cores with parallel patterns both culminate in Lower Phase 3 (**Fig. 8.13**), while examples of divergent bladelet cores only appear in the Lower and Upper Phase 3 assemblages (**Fig. 8.14**). These arrangements provide additional evidence that these two core groups were not functionally aligned, with bladelet cores being more intensively knapped in later assemblages, as opposed to the greater shares of irregularly knapped micro-flake cores.

The retouched fragments are the only tool group to follow a lenticular pattern, peaking in Lower Phase 3 before undergoing an incremental decline across subsequent assemblages (**Fig. 8.14**). At the same time, this tool group also features a pronounced plunge in Phase 1, suggesting that similar influences relating to the final abandonment of the site are also at play.

In contrast to the tool groups, numerous individual tool types follow a lenticular, unimodal pattern. Amongst the scrapers, the endscraper with notch and broad carinated scraper types are most common in Lower Phase 3, while multiple scrapers and nosed scrapers peak in Upper Phase 3 and Phase 2 respectively (**Fig. 8.14**). Burin/notched pieces similarly crest amongst the multiple tools in Upper Phase 3 (**Fig. 8.14**), while the collective dihedral burin types reach their greatest proportions in Phase 2 (**Fig. 8.15**). Alternately retouched bladelets and those with retouch on both edges culminate in Upper and Lower Phase 3 respectively amongst the 'complete' non-geometric microliths (**Fig. 8.15**). Given that both of these types represent pieces with retouch along lateral margins, it appears that a functional link exists between these two types, with this general approach of sickle bladelet manufacture declining in popularity after the abandonment of Structure 3, being replaced by more standardised Helwan bladelets. Lenticular patterns are also exhibited by the semi-steep lunates and denticulated pieces within their respective tool groups, peaking in Upper Phase 3 and Phase 2 respectively (**Fig. 8.16**).

Numerous tool attributes also present lenticular distributions between the Phase 4 and 2 samples. The proportions of scrapers with a bi-directional along axis scar orientation, multiple tools on blade blanks (**Fig. 8.14**), unidirectional multiple tools, burins on flake blanks, bi-directional crossed burins (**Fig. 8.15**), radial non-geometric microliths, bi-directional along axis notched and denticulated pieces (**Fig. 8.16**), and radial retouched flakes (**Fig, 8.17**) all peak in Lower Phase 3 before declining across Upper Phase 3 and Phase 2.

Multiple tools made from core trimming elements (**Fig. 8.14**), non-geometric microliths with change of orientation scar layouts, geometric microliths with bi-directional crossed layouts, notched and denticulated pieces with change of orientation or radial layouts (**Fig. 8.16**) and retouched flakes with change of orientation layouts (**Fig. 8.17**) all peak in Upper Phase 3. These trends are all consistent with the increased production of unidirectional debitage blanks in later phases, with the notable exception of the multiple tools, although this is likely reflective of the smaller sample available for this tool group in Phase 2.

<u>8.2.6</u> <u>Patterns of sinuous change (the 'well curve')</u>

This group comprises types or attributes exhibiting a bimodal distribution peaking in the earliest and latest occupations, resulting in a sinuous or 'inverse-lenticular' distribution over time. Both the blade and bladelet types exhibit this pattern, being comparatively common in Phase 4, declining across subsequent assemblages, before again surging in Phase 1 (**Fig. 8.18**). This latter surge most likely relates to the increased proportions of usable debitage blanks left behind as *de facto* refuse on the final occupational surface, as elaborated upon in Chapter 10. Alternatively, the increased shares of intact blade and bladelet blanks may also

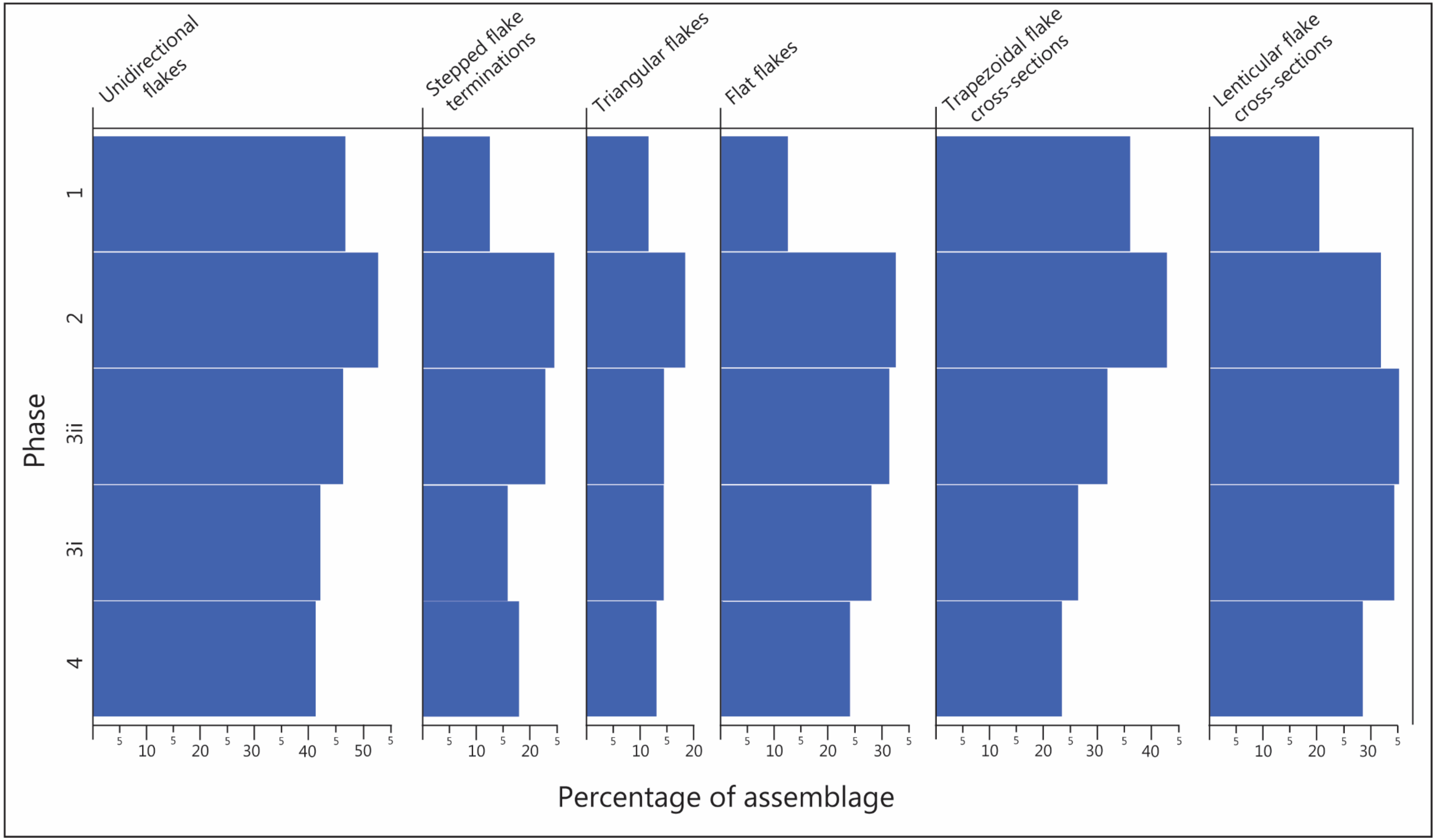


Figure 8.11: Types and technological attributes exhibiting a lenticular distribution over time (1/7).

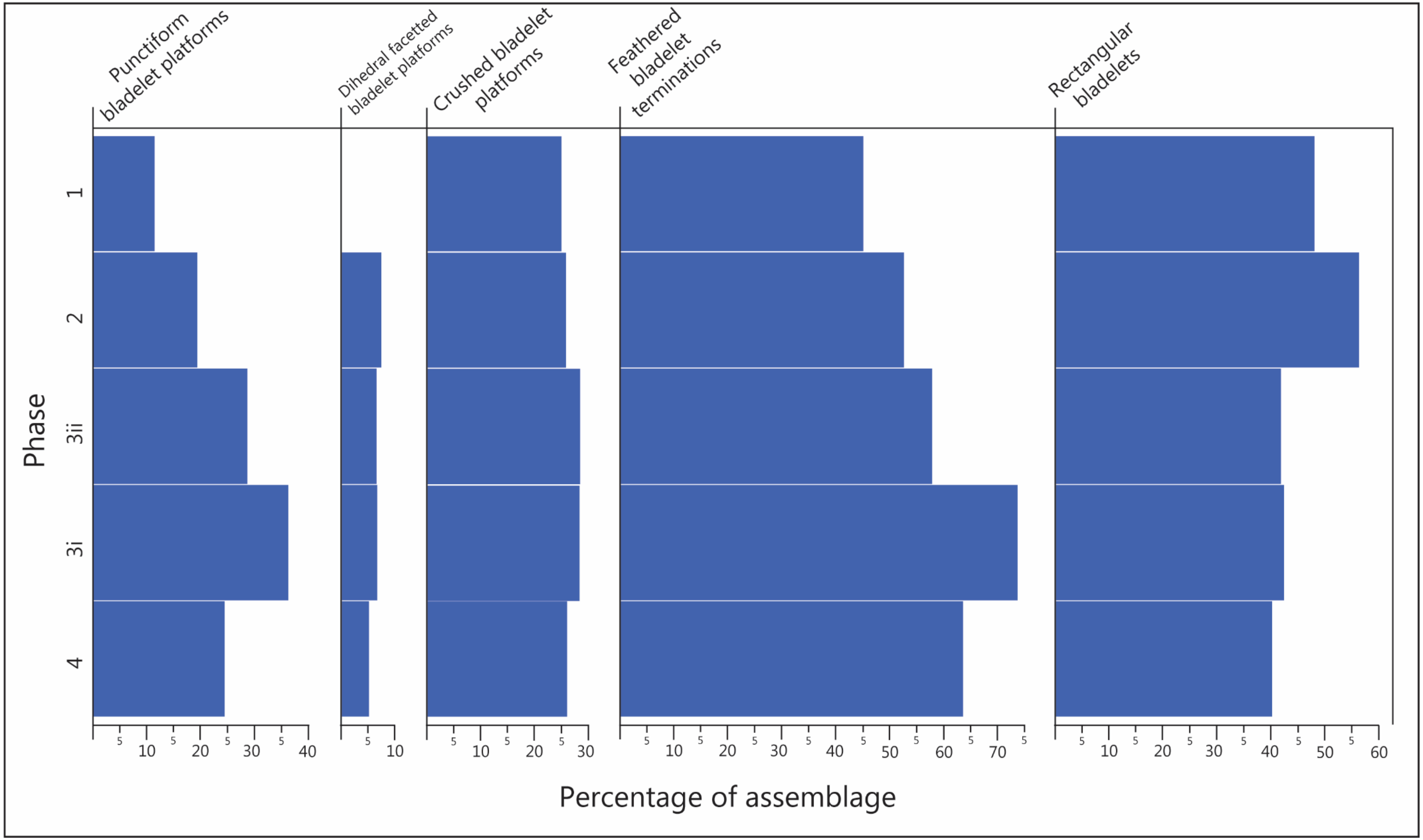


Figure 8.12: Types and technological attributes exhibiting a lenticular distribution over time (2/7).

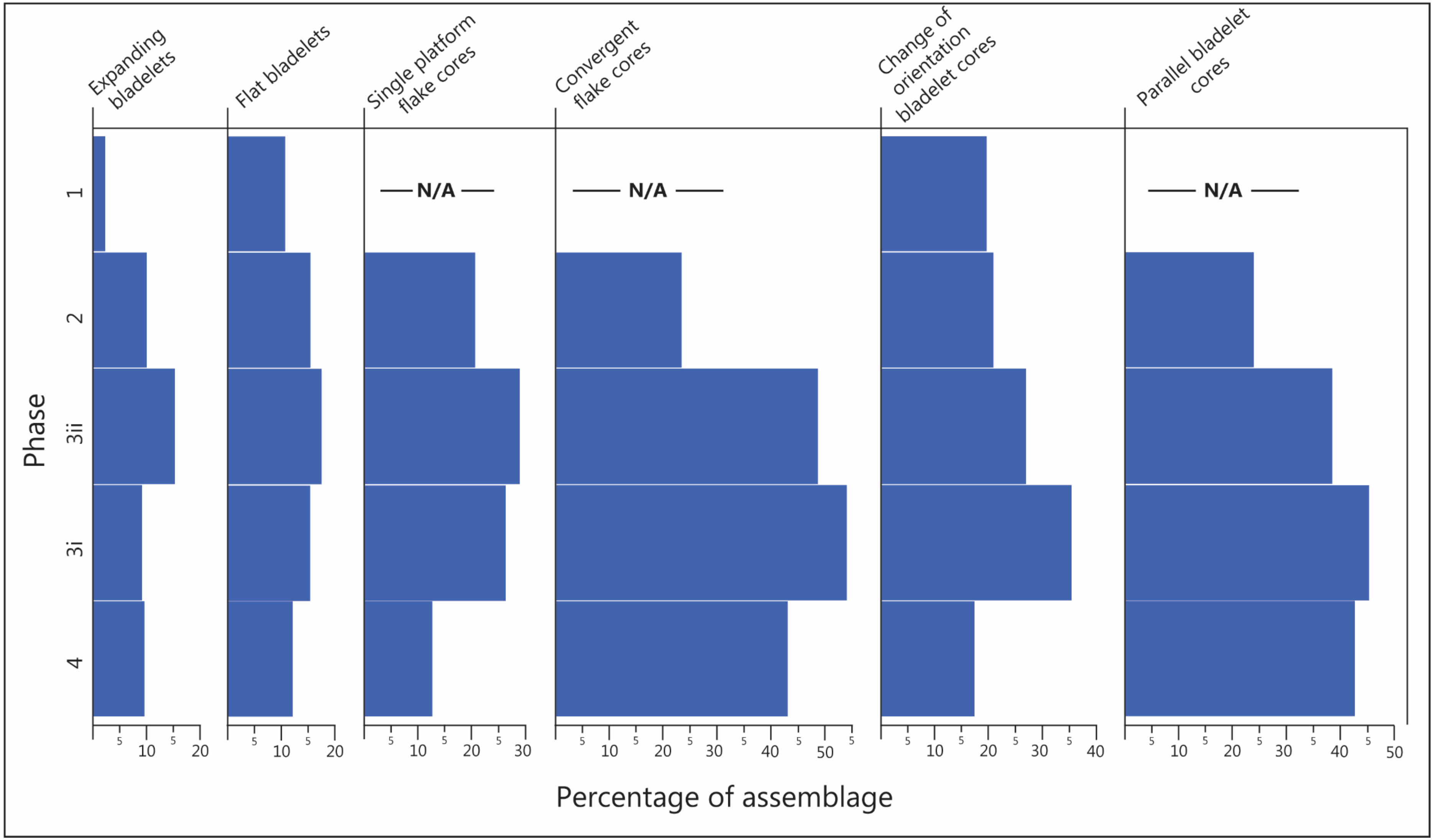


Figure 8.13: Types and technological attributes exhibiting a lenticular distribution over time (3/7).

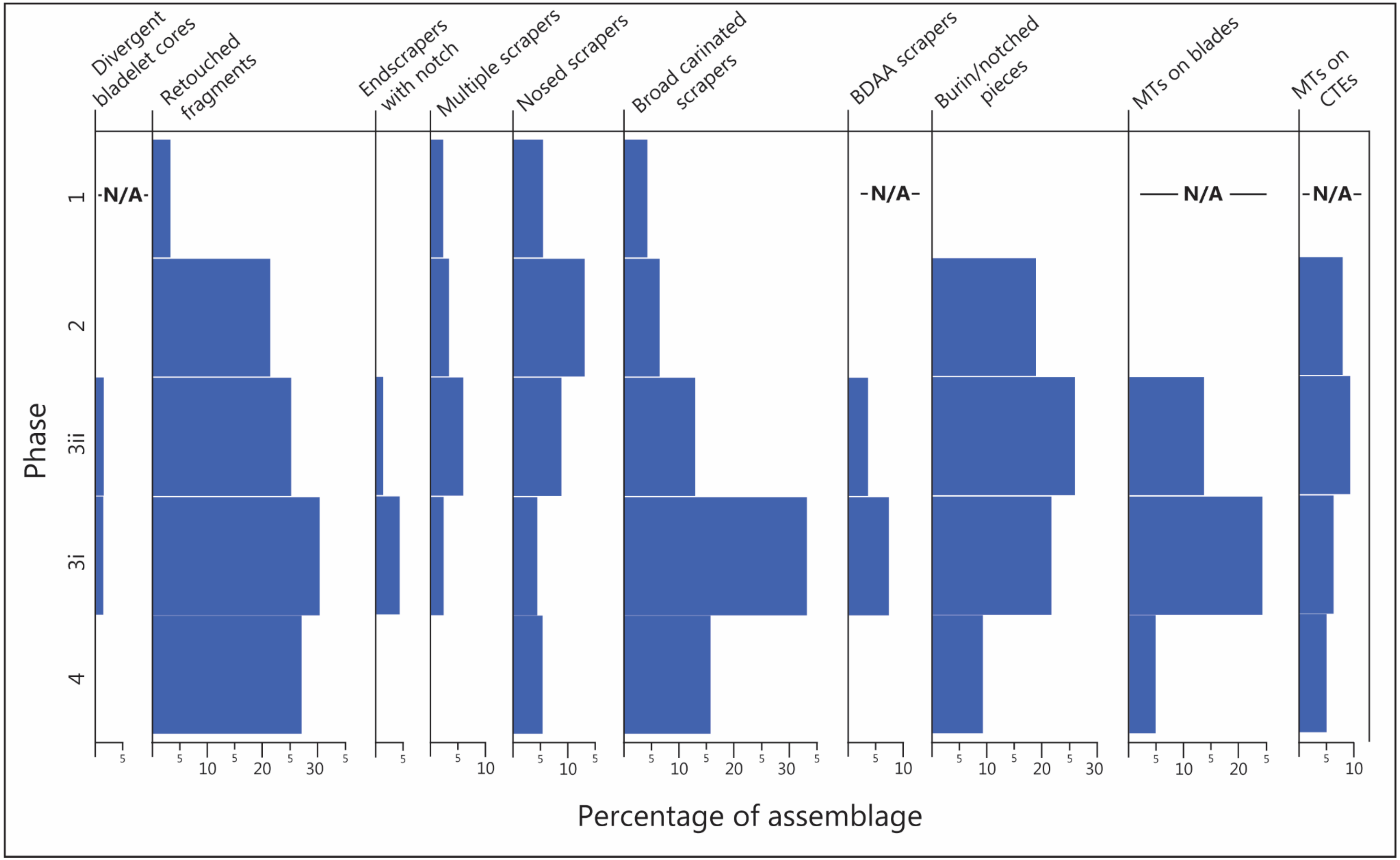


Figure 8.14: Types and technological attributes exhibiting a lenticular distribution over time (4/7). BDAA = bi-directional along axis; MTs = multiple tools; CTEs = core trimming elements.

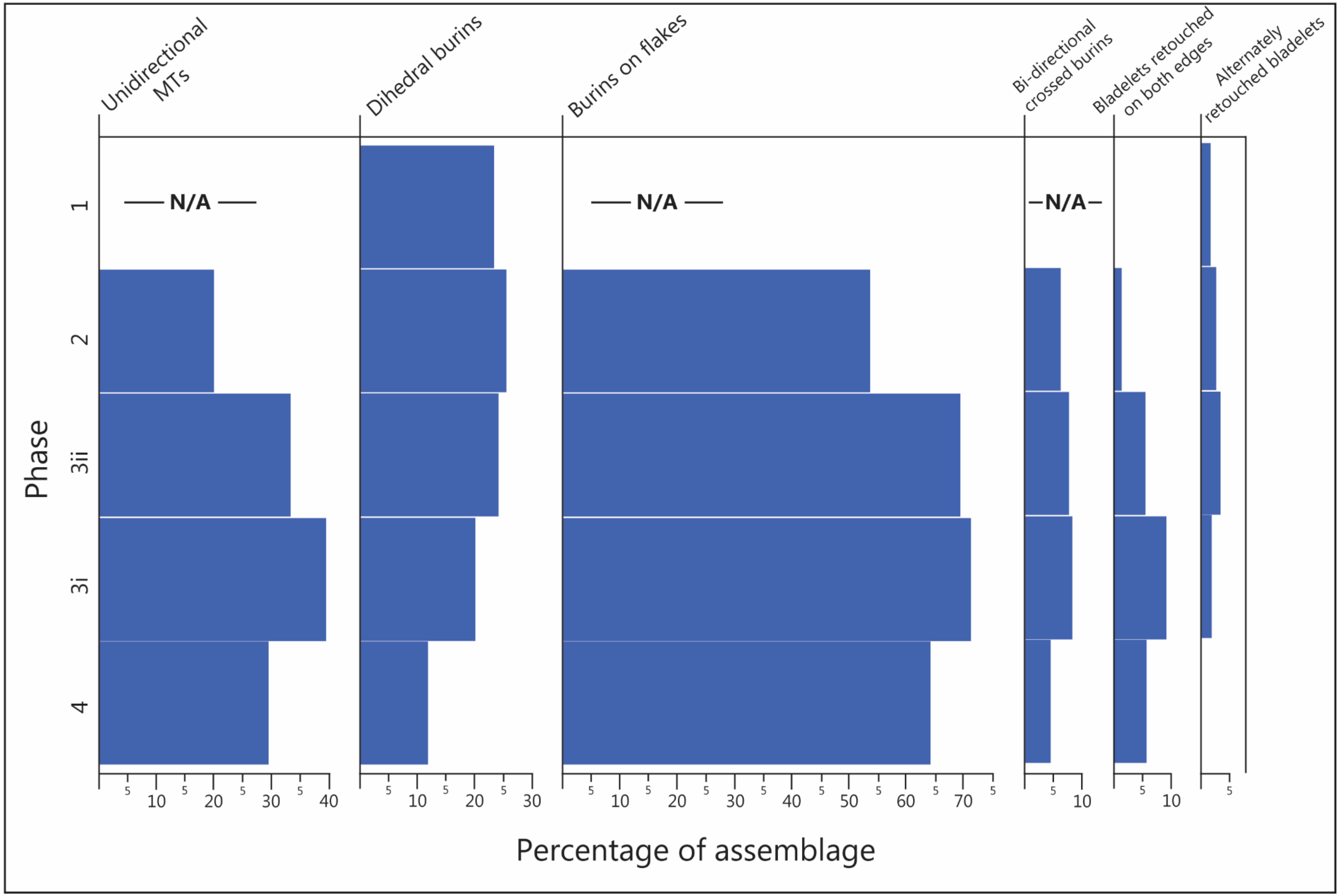


Figure 8.15: Types and technological attributes exhibiting a lenticular distribution over time (5/7). MTs = multiple tools.

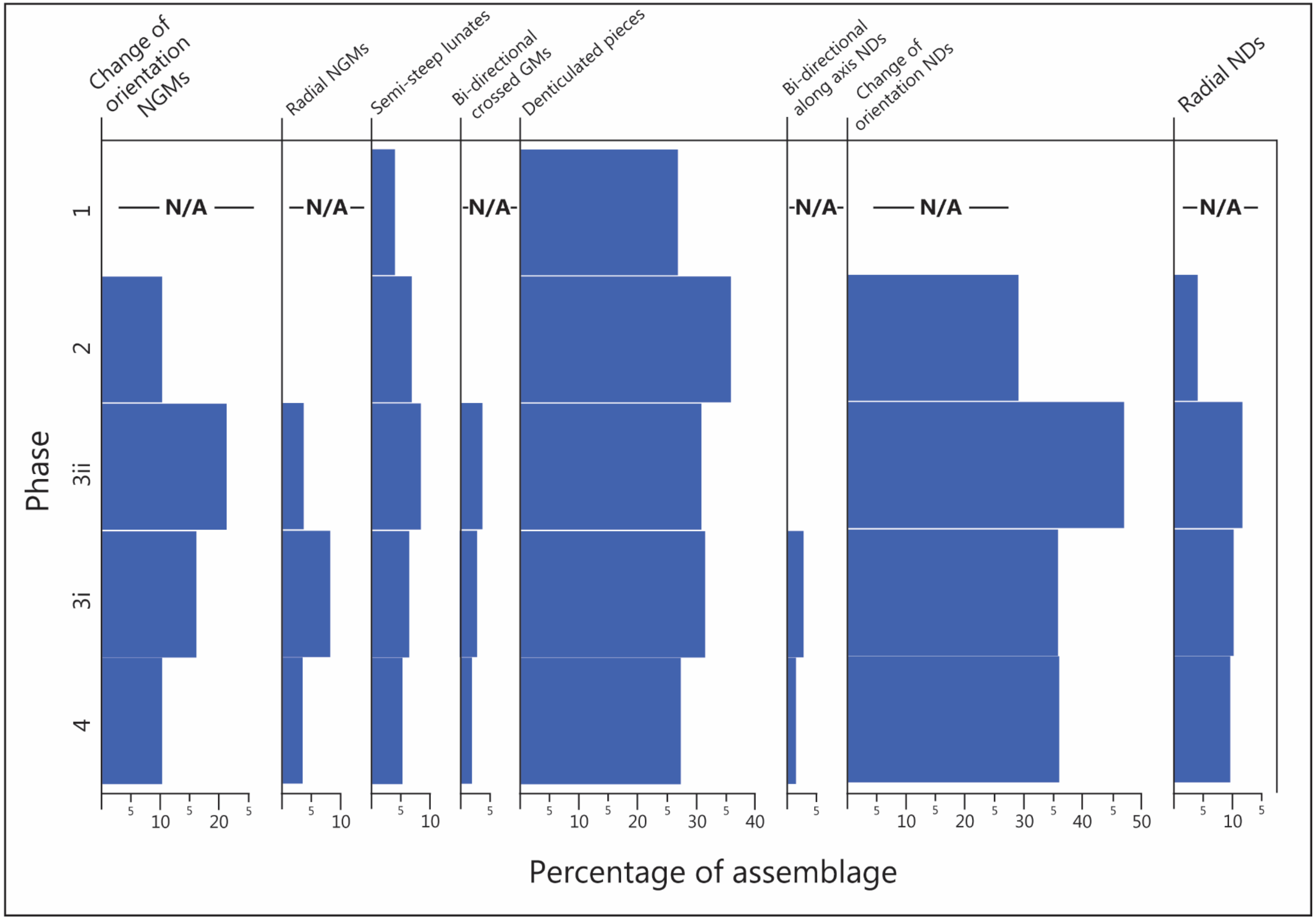


Figure 8.16: Types and technological attributes exhibiting a lenticular distribution over time (6/7). NGMs = non-geometric microliths; GMs = geometric microliths; NDs = notched and denticulated pieces.

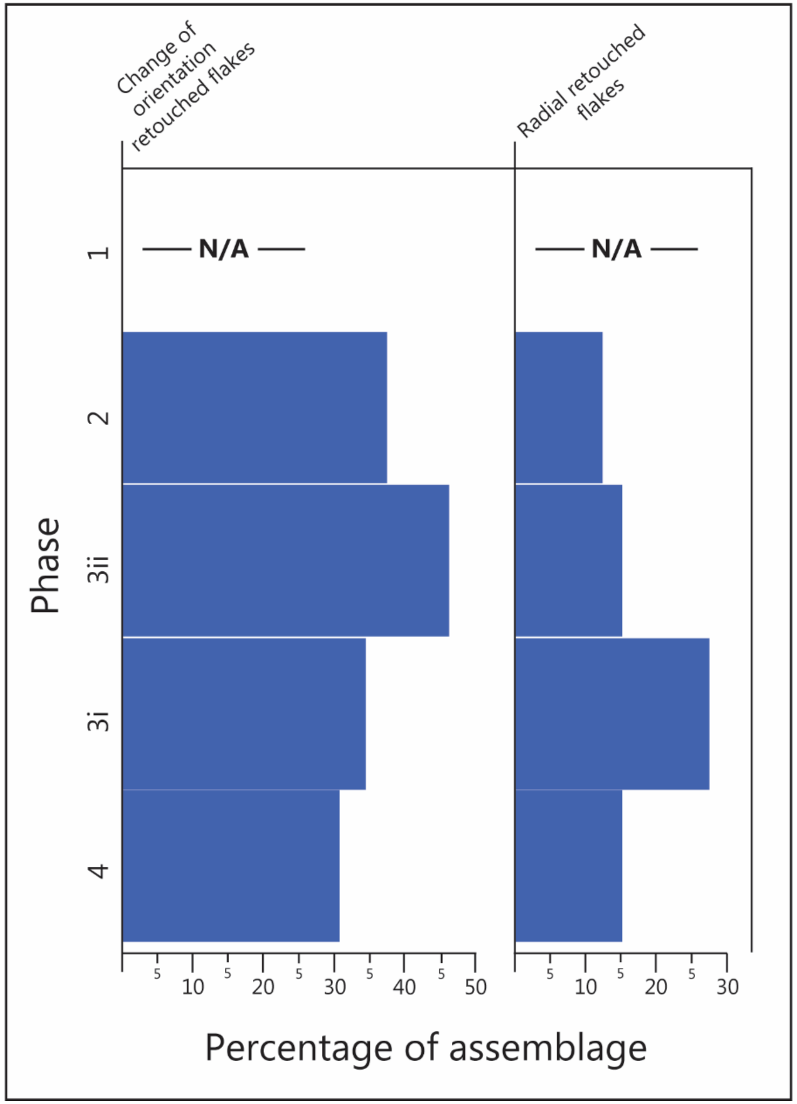


Figure 8.17: Types and technological attributes exhibiting a lenticular distribution over time (7/7).

relate to variations in the nature of the different occupations, with a comparatively reduced degree of foot traffic associated with the Phase 4 burial ground deposits resulting in fewer pieces being broken.

Debitage attributes manifesting bimodal, sinuous patterns include flakes with crushed platforms, plunging terminations, irregular shapes and incurvate profiles (**Fig. 8.18**). Bladelets with plunging and stepped terminations (**Figs. 8.18 – 8.19**) and incurvate or outcurving profiles similarly exhibit inverse-lenticular patterns over time. Flake cores with divergent scar patterns show a sinuous distribution between Phases 4 and 2 (**Fig. 8.19**), as do the bladelet cores with convergent scar patterns (**Fig. 8.20**), further emphasising the functional disassociation between these two groups of cores.

Among the tool groups, the scrapers, awls and borers, retouched flakes and informal tools also exhibit this pattern (**Fig. 8.20**). Some variation between these groups is nonetheless evident, with the second peak of awls and borers encompassing Phases 2 and 1, while the pattern amongst the retouched flakes is relatively minor, and thus may represent stochastic drift rather than a functionally related trend. In any case, these patterns may be explained by minor variations in the significance of certain onsite activities between the occupations associated with the burial ground and Structure 3, after which they underwent a gradual re-intensification across subsequent assemblages.

Among the tool types exhibiting this pattern, the rounded scrapers (**Fig. 8.20**), burin/scraper combinations (**Fig. 8.21**) and burins on truncations (**Fig. 8.22**) exhibit the most symmetrical distributions. These patterns are largely dependent on the aforementioned scraper types which dip in Phase 3 before rising in Phase 2. The endscraper (**Fig. 8.20**) and piece with notches (**Fig. 8.22**) also showcase well-curve patterns, although in these cases the upper frequency peak easily overshadows the lower one.

Among the tool attributes, the bi-directional crossed scrapers, multiple tools on flake blanks (**Fig. 8.21**), radial multiple tools, burins on blade blanks, bi-directional along axis burins, notched and denticulated pieces on blade blanks (**Fig. 8.22**) and retouched flakes with unidirectional or bi-directional crossed scar layouts (**Fig. 8.23**) all reveal inverse-lenticular pattern of change over time.

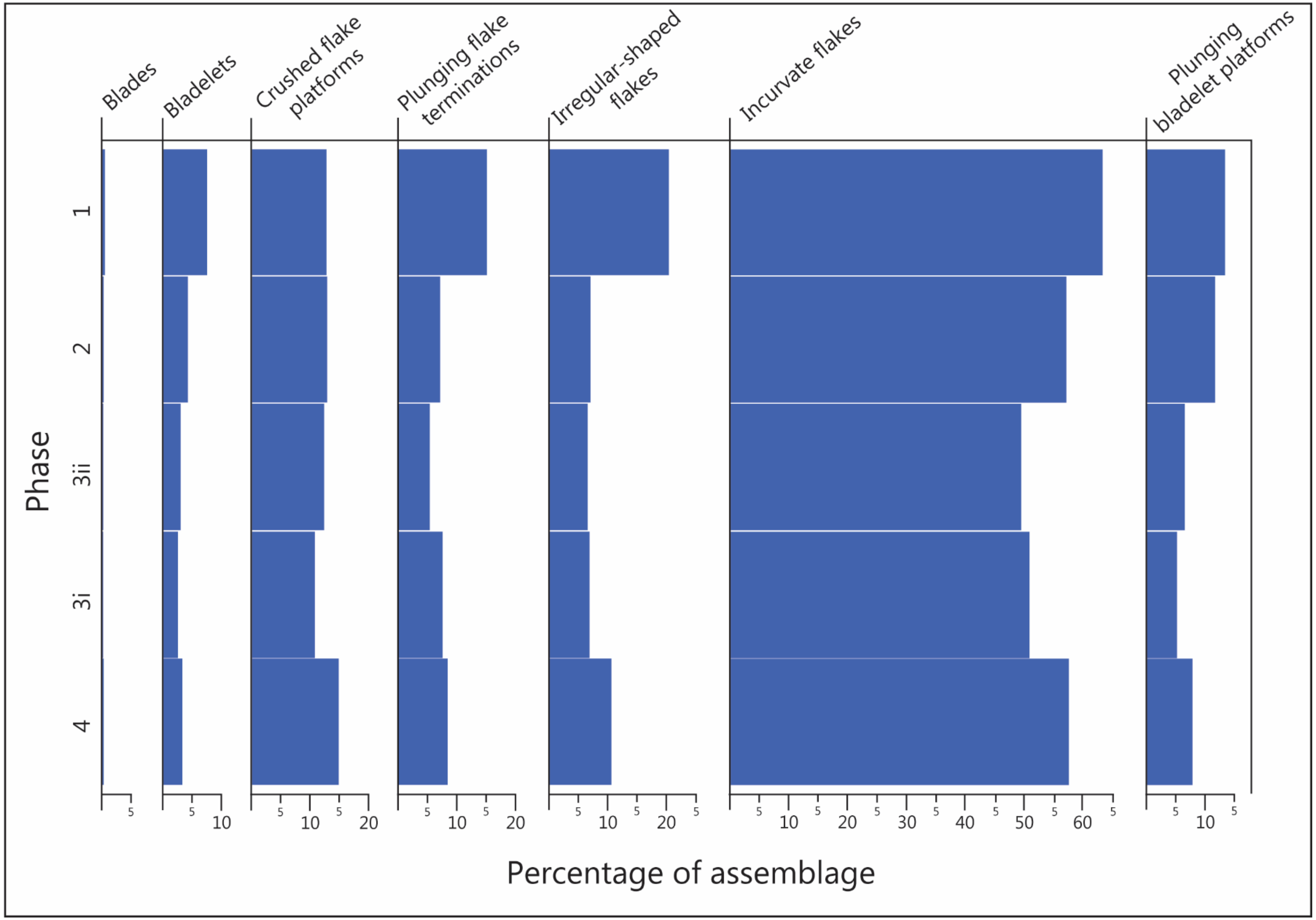


Figure 8.18: Types and technological attributes exhibiting a sinuous distribution over time (1/6).

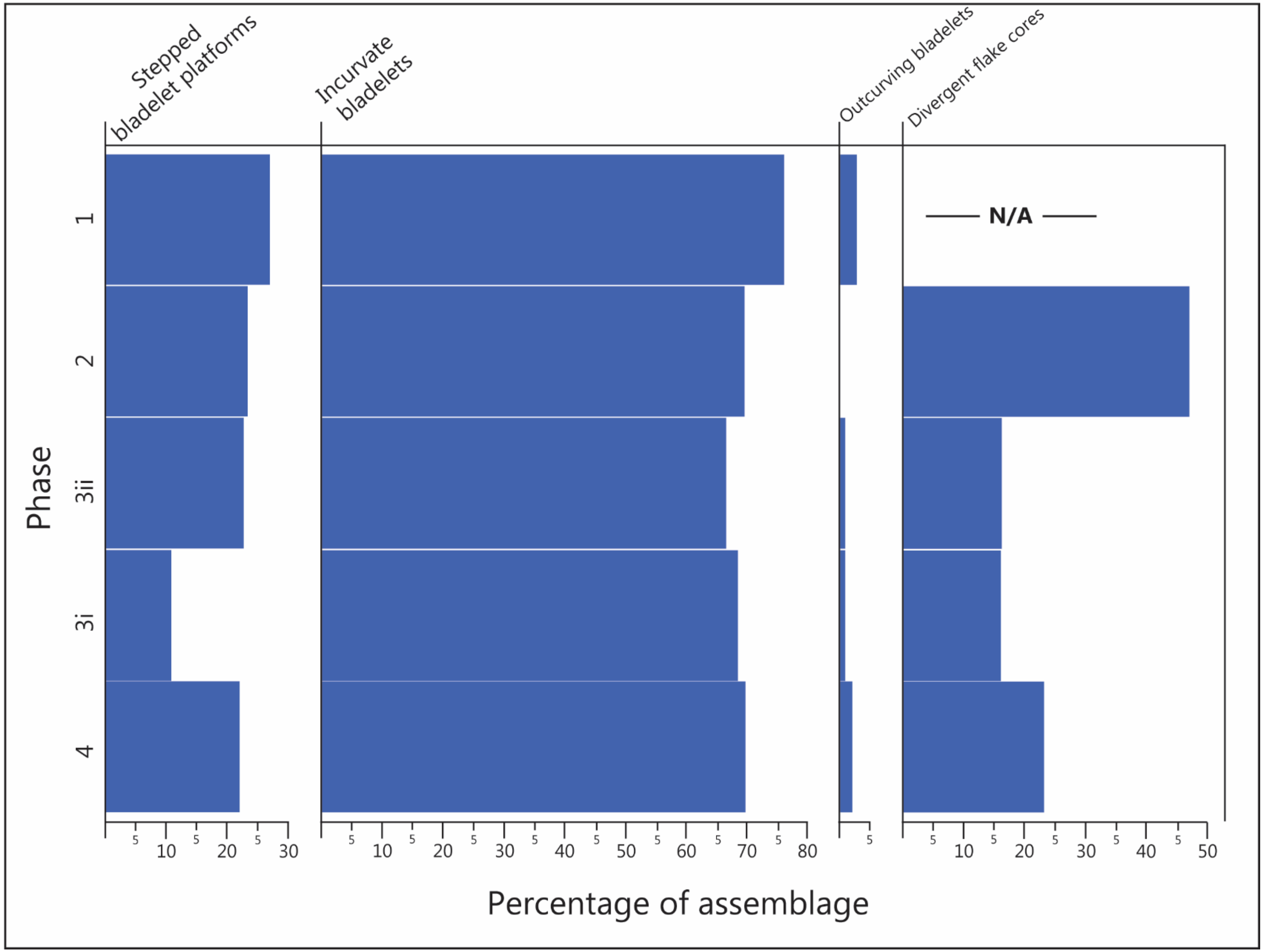


Figure 8.19: Types and technological attributes exhibiting a sinuous distribution over time (2/6).

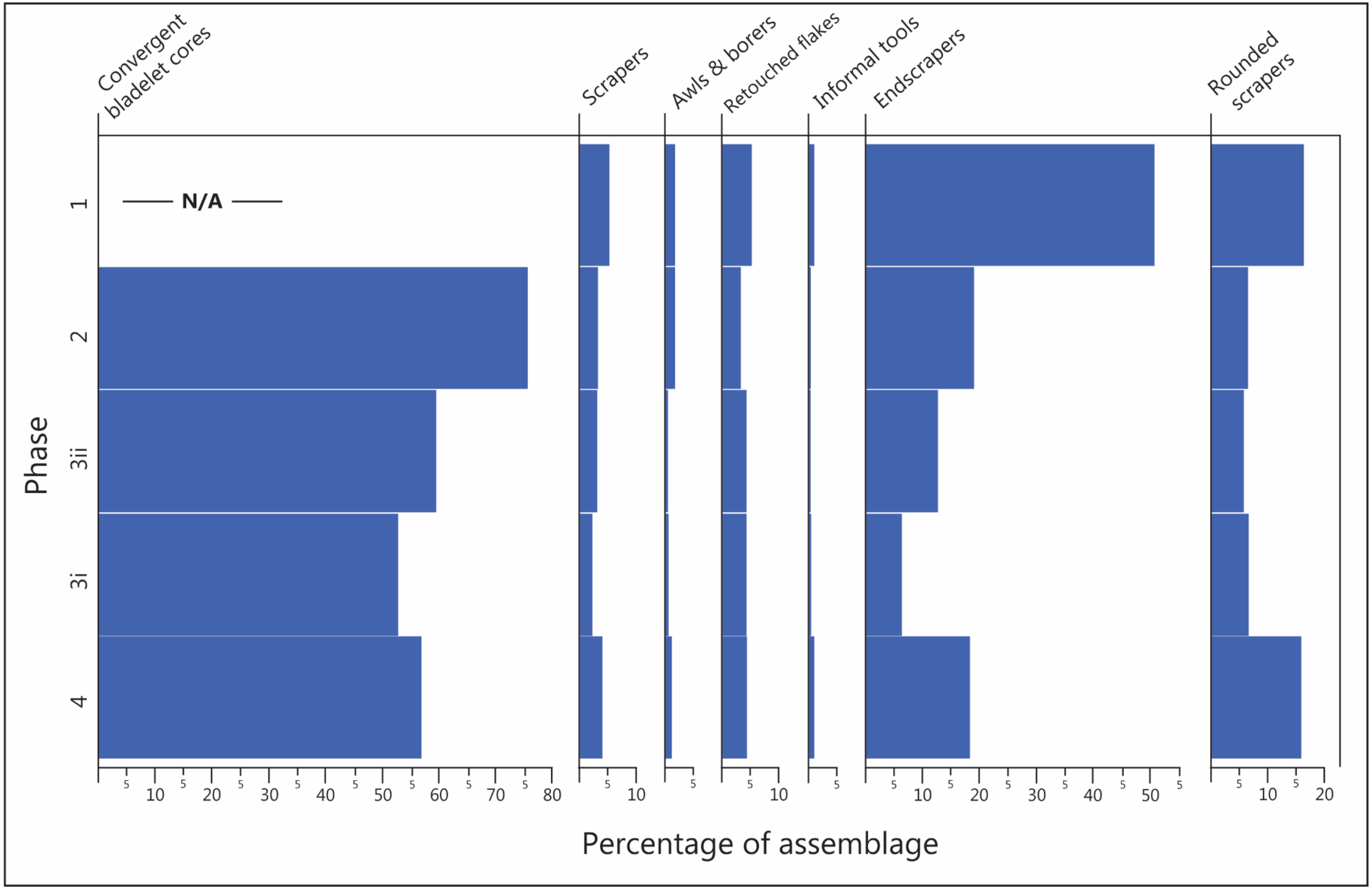


Figure 8.20: Types and technological attributes exhibiting a sinuous distribution over time (3/6).

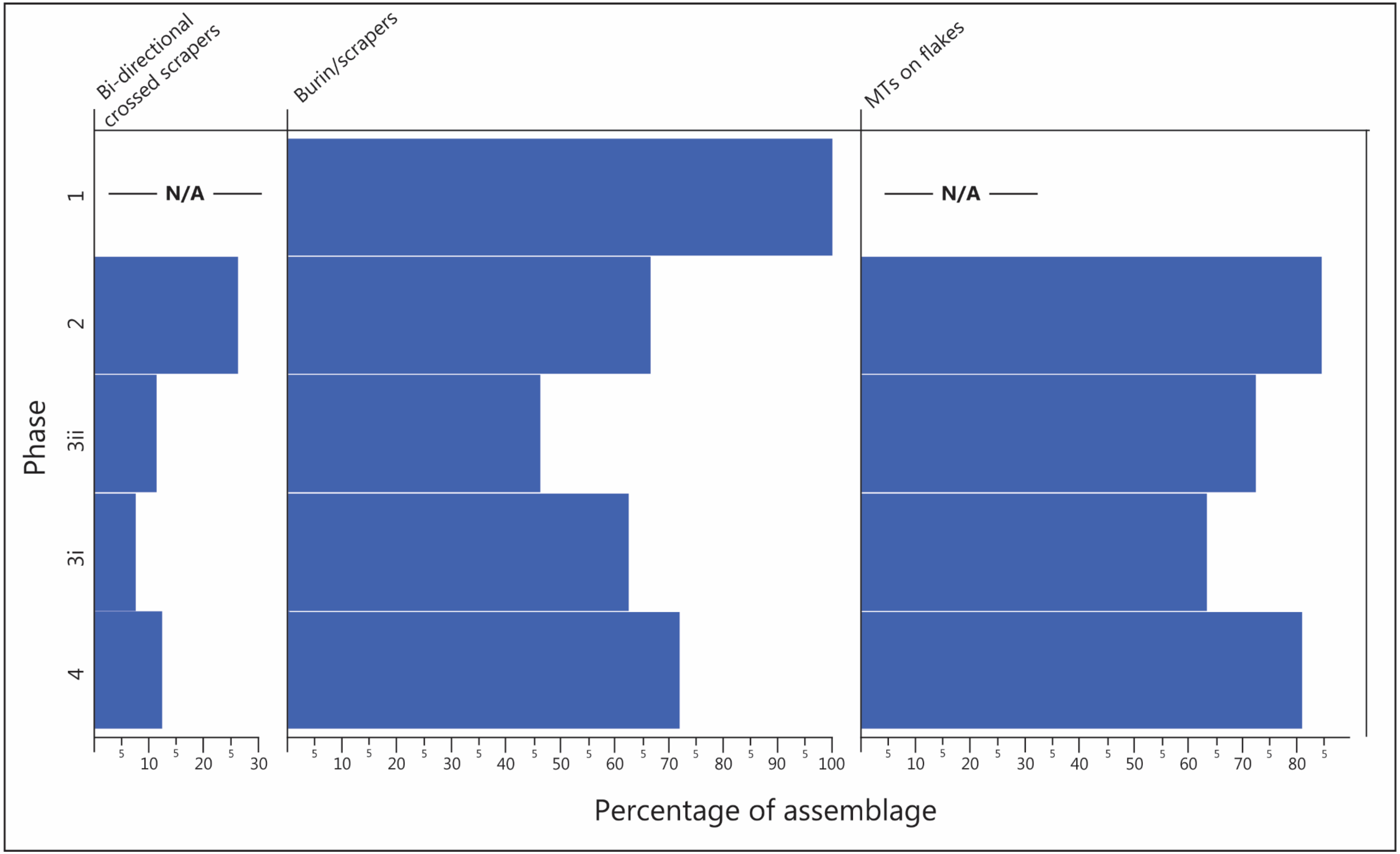


Figure 8.21: Types and technological attributes exhibiting a sinuous distribution over time (4/6). MTs = multiple tools.

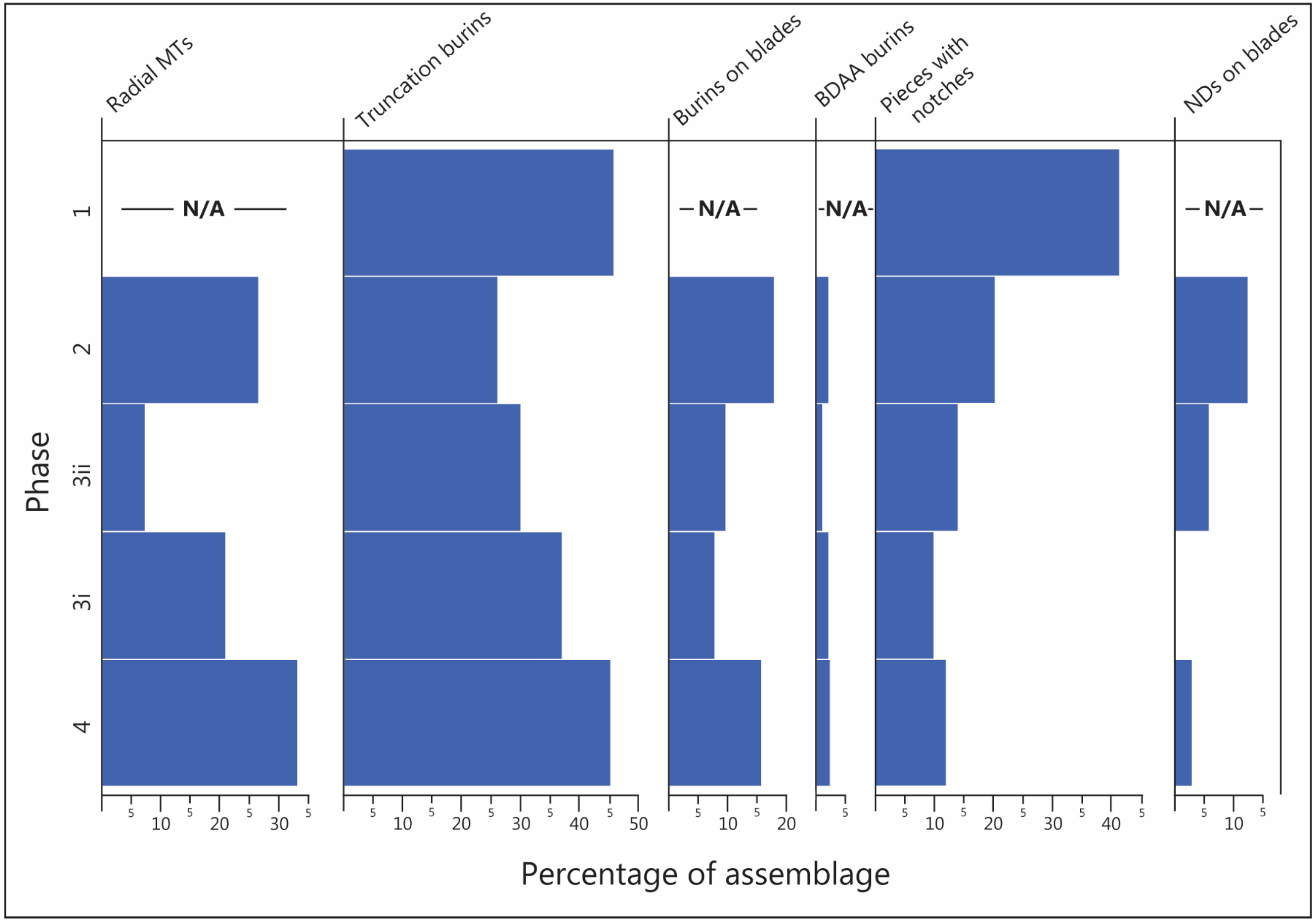


Figure 8.22: Types and technological attributes exhibiting a sinuous distribution over time (5/6). MTs = multiple tools; BDAA = bi-directional along axis; NDs = notched and denticulated pieces.

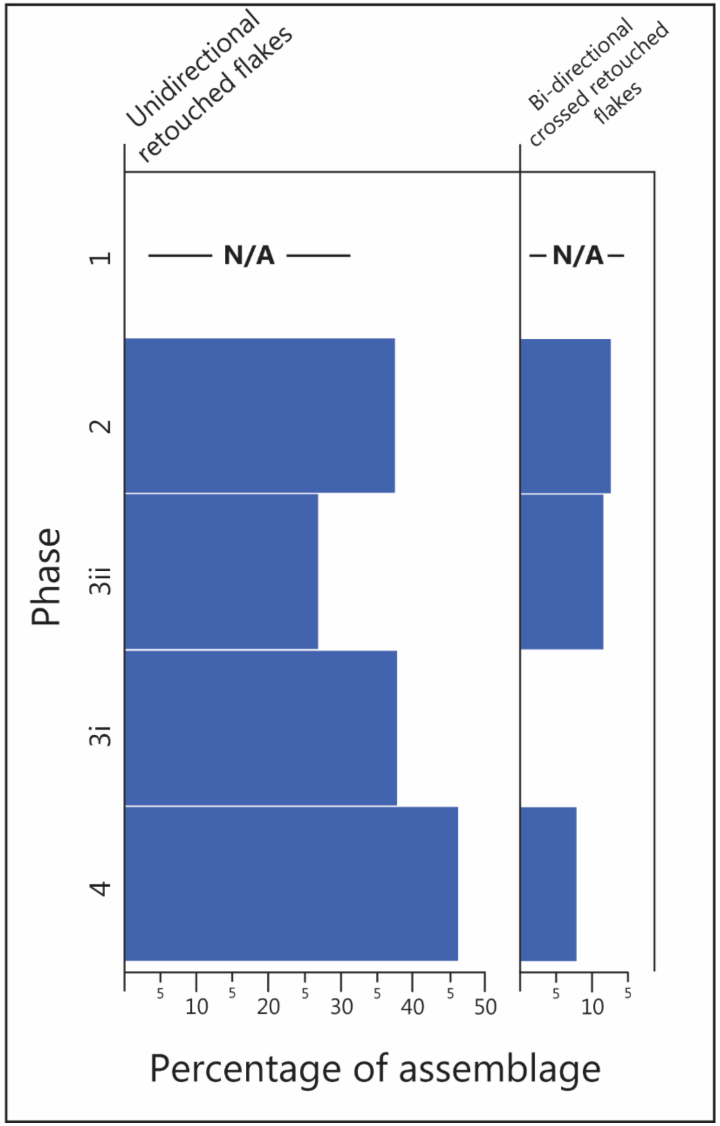


Figure 8.23: Types and technological attributes exhibiting a sinuous distribution over time (6/6).

8.2.7 Stochastic or unpatterned change

The remaining types and attribute states fluctuate across time on an assemblage-by-assemblage basis, without any obvious patterning evident. The degree of these fluctuations varies considerably, with the actual proportions of some types and attributes likely in fact remaining static over time, with their minor inter-assemblage variations purely being the result of stochastic noise. Others exhibit a more pronounced degree of inter-assemblage variation.

Flake dimensions remain largely static over time at Wadi Hammeh 27, as do the lengths and width of the blades (**Table 8.1**). Likewise, the blade and bladelet dorsal scar counts both remain stable enough to be statistically insignificant. Bladelet core dimensions also remain static across time, being consistently smaller than flake cores in every assemblage aside from Phase 2, where the two core groups exhibit similar dimensions (**Table 8.2**). Furthermore, despite the presence of some apparent shifts in tool dimensions or other numerical attributes, none of these changes are statistically significant (**Tables 8.3 - 8.4**).

The broken flakes and burin spalls each present relatively minor levels of fluctuation, suggesting that their proportions remain largely static over time (**Fig. 8.24**). This pattern is unusual in the case of the broken flakes, given that the percentages of whole flakes are doubled in Phase 1.

Unpatterned diachronic distributions are widespread amongst the debitage attributes. Among the flakes, pieces with cortical platforms, bi-directional and change of orientation scar patterns (**Fig. 8.24**), expanding forms and twisted profiles demonstrate comparatively minor interassemblage variations, as do the bladelets with multifaceted and cortical platforms, bi-directional along axis scar orientations (**Fig. 8.25**), canted forms and trapezoidal cross-sections (**Fig. 8.26**). In contrast, the flakes with punctiform platforms, hinged terminations (**Fig. 8.24**) and outcurving profiles reveal more pronounced variations, as do the bladelets with absent platforms, bi-directional crossed, change of orientation and radial scar orientations (**Fig. 8.25**) and lenticular cross-sections (**Fig. 8.26**).

The percentages of blade cores vary across time, whilst comprising low shares overall (**Fig. 8.26**). Amongst the bladelet cores, the single platform, opposed platform and multiple platform types all oscillate (**Fig. 8.27**). The patterns of these types clearly correlate with one another, with the drop in single platform bladelet cores in Phase 2 corresponding with a

Table 8.3: Table of single factor Anova p-values for scrapers, multiple tools, burins and non-geometric microliths between Phase 4 and 2.

	Scrapers		Multiple tools		Burins		Non-geometric microliths	
	P-value	H_1	*P-value*	H_1	*P-value*	H_1	*P-value*	H_1
Length	0.766989	No	0.109648	No	0.472703	No	0.229434	No
Width	0.745241	No	0.575360	No	0.122494	No	0.112463	No
Thickness	0.796095	No	0.076452	No	0.474432	No	0.109076	No
Weight	0.532212	No	0.111455	No	0.492907	No	0.136519	No
Cortex %	0.946727	No	0.497485	No	0.583703	No	0.271500	No
Dorsal scar no.	0.344009	No	0.066880	No	0.437810	No	0.205591	No
Edge retouch %	0.755728	No	0.321609	No	0.239394	No	0.706720	No
Burin bit angle	-	-	0.553658	No	0.347902	No	-	-

Table 8.4: Table of single factor Anova p-values for lunates, notched and denticulated pieces and retouched flakes between Phase 4 and 2.

	Lunates		Notched and denticulated pieces		Retouched flakes	
	P-value	H_1	*P-value*	H_1	*P-value*	H_1
Length	0.416315	No	0.326390	No	0.846471	No
Width	0.105267	No	0.226589	No	0.126009	No
Thickness	0.529313	No	0.698379	No	0.469613	No
Weight	0.502938	No	0.476012	No	0.544815	No
Cortex %	0.902430	No	0.232041	No	0.807257	No
Dorsal scar no.	0.221682	No	0.911279	No	0.232574	No
Edge retouch %	0.836492	No	0.157018	No	0.183911	No

temporary rise in the latter two types. The only core attribute to fluctuate even slightly are the proportions of flake cores with parallel scar patterns (**Fig. 8.26**).

The geometric microliths and notched and denticulated pieces share similar patterns, both remaining static over time, aside from a spike in Phase 2 (**Fig. 8.27**). Numerous scraper types also exhibit unpatterned distributions, although most are numerically marginal types such as thumbnail scrapers, transversal endscrapers (**Fig. 8.27**), circular/oval scrapers, double endscrapers, narrow carinated scrapers, micro-carinated scrapers and nucleiform scrapers (**Fig. 8.28**). In contrast, the only scraper types to present unpatterned change which exceeded ten percent of any assemblage are the endscrapers on retouched pieces (**Fig. 8.27**) and sidescrapers (**Fig. 8.28**).

The burin/truncations display an overall irregular distribution (**Fig. 8.28**), although if it were not for the slight decline in this type between Phase 4 and Lower Phase 3 then it would exhibit the same lenticular pattern as the burin/notched pieces. Amongst the abridged burin types, the burins on natural surface, transversal burins and ventral burins all evince unpatterned distributions over time, though the inter-assemblage variations in these three cases remain relatively minor (**Fig. 8.29**).

The bladelets with semi-steep, alternating, inverse and abrupt retouch all fluctuate over time (**Fig. 8.29**). Notably, these types feature two clear examples of dependent change, with the increased proportions of inverse bladelets correlating with a downturn in bladelets with semi-steep retouch. This orientation suggests that both types represent alternative methods of manufacturing a semi-steep retouched edge, as opposed to serving as interchangeable preparatory steps in the production of Helwan retouch. A similar dependent relationship appears to exist between bladelets with abrupt and alternating retouch. Amongst the lunates, the only type showing stochastic variation are the inverse category. They exhibit an overall lenticular pattern, broken by a drop in Phase 2 (**Fig. 8.30**).

All three retouched flake types fluctuate across time. The relationship between regularly retouched and backed flakes is clearly a dependent one, with backed flakes rising in proportion whenever the dominant retouched type declines (**Fig. 8.31**). In contrast, the Helwan-retouched flakes retain marginal portions throughout the occupation of Wadi Hammeh 27, with little obvious relation to the proportions of the other two types. The continued presence of this third type may represent either a ‘hangover’ retouch habit, or more likely, aborted attempts at manufacturing Helwan lunates from small flakes.

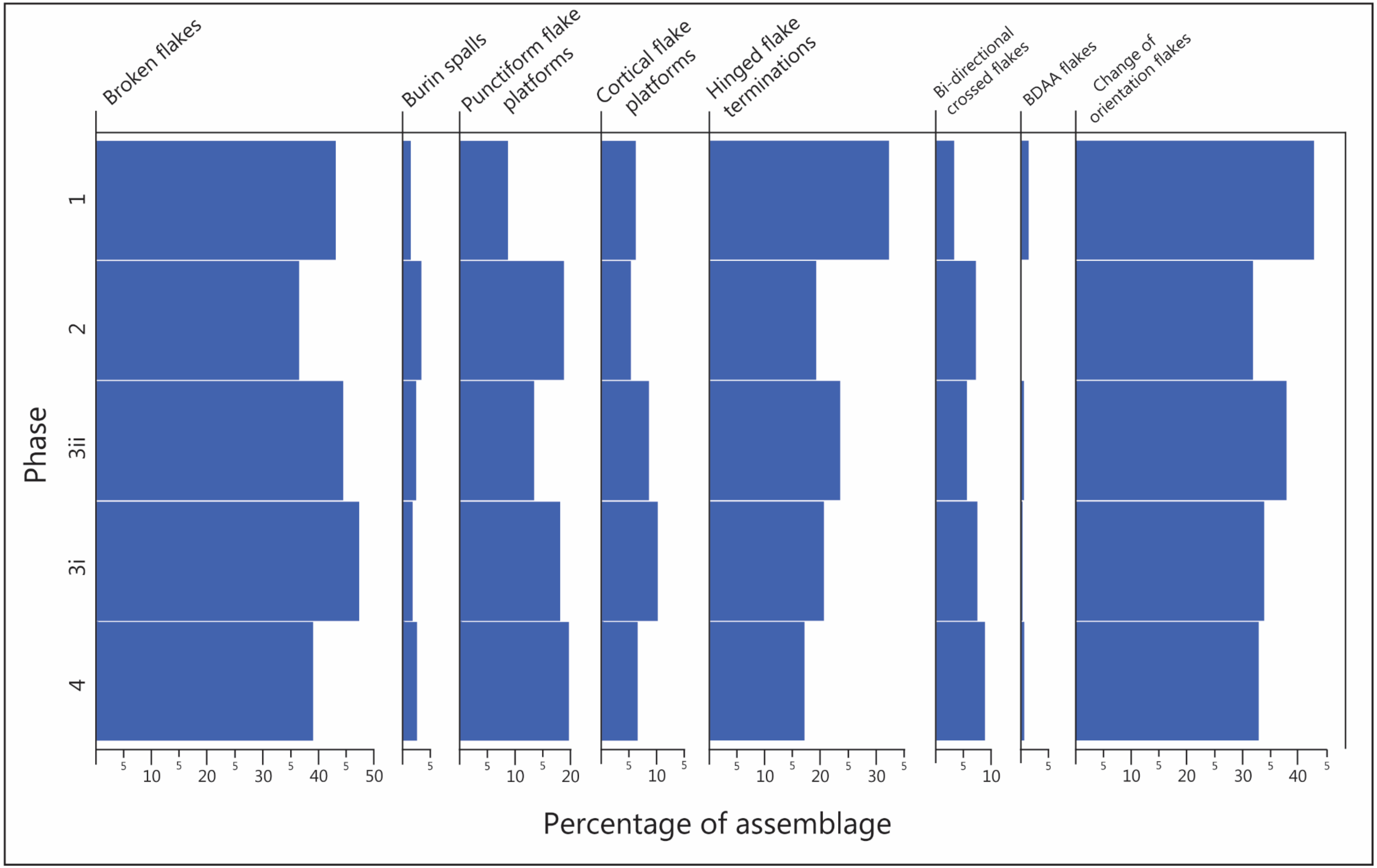


Figure 8.24: Types and technological attributes exhibiting an unpatterned distribution over time (1/8).

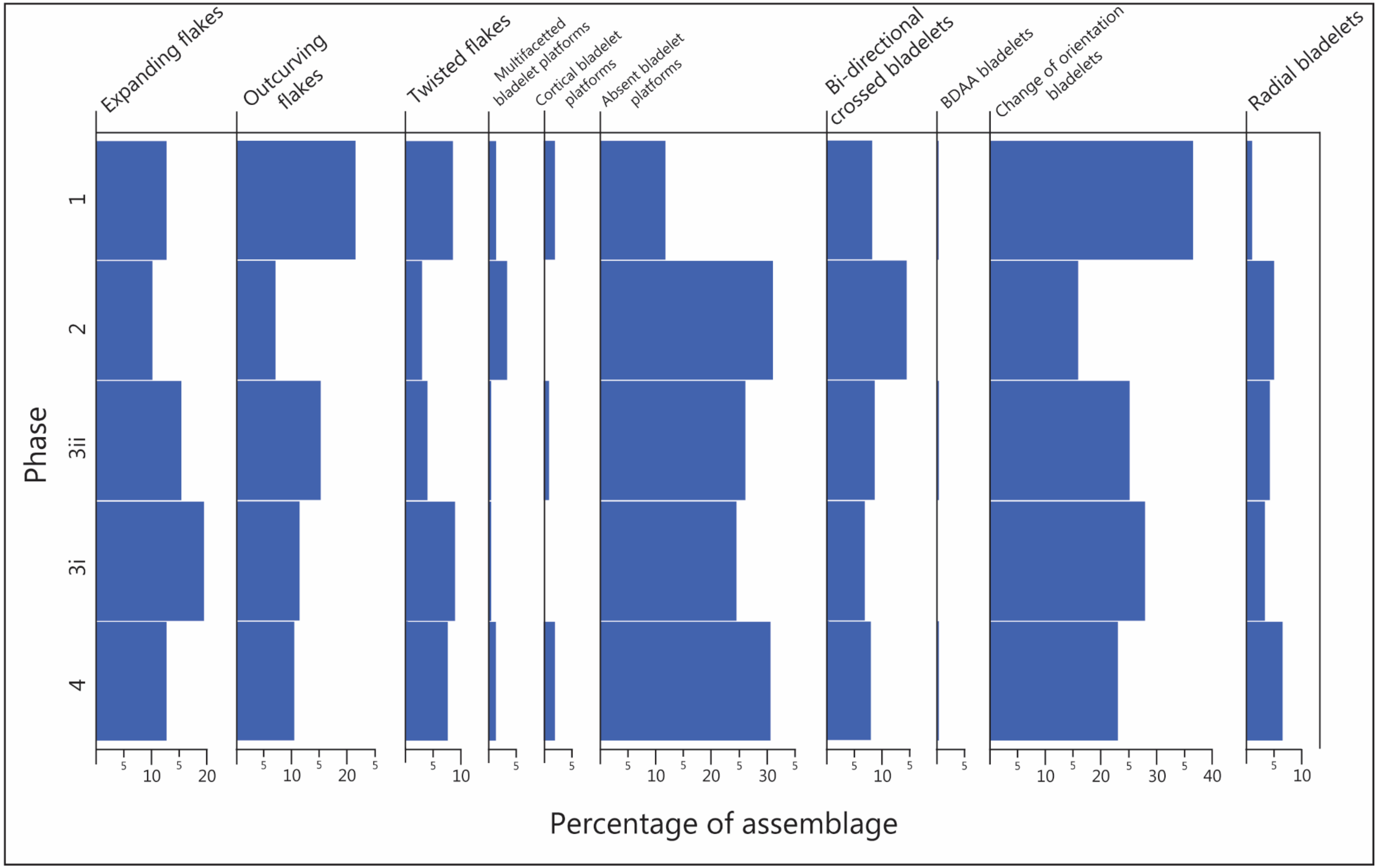


Figure 8.25: Types and technological attributes exhibiting an unpatterned distribution over time (2/8). BDAA – bi-directional along axis.

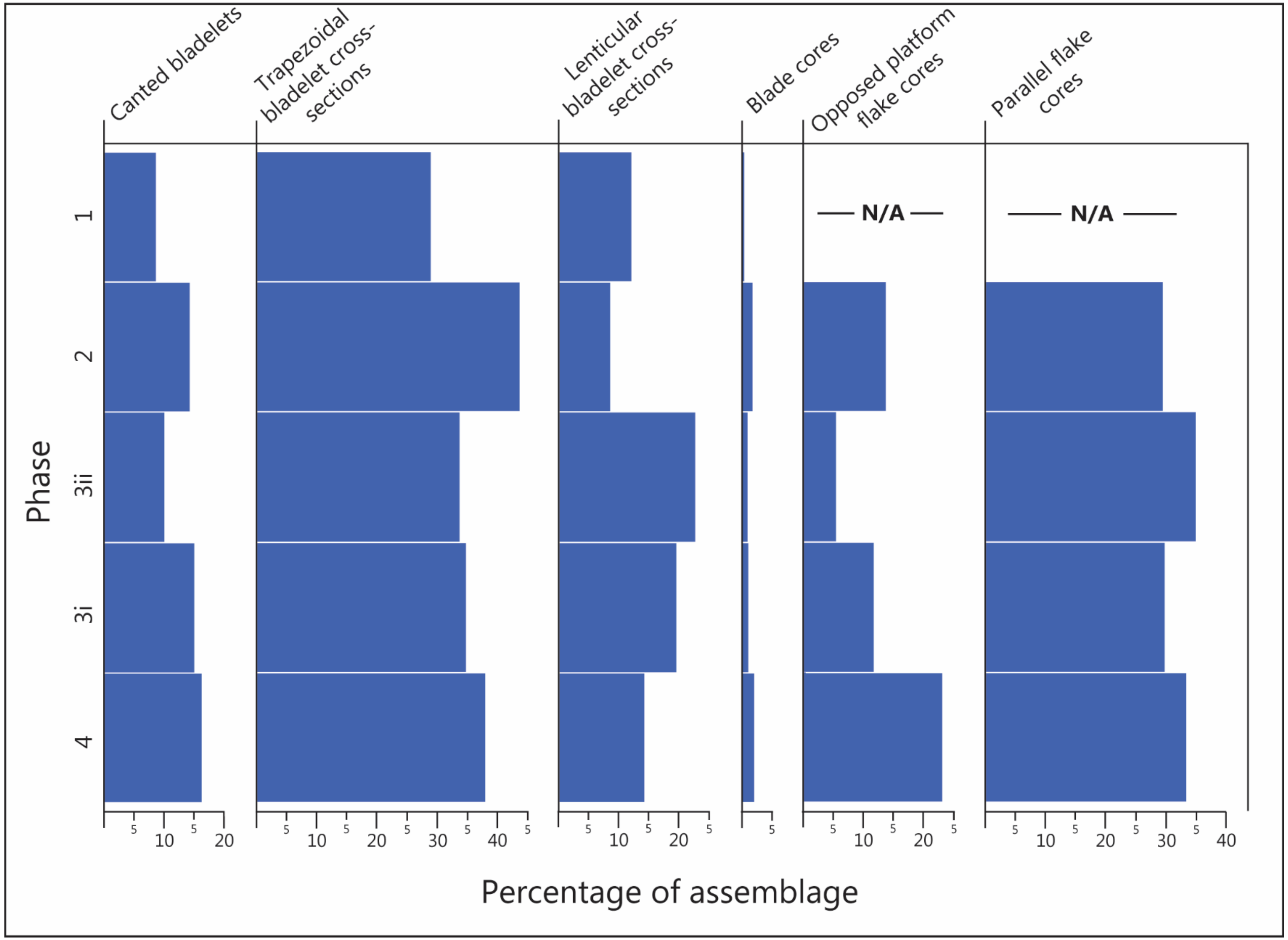


Figure 8.26: Types and technological attributes exhibiting an unpatterned distribution over time (3/8).

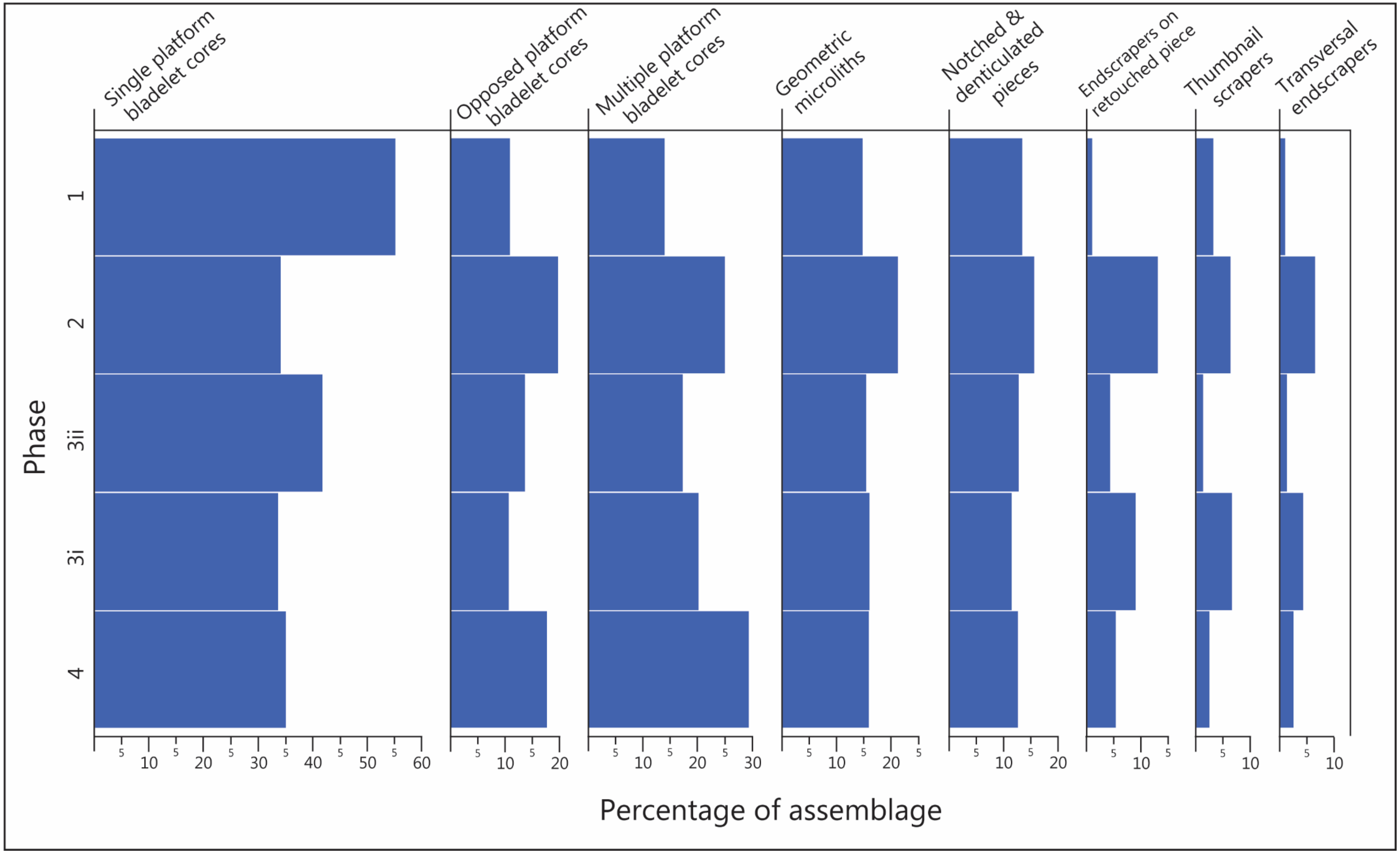


Figure 8.27: Types and technological attributes exhibiting an unpatterned distribution over time (4/8).

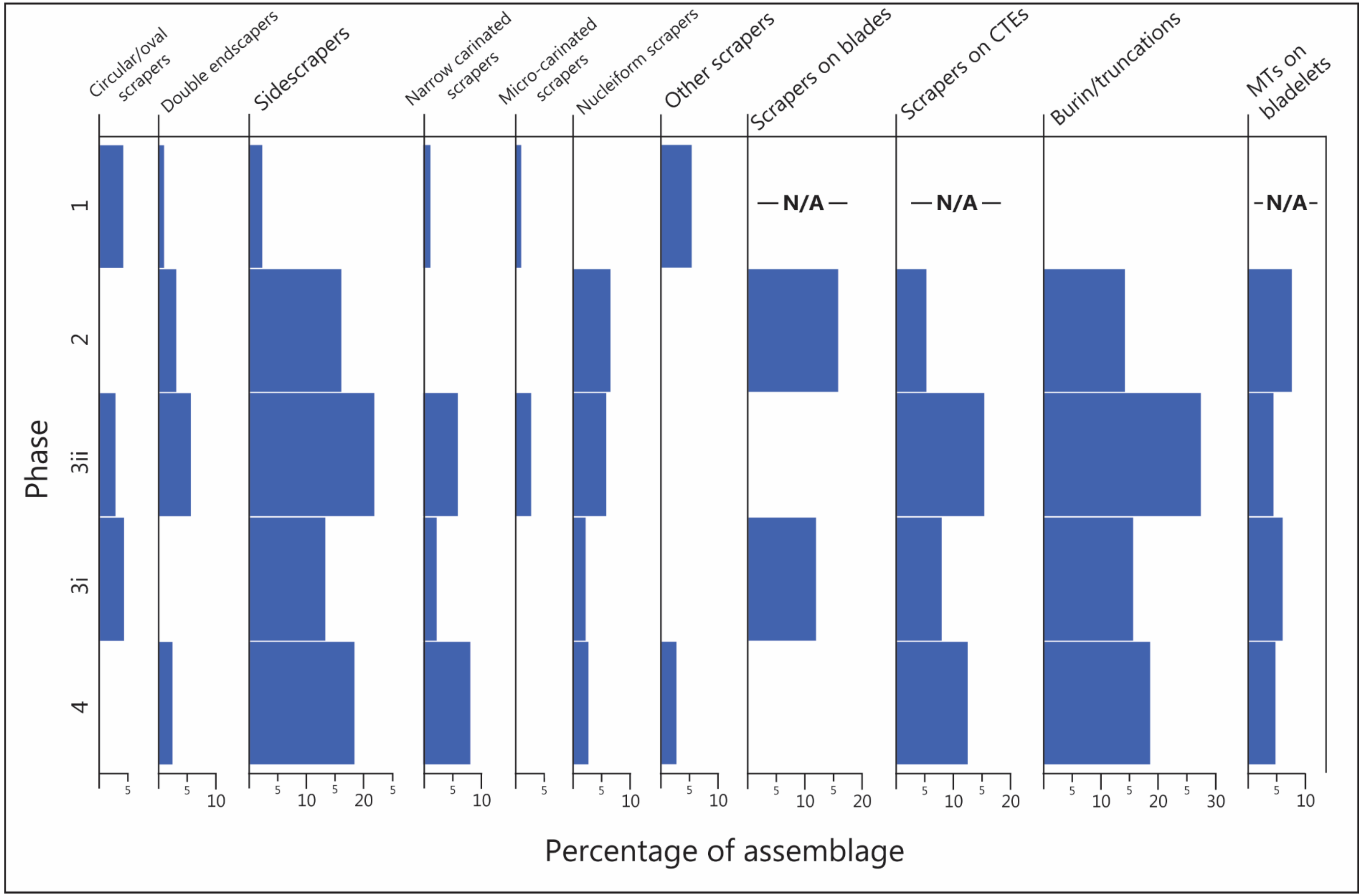


Figure 8.28: Types and technological attributes exhibiting an unpatterned distribution over time (5/8). CTEs = core trimming elements; MTs = multiple tools.

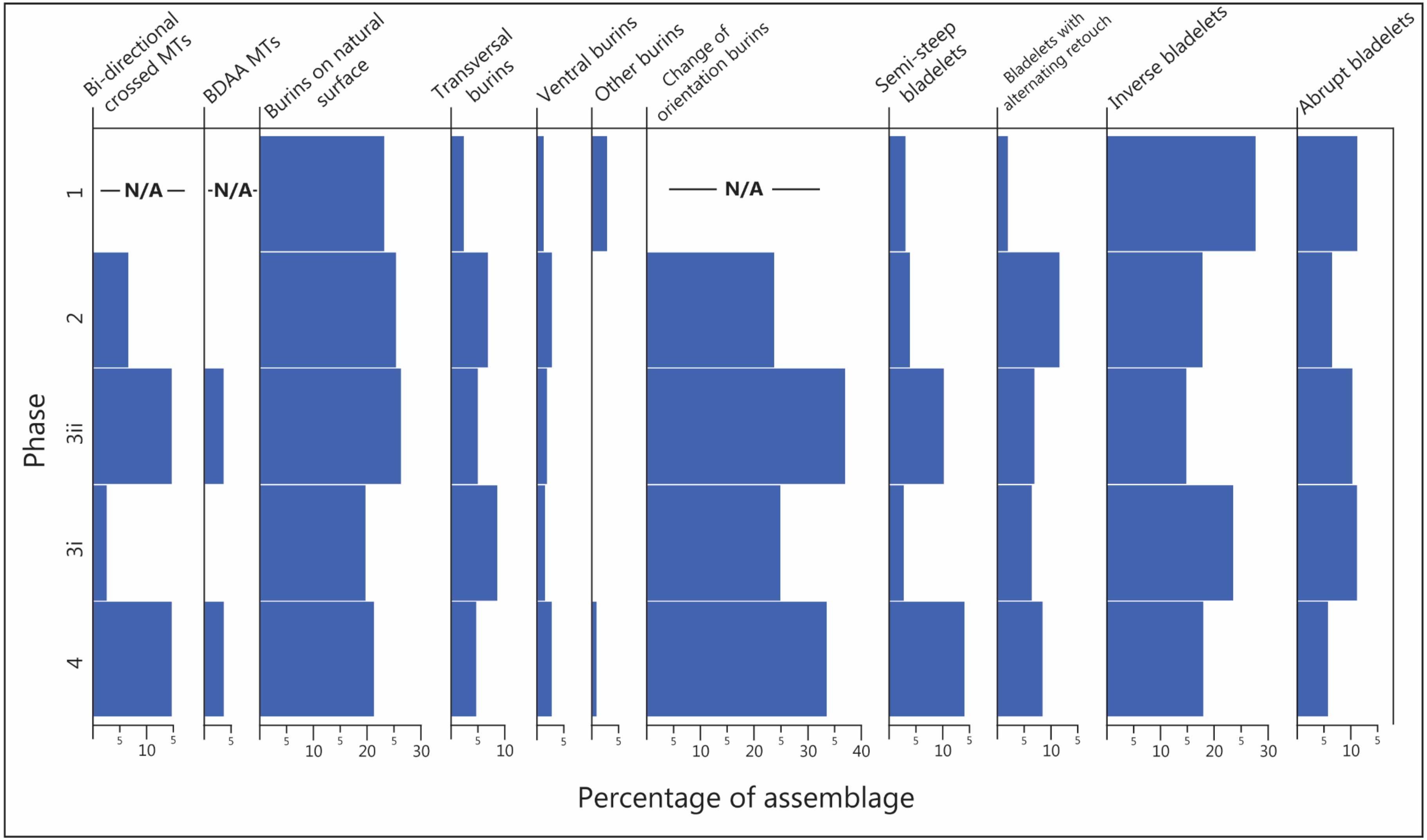


Figure 8.29: Types and technological attributes exhibiting an unpatterned distribution over time (6/8). MTs = multiple tools; BDAA = bi-directional along axis.

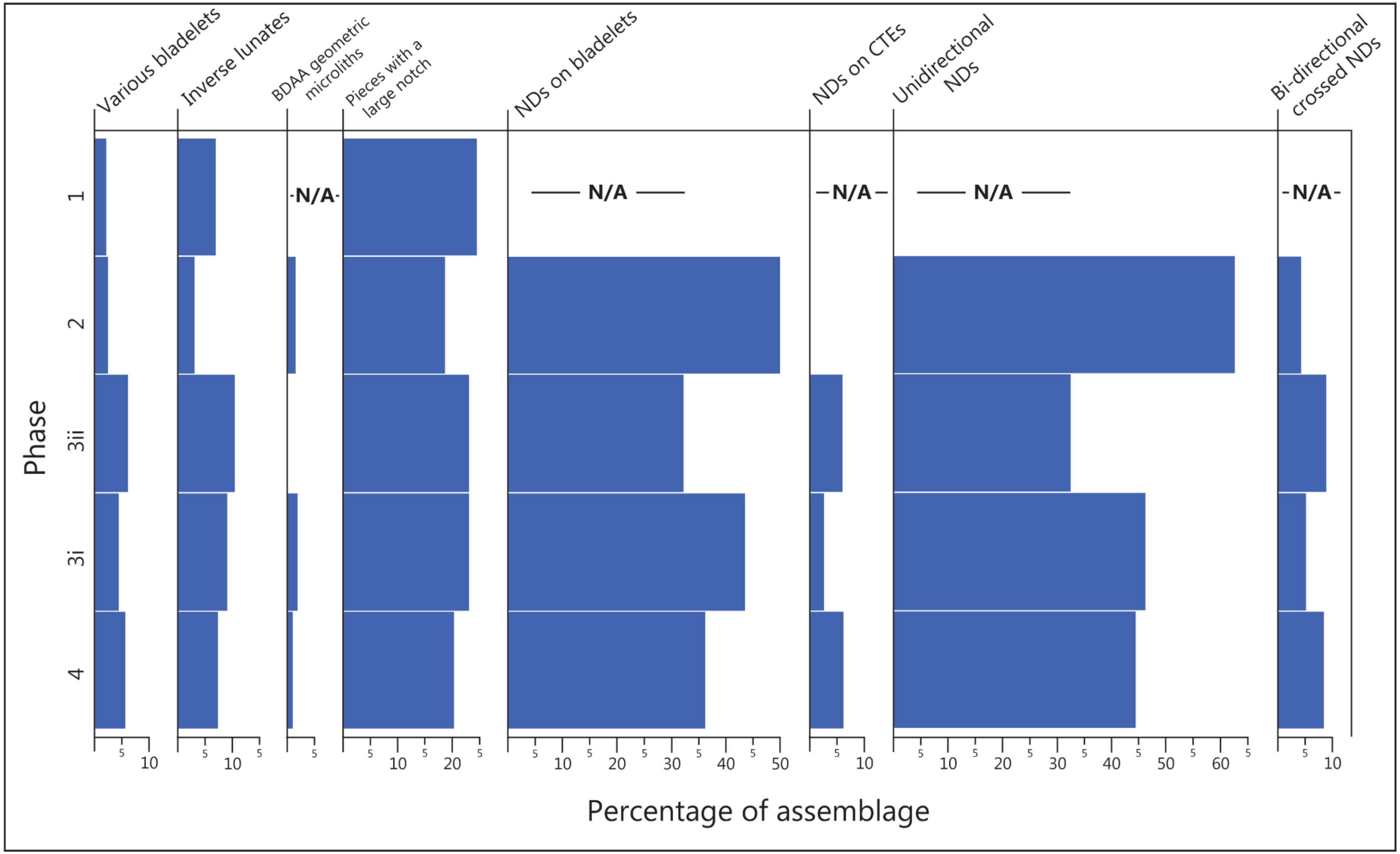


Figure 8.30: Types and technological attributes exhibiting an unpatterned distribution over time (7/8). BDAA = bi-directional along axis; NDs = notched and denticulated pieces; CTEs = core trimming elements.

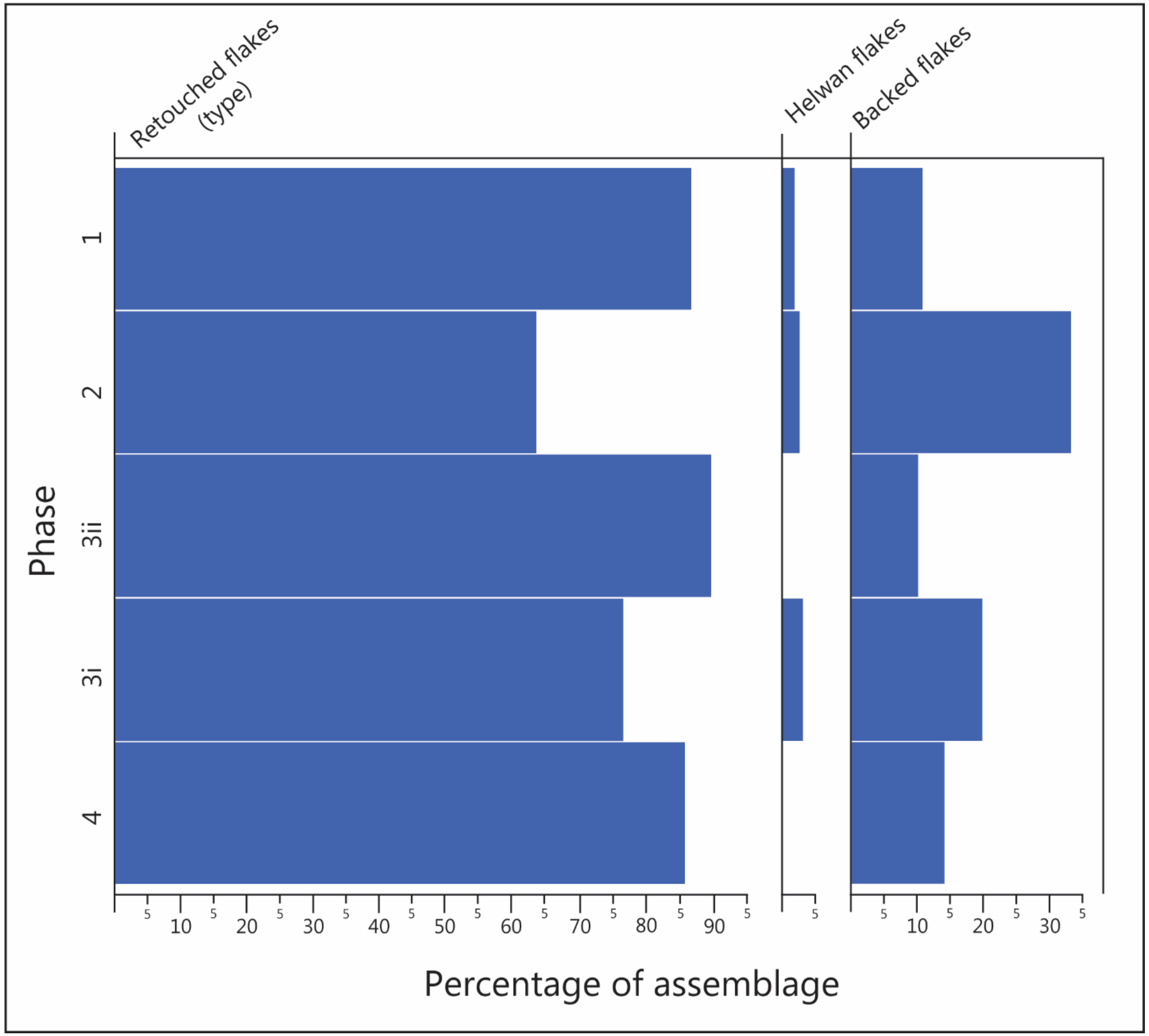


Figure 8.31: Types and technological attributes exhibiting an unpatterned distribution over time (8/8).

Scrapers manufactured from blade and core trimming elements oscillate in a dependant fashion to one another (**Fig. 8.28**). Likewise, the shares of multiple tools on bladelet blanks vary slightly. Multiple tools manufactured from blanks with bi-directional scar orientations vary considerably, being most common in Phase 4 and Upper Phase 3 (Fig. **8.29**). The proportions of burins with change of orientation scar also fluctuate moderately. The small numbers of geometric microliths with bidirectional-along-axis scar orientations also similarly vary over time (**Fig. 8.30**). Finally, the notched and denticulated pieces exhibit a considerably degree of dependent, unpatterned change, namely between those manufactured from bladelet blanks and core trimming elements on one hand, and between pieces with unidirectional and bi-directional crossed scar patterns on the other.

The influences behind these stochastic patterns likely vary, may include a number of complex variables, including deposition factors such as duration of occupation from phase to phase. Other patterns, particularly those relating to tool types which remain comparatively uncommon regardless, are in all likelihood the result of a flexible approach to manufacturing specific types of tools such as scrapers, with a greater emphasis being placed manufacturing a workable tool, rather than a preoccupation with selecting predetermined chains of reduction.

8.3 Theoretical implications of the Wadi Hammeh 27 sequence

Having thus summarised the variety of changes observed over time at Wadi Hammeh 27, these patterns may subsequently be compared with the theoretical case studies of cultural and technological change discussed in Chapter 2.2.

8.3.1 Configuring patterns of change

While Lucas (2018) advocates linking archaeological change with multiple temporal frameworks in order to interpret its meaning – in his case with the rich early modern Icelandic historical record – this is obviously not an option in the case of prehistoric sites such as Wadi Hammeh 27. Instead, the dated, stratigraphic sequence at Wadi Hammeh 27 serves as the most reliable means of measuring change against time, if at the scale of a single residential locale rather than the settlement as a whole.

This latter caveat is exemplified by the fact that Area XX F only provides a restricted, localised perspective of the earlier phases of Wadi Hammeh 27. It is entirely possible that if one were to excavate a similarly sized sondage beneath Structure 2, that an entirely distinct sequence of architectural phasing would be revealed. Perhaps then that this area of the settlement served an entirely different function prior to the establishment of Structure 2, such as it being an outdoor clearing primarily utilised for the processing of gazelle hides? How then would this shift in the use of space affect the diachronic patterning of the artefacts deposited there, and our subsequent interpretation of their meaning? Would any of the trends exhibited in the Area XX F sequence still be detectable, or would they be superseded by an entirely different - if equally convoluted - system of interrelated diachronic patterns? This problem is rectified somewhat by the incorporation of assemblages drawn from both interior and exterior spaces in the Phase 4 and 3 assemblages, although the move to a purely indoor context in Phase 2 raises the possibility that some of the abrupt technological and typological shifts between Upper Phase 3 and Phase 2 reflects a change in the area of the settlement being sampled more than anything. In any case, the finds summarised above in this chapter must be taken at face value in the absence of any alternative means of recording change in prehistory within the practical limitations of sampling a broad, architecturally complex settlement like Wadi Hammeh 27.

Instances of gradual increase or decline over time could be interpreted as expressions of a unimodal distribution, as outlined by Dethlefsen & Deetz (1966) and Clarke (1968), with the latest and earliest deposits of Wadi Hammeh 27 occurring near the height of their popularity respectively. At the same time, Clarke's (1968) argument that the popularity of every sociocultural entity will produce a standardized, unimodal plot does not match many of the bimodal configurations at Wadi Hammeh 27, such as the decline and resurgence of truncation burins. These artefacts are continuously present in each assemblage, demonstrating no discontinuity in their manufacture, and thus they cannot be segregated into separate populations as suggested by Clarke (1968: 166-172). Such patterns instead support Lucas' (2004: 12-14) assertion that cultural developments have the potential of undergoing periods of regression. Alternatively, if stylistic change is purely stochastic, as suggested by Dunnell (1978), then many of the typological changes - such as the decline and resurgence in truncation burins - must be viewed at face value as being purely preferential.

While the technological and typological patterning of the Wadi Hammeh 27 assemblages exhibit some consistent diachronic patterning, the overall structure the knapping strategies employed remains relatively stable over time, as does the composition of the toolkits produced. These patterns attest to a persistent, conservative retention of many aspects of the lithic assemblages over time, with the final occupants of the settlement replicating most of the knapping strategies and tool designs imported to the site by their predecessors some 500 years earlier. It is for this same reason that many of the minor typological perturbations seen at the site likely stem from numerous intersecting depositional factors rather than any behavioural shifts.

8.3.2 The transmission of information in an Early Natufian context

If the idea of cultural flow and alterations being responsible for technological and cultural changes over time serves as a valid explanation for the Early Natufian archaeological record, it must be viewed from a regional scale rather than on a site-by-site basis. This aspect is made apparent by the extensive utilisation of wide-reaching, inter-societal exchange networks between Early Natufian sites (Delage 2018; Weinstein-Evron et al. 2001), which would have facilitated the horizontal transmission of information on a regional scale. This aspect would have been further bolstered if Early Natufian communities regularly exchanged marriage or mating partners, as suggested by Bocquentin's (2003: 480-1) patrilocal model of residence. It is for these same reasons that the concept of cultural or stylistic drift can be discounted as a causal development for any of the major trends at Wadi Hammeh 27, as this model explicitly requires the population in question to be isolated from external developments (Koerper & Stickel 1980: 466-7).

The idea that the horizontal, intra-societal transmission of cultural traits through indirect and frequency dependency biases (see Chapter 2.2) become more prominent as societies grow larger and more complex (Bettinger & Eerkens 1997: 179) may explain some of the patterning at Wadi Hammeh 27. This possibility is best represented by the increasing standardisation in sickle element and lunate production in the latest two phases, particularly in regards to the application of Helwan retouch. These shifts correspond with the establishment and occupation of Structures 1 and 2, which significantly outsize their Phase 3 predecessor. While it is impossible at the current stage to determine whether the total settlement size and population increased alongside the establishment of these larger structures, it is highly possible that they were occupied by multiple and/or extended familial units compared to Structure 3, thus further driving the horizontal transmission of information and maximising cultural homogeneity within the settlement.

8.4 Conclusion

The flaked stone assemblages at Wadi Hammeh 27 present a mosaic of change at varying levels, with different modes of change occurring a varying pace. Some of the changes can be correlated with specific events, such as the shift to the occupation of Structure 1, or the final abandonment of the site. This latter correlation is discussed in more detail in Chapter 10. Other changes suggest an increasing emphasis on the production and manufacture of sickle elements, the consequences of which are explored in the following chapter. However, the proportions of many types and attributes fluctuate over time without any apparent relationship with one another. Attempting to reconstruct the causal relationship for many of these seemingly contradictory patterns is beyond the scope of this study, and they thus must be viewed in the context of the flexible knapping and tool acquisition patterns employed at Wadi Hammeh 27 over time.

Chapter 9: Raw material provisioning, reduction pathways and tool use over time at Wadi Hammeh 27

9.1 Introduction

The previous chapter detailed a complex series of changes over time for many artefact types and attribute states, while other variables remain static. This chapter aims to utilise these changes and consistencies in order to provide an interpretation of the flaked stone reduction sequence at Wadi Hammeh 27. This undertaking is related to the broader environmental and functional influences at hand. Some of the theoretical approaches discussed in Chapter 2 are used as a frame of reference to aid in interpretation, particularly in the context of some of the key changes discussed in the previous chapter.

9.2 Summary of the Wadi Hammeh 27 reduction sequence

The bulk of the reconstructed Wadi Hammeh 27 *chaîne opératoire* corresponds with the multiple-pathway sequence first described by Edwards (2013e: 145) for the Phase 1 assemblage. Numerous large chert cobbles were imported to Wadi Hammeh 27 in an unworked or scarcely reduced state, some of which exceeded 1kg in mass. These blocks were primarily reduced into large flake or blade cores, while a much smaller number were instead fashioned into nucleiform picks and axes (**Fig. 9.1**). Three identified reduction pathways resulted in the presence of large, cortex-rich debitage within each assemblage, further supporting the idea that this initial stage of core reduction was consistently being performed in a domestic context at Wadi Hammeh 27 (*cf.* Dibble et al. 2005: 546-7). A limited number of these cortex-rich pieces were subsequently selected as blanks for large burins and carinated scrapers.

Most of the large flake and blade cores subsequently underwent a substantial degree of reduction, with only a small number being disposed of prior to the secondary removal of smaller flakes and bladelets. The existence of larger cores is nonetheless attested to by the comparatively large quantities of large flakes and blades in each assemblage, along with the consistent presence of core trimming elements with corresponding dimensions. Many of the flakes produced during this stage were retouched into a broad variety of macrolithic tools, including scrapers, multiple tools, burins, notched and denticulated pieces and expediently

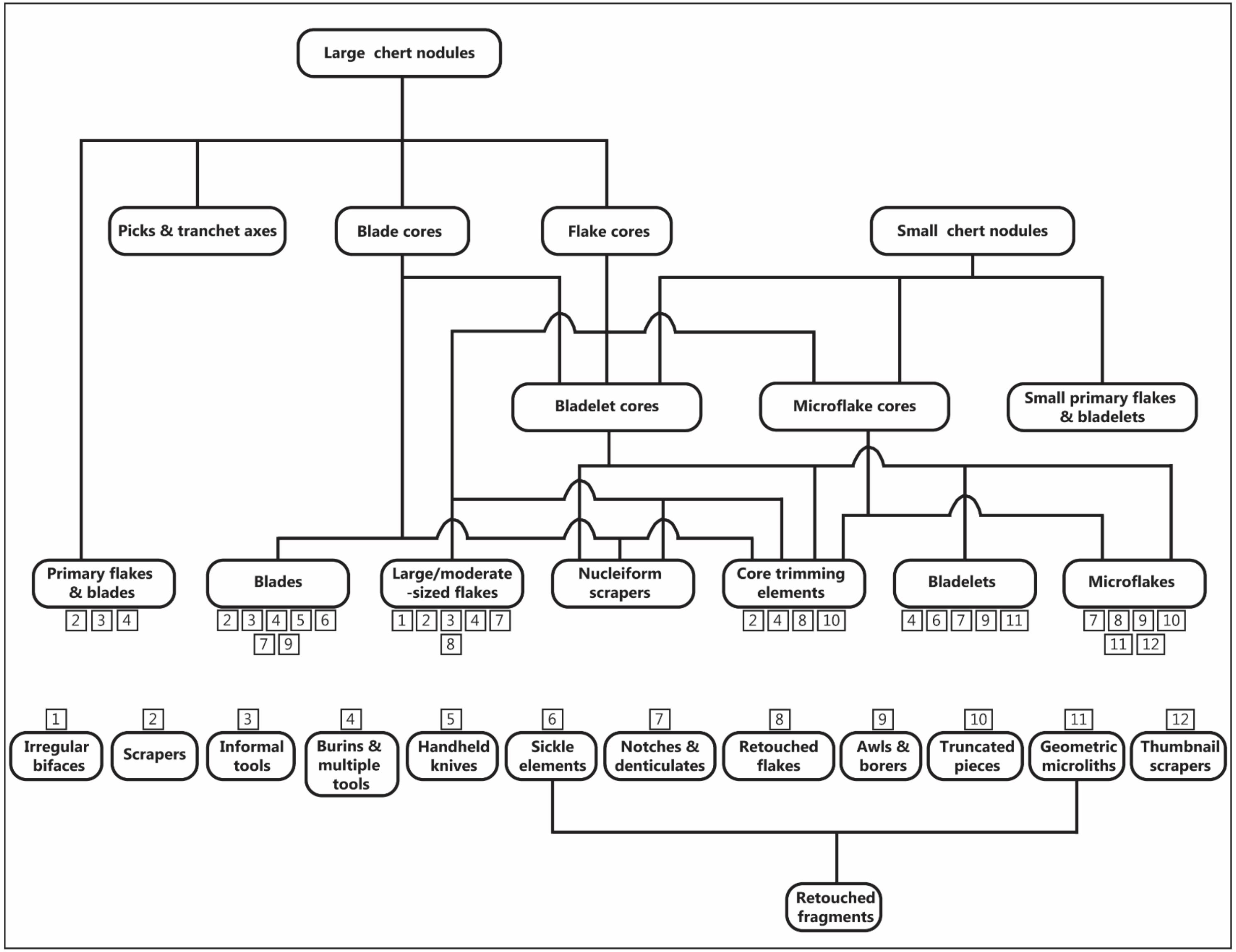


Figure 9.1: The Wadi Hammeh 27 reduction sequence.

retouched flake tools. At least one of these flakes was also utilised in Upper Phase 3 to manufacture an irregular biface through the application of a similar method of percussion as applied to the nucleiform picks and axes.

The few blade cores are characterised either by parallel or convergent scar patterns and low cortical coverage. The blades themselves are usually characterised by punctiform platforms, supporting the widespread usage of indirect percussion in their production. They mostly exhibit feathered terminations, incurvate profiles, trapezoidal cross-sections and a mixture of rectangular and triangular forms. Blades with plunging and stepped terminations are also relatively common, although these objects presumably represent the inherent difficulty in controlling the fracture direction when knapping these elongated pieces. The dorsal scar orientations of the blades are a combination of unidirectional and 90° change of orientation patterns. Cortex on the blades is rare, and when it does occur is usually limited to their distal end, supporting the idea that these pieces were manufactured exclusively as targeted blanks rather than as by-products of the initial core reduction process.

Blades were employed as blanks for the manufacture of a similarly broad range of macrolithic tools as the flakes, including scrapers, multiple tools, burins, handheld knives, notched and denticulated pieces and some of the larger awls and borers. Only a comparatively narrow quantity of these large blades could be removed per blade core, after which the diminished core dimensions dictated a shift towards the fabrication of smaller, more gracile pieces. The blades produced through this second stage of production were primarily selected for retouch into sickle elements, with Helwan retouch being applied to these pieces in a manner identical to the that of the bladelet products. Such a function is further supported by the widespread presence of sickle sheen on these pieces.

As core reduction proceeded and core size diminished there was a shift in the types of debitage being produced. The blade cores were recycled exclusively into bladelet cores, with this transformation likely being a gradual one as the dimensions of the blade blanks steadily declined. Likewise, many of the flake cores transitioned into microflake cores simply though continual rotation and reduction. On the other hand, significant numbers of large flake cores were intentionally recycled into bladelet cores once a sufficient amount of mass had been removed. The degrees to which these two reduction pathways were employed clearly varies over time, as the final two assemblages exhibit a marked decline in the proportions of exhausted microflake cores being deposited, whereas the larger flake debitage remains a conspicuous element throughout the stratigraphic sequence. This pattern suggests that while large flakes were regularly being manufactured at Wadi Hammeh 27, their corresponding cores were recycled into bladelet over microflake cores to a greater extent in the later phases. This is not to say that microflake production ceased in the later phases, however, as many of the 'bladelet cores' at Wadi Hammeh 27 actually served to create a combination of bladelet and microflake blanks.

Specialised bladelet and microflake cores were simultaneously manufactured from smaller chert cobbles in each assemblage between Phases 4 and 2, thus bypassing the roughing out of large cores for flake and blade production. This parallel reduction pathway is attested to by the consistent presence of single and opposed platform bladelet cores which retain a considerable amount of their original cortical surface, along with the existence of small, cortex-rich flakes and bladelets. Unlike the larger cortical flakes, however, these pieces appear to have been treated exclusively as waste, being too minute and fragile to serve as blanks for scrapers and other macrolithic tools, while their uneven dorsal surfaces proved unsuitable for the application of fine microlith retouch.

Microflake cores persistently comprise a majority of the flake cores deposited in each phase, with each assemblage being characterised by change of orientation and multiple platform cores with facetted platforms, convergent scar patterns, high flake scar counts and comparatively slight dimensions. At the same time, the change of orientation and single platform flake cores retain relatively high amounts of cortical coverage, suggesting that more of these pieces were manufactured from smaller cobbles, whereas the multiple platform cores are exclusively represented by larger flake cores which were continuously rotated until exhaustion. These pieces nonetheless remain larger on average than the single platform and opposed platform varieties, demonstrating that, much like with the bladelet cores, that the multiple platform flake cores do not represent a successive stage for the former types.

Mean flake dimensions are regularly diminutive, reflecting the fact that greater quantities of smaller flakes were produced than larger ones. Most flakes possess relatively broad, plain platforms, which are mostly supplemented by pieces with punctiform platforms (in Phase 4 and Lower Phase 3) or those which lack them (between Upper Phase 3 and Phase 1). These data support the idea of a combination of hard-hammer and indirect percussion being utilised in order to knap flakes at Wadi Hammeh 27. Their bulbs of percussion are generally pronounced, particularly in the first two phases, and they tend to exhibit feathered terminations and incurvate profiles. Most flakes possess unidirectional scar orientations, followed by smaller proportions with a change of orientation layout. These finds nonetheless remain consistent with the steady dominance of multiple platform flake cores, only indicating that significant numbers of flakes were removed when the core was rotated, rather than representing a process where the core was being continuously rotated and expediently knapped. Microflakes were selected comparatively rarely for the manufacture of microlithic notched and denticulated pieces, awls and borers, retouched flakes, truncated pieces, thumbnail scrapers and geometric microliths.

Despite their name, many of the bladelet cores were clearly used to manufacture both bladelets and gracile microflakes. These products are technologically varied, although single platform varieties remain the most common layout in every assemblage aside from Upper Phase 3, with a particularly pronounced numerical dominance in the final two phases. While the dimensions of bladelet cores remain relatively consistent regardless of type, their other attributes suggest some typological divergences in terms of the reduction pathways represented. The single platform and opposed platform bladelet cores in most assemblages are generally characterised by fewer flake scars with a convergent pattern and a greater retention of cortical coverage, suggesting that more of these objects are specialised cores manufactured from comparatively diminutive cobbles. In contrast, the change of orientation and multiple platform bladelet cores are characterised by greater numbers of flake scars and lower cortical coverage, suggesting that more of these pieces were produced from recycled flake and blade cores. The single platform bladelet cores from Phase 2 likewise exhibit extremely low levels of cortical coverage, suggesting either a shift away from utilising small cobbles or the implementation of a more intensive knapping regimen.

The dimensions of the bladelets manufactured at Wadi Hammeh 27 remain static over time. Their platforms are represented by a combination of punctiform, crushed and absent types. Platform angles are consistently acute, and their profiles are usually incurvate. Bladelet dorsal scar orientations are likewise overwhelmingly unidirectional, supported by much smaller proportions with change of orientation and bi-directional patterns. Their cross-sections are either trapezoidal or triangular. All of these attributes support the widespread usage of indirect percussion to knap bladelet blanks from prismatic and sub-conical single platform cores, which were supplemented by slightly smaller numbers of less formalised, cuboid cores, some of which were heavily rotated. Cortex is extremely scarce amongst the bladelets, and when it does occur is usually restricted to the distal end in a similar fashion to the blades.

At the same time, bladelets with cortical coverage along one lateral margin are present in each assemblage, demonstrating that diminutive cobbles were consistently being utilised as a starting point for some of bladelet cores at Wadi Hammeh 27. Bladelets were primarily fashioned into standardised lunates and sickle bladelets, although smaller numbers also served as blanks for awls and borers, notched and denticulated pieces and some of the smallest burins.

Typology aside, the scrapers of Wadi Hammeh 27 can be roughly divided into four groups based on the type of blanks that they were shaped from. Predominant are those fashioned from moderate to large-sized, cortex-free flakes, which are supplemented by scrapers made from long blade blanks, limited numbers of exceptionally large nucleiform scrapers and a few minute thumbnail scrapers manufactured from microflakes. The scrapers can similarly be roughly divided between expediently- and intensively-retouched pieces, although this situation does not appear to correlate with blank selection to any significant degree. Their overall dimensions remain uniform over time.

Multiple tools and burins were primarily manufactured from medium to large flakes supplemented by smaller numbers on blades, bladelets and core trimming elements. Most lack cortex, but the presence of some exceptionally large, cortex-rich burins attests to the use of primary flakes whenever suitable. The burins display an exceptional range of dimensions, indicating that they served a variety of different applications based on the degree of precision required.

The largest retouched blades represent some of the biggest retouched lithic objects to be recovered from Wadi Hammeh 27, with only some of the scrapers, burins and bifacial tools outsizing them. The large size, weight and irregularity of the retouch applied to these objects makes them unlikely candidates to have functioned as composite sickle components, with a role as generalised, handheld knives more probable. Despite their size, cortex remains scarce on these pieces, indicating that their blanks were still mostly struck from specialised blade cores. Only a limited number of these large blades could be removed per blade core, after which the diminished core dimensions dictated a shift towards the production of more gracile blades to be used as sickle components.

The creation of non-geometric microliths at Wadi Hammeh 27 was a highly standardized process. Most of the employed bladelets feature three or four dorsal flake scars with a unidirectional layout. Almost all are entirely free of cortex. These attributes are consistent with the aforementioned bladelet cores and debitage, demonstrating that sickle elements were produced from specialised bladelet cores with convergent or parallel scar patterns. Such bladelets were likely produced *en masse* in episodes of production with a minimum amount of core rotation, after which the most suitably-shaped pieces were selected for retouch into sickle elements. Retouch was almost universally applied to one lateral margin and both terminations. In most cases this resulted in an almost geometric, rectilinear form with bi-truncated ends, although in some cases a rounded edge more akin to that of a lunate was instead created. The occurrence of silica sheen is common, albeit heavily influenced by type, with artefacts manufactured using Helwan or inverse retouch tending to possess higher rates of this attribute than those with abrupt or obverse semi-steep retouch.

The production of lunates was similarly and consistently standardised at Wadi Hammeh 27. They were largely manufactured from bladelet blanks with a unidirectional scar orientation, most of which would have likely been produced from similar, if slightly smaller, bladelet cores to those utilised to produce sickle components. At the same time, many of the lunates were likely produced from gracile microflakes, with the degree of retouch applied masking this distinction. This idea is supported by the variation in form exhibited by the lunates, with some exhibiting squatter forms reminiscent of a flake. Regardless of this variation in form, the mean lunate dimensions remain static in each assemblage, supporting Edwards (2013e: 181)'s findings that no shifts in lunate size are observable over the course of Wadi Hammeh 27's occupation. Geometric microlith types other than lunates remain exceptionally rare throughout the Wadi Hammeh 27 assemblages, and probably represent either examples of exceptionally short sickle elements (in the case of the rectangles) or unsuccessful attempts at manufacturing a curved lunate edge (in the cases of the trapezes and triangles).

Notched and denticulated pieces between Phases 4 and Upper Phase 3 are characterised by a combination of pieces made from bladelets and medium-small, cortex-free flakes. The Phase 2 assemblage subsequently exhibits a particular bias towards bladelet blanks with a unidirectional scar orientation – another shift in line with the increased reliance on single platform bladelet cores in this phase. Awls and borers were mostly manufactured from unidirectional blades, followed by smaller proportions of 'micro-borers' made from bladelets and microflakes.

9.3 The function of the Wadi Hammeh 27 reduction sequence

9.3.1 Raw material provisioning

The inhabitants of Wadi Hammeh 27 clearly had consistent access to a reliable source of knapping material, as evidenced by the disposal of unexhausted cores and large quantities of unused, high-quality chert debitage in each assemblage (Delage et al. 2020; see Chapter 4.3). When this evidence is placed alongside the extensive architectural evidence for settlement permanence and the widespread removal of various-sized flakes from heavily rotated cores, as one would expect from a 'typical' Natufian assemblage (Ashkenazy 2013: 654), it is clear this aspect of core provisioning at Wadi Hammeh 27 bears a strong resemblance to the expedient configurations argued for numerous sedentary pre-Columbian sites in North America with a similarly reliable access to high quality raw materials (Parry & Kelly 1988; Nelson 1994).

Although the expedient manufacture of flakes and many of their associated end-products is as expected with these models given the reliability of the raw material sources, the same cannot be said for the parallel bladelet-focussed sequence. While the broader production of microflakes and the presence of a combination of bladelet and microflake scars on some cores are consistent with Delage (2005)'s argument that a comparatively informal strategy of producing gracile flakes was employed at Early Natufian base-camps, the increasing emphasis on prepared, single platform bladelet cores at Wadi Hammeh 27 suggests other intentions must also be taken into consideration.

The emphasis on formal bladelet cores at Wadi Hammeh 27 is exemplified by the final two structural phases of the site, where the apparent rise in bladelet manufacturing does not correspond with any evidence for reduced access to MCM cherts or an increased degree of mobility by its inhabitants; on the contrary, it occurs alongside the establishment of structures which surpassed those of the preceding phases in terms of their size and architectural complexity. This aspect of the Wadi Hammeh 27 archaeological assemblage instead appears to confirm Jeske's (1989) suggestion that the impetus for pursuing certain debitage types may be driven exclusively by technological requirements, in this case the production of bladelets for the construction and maintenance of composite sickles. At the same time, this shifting focus would not have hindered the preparation of projectiles for hunting, as the same lightweight bladelet blanks used to manufacture sickle elements could also be utilised in the production of lunates.

9.3.2 The range and functions of the Wadi Hammeh 27 toolkit

The array of tools present at a site has long been recognised as a reliable means of interpreting the range of activities which were performed onsite (Byrd 1988: 263; Olszewski 2010: 92), provided that they enter the archaeological record in their setting of use or maintenance (Camilli 1989: 22-23). Given that there is minimal evidence of floor cleaning having been performed at Wadi Hammeh 27 throughout the span of its occupation (see Chapter 7), it can thus be assumed that the composition of the Wadi Hammeh 27 toolkits provide a relatively reliable means of gauging the heterogeneity of activities represented.

The toolkit at Wadi Hammeh 27 includes a complete range of flaked stone tools which one would expect from an Early Natufian base-camp (see Chapter 11). In addition to the aforementioned sickles and projectiles, these pieces include scrapers, knives and expediently-retouched flakes for processing animal carcasses, burins and borers for manufacturing beads, bone tools and mobiliary art, axes for woodworking and picks for earth moving activities. The Wadi Hammeh 27 reduction sequence is thus consistent with Marks and Friedel's (1977: 152) suggestion that predictable, multi-phase reduction sequences were utilised from the Upper Palaeolithic onwards to produce a wide variety of blanks in order to be retouched into a similarly broad variety of tools. The rise in burin and awl and borer proportions in the later assemblages is also functionally significant, given the corresponding jump in the quantity of gazelle phalanx beads (Edwards & Le Dosseur 2013: 261).

The variability of the Wadi Hammeh 27 toolkit supports Myers' (1989) and Edwards' (2007) ideas that assemblages may exhibit a combination of reliable and maintainable attributes. In particular, the composite sickles and projectiles represent textbook examples of maintainable technologies, whereas the redundant nature of many of the scrapers, burins, bifaces and knives conform well to the category of reliable technologies, albeit with a reduced risk of failure given that replacements for any of these tools could easily be made from the ready stockpile of unused debitage blanks present onsite.

High percentages of composite tool fragments have been taken as an indicator that a high degree of tool maintenance took place onsite (Hillgruber 2013: 42; Neeley & Barton 1994: 284; Shott 2007: 138). Therefore, the large quantities of retouched fragments deposited onsite at Wadi Hammeh 27 may largely reflect the replacement of broken sickle components and, to a lesser extent, broken projectile points. While this aspect is consistent with Binford's (1977) definition of a curated technology, any division between expedient and curated tools at Wadi

Hammeh 27 is made redundant by its sedentary nature. This situation is exemplified by the fact that sickles and projectile points are the only flaked stone technologies in the Wadi Hammeh 27 toolkit designed purely for use offsite during hunting and foraging expeditions, as demonstrated by the Phase 1 'toolkit' (Edwards 2007: 873). Most other tools would have likely served onsite functions and could subsequently be retained onsite for future use without any need to consider which were worth keeping based on their economic value.

The possibility that the range of tools at Wadi Hammeh 27 is influenced by the etic perspective of the analyst must also be considered. For example, many of the carinated scrapers were manufactured purely through the removal of flakes struck from the ventral surface of the blank, and as such may simply represent expedient flake cores rather than actual tools. Conversely, it is also possible that some of the 'flatter' cores may have been expediently utilised for scraper activities without the requirement of specialised scraper retouch, so long as a suitable, acute edge was present to serve as a working edge.

9.3.3 The range and function of hafted versus handheld tools

Significant amounts of ethnographic and experimental research have illustrated the prevalence and benefits of hafted tools over those gripped in the hand. Hafted knives and scrapers are both easier to control when applying pressure and require less energy expenditure than their non-hafted equivalents, thus providing considerable benefit, particularly when processing large amounts of large animal carcasses within a relatively short period of time (Tomka 2001: 211-212). Ethnographic evidence from North America similarly indicates that endscrapers manufactured from blades primarily functioned as hafted tools, being attached to a handle using either a socket, binding or an adhesive substance (Shott 1995: 58). Keeley (1982: 799) likewise noted that flaked stone axes, picks and knives may all be hafted to increase the force exerted through their use, whereas a hafted awl may be utilised with more precision than a handheld one. Keeley (1982: 803) further suggested that the use of hafted tools may vary on an economic basis, with societies having the option to prioritise handheld, expedient tool variants in cases when reliable quantities of high-quality knapping materials are available.

The retouched applied to a tool in order to facilitate hafting may be indistinguishable from regular burin or scraper retouch (Keeley 1982: 801), and as such some of the burin-endscraper or double burin combinations may in fact represent hafted objects rather than handheld tools which were recycled to serve a second function. Likewise, the existence of seemingly superfluous notches and truncations on non-microlithic artefacts such as scrapers or burins has been as evidence that such pieces were hafted (Keeley 1982: 801).

While Keeley's hafting model is unnecessary for the lunates and sickle elements, since these tools were by definition designed to be hafted, the potential that other tool types were also designed as hafted objects must also be considered. The presence of such modifications is widespread throughout the Wadi Hammeh 27 assemblage, manifested primarily either through the truncation of the end opposite the burin bit or the application of a notch immediately perpendicular to the opposed end. Alternatively, at least some of these modifications may represent an initial attempt at creating a burin bit that was subsequently found to be unsuitable for the removal of a spall, with the creation of a burin bit subsequently successfully performed on a different area of the blank edge.

The principle of equifinality must also be taken into consideration when investigating the evidence for hafting based on lithic form. Equifinality, as applied to lithic technology, is a principle of systems theory based around the idea of multiple pathways leading towards a single end product, with artefact form negotiated through continuous retouch in order to prolong the use-life of the tool, with priority on maintaining the original form (Hiscock 2004: 72, 76). While this theory is applicable in discussing the expedient scrapers, retouched flakes and possibly some of the burins and retouched blades from Wadi Hammeh 27, it is inapplicable to pieces with clear evidence of hafting modification, particularly the lunates and sickle components. As such, the Wadi Hammeh 27 assemblages appear to exhibit a combination of imposed forms designed for hafting and versatile, expedient forms.

9.3.4 The role of unretouched flakes as tools

As previously discussed, the inhabitants of Wadi Hammeh 27 produced vast quantities of flakes of various shapes and sizes. While it is likely that most of these objects represent unwanted by-products from the process of reducing the cobbles imported onsite to a desirable size for manufacturing microflakes and bladelets, the possibility that some served as expedient tools without retouch must also be acknowledged.

The knapping of flakes for expedient use without retouch may be performed either as a secondary process after a number of desired specialised blanks have first been procured from a prepared core (Binford & O'Connell 1984: 427-8), or retrospectively, involving the selection of suitably-shaped flakes from an existing stockpile produced through the various stages of core reduction (Holdaway et al. 2015: 46-7, 58). However, the identification of such functions is complicated by the fact that some activities which these objects would have been utilised leave no detectable use-wear at all, rending the task of discerning complete expedient flake-tool assemblages from unused debitage an extremely elusive – if not outright impossible – goal for most assemblages (Dibble et al. 2017: 822). Use-wear analysis lay outside the scope of this thesis, so any further investigations into this aspect must be laid aside for future analyses.

9.4 A territorial model for change at Wadi Hammeh 27

While the overall sequence of Wadi Hammeh 27 manifests a strong degree of continuity over time, some key variations are consistent with increasing territorial influences. The rise in Helwan retouch in the later phases correlates with an increased emphasis on bladelet production, along with evidence of continued settlement entrenchment and permanence in the form of Structures 1 and 2. Taken together, these lines of evidence indicate an increased reliance on the production and maintenance of standardized sickles for cereal reaping. This trend fits neatly with territorial models for the Neolithisation process, with people being forced to rely on lower ranked resources to an increasing extent due to the depletion of higher ranked resources within a system of increasingly defined territorial units (Kosse 1994; Rosenberg 1990: 407-9; 1998: 658-662).

Proponents of broad spectrum economy models generally view technological developments made throughout the course of the Upper Palaeolithic and Epipalaeolithic through an adaptative lens, serving primarily as a means of reducing the cost of acquiring lower-ranked resources (Stiner et al. 2000: 56-8; Stutz et al 2009: 302). In the case of the Early Natufian, the invention and utilisation of composite sickles instead of beaters in the harvesting of wild grasses has been interpreted as a manifestation of a desire to maximise the productivity of a low-ranked resource within a limited foraging range, with sickles demonstrating superior returns per unit area compared to beaters (Bar-Yosef 2002: 116-7; Belfer-Cohen & Bar-Yosef 2000: 25; Hillman & Davies 1990).

The growing emphasis on bladelet cores and Helwan-retouched sickle components during the later occupational phases of Wadi Hammeh 27 is thus informative on several fronts: that it attests to a growing emphasis on the manufacture of uniform cereal-harvesting implements, and that these modifications are detectable on an intra-site basis. The fact that the rest of the assemblage remains largely static across time is illuminating, demonstrating that such modifications in the Early Natufian cultural niche had limited effect on other technological aspects, with knappers adapting to the continued need for a wider range of implements through the continued application of the two-stage knapping system described by Edwards (2013e: 145), or through the manufacture of lunates and notched and denticulated pieces from bladelet blanks over flakes to a greater extent. It must be stressed that these technological trends do not necessarily indicate that a broader range of cereals were being exploited over time at Wadi Hammeh 27 – an unlikely situation given that the extensive exploitation of grains clearly predates the establishment of the settlement (Arranz-Otaegui et al. 2018; Groman-Yaroslavski et al. 2016) – only that lithic knappers modified their reduction sequence to prioritise the production of the relevant tools for this activity.

The concept that increasing territoriality and sedentism was responsible for technological developments relating to subsistence activities recalls Collins' (1973: 56-7) idea that process drives innovation, if at the scale of the broader Neolithisation process rather than the occupational lifespan of Wadi Hammeh 27. While some aspects of this transition are in fact evident at Wadi Hammeh 27, namely the increased emphasis on manufacturing and maintaining sickle elements, these changes represent only an isolated aspect of the broader Neolithisation process, which arguably only reached its zenith with the establishment of Late Pre-Pottery Neolithic B megasites.

This model for a gradually intensifying adaption clearly does not support David's (1973) idea that technological and typological shifts driven by external ecological factors will be abrupt, as the reaping of cereals using composite sickles clearly played an important role in the subsistence economy of Wadi Hammeh 27 from its earliest occupation. At the same time, the establishment of Structure 1 in Phase 2 correlates with a significant jump towards emphasising the manufacture of uniform sickle components, suggesting that at least one individual episode of relatively sudden change may be detectable in the case of Wadi Hammeh 27.

9.5 Conclusion

The inhabitants of Wadi Hammeh 27 employed a combination of planned and informal knapping strategies in order to manufacture a diverse range of tools consistent with its function as a sedentary or semi-sedentary settlement. The overarching aim of the strategy was the creation of gracile bladelets for the production of sickle elements, with the acquisition of other tool varieties being far more flexible in terms of the reduction pathways and debitage blanks utilized. The increasing proportions of prepared bladelet cores in the later phases of Wadi Hammeh 27 more likely relate to shifting technological requirements rather than any shift in mobility or raw material access. This approach overall lends further credence towards to idea of increasing territoriality over time at Wadi Hammeh 27, resulting in resource depletion and the intensification of grain exploitation. None of these explanations, however, can account for the range of drastic typological shifts exhibited by the Phase 1 assemblage. These changes must instead be investigated separately in the following chapter, from the perspective of the final abandonment of Wadi Hammeh 27.

Chapter 10: Refuse modes, activity areas and settlement abandonment: the contextual taphonomy of Wadi Hammeh 27

10.1 Introduction

The artefact disposal patterns for each architectural phase of Wadi Hammeh 27 were described in detail in Chapter 7. This analysis revealed that - a few notable exceptions aside - the artefact assemblages at Wadi Hammeh 27 are overwhelmingly composed of broken, exhausted, or otherwise discarded implements and refuse from everyday domestic activities. This chapter applies an interpretive model to these findings, centred on reconstructing the broader cultural processes leading to site formation through the identification of specific refuse types and activity areas. The means of identifying different modes of refuse disposal in this chapter are based on those summarised in Chapter 2.4. This chapter is largely concerned with the comparison and contrasting of the consistent archaeological signatures between Phases 4 and 2 with those of Phase 1, with the ultimate aim of demonstrating that the latter assemblage exhibits characteristics of an unplanned final abandonment. This final third of this chapter subsequently explores the identification of activity areas in the earlier phases.

It has been claimed that the occupational deposits associated large Natufian settlements in the Mediterranean zone represent palimpsests drawn from numerous extended, superimposed occupations (Samuelian 2013: 174-5; Yeshurun et al. 2014: 593-4). This aspect does not necessitate a time perspectivist approach at Wadi Hammeh 27, however, as required at sites such as those within the Lower Palaeolithic Koobi Fora formation of Kenya (Stern 1993). The lithic assemblages from these sites are true palimpsests, with the associated artefacts accumulating in close proximity to one another from a range of unrelated activities carried out over the span of tens of thousands of years, meaning that the spatial distribution of these artefacts cannot be utilised as a reliable means of interpreting hominin behaviour onsite (Stern 1993: 202, 210). In contrast, the various assemblages of Wadi Hammeh 27 are each associated with clearly defined occupational floors, often with short-term activity areas identifiable *in situ*, meaning that they can be interpreted in the context of regular occupational deposits.

10.2 Phase 1 as an abandonment assemblage

In societies which employ regular floor sweeping, the distribution of artefacts in an archaeological setting are generally considered to reflect abandonment processes or the effects of post-abandonment deposition rather than serving as a representation of regular occupational activities (LaMotta & Schiffer 1999: 21, 25; Murray 1980: 497-8). Such an identification is less applicable to Wadi Hammeh 27, however, as these forms of abandonment refuse are almost indistinguishable from the multitudes of primary refuse allowed to accumulate across the duration of its occupation. An alternative means of identifying Natufian abandonment refuse is thus required, namely through the examination of key variations in the associated lithic assemblages, in conjunction with the occurrence of distinct *de facto* refuse Artefact Clusters on the Phase 1 surface.

10.2.1 The lithic signature

One of the key variations between the Phase 1 lithic assemblage and those of the earlier deposits is the underrepresentation of some of the smallest lithic types in the final assemblage, such as the chips and flakes <2cm (see Chapter 4.4.5). Given that identical sieving and cataloguing methods were utilised for each assemblage, a taphonomic explanation seems most probable for this discrepancy. In particular, the winnowing of small-size artefacts through pedoturbation is a probable explanation for this pattern, given the relatively poor state of preservation of the latest phase due to its comparatively shallow deposition, along with the aforementioned influences from faunalturbation and argilloturbation (see Chapter 3.4). Such an explanation is supported by comparing the tusk shell artefact assemblages, which are likewise far less common in Phase 1 than any of the earlier deposits.

The ratio between intact and broken debitage types is also considerably reduced in Phase 1 compared to the earlier assemblages. This drop is particularly pronounced in the case of the blades and bladelets, with the percentage of fragmentary artefacts belonging to these types dropping from just over ninety percent of each assemblage between Phase 4 and Phase 2, to seventy percent of the blades and bladelets in Phase 1 (**Fig. 10.1**). This abrupt shift is likely reflective of several variables between Phase 1 and the underlying assemblages.

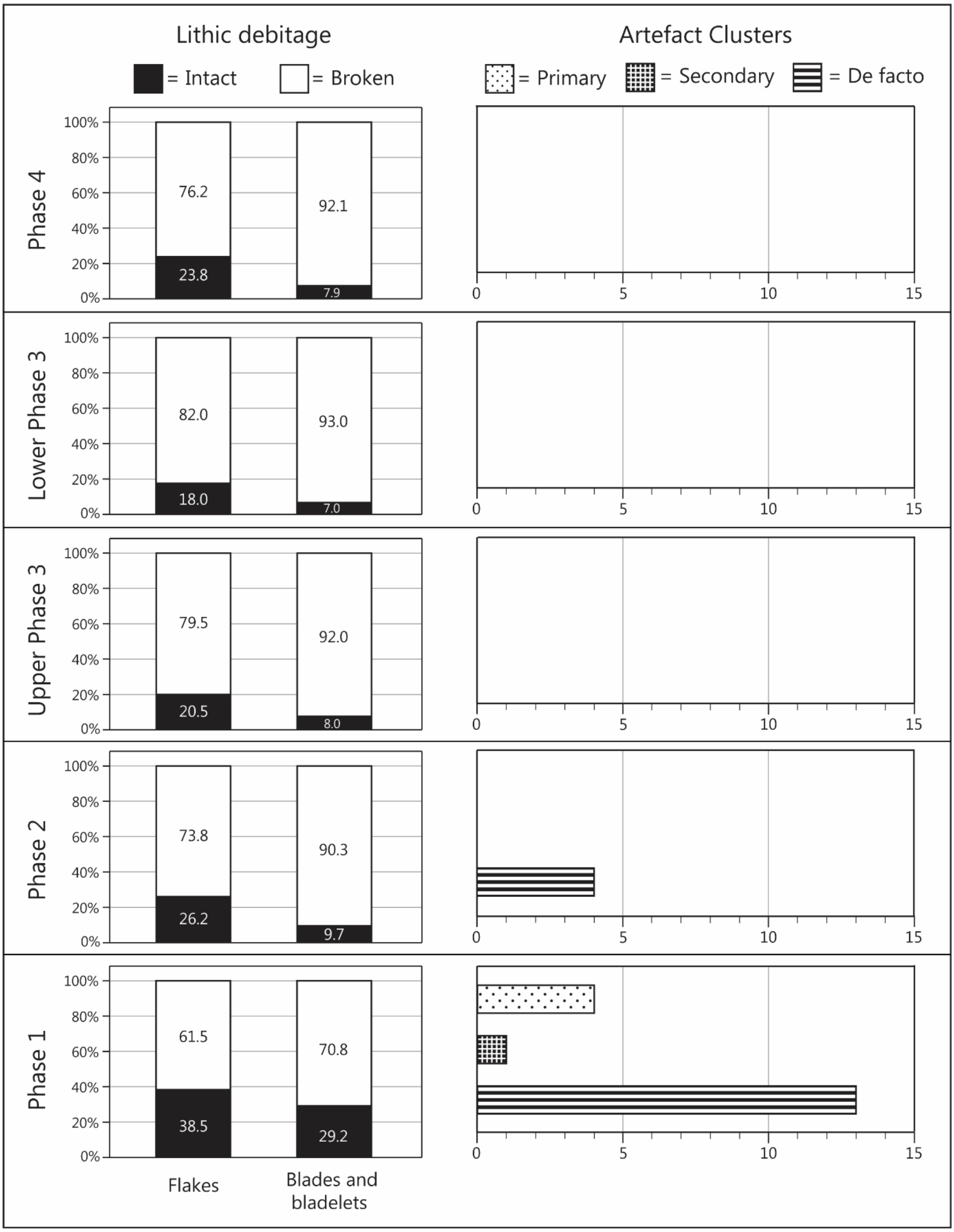


Figure 10.1: Comparison of broken debitage percentages over time with the occurrence of de facto refuse artefact clusters.

The lithic assemblages of Wadi Hammeh 27 display a consistently high rate of artefact fracturing. Knapping experiments by Amick and Maudlin (1997) demonstrated that a positive correlation exists between the use of higher quality raw materials and the percentage of complete flakes in an assemblage. Given then that the overwhelming majority of flaked stone artefacts at Wadi Hammeh 27 are manufactured from fine grained, homogenous cherts, it can thus be assumed that at least a significant portion of the broken debitage artefacts in each assemblage were the result of cultural taphonomic processes, such as trampling from everyday foot traffic. This identification is supported by the consistently higher fragmentation rate of the gracile blades and bladelets over the flakes at Wadi Hammeh 27.

With these taphonomic considerations for the overall high rates of artefact breakage over time having been established, a behavioural explanation may now be sought for the variations in Phase 1. The replacement of tools utilised in a sedentary, domestic setting is often far less costly than replacing essential tools utilised by more mobile groups, as debitage blanks (or the raw material needed to expediently create them) can be stockpiled onsite for immediate use whenever the need might arise (Bamforth 1991: 229). In some cases, the retention of an onsite stockpile of usable debitage may function in a feedback loop, further encouraging the future reoccupation of a site or locale (Bailey & Galanidou 2009: 220-1; Dibble et al. 2017: 829-30).

In the context of an Early Natufian architectural site, such stockpiles should theoretically be represented through the onsite retention of viable cores and/or debitage blanks - artefacts which are found in significant quantities throughout Wadi Hammeh 27. While some of these artefacts would undoubtedly have entered the archaeological record through loss or other forms of unconscious disposal, others may indeed be representative of an onsite stockpile. This possibility is particularly relevant when considering the relatively large proportions of intact debitage in Phase 1. Evidence of raw material stockpiling for the manufacture of flaked stone artefact manufacture is clearly attested to in the case of several of the *de facto* refuse artefact clusters, such as Artefact Cluster 20 in Phase 2 (**Fig. 10.2**) and possibly Artefact Clusters 12 and 16 in Phase 1 (**Fig. 10.3**; **Table 10.1**; see Chapter 10.3.2).

In cases of planned settlement abandonments, such debitage stockpiles may be heavily influenced by the process of 'draw-down'. This process refers to the depletion of an existing inventory of replaceable tool elements prior to a planned abandonment without new components being manufactured, resulting in the abandonment assemblage being

Figure 10.2: Artefact Cluster 20: A collection of three large flake cores and two unworked cobbles (Phase 2).

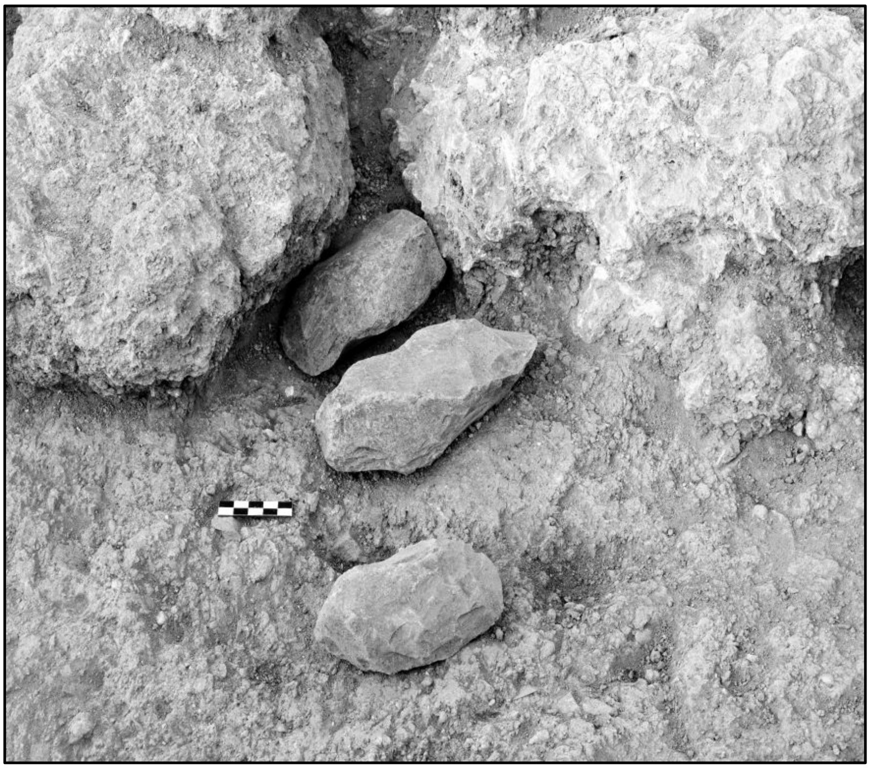


Figure 10.3: Artefact Cluster 16: A collection of three bifacial tools (Phase 1).

characterised by lower amounts of usable *de facto* refuse (Deal 1985: 269; Schiffer 1987: 97). This situation, however, is the exact opposite to what is seen at Wadi Hammeh 27. As such, assuming that the large quantity of intact Phase 1 debitage is in fact reflective of an intentionally maintained stockpile left onsite as *de fact*o refuse, that the draw-down process appears to have had little influence on its composition.

<u>10.2.2 The *de facto* refuse evidence</u>

The identification of an extant stockpile of debitage blanks upon the Phase 1 occupational floor is strengthened when placed alongside the increased evidence of other forms of *de facto* refuse on the final occupational surface. Edwards and Hardy-Smith (2013: 105) identified 17 distinct Artefact Clusters across the Phase 1 floors (**Table 10.1**), 11 of which they characterised as comprising *de facto* refuse (Edwards and Hardy-Smith 2013: 117).

Most notable among these *de facto* refuse Artefact Clusters are the four situated in close proximity to one another immediately within the entrance to Structure 1, at the southern termination of Wall 1. These collections comprise four complete basaltic mortar and pestle sets (Artefact Clusters 6 and 11; **Figs 10.4 – 10.5**), a pair of basaltic shaft straighteners (Artefact Cluster 8) and a collection of objects identified as a complete toolkit of objects taken into field during hunting and gathering activities (Artefact Cluster 9), including a complete bone sickle inset with ten Helwan bladelets (**Fig. 10.6**). Other Artefact Clusters identified as *de facto* refuse include a pair of basaltic pestles (Artefact Cluster 2; **Fig. 10.7**) and three flaked stone bifaces (Artefact Cluster 12) located outside the entrance to Structure 1, as well as a collection of two basaltic handstones with a large chunk of yellow ochre (Artefact Cluster 15; **Fig. 10.8**) and another collection of three lithic bifaces (Artefact Cluster 16; **Fig. 10.3**) placed against the interior of Wall 1 at the rear end of Structure 2. Further evidence of artefact caching is evident in the two collections of bone tools (Artefact Clusters 5 and 14). The collection of unworked gazelle phalanxes in Artefact Cluster 4 (Hardy-Smith & Edwards 2013: 105, 108) and the retention of an articulated gazelle hoof in Artefact Cluster 10 (Edwards & Hardy-Smith 2013: 111) are also notable, as these clusters represent similar examples of stockpiling blanks for the future manufacture of phalanx beads, one of the most common type of bone artefact in the later phases of Wadi Hammeh 27. The presence of gazelle phalanx stockpiling on the Phase 1 floor can subsequently be viewed in the same light as the contemporaneous lithic debitage stockpile, in that both cases represent the

Table 10.1: List of Artefact Clusters from Wadi Hammeh 27. Artefact Clusters 1-18 were uncovered and defined as part of the 1980s excavations (Edwards & Hardy-Smith 2013: 105-117), while Artefact Clusters 19-21 were uncovered during the 2014 season of excavations. Artefact Clusters 4, 5 and 14 have been changed to *de facto* refuse, while Artefact Cluster 13 has been reassigned as primary refuse.

Artefact cluster	Provenance	Square	Description	Refuse type
Phase 1				
1	XX D 11.1	E15	Two drilled dentalium beads and two dentalium fragments	Primary
2	XX E 1.2	D8	Pair of complete basaltic pestles	De facto
3	XX E 2.2	G8	Basaltic mortar fragment and six dentalium fragments	Primary
4	XX E 2.2	D7	Fifteen gazelle phalanges, one drilled gazelle phalanx bead and one bone pendant	De facto
5	XX E 2.2	F8	Seven bone artefacts and three dentalium fragments	De facto
6	XX E 3.3	F11	Two pairs of pestles and a pair of mortars	De facto
7	XX E 3.1	E9	Three drilled bone artefacts, including zoomorphic avian pendant	De facto
8	XX E 5.2	G11	Two basaltic shaft straighteners	De facto
9	XX E 5.2	G11	Hunter-gatherer tool-kit: intact sickle with ten inset Helwan bladelets, twenty-one lunates, five gazelle phalanges, seven polished pebbles, one bladelet core and three fragmentary bone artefacts	De facto
10	XX E/F 2.2	I6	Articulated gazelle hoof and one gazelle phalanx	De facto
11	XX E/H 4.1	G12	Pair of basaltic mortars and pestles, as well as two basaltic handstones	De facto
12	XX F 3.1	D3	Three flaked-stone bifacial axes	De facto
13	XX F 2.2	I5	Two burnt lunates, with other lunates nearby	Primary
14	XX G 1.3	M2	Four gazelle phalanx beads, one bone point and one bone fragment	De facto
15	XX H 3.1	K18	Two basaltic handstones and a lump of yellow ochre	De facto

16	XX H 3.1	J16	Three flaked-stone bifacial axes	De facto
17	XX K 3.1	J/K 25	Midden of flaked-stone artefacts and faunal material	Secondary
Phase 2				
18	XX F 2.5	XX F sondage	Twenty-five dentalium fragments, one limestone shaft straightener, three worked bone fragments and three alluvial pebbles	De facto
19	XX F 2.5	C3	Pair of large, lightly retouched blades	De facto
20	XX F 2.5	E2	Three large, partially worked flake cores and two unworked chert cobbles	De facto
21	XX F 2.5	E6	138 dentalium beads overlying two flaked-stone awls, surrounded by one basaltic shaft straightener, one basaltic, zoomorphic pestle, one limestone, phalliform statuette, a probable basaltic preform and the fragment of a zoomorphic bone haft	De facto

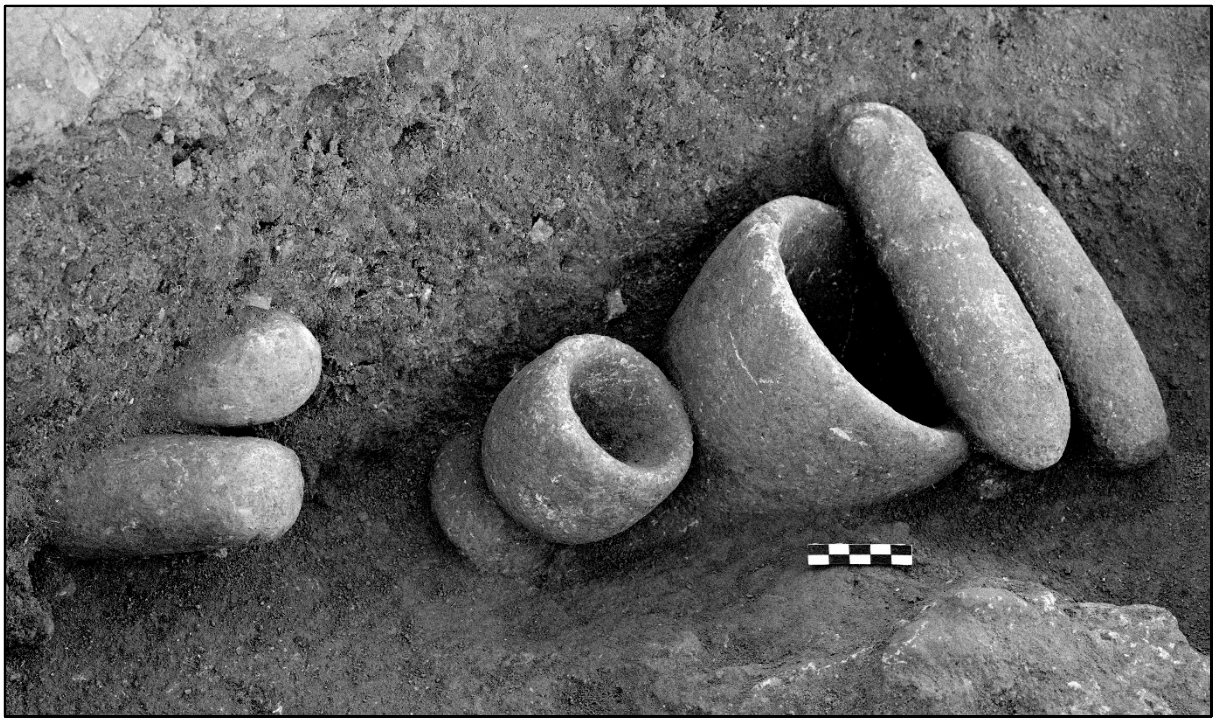


Figure 10.4: Artefact Cluster 6: Two pairs of basaltic pestles and a pair of mortars (Phase 1).

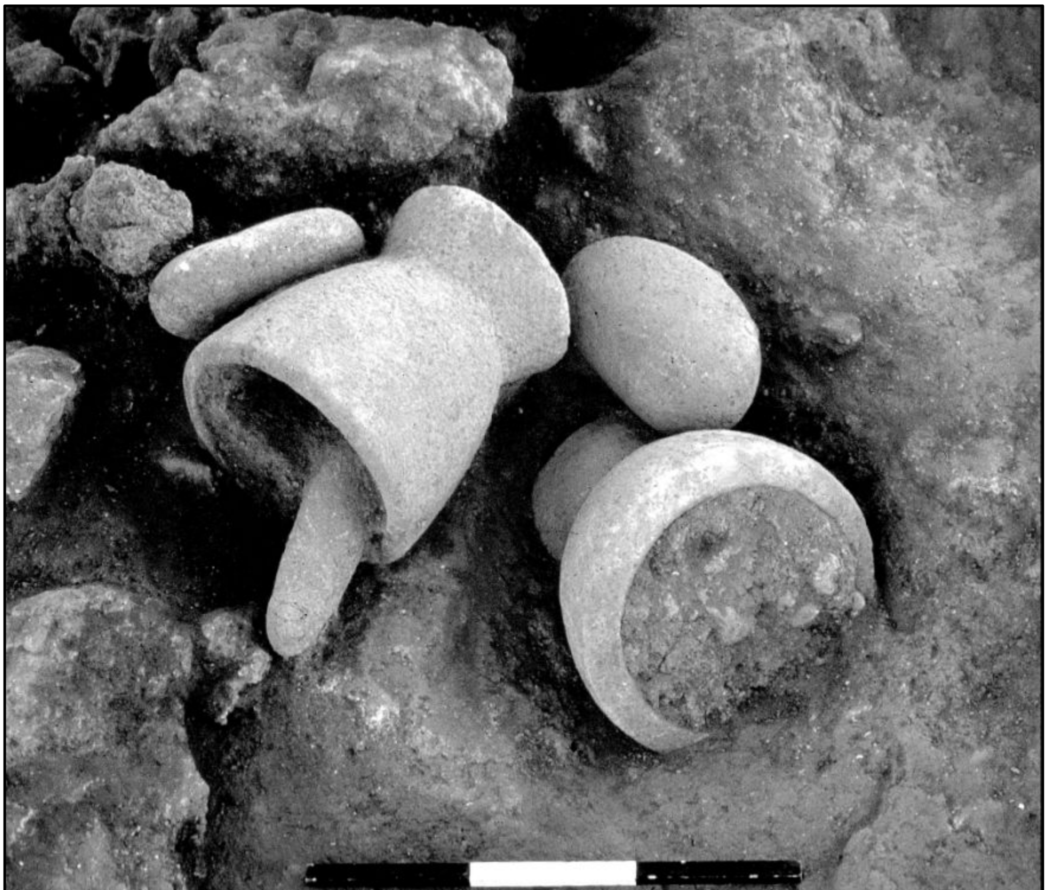


Figure 10.5: Artefact Cluster 11: A basaltic mortar and pestle set, an additional mortar and two handstones (Phase 1).

Figure. 10.6: Artefact Cluster 9: the ‘hunter-gatherer toolkit’ (Phase 1).

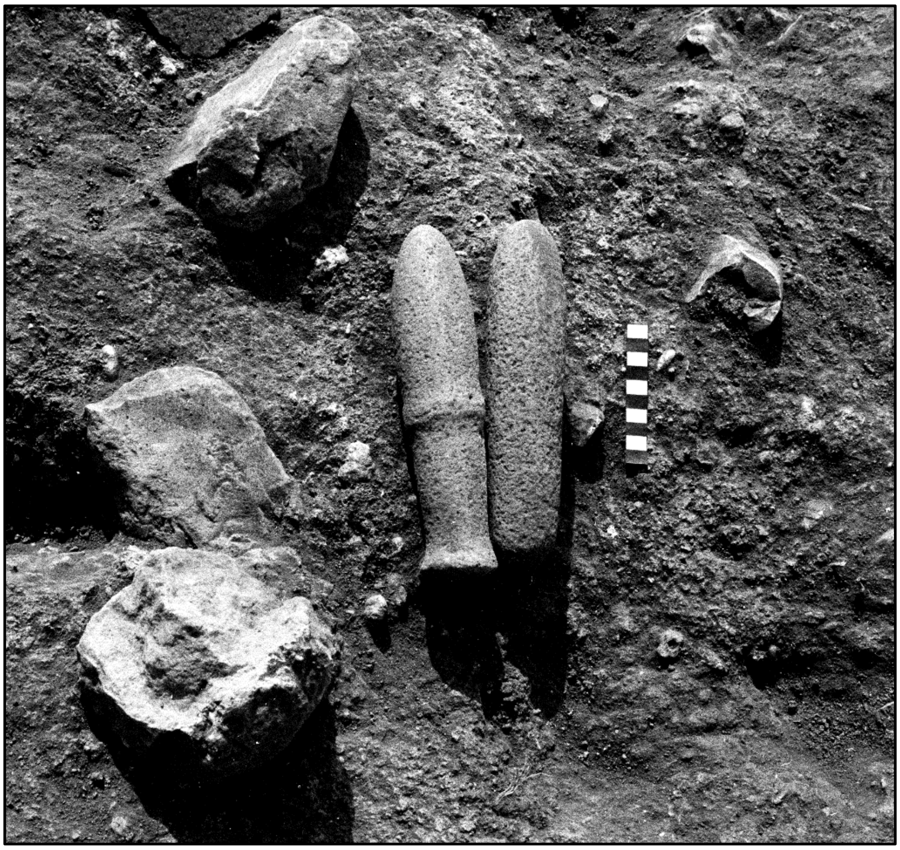


Figure. 10.7: Artefact Cluster 2: A pair of basaltic pestles (Phase 1).

accumulation of usable blanks in a domestic context, with an intention of further working sometime in the future whenever necessary or convenient.

Artefact Clusters 6 and 11 represent the only instances of large, basaltic bowl mortars being recovered intact from the entire site. Likewise, the creation of a sickle haft generally involves a far greater investment of time and energy than its replaceable lithic components, and thus represents a far more desirable target for curation (Goring-Morris 1996: 134; Neeley & Barton 1994: 284; Keeley 1982: 800-1). The presence of such high-value artefacts within this limited space is striking, and supports the notion that delayed curation was a minimal influence on the Phase 1 artefact assemblage, if a factor at all. The situation of these clusters within a restricted, sheltered location thus arguably represents one of the clearest examples of *de facto* refuse stockpiling to be recorded outside an ethnoarchaeological context.

In contrast to Phase 1, *de facto* refuse clusters are relatively uncommon in the underlying deposits. Artefact Cluster 18, from Phase 2 in the XX F sondage, is a collection of loosely associated concentration of 25 disarticulated dentalium fragments, a limestone shaft straightener, three alluvial pebbles and three worked bone fragments (Edwards & Hardy-Smith 2013: 115-6). This collection was directly compared to Artefact Cluster 9 in its incorporation of a wide variety of artefact types, albeit without approaching the level of spatial definition or functional association as seen with the Phase 1 tool-kit (Edwards & Hardy-Smith 2013: 116). Artefact Cluster 21, in Square E6, comprises a collection of 138 scaphopod artefacts overlaying a pair of awls (with Helwan and alternating retouch respectively). These objects are surrounded by a large quantity of intact groundstone objects, including an anthropomorphic basaltic pestle, a basaltic shaft straightener and a large, possibly phalliform, limestone statuette (**Fig 10.9**). The neighbouring square (E7) is also rich in intact groundstone pieces, including a phalliform pestle, although these artefacts most likely represent an extension of Artefact Cluster 21. The other two new Artefact Clusters are comprised entirely of flaked stone artefacts, represented by a pair of lightly retouched blades in Square C3 (Artefact Cluster 19) and a pile of three large flake cores in Square E2 (Artefact Cluster 20; **Fig 10.2**).

Artefact Clusters are absent from the Phase 3 and 4 deposits, indicating a shift in caching practices unrelated to the final abandonment of the site between the earlier phases and the occupation of Structures 1 and 2 in the latest two phases. The fact that *de facto* refuse clusters are present on the Phase 2 surface in any capacity is itself interesting from a behavioural

Figure. 10.8: Artefact Cluster 15: Two basaltic handstones and a chunk of yellow ochre (Phase 1).

Figure 10.9: Artefact Cluster 21: Collection of 138 scaphopod artefacts, two awls and various basaltic and limestone groundstone artefacts (Phase 2).

perspective, given that Structure 1 was clearly not abandoned after this architectural phase. These Artefact Clusters thus most likely represent incidents of loss through the rapid rate of sedimentation at the site obscuring them.

Establishing differences between the *de facto* refuse Artefact Clusters discovered on the Phase 1 surface and those from Phase 2 is of paramount importance in highlighting Phase 1's identification as an assemblage of unplanned or catastrophic abandonment. Of the four collections uncovered from Phase 2, only Artefact Clusters 19 and 20 can be securely identified as instances of stockpiling, as they represent the intentional collection of flake cores and cobbles and tusk shell artefacts respectively. This context differs from the archaeological signature of Phase 1, where all of the *de facto* refuse caches evidently represent the caching of artefacts for future use. Furthermore, the collection of scaphopod artefacts in Artefact Cluster 20 represents the only instance of an exotic material being stockpiled in the lower deposits, with the other Phase 2 Artefact Clusters comprising artefacts manufactured from locally obtained materials.

The relative abundance of *de facto* refuse sets in Phase 1 is all the more notable given the increased number of adverse taphonomic influences affecting the final structural phase, as summarised in Chapter 3.4. Furthermore, the overall distribution of groundstone artefacts in Phase 1 remain spatially associated with a number of stone rings (Features 6, 7, 8, 20 and 21 on the Phase 1 occupation surface; Edwards & Hardy-Smith 2013: 99), indicating a functional connection preserved in this phase which is not evident in the underlying deposits.

The micro-stratigraphic record of Phase 1 also supports its identification as a true abandonment phase. The final occupation is characterised by a distinct, thin layer of relatively large artefacts, which is followed by a significant reduction in the amount of micro-debris in the overlying sediments (Prossor, personal communication 2020). Furthermore, the Phase 1 microstratigraphic record exhibits a much higher rate of mesofaunal bioturbation than the underlying deposits, indicating that Phase 1 existed as a stable surface for longer than any of the underlying floors (Prossor, personal communication 2020).

10.3 The implications of Phase 1 as an abandonment assemblage

Having put forward a case for Phase 1 representing the unplanned final abandonment of Wadi Hammeh 27, the discussion may now turn to the broader theoretical implications of this interpretation. Based on Graham's (1993) observations, the household assemblages of seasonally abandoned settlements with an anticipated return may be recognised by the onsite retention of food preparation and other high-value yet unwieldy equipment - objects which would otherwise be removed in the process of a planned final abandonment. Alternatively, LaMotta & Schiffer (1999: 22-3) argued that abandonment assemblages featuring large amounts of objects with a high curate value should be viewed as being reflective of rapid, unplanned abandonment events (LaMotta & Schiffer 1999: 22-3).

At the same time, the abandonment assemblages of different structures within a single settlement may vary according to several factors, such as their function, location and the order of abandonment, regardless of the actual mode of abandonment employed by the settlement as a whole (Joyce & Johannessen 1993). This behaviour includes the caching of objects within a single structure of a permanently abandoned settlement, on the off-chance of an eventual return (Joyce & Johannessen 1993: 148-9). While the clustering of *de facto* activity sets in Structure 1 at Wadi Hammeh 27 fits such an interpretation to an extent, the presence of *de facto* refuse clusters within Structure 2 suggests similar influences were at play with the abandonment of both structures. Furthermore, the discovery of a cluster of two large, intact, basaltic pestles during the geoarchaeological sampling of the East Cliff Exposure of the Wadi Hammeh plateau (Edwards et al. 2018c: 284) suggests that similar caches are widespread across the remainder of the Phase 1 settlement. As such, the archaeological signature of an unplanned final abandonment appears to apply to the broader site, and that this process occurred within a relatively limited timeframe.

The behavioural interpretation of the final abandonment of Wadi Hammeh 27 partially hinges on whether or not seasonal mobility was practiced by its occupants. If the settlement functioned as permanently occupied, sedentary village, then the archaeological patterns point to LaMotta & Schiffer's (1999) model as a likely explanation. However, if some degree of seasonal mobility was implemented by the inhabitants of Wadi Hammeh 27, the potential arises that the Phase 1 record is instead represents a form of onsite storage similar to that recorded by Graham (1993) for the Rarámuri in Mexico, wherein valuable but unwieldy are stored indoors during periods of seasonal abandonment, albeit in this case with the final abandonment being extended indefinitely.

Having established the strong probability of an unplanned final abandonment of Wadi Hammeh 27, the question must naturally turn to its cause. While it is of course impossible to conclusively determine the circumstances behind the decision making of a 14,000 year-old pre-literate community with the available lines of evidence, the setting of Wadi Hammeh 27 itself may offer up an explanation. The entire Palaeolithic sequence of the Wadi al-Hammeh is characterised by a rapid, uninterrupted rate of aquifer-fed alluvial sedimentation prior to the evaporation of Lake Lisan at 11,000 BP (Macumber & Head 1991). This speed is exemplified by the seven metres of sedimentation which accumulated between Wadi Hammeh 26 and Wadi Hammeh 27 over a period of approximately 7,000 years (Macumber & Head 1991: 171). The inhabitants of Wadi Hammeh 27 clearly had to grapple with the constant inundation of alluvial sediment throughout the 500 – 600-year occupation of the settlement, as attested to by the repeated rebuilding of structures and other stone features amidst deposits reaching a depth of 1.5m. This process continued after the settlement was abandoned, with up to 2m of alluvial sediment accumulating atop parts of the plateau over the span of a millennium (Edwards 2013c: 81; Macumber & Head 1991: 170).

It is thus probable that the unusually high numbers of valuable *de facto* refuse were left on the Phase 1 surface due to their concealment by alluvial sediments over a relatively short period of time, during a period of scheduled abandoned with an anticipated return. This is not, however, to say that Wadi Hammeh 27 functioned as a component of a rotational, seasonal system of mobility. It is instead only indicative that the site was unoccupied for at least one extended period of time, for what was intended by its inhabitants to have been on a temporary basis.

10.4 Deciphering artefact patterning and refuse disposal in the lower Wadi Hammeh 27 deposits

As a rule, the distribution of most lithic debitage and tool types at Wadi Hammeh 27 follow that of chip debris in each phase, suggesting that nearly all lithic artefacts were deposited as primary refuse. This situation mirrors Hardy-Smith and Edwards' (2004) observations for the Phase 1 occupational surface. It can thus be concluded that the Phase 1 artefact patterning does not represent a cessation of refuse disposal practices with the final abandonment of the site, but rather a continuation of the phenomenon exhibited throughout its occupation.

While such a degree of heterogeneity is also one of the main hallmarks of secondary refuse middens (Keeley 1991: 258), such an identification is highly unlikely in this case, due to the lack of evidence of floor sweeping having ever taken place in any of the occupational phases of Wadi Hammeh 27. It is also unlikely that its inhabitants would have ever been required to dump their secondary refuse indoors, given the broad exterior spaces available. If any secondary refuse deposits are in fact present within Plot XX F, they are virtually impossible to differentiate from the conglomeration of primary refuse allowed to accumulate within the same space. The only observable mode of secondary refuse in this space is represented by the disposal of particularly large lithic objects, primarily cores, core fragments and large flakes, into the exterior areas of Structure 3, most likely in the context of having been thrown into a toss-zone.

10.4.1 'Chip clusters' and the identification of knapping areas

As demonstrated in Chapter 7, chips constitute by far the most common type of flaked stone artefact throughout the Wadi Hammeh 27 deposits, regardless of their depositional context in each phase. Given that micro-refuse are the most likely artefacts to survive floor cleaning practices in a primary context of deposition (see Chapter 2.4), knapping can thus be said to have been practiced widely and habitually at the site. At the same time, the clear groupings of 'chip clusters' in specific areas of each phase denotes that certain areas were favoured for knapping.

The fact that micro-debris artefacts consistently display a strong spatial relationship with most other debitage types is significant, as it suggests that a wide range of lithic artefact types were allowed to accumulate as primary refuse within the immediate context of these knapping floors, signalling that the resulting clusters encompass a broad snapshot of the overall lithic reduction process. Also notable is the fact that these clusters also correspond with the distribution of faunal remains in each phase, indicating that a broader range of activities were undertaken in areas also utilised for knapping activities.

While a clear spatial association with the interior deposits of Structure 3 is evident in the distribution of chips in Upper Phase 3, the Lower Phase 3 artefacts display a relatively even dissemination between the interior and exterior loci. This latter orientation suggests that knapping activities were performed in both indoor and outdoor settings at Wadi Hammeh 27, this aspect bearing a high degree of resemblance to the situation at Early Epipalaeolithic Ohalo II (Nadel 2003: 224). When discrete clusters of knapping refuse occur in indoor Epipalaeolithic contexts, they tend to be situated within close proximity to the main entrance, suggesting that the availability of sunlight played a role in determining where these activities were executed (Hardy-Smith & Edwards 2014; Samuelian 2013: 178-181; Weiss et al. 2008: 2411).

Assuming then that the entrance to Structure 1 existed in its south-western end during Phase 2 as it did during Phase 1 (Edwards 2013d: 65, 68), the concentration of primary refuse along the southern baulk of the XX F sondage indicates that knappers similarly took advantage of indoor sunlight at Wadi Hammeh 27. Likewise, the interior clusters associated with Structure 3 demonstrate that a large degree of knapping was carried out immediately within the entrance to Structure 3, although the limited excavation area in this case renders it impossible to determine whether or not this density remains consistent throughout the rest of the Structure 3 interior area.

10.4.2 Burnt artefacts, hearths and combustion features

The high numbers and widespread distribution of burnt artefacts at Wadi Hammeh 27 characterise Early Natufian settlements in general, where lithics dropped underfoot are subsequently exposed to hearth activity (Edwards & Edwards 1990: 5; Hardy-Smith & Edwards 2004: 279; Yeshurun et al. 2014: 598). The widespread dispersal of burnt artefacts in the earlier phases of Wadi Hammeh 27 thus points to a degree of horizontal artefact displacement (Sergant et al. 2006), resulting in the artefacts associated with numerous ephemeral hearths becoming intermixed into a conglomeration of artefacts. This effect is best demonstrated by the high percentages of burnt artefact in marginal zones (such as along the interior face of structural walls) where the use of open hearths would be impractical, such as in the entryway or along the interior wall of Structure 3. In this sense, the high quantity and widespread distribution of burnt artefacts throughout the current samples may be viewed in the context of what Mentzer (2014: 617) refers to as 'combustion features' – the disarticulated remains of an unknown number of hearths and their associated artefacts displaced horizontally through taphonomic processes such as scuffage.

10.4.3 Differential tool distributions and the identification of activity areas

Several artefact clusters encompassing multiple activities were identified in each phase. As noted by Keeley (1991: 259) the distribution of composite tool elements in a domestic setting should be viewed as indicative of their location of their replacement rather than use, although this distinction may be clouded by the disposal of hafted and non-hafted varieties of a tool in the same space (Keeley 1982: 802). While this approach is a straightforward consideration in regards to the sickle blades and lunates, which by definition were designed to be hafted for offsite use, it raises serious concerns for other tool groups which may have served as hafted objects only in some cases (see Chapter 9.3.3). It is probable that many of the scrapers, burins, multiple tools and awls and borers utilised at Wadi Hammeh 27 originally functioned as part of composite tools, yet without any means of conclusively determining the percentage of these objects which functioned as such, it remains impossible to determine how many are dissociated from their original context of use.

The non-geometric microliths, geometric microliths and retouched fragments are the only tool groups to consistently follow the distribution of primary knapping refuse and faunal remains in each occupational surface between Upper Phase 4 and Phase 2, indicating that the retooling of composite sickles and projectiles was another task to be regularly practiced in these generalised activity areas.

Differences between the use of space between Structures 3 and 1 must also be considered. Given that the interior floor area of Structure 1 is at least four times that of Structure 3, it stands to reason that the demarcation of activity areas would have varied considerably between the two buildings. The noticeably reduced density of artefacts in Phase 2 compared to the Upper and Lower Phase 3 assemblages (see Chapter 4) supports the idea that the distribution of refuse was more widely distributed across the Structure 1 (Phases 1 and 2) floors than in Structure 3. At the same time, the fact most tool groups were deposited as primary refuse amongst the debris, debitage and faunal remains suggests that little spatial demarcation was present between the activities performed onsite, despite the broad interior space available. It can thus be argued that the similar deposition of artefacts from a broad range of activities inside Structure 3 was likely not the result of refuse overlap due to the limited space available, but again rather reflective of the inhabitants choosing to undertake multiple tasks within the same activity area.

10.5 Conclusions

The abandonment signature of Wadi Hammeh 27 presents a distinctive formulation, undoubtedly influenced by the site’s unique setting at the onset of sedentism. The clustering of high-value *de facto* refuse sets across the Phase 1 settlement supports the identification of an unplanned final abandonment of the settlement. This identification is aided by clear breaks in the Phase 1 lithic record compared to the underlying assemblages, namely in the retention of significantly higher proportions of intact debitage likely reflective of an active stockpile.

The conclusion of this investigation into the final abandonment of Wadi Hammeh 27 brings the investigations into the diachronic patterning at the site to a close. To close, the patterns discussed in this and previous discussion may now be placed into a regional context in the following chapter.

Chapter 11: Assemblage variation in the Early Natufian period: Wadi Hammeh 27 in a regional context

11.1 Introduction

Having detailed the composition and spatial distribution of the Wadi Hammeh 27 lithic assemblages, the discussion may finally turn to the regional significance of this sequence. Flaked stone artefacts are the only technological component common to every Natufian site regardless of its size, complexity or setting, making them a suitable class of evidence for comparing sites with and without characteristics of a 'base-camp' (Ashkenazy 2013: 664).

An inter-site comparison was undertaken by Edwards (2013e: 185) using the Phase 1 assemblage, resulting in `Ain Mallaha being recognised as the closest equivalent to Wadi Hammeh 27 in terms of its overall toolkit composition. A similar approach embarked on in this chapter, with the additional benefit of being able to approach the subject from a diachronic perspective. Furthermore, multiple new Early Natufian assemblages have been made available for comparison since Edwards' analysis, including from four more architectural sites: Dederiyeh Cave, Hof Shahaf, Jeftelik and Shubayqa 1. Most important for this study, however, is the publication of similarly superimposed sequences of flaked stone artefact assemblages from the ongoing excavations at El Wad Terrace (Kaufman et al. 2015; Weinstein-Evron et al. 2018), allowing for direct comparisons with several of the diachronic trends seen at Wadi Hammeh 27.

The debitage categories employed in this discussion include variants of those utilised in the previous chapters, in order to maximise intercompatibility. For example, 'flakes' in this chapter encompass the 'flake' and 'broken flake', types employed in Chapter 3. Likewise, given the varying definitions utilised in differentiating blades and bladelets (see Chapter 4.2), these two debitage types have been combined for this chapter, along with the 'broken blades and bladelets'. This approach is necessary given that some of the comparative assemblages do not distinguish microlithic bladelets from macrolithic blades at all (Byrd 1989a: 28; Byrd & Garrard 2013a: 139). The 'flakes <2cm' and 'bladelets <2cm' types have been excluded from the debitage assemblage comparison for Wadi Hammeh 27. This decision was made due to the informal nature and minute size of many of these pieces blurring the line between debris and debitage, and their incorporation would thus run the risk of inflating the proportions of flakes and bladelets. Large numbers of 'Indeterminate fragments' are also present in some assemblages, such as at Shubayqa 1; these pieces have been reassigned as broken flakes in this chapter in order to remain consistent with the Wadi Hammeh 27 typology. The composition of the comparative retouched tool assemblages have also been modified whenever expedient in order to closely match the Wadi Hammeh 27 typology. This change was achieved in most cases by moving generic broken tool types into the 'retouched fragment' group in cases where they are individually listed.

11.2 An overview of comparative sites

There have been numerous essays over the decades at clustering Natufian sites according to their lithic assemblage characteristics (see Chapter 1.2.2). These models broadly assign three attributes to 'base-camp' settlements: lithified architecture, human burials and the presence of heavy groundstone implements. The sites discussed in this chapter have subsequently been sorted into four group depending on how many of these attributes occur by site (**Table 11.1**).

It is, however, in the author's view that the presence of complex, durable architecture is the most reliable means of inferring site longevity, at least on a broad scale. As argued by Marks and Freidel (1977: 149), the modification of a locale through the construction of durable architecture predetermines its continued or repeated occupation, due to both the time and energy investment involved in its establishment as well as from the draw for future reoccupations above other locations situated within the same environmental niche. Furthermore, Early Natufian burials almost always occur alongside stone structures, the only exceptions, of the sites discussed in this chapter, being at Kebara Cave and Azraq 18 (**Table 11.1**). Likewise, passive groundstone artefacts are widespread at both architectural sites as well as repeatedly occupied campsites such as Tabaqa and Wadi Judayid 2. As such, lithic architecture has been utilised as the primary means of distinguishing 'settlements' from other Early Natufian sites in this study.

<u>11.2.1 Architectural sites</u>

The site of El Wad is one of several Palaeolithic cave sites overlooking the Wadi al-Mughara in the Mount Carmel region (**Table 11.1**; **Fig. 11.1**). It was first excavated by Charles Lambert in 1928 (Weinstein-Evron 2009: 22-3), before being excavated by Dorothy Garrod

Table 11.1: Table of non-lithic cultural elements present at Early Natufian and other contemporaneous sites mentioned in this chapter. Stationary groundstone implements do not include bedrock mortars which could not be safely dated to the primary site occupation.

	Permanent architecture	Burials	Stationary groundstone implements	Site type	Comparative lithic assemblage	Securely dated
All elements						
`Ain Mallaha	Present	Present	Present	Open air	Yes	Yes
El Wad	Present	Present	Present	Cave	Yes	Yes
Hayonim Cave	Present	Present	Present	Cave	Yes	Yes
Hof Shahaf	Present	Present	Present	Open air	Yes	No
Shubayqa 1	Present	Present	Present	Open air	Yes	Yes
Wadi Hammeh 27	Present	Present	Present	Open air	Yes	Yes
2/3 elements						
Dederiyeh Cave	Present	Absent	Present	Cave	Yes	Yes
Jeftelik	Present	Absent	Present	Open air	Yes	Yes
Jericho	Present	Unclear	Present	Open air	Yes	No
Kebara Cave	Absent	Present	Present	Cave	No	Yes
Upper Besor 6	Present	Absent	Present	Open air	No	No
1/3 elements						
Azraq 18	Absent	Present	Absent	Open air	Yes	No
Tabaqa	Absent	Absent	Present	Open air	Yes	No
Wadi Judayid 2	Absent	Absent	Present	Open air	Yes	Yes
Wadi Mataha 2	Present	Absent	Absent	Open air	No	Yes
0/3 elements						
Azariq XV	Absent	Absent	Absent	Open air	Yes	No
Beidha	Absent	Absent	Absent	Open air	Yes	Yes
Jordan River Dureijat	Absent	Absent	Absent	Open air	Yes	Yes
Wadi Jilat 22	Absent	Absent	Absent	Open air	Yes	Yes
Wadi Khawwan 1	Absent	Absent	Absent	Open air	Yes	No
Yutil al-Hasa	Absent	Absent	Absent	Rockshe-lter	Yes	Yes

Figure 11.1: Location of Early Natufian and contemporaneous sites mentioned in this chapter.

over five seasons between 1929 and 1933 (Garrod 1932: 258-61; 1934: 133). Garrod's excavations served to establish the overall phasing of the Natufian period, and resulted in the exposure of a curvilinear structure situated on the terrace measuring 8m or 9m in diameter, along with 62 burials in the outer chambers of the cave encompassing 89 individuals (Garrod 1934: 136, 138; Weinstein-Evron 2009: 61). However, Garrod's excavations resulted in little to no *in situ* deposits surviving in these areas of the site (Weinstein-Evron 2009: 61), without any adequate sampling of the associated lithic assemblages having been performed. Excavations resumed at El Wad between 1980 and 1981 under the direction of Valla (Valla et al. 1986), who excavated a 4.5m^2 sondage adjacent to Garrod's trench on the terrace. Chamber III, situated deeper in the cave, was subsequently excavated in 1988 and 1989 by Weinstein-Evron (1998: 63).

The most substantial renewed excavations have been those carried out by Weinstein-Evron since 1994 on the terrace to the north-east of Garrod's original exposure (Weinstein-Evron et al. 2007: 43). This project has resulted in a superimposed sequence of Late to Early Natufian cultural horizons being comprehensively sampled. While the base of the Early Natufian deposits have yet to be reached in this area, a total of five stratigraphic phases (numbered W3 – W7) have been identified which date exclusively to this period (Kaufman et al. 2015: 146, 153-4; Weinstein-Evron et al. 2018: 10). Phases W-7 and W-6 are characterised by two superimposed, curvilinear stone structures (Structures II and I respectively), with Structure I significantly outsizing its predecessor (Weinstein-Evron et al. 2018: 11-12, 45) in a manner which resembles the relationship between Structures 3 and 1 at Wadi Hammeh 27. Phase W-5 subsequently represents a series of occupation fill deposits associated with Structure I, whereas Phases W-4 and W-3 represent post-architectural occupations of the terrace (Weinstein-Evron et al. 2018: 10). Comprehensive lithic analyses of this sequence have been carried out on both the overall Early Natufian sequence (Kaufman et al. 2015), and for a series of occupational floors within the architectural strata (Weinstein-Evron et al. 2018). Both of these studies have been utilised as comparative assemblages in this chapter.

Hayonim Cave is situated in the Nahal Meged, 13km east of Acre (Belfer-Cohen & Bar-Yosef 2013: 507). The cave and terrace deposits of Hayonim have been excavated as two separate sites, with the cave presenting a combination of Early and Late Natufian cultural horizons, whereas only Late Natufian deposits have hitherto been uncovered on the terrace (Belfer-Cohen & Bar-Yosef 2013). The cave deposits were originally excavated by Bar-Yosef between 1965 and 1971 (Bar-Yosef & Goren 1973), followed by excavations carried out by Naama Goren in 1975 and from 1977 to 1979, ultimately encompassing a total area of 150m^2 (Belfer-Cohen 1988: 20). Layer B was divided into five phases, with the earliest two (Phases 1 and 2) representing the Early Natufian occupation, whereas Phases 4/5 and Phase 3 represent Late Natufian and intermediate deposits respectively (Belfer-Cohen 1988: 129). Phases 2 and 3 are characterised by a compact cluster of small, curvilinear, stone structures, which overly a Phase 1 burial ground (Belfer-Cohen 1988: 24; Belfer-Cohen & Bar-Yosef 2013: 510).

The associated lithic assemblages of Hayonim Cave do not present an ideal comparative case study for several reasons. Earthmoving activities undertaken by the Early Natufian occupants of the site not only caused the various deposits from this period to become intermixed, but the disturbance of underlying Kebaran, Aurignacian and Mousterian deposits resulted in contamination from these assemblages (Bar-Yosef & Goren 1973: 54; Lieberman 1991: 49). However, this problem was mitigated by Belfer-Cohen (1988: 47) only incorporating lithics from undisturbed loci into her analysis, and this sample has thus been retained as a comparative assemblage.

The deposits on the exterior terrace of Hayonim were excavated between 1974 and 1975 by Henry (Henry et al. 1981: 35), with subsequent excavations undertaken by Valla between 1980-1981 and 1985-1989 (Valla et al. 1989). These latter excavations revealed a significant Natufian settlement at this location, including the presence of stone architecture and massive basaltic mortars (Valla et al. 1989). The lithic assemblage excavated from Layer D during Henry's excavations of the site (Henry & Leroi-Gourhan 1976) was utilised as a comparative assemblage by Edwards (2013e). However, subsequent revaluations of the excavated Hayonim Terrace deposits have determined that they most likely date exclusively to the Late Natufian period (Belfer-Cohen & Bar-Yosef 2013), and the associated assemblages have thus not been retained for comparative purposes in this study.

The open-air settlement of `Ain Mallaha, in the Hula Valley, was extensively excavated between 1955-1956 and 1959-1961 by Jean Perrot, who in doing so all but entirely cleared out the Early Natufian deposits of this site. Despite these excavations encompassing an enormous area (255m^2), only 50,000 associated lithic artefacts were recovered due to a lack of sieving being implemented (Perrot 1960: 14-15; 18). The Early Natufian deposits were revisited in 1974 by Monique Lechevallier and Francois Valla (1974), and subsequently in 1975 by Valla alone (Valla 1984). These renewed excavations resulted in a sequence of superimposed curvilinear stone structures (Structures 62, 51 and 131) being exposed. These three superimposed structures partially overlay Cemetery B, a collection of twelve interments including the famous 'puppy burial' (Boyd 1995: 21). It is from the occupational floor deposits of Structure 131 (Layer IVa), the earliest of these three buildings, that that the comparative lithic assemblage utilised in this chapter was sampled (Valla 1984: 22, 33). Comprehensive excavations targeting the Final Natufian occupation of the site were subsequently carried out by Valla between 1996 and 2005, revealing the continued existence of an architectural settlement in this period (Valla et al. 1998; 2001; 2004; 2007).

The partially preserved remains of a single curvilinear structure were excavated between 2007 and 2008 at the open-air site of Hof Shahaf, on south-west edge of Lake Galilee (Marder et al. 2013: 505-6). While no radiocarbon dates were recovered from the site, it was tentatively assigned to the Early Natufian period based on the dominance of Helwan retouch on its geometric and non-geometric microliths (Klein 2012: 5-6, 64). Despite the presence of durable stone architecture, Klein (2012: 5-6) argues that Hof Shahaf instead represents one of several sites occupied on a rotational basis rather than a sedentary or semi-sedentary settlement. This assignment was based on the relatively low volume of flaked stone artefacts onsite, although she also acknowledges that this may also be the result of erosion, given the situation of the site on a steep gradient (Klein 2012: 74).

Dederiyeh Cave is located on the edge of Wadi Dederiyeh in northern Syria (Nishiaki et al. 2017: 9). Excavations of the entrance chamber were carried out between 2003 and 2008, revealing six overlapping curvilinear structures comprising three architectural phases (Nishiaki et al. 2017: 9-11). While the latest phase (Phase 3) provided radiocarbon dates indicative of a Late Natufian occupation, the underlying Phase 2 and 1 occupations were dated to the Early Natufian period (Nishiaki et al. 2017: 11-12). Given that the excavations of this site were primarily centred around the broad exposure of the latest phase (Nishiaki et al. 2017: 9-10), the lithic samples available from the Early Natufian strata are relatively limited.

Jeftelik is an open-air Early Natufian site located in the Bouqaia Basin at the Homs Gap, western Syria, with excavations carried out in 2008 and 2009 revealing three partially preserved, curvilinear, stone structures (Rodríguez et al. 2013). A rich assemblage of flaked stone debitage and cores were reported in the deposits associated with these buildings, although only a small sample of the retouched artefact component has been published as of writing (Rodríguez et al. 2013: 64-7).

Shubayqa 1 is another architectural site situated outside the traditional Early Natufian 'homeland', being situated deep in the Jordanian *Badia* near the south-eastern foot of Jebel Druze. Excavations carried out between 2012 and 2015 revealed a sequence of seven stratified phases spanning the Early and Late Natufian periods, with both periods being characterised by small, oval-shaped structures paved with basaltic slabs (Richter 2017: 95; Richter et al. 2017: 1-2). While Phases 7 to 4 all date to the Early Natufian period (Richter et al. 2017: 4), only the small lithic assemblage from Phase 7 has been published thus far (Richter & Mawler 2019).

Finally, while the Natufian settlement at Jericho was assigned to the Early Natufian period due to its technological similarities with corresponding occupation at El Wad (Kenyon & Holland 1981: 268, 272), the more recent Italian-Palestinian investigators instead identified these deposits as belonging to the Late Natufian (Nigro 2020: 178). This later assignment is supported by the date of the single radiocarbon sample available (11,090 ± 90 BP; Kenyon & Holland 1981: 268, 272, 502). In any case, the lack of sieving performed during Kenyon's excavations prevents it from being utilised as a comparative case-study. Also worth noting is the site of Upper Besor 6, which represents the first (and, thus far, the only) example of durable Early Natufian architecture to be uncovered in the Negev and Sinai regions (Horwitz & Goring-Morris 2001: 112). Originally excavated in 1995 by Goring-Morris (1998: 87), no quantifiable data has been published for this assemblage to date, despite the site exhibiting an impressive array of scrapers, burins, sickle elements, geometric microliths, notched and denticulated pieces and bifacial tools (Goring-Morris & Belfer-Cohen 2013: 565, 568; Horwitz & Goring-Morris 2001: 113). Evidence of Early Natufian domestic stone architecture is also present at the site of Wadi Mataha 2 in southern Jordan, although little information has been published on the corresponding lithic assemblage other than noting its similarity with those of the nearby site of Beidha (Baadsgaard et al. 2010: 9-11, 17).

11.2.2 Non-architectural sites

While this chapter focusses on the comparison of the Wadi Hammeh 27 assemblages with those of other architectural settlements, some other sites have also been included for comprehensive purposes. The recently published site of Jordan River Dureijat, in the Hula Valley, provides a rare example of an intermittently-occupied, task-specific, Early Natufian occupation in the traditional Natufian core-area, having been utilised primarily for fishing and hunting activities (Sharon et al. 2020: 60). Layer 3c of this site encompasses the Early Natufian cultural horizon, which is represented archaeologically by a loose scatter of lithics, along with a collection of modified and unmodified basaltic and limestone cobbles identified as net sinkers and line weights (Sharon et al. 2020: 42-43, 57-58).

The site of Beidha, on the eastern edge of the Wadi Arabah, was excavated by Diana Kirkbride over seven seasons between 1958 and 1967, with an eighth season subsequently carried out in 1983 (Byrd 1989a: 19). As sieving was only consistently employed in this final season (Byrd 1989a: 19, 24), only this lithic assemblage has been employed for comparison, with the exception of the core typological comparison. Architectural features at the site are limited to hearths and large, round 'roasting areas', although the thick deposits, large lithic assemblages and broad horizontal extent of the site (up to 4km^2) led Byrd (1989a: 78-81, 85) to argue that the site was repeatedly occupied on a seasonal basis.

Azariq XV is a small site situated at the foot of the Shluhat Qeren in the Negev Desert (Goring-Morris 1987: 19, 258). The site encompasses an area of approximately 20m^2, with the only built feature of note being the remains of a hearth (Goring-Morris 1987: 258). Despite its small size, the site yielded an impressive collection of 293 scaphopod shell fragments (primarily from the tips of the mollusc) suggesting that its occupants were involved with the manufacture and transportation of these beads inland from the Mediterranean coast.

Tabaqa is an open-air site located in the lower sub-basin of the Wadi al-Hasa, approximately 6km downstream from the Early Natufian site of Yutil al-Hasa in the upper sub-basin and only 700m from the WHS 1021 surface artefact scatter, which has also been tentatively identified as being Early Natufian in date (Olszewski 2013: 412-5). All three sites are hypothesised by Olszewski (2013: 423) to represent short term encampments utilised by mobile hunter-gatherers operating within the Irano-Turanaian steppic zone. The lithic assemblages from Tabaqa and Yutil al-Hasa have been employed as comparative assemblages in this chapter.

Wadi Judayid 2 is an open-air site situated near the eastern edge of the Judayid Basin in southern Jordan, which comprises a concentration of flaked stone artefacts, bone and burnt sediment covering an area of 400m^2 (Henry 1995: 319-320; Henry & Turnbull 1985: 46). The excavators argued that the site represents an example of a base camp occupied on a multi-seasonal basis due to its ecotonal setting and high density of flaked stone artefacts (Henry

1995; Henry & Turnbull 1985: 48-9). Henry (1995: 329) even went as far as claiming that the density of artefacts at this site (14,374 pieces per cubic metre, debris included) is greater than that of Plot XX D at Wadi Hammeh 27, although this claim does not hold up when compared to the much larger densities recorded by Edwards (2013e) for the Phase 1 assemblages, or those described in this thesis. In any case, the use of lithic densities as a sole means of measuring the mobility of Natufian sites is equivocal at best, given the range of other factors which must also be taken into account (see Chapter 11.5). It is thus far more likely that this site functioned at most as a seasonally occupied campsite in a similar fashion to Beidha and Tabaqa.

Wadi Jilat 22 is a partially eroded, deflated mound situated on the edge of the Wadi al-Jilat in the south-west margin of the Azraq Basin (Hunt & Garrard 2013: 74). The lithic assemblage of the uppermost cultural horizon was identified as belonging to the Mushabian industry due to the extensive evidence of microburin usage, the high proportion of non-geometric to geometric microliths, the dimensions of the non-geometric microliths and the presence of La Mouillah points (Byrd & Garrard 2013e: 387). However, the late date of the single radiocarbon sample retrieved from these deposits (11,920 ± 180 BP) led investigators to conclude that the Upper Phase is Late Epipalaeolithic in date (Hunt & Garrard 2013: 78), and it has thus been tentatively utilised as a comparative assemblage.

While Azraq 18 was one of the ten sites utilised by Edwards (2013e: 186) as a comparative assemblage for Wadi Hammeh 27, no radiocarbon dates were recovered from this site, and investigators were unable to the conclusively determine whether the associated lithic assemblages belong to either the Early or Late Natufian period (Byrd & Garrard 2013d: 316; Hunt & Garrard 2013: 103). Azraq 18 has subsequently not been retained as a comparative assemblage in this chapter.

Dates are likewise unavailable for the ephemeral Natufian site of Wadi Khawwan 1, situated 2km south-west of Wadi Hammeh 27 (Edwards et al. 1998: 25). An Early Natufian affiliation is nonetheless suggested by the preponderance of Helwan retouch among the small geometric and non-geometric microlith assemblages of the site, along with the absence of evidence for the microburin technique having been utilised (Edwards et al. 1998: 26). In any case, the possibility that Wadi Khawwan 1 served as a satellite camp for at least one of the architectural phases of Wadi Hammeh 27 warrants its inclusion as a comparative assemblage in this study.

11.3 The chronological placement of Wadi Hammeh 27

For regional diachronic patterning to be clarified, the chronological relationships of the comparative sites must first be determined. Out of the sites discussed in this chapter, consistent conventional radiocarbon and accelerator mass spectrometry (AMS) dates have been published for `Ain Mallaha (Davis & Valla 1978: 610; Valla et al. 2007: 146); Dederiyeh Cave (Nishiaki et al. 2017: 12), El Wad Terrace (Weinstein-Evron et al. 2018: 31), Hayonim Cave (Hopf & Bar-Yosef 1987: 117; Regev et al. 2011: 122), Jeftelik (Rodríguez et al. 2013: 71), Jordan River Dureijat (Sharon et al. 2020: 40); Shubayqa 1 (Richter et al. 2017: 5), Wadi Jilat 22 (Hunt & Garrard 2013: 78) and Yutil al-Hasa (Olszewski 2010: 89). Radiocarbon dates are also available for Beidha (Byrd 1989a: 26) and Wadi Judayid 2 (Henry 1995: 321) although these samples are too imprecise for any temporal assignment other than confirming their general placement within the Early Natufian period (**Table 11.2**). Each date was calibrated for this study using OxCal v4.4.2, with the application of the IntCal20 atmospheric curve (Reimer et al. 2020).

The consistently early AMS dates between Phases VII and IV at Shubayqa 1 suggests that the establishment of this site likely pre-dates Wadi Hammeh 27, with a possible overlap between the later occupational deposits of Shubayqa 1 and the earlier Wadi Hammeh 27 strata. At the same time, the possibility that the Early Natufian occupation of Shubayqa 1 pre-dates Wadi Hammeh 27 entirely must not be discounted due to the consistent clustering of its dates towards the middle of the thirteenth millennium BCE.

The radiocarbon dates recovered from Phases W-7 and W-6 of El Wad Terrace are similar to those recovered between Lower Phase 4 and Lower Phase 3 at Wadi Hammeh 27, suggesting that both sequences are roughly contemporaneous, if Wadi Hammeh 27 is not slightly younger. That being said, the Early Natufian deposits at El Wad Terrace have yet to be comprehensively excavated below Phase W-7 (Weinstein-Evron et al. 2018: 11, 56), and it is thus almost certain that the establishment of this settlement predates Wadi Hammeh 27 by a significant margin. The dates from Layer 3c at Jordan River Dureijat and the lower occupational phase of Yutil al-Hasa likewise suggests that these ephemeral sites existed around the same time as the earlier occupation of Wadi Hammeh 27.

The dates from Phases W-5 and W-4 at El Wad conversely suggest their relative contemporaneity with Phase 1 of Wadi Hammeh 27, although it is also likely that Phase W-4 postdates it. Phase 2 at Dederiyeh Cave similarly presents dates within the range of or slightly

Table 11.2: Calibrated dates for Wadi Hammeh 27 and the comparative sites. All samples from other sites have been recalibrated by the author using OxCal v4.4.2 (2020 Bronk Ramsey), with the utilisation of the IntCal20 atmospheric curve (Reimer et al. 2020).

Sample	Provenance	Date (BP)	Calibrated date BCE (2σ)	Reference
Wadi Hammeh 27				
ANU-120	Phase 0	11,100 ± 120	11,163 – 10,792 (95.4%)	-
OxA-393	Phase 1	11,920 ± 150	12,174 – 11,521 (95.4%)	-
OxA-394	Phase 1	12,220 ± 160	12,970 – 11,833 (95.4%)	-
OxA-507	Phase 1	11,950 ± 160	12,298 – 11,515 (95.4%)	-
Wk-22244	Lower Phase 3	12,349 ± 44	12,881 – 12,737 (22.6%) 12,621 – 12,178 (72.8%)	-
Wk-46912	Upper Phase 4	12,383 ± 29	12,886 – 12,732 (26.1%) 12,638 – 12,271 (69.3%)	-
Wk-46913	Upper Phase 4	12,438 ± 28	12,941 – 12,362 (95.4%)	-
Wk-46914	Upper Phase 4	12,290 ± 28	12,836 – 12,778 (6.1%) 12,383 – 12,142 (89.4%)	-
Wk-46915	Lower Phase 4	12,404 ± 30	12,897 – 12,716 (26.4%) 12,685 – 12,320 (69.1%)	-
Wk-46916	Lower Phase 4	12,379 ± 30	12,884 – 12,734 (26.1%) 12,631 – 12,259 (69.4%)	-
`Ain Mallaha				
Ly 1661	Phase III, Structure 51	11,740 ± 570	13,681 – 10,731 (95.4%)	Davis & Valla 1978
Ly 1662	Phase III, Structure 51	11,310 ± 880	14,251 – 9,145 (95.4%)	Davis & Valla 1978
Ly 1660	Phase IV, Structure 131	11,600 ± 360	12,854 – 12,765 (1.1%) 12,537 – 10,809 (94.3%)	Davis & Valla 1978
GifA 70014	Locus 239	12,250 ± 60	12,854 – 12,763 (7.1%) 12,487 – 12,087 (88.3%)	Valla et al. 2007
Beidha				
AA-1463	C-01-24 Level 4	12,910 ± 250	14,281 – 12,839 (90.1%) 12,780 – 12,475 (5.3%)	Byrd 1989a
AA-1465	C-01-16 Level 4	12,450 ± 170	13,260 – 12,116 (95.4%)	Byrd 1989a
AA-1464	C-01-23 Level 4	12,130 ± 190	12,932 – 11,651 (95.4%)	Byrd 1989a
Dederiyeh Cave				
TERRA-102306b13	Phase 2, Construction 2	12,240 ± 62	12,855 – 12,762 (6.3%) 12,487 – 12,076 (89.1%)	Nishiaki et al. 2017

TERRA-102306b16	Phase 2, Construction 2	12,123 ± 70	12,219 – 11,851 (95.4%)	Nishiaki et al. 2017
El Wad				
RTT 5786	Unit 2, W-3	11,370 ± 115	11,519 – 11,143 (95.4%)	Weinstein-Evron et al. 2018
RTT 6106	Unit 2, W-3	11,840 ± 100	12,063 – 11,976 (7.5%) 11,923 – 11,545 (87.9%)	Weinstein-Evron et al. 2018
RTD 6956	Unit 2, W-3	11,460 ± 45	11,504 – 11,287 (94.4%) 11,252 – 11,243 (1.0%)	Weinstein-Evron et al. 2018
RTT 5790	Unit 2, W-4	11,965 ± 125	12,152 – 11,634 (93.7%) 11,600 – 11,566 (1.7%)	Weinstein-Evron et al. 2018
RTT 6096-2	Unit 2, W-5, level I	12,340 ± 85	12,906 – 12,131(95.4%)	Weinstein-Evron et al. 2018
RTT 6105	Unit 2, W-5, Level II	11,935 ± 100	12,099 – 11,646 (95.2%) 11,587 – 11,583 (0.3%)	Weinstein-Evron et al. 2018
RTD 6959	Unit 2, W-5	11,445 ± 50	11,497 – 11,281 (89.8%) 11,263 – 11,233 (5.7%)	Weinstein-Evron et al. 2018
RTT 6098-2	Unit 2. W-6, level IV	12,430 ± 80	13,028 – 12,244 (95.4%)	Weinstein-Evron et al. 2018
RTT 6107	Unit 2, W-6, level VII	12,350 ± 100	12,964 – 12,129 (95.4%)	Weinstein-Evron et al. 2018
RTD 6975	Unit 2, W-6	12,140 ± 50	12,209 – 12,018 (68.9%) 12,001 – 11,862 (26.5%)	Weinstein-Evron et al. 2018
RTD 6960	Unit 2, W-6	12,350 ± 50	12,885 – 12,733 (22.4%) 12,639 – 12,164 (73.1%)	Weinstein-Evron et al. 2018
RTT 6117-2	Unit 2, W-7, Level VIII	12,300 ± 70	12,879 – 12,739 (15.8%) 12,620 – 12,111 (79.6%)	Weinstein-Evron et al. 2018
RTT 6115	Unit 2, W-7, level IX	11,570 ± 75	11,644 – 11,592 (9.2%) 11,577 – 11,352 (86.2%)	Weinstein-Evron et al. 2018
RTD 8021	Unit 2, W-7, level XII	12,128 ± 30	12,149 – 12,035 (73.5%) 11,986 – 11,912 (21.9%)	Weinstein-Evron et al. 2018
Hayonim Cave				
RTT 6130.1	Phase II-III	12,470 ± 70	13,068 – 12,330 (95.4%)	Regev et al. 2011
RTT 6130.2	Phase II-III	12,210 ± 70	12,854 – 12,763 (4.5%) 12,482 – 12,436 (1.0%) 12,411 – 12,038 (85.7%) 11,989 – 11,910 (4.2%)	Regev et al. 2011

RTT 6129.1	Phase 1	12,260 ± 70	12,866 – 12,752 (10.3%) 12,565 – 12,084 (85.1%)	Regev et al. 2011
OxA 743	Phase 1	12,010 ± 180	12,858 – 12,761 (2.4%) 12,546 – 11,537 (93.1%)	Hopf & Bar-Yosef 1987
OxA 742	Phase 1	12,360 ± 160	13,165 – 12,070 (95.1%) 11,958 – 11,940 (0.4%)	Hopf & Bar-Yosef 1987
Jeftelik				
CAN 528	SU 22	12,110 ± 45	12,361 – 12,081 (95.4%)	Rodriguez et al. 2013
Beta – 257748	SU 24	12,100 ± 70	12,175 – 11,847 (95.4%)	Rodriguez et al. 2013
CAN 527	SU 28	12,075 ± 45	12,110 – 11,858 (95.4%)	Rodriguez et al. 2013
Jordan River Dureijat				
Poz-94109	Layer 3c horizon	12,416 ± 47	12,955 – 12,308 (95.4%)	Sharon et al. 2020
Poz-94108	Middle of Layer 3c	12,350 ± 60	12,892 – 12,724 (22.2%) 12,670 – 12,153 (73.3%)	Sharon et al. 2020
Poz-94107	Bottom of Layer 3c	12,460 ± 70	13,056 – 12,316 (95.4%)	Sharon et al. 2020
Shubayqa 1				
RTK-6813	Phase IV	12,344 ± 85	12,914 – 12,133 (95.4%)	Richter et al. 2017
RTK-6816	Phase IV	12,389 ± 78	12,979 – 12,199 (95.4%)	Richter et al. 2017
RTK-6823	Phase V	12,321 ± 78	12,893 – 12,721 (19.2%) 12,679 – 12,120 (76.3%)	Richter et al. 2017
RTK-6820	Phase V	12,385 ± 75	12,967 – 12,197 (95.4%)	Richter et al. 2017
RTK-6821	Phase V	12,385 ± 78	12,973 – 12,192 (95.4%)	Richter et al. 2017
RTK-6822	Phase V	12,412 ± 79	13,007 – 12,227 (95.4%)	Richter et al. 2017
RTK-6818	Phase V	12,477 ± 76	13,101 – 12,327 (95.4%)	Richter et al. 2017
RTD-7314	Phase VI	12,273 ± 48	12,855 – 12,762 (8.2%) 12,481 – 12,439 (1.4%) 12,410 – 12,109 (85.8%)	Richter et al. 2017
RTD-7947	Phase VI	12,332 ± 38	12,867 – 12,751 (19.7%) 12,561 – 12,164 (75.7%)	Richter et al. 2017
RTD-7316	Phase VI	12,337 ± 46	12,875 – 12,743 (20.5%) 12,600 – 12,156 (75.0%)	Richter et al. 2017
RTD-7313	Phase VI	12,346 ± 46	12,880 – 12,739 (21.9%) 12,618 – 12,167 (73.5%)	Richter et al. 2017

RTD-7311	Phase VI	12,367 ± 65	12,904 – 12,179 (95.4%)	Richter et al. 2017
RTD-7312	Phase VI	12,405 ± 50	12,932 – 12,267 (95.4%)	Richter et al. 2017
RTD-7315	Phase VI	12,445 ± 70	13,034 – 12,294 (95.4%)	Richter et al. 2017
RTD-7951	Phase VII	12,116 ± 55	12,157 – 11,857 (95.4%)	Richter et al. 2017
RTD-7317	Phase VII	12,289 ± 46	12,856 – 12,761 (10.6%) 12,496 – 12,123 (84.8%)	Richter et al. 2017
Beta-112146	Phase VII	12,310 ± 60	12,873 – 12,745 (16.3%) 12,596 – 12,125 (79.2%)	Richter et al. 2017
RTD-7318	Phase VII	12,332 ± 46	12,872 – 12,746 (19.5%) 12,587 – 12,153 (75.9%)	Richter et al. 2017
RTD-7948	Phase VII	12,478 ± 38	13,032 – 12,829 (34.6%) 12,789 – 12,400 (60.9%)	Richter et al. 2017
Wadi Jilat 22				
OxA 1770	Upper Phase	11,920 ± 180	12,358 – 11,456 (95.1%) 11,431 – 11,412 (0.3%)	Hunt & Garrard 2013
Wadi Judayid 2				
SMU-805	Layer C	12,090 ± 800	15,018 – 10,724 (95.4%)	Henry 1995
SMU-806	Layer C	12,750 ± 1,000	16,278 – 11,047 (95.4%)	Henry 1995
SMU-803	Layer C	12,784 ± 650	15,303 – 15,280 (0.1%) 15,182 – 11,536 (95.3%)	Henry 1995
Yutil al-Hasa				
Beta-129815	Area D	12,270 ± 60	12,859 – 12,759 (9.9%) 12,524 – 12,101 (85.6%)	Olszewski 2010

predating Phase 1 at Wadi Hammeh 27, suggesting that the undated Phase 1 occupation of Dederiyeh likely corresponds with the early or intermediate occupation of Wadi Hammeh 27. The dates from Jeftelik are also roughly contemporaneous with the Phase 1 occupation of Wadi Hammeh 27, while the date recovered from the Upper Phase of Wadi Jilat 22 is either contemporaneous with or slightly post-dates it. Finally, the late dates from Phase W-3 of El Wad suggests that the associated occupation post-dates the abandonment of Wadi Hammeh 27.

Despite also exhibiting similar multiple architectural sequences as Wadi Hammeh 27, the Early Natufian settlements at `Ain Mallaha and Hayonim Cave can only be broadly temporally related due to their limited range of precise dates. The margins of error for the original radiocarbon dates taken from Phases III and IV of `Ain Mallaha are too broad to allow for any sort of precise inter-site correlations, while the far more precise date from the Locus 239 burial deposits suggests that the establishment of this settlement is either roughly contemporaneous with or post-dates that of Wadi Hammeh 27. Similarly, the small array of dates from Hayonim Cave suggest that the architectural strata of this settlement occurred across a similar timespan as Wadi Hammeh 27, albeit with a slightly earlier establishment and abandonment.

11.4 Assemblage comparison

<u>11.4.1 Debitage and cores</u>

The proliferation of small to medium-sized unretouched flakes in assemblages which favoured blade or bladelet blanks for retouch is a phenomenon which has been well established for the Late Epipalaeolithic Levant (Byrd 1988: 260; Byrd & Colledge 1991: 267; Byrd & Garrard 2013c), with the assemblages from Wadi Hammeh 27 joining these ranks. El Wad Terrace exhibits similarly minor fluctuations between flake and blade/bladelet proportions as Wadi Hammeh 27, with flakes nonetheless remaining dominant numerically at both sites (**Tables 11.3-11.4**). The Hayonim Cave and Dederiyeh assemblages have comparatively reduced shares of flakes (**Tables 11.5**), although these proportions are likely offset by the substantial representation of 'primary elements' in each of these cases. In short, it is clear that architectural Early Natufian settlements are characterised by flake-dominated assemblages, regardless of their chronological placement. This pattern almost certainly reflects a combination of the extensive knapping strategies and desultory refuse disposal

Table 11.3: Comparison of lithic assemblages between the El Wad Terrace and Wadi Hammeh 27 Early Natufian sequences. Flakes and bladelets under 2cm excluded from the Wadi Hammeh 27 assemblages.

	El Wad Terrace (Kaufman et al. 2015)							**Wadi Hammeh 27**					
Phase	Architectural				Post-architectural			Cemetery	Architectural				
	W7	W6	W5	**Total**	W4	W3	**Total**	4	Lower 3	Upper 3	2	1 (XX D)	**Total**
Flakes	49.6	46.4	49.4	**48.1**	48.4	60.0	**53.2**	46.5	53.7	51.1	45.3	66.5	**56.7**
Blades and bladelets	29.6	32.1	31.9	**31.4**	28.8	23.7	**26.7**	39.5	35.5	35.8	41.4	26.2	**32.9**
Primary element	7.3	6.5	6.1	**6.6**	7.7	6.9	**7.4**	-	-	-	-	-	**-**
Core trimming elements	2.2	2.7	2.7	**2.6**	3.0	2.1	**2.6**	2.2	1.1	1.8	1.5	0.4	**1.1**
Burin spalls	2.0	1.8	1.9	**1.9**	1.7	1.1	**1.5**	2.4	1.7	2.4	3.2	1.5	**2.0**
Microburin byproducts	0.2	0.2	0.1	**0.2**	0.4	0.2	**0.3**	0.0	0.0	0.1	0.1	0.2	**0.1**
Total debitage	90.8	89.7	92.1	**90.7**	89.9	94.1	**91.6**	90.7	92.0	91.1	91.5	94.8	**92.7**
Cores	2.4	2.4	2.0	**2.3**	2.1	1.2	**1.7**	1.1	1.0	1.1	1.3	0.9	**1.0**
Tools	6.7	7.9	6.0	**7.0**	8.0	4.7	**6.6**	8.2	7.0	7.8	7.2	4.3	**6.2**
Artefact no.	10,652	20,307	13,810	**44,769**	4,178	2,984	**7,162**	11,282	27,896	27,919	13,114	39,680	**108,609**

Table 11.4: Comparison of lithic assemblages between the El Wad Terrace and Wadi Hammeh 27 architectural sequences. Flakes and bladelets under 2cm excluded from the Wadi Hammeh 27 assemblages.

	El Wad Terrace (Weinstein-Evron et al. 2018)										**Wadi Hammeh 27**					
Phase	Structure II				Structure I						Structure 3			Structures 1 & 2		
	XI	IX-X	VIII-VIIIB	**W7 total**	VIIA	VII	VI	V	IV	**W6 total**	Lower 3	Upper 3	**Total**	2	1 (XX D)	**Total**
Flakes	8.6	7.8	7.3	**7.7**	8.1	7.8	7.5	6.5	6.5	**7.3**	9.6	10.5	**10.1**	11.8	25.6	**22.2**
Broken flakes	39.8	28.1	22.4	**26.5**	29.9	22.5	16.1	23.5	24.0	**23.0**	44.0	40.6	**42.3**	33.4	40.9	**39.0**
Blades and bladelets	5.6	4.6	4.0	**4.4**	2.0	3.7	3.8	4.8	4.2	**3.8**	2.5	2.8	**2.7**	4.0	7.6	**6.7**
Broken blades and bladelets	17.6	14.8	10.4	**12.7**	15.7	14.2	9.8	12.8	10.3	**12.5**	33.0	32.9	**33.0**	37.3	18.5	**23.2**
Misc. fragments	3.6	23.0	36.1	**27.8**	27.8	33.6	47.2	32.9	37.4	**35.9**	-	-	**-**	-	-	**-**
Primary element	3.4	2.0	4.9	**3.9**	2.3	3.7	5.0	3.3	3.9	**3.7**	-	-	**-**	-	-	**-**
Core trimming elements	3.5	3.3	2.8	**3.0**	2.2	3.1	1.7	2.7	2.9	**2.6**	1.1	1.8	**1.5**	1.5	0.4	**0.7**
Burin spalls	3.5	3.1	2.1	**2.6**	2.5	2.3	1.3	2.9	2.6	**2.4**	1.7	2.4	**2.1**	3.2	1.5	**1.9**
Microburin byproducts	0.5	0.7	0.1	**0.3**	0.2	0.2	0.0	0.5	0.3	**0.3**	0.0	0.1	**0.0**	0.1	0.2	**0.2**
Total debitage	86.1	87.3	90.2	**88.8**	90.6	91.2	92.3	89.8	92.1	**91.3**	92.0	91.1	**91.6**	91.5	94.8	**94.0**
Cores	2.4	2.9	2.6	**2.7**	1.7	1.3	1.7	1.7	1.4	**1.5**	1.0	1.1	**1.0**	1.3	0.9	**1.0**
Tools	11.5	9.8	7.2	**8.5**	7.7	7.5	6.0	8.5	6.5	**7.2**	7.0	7.8	**7.4**	7.2	4.3	**5.0**
Artefact no.	1,088	1,843	4,193	**7,124**	1,974	3,447	2,285	2,332	3,170	**13,208**	27,896	27,919	**55,815**	13,114	39,680	**52,794**

Table 11.5: Overall composition between Wadi Hammeh 27 and other comparative lithic assemblages, debris excluded (in percentages). Types modified where possible to match the Wadi Hammeh 27 typology. Flakes and bladelets under 2cm excluded from the Wadi Hammeh 27 assemblages. *No distinction made between flake and blade/bladelet blanks at `Ain Mallaha.

	Wadi Hammeh 27 (phases 2-4)	Wadi Hammeh 27 (Phase 1; Area XX D)	`Ain Mallaha (Phase IVa)	Beidha (Area C-01)	Dederiyeh Cave (Phases 1-2)	Hayonim Cave (Phases 1-2)	Hof Shahaf	Jordan River Durejjat (Layer 3c)	Tabaqa	Wadi Jilat 22 (Upper deposits)	Wadi Judayid 2	Wadi Khawwan 1	Yatil al-Hasa (Area D)
Flakes	50.4	66.5	82.7*	36.2	47.9	39.4	75.7	52.0	73.7	43.4	53.4	82.4	61.4
Blades & bladelets	37.1	26.2	-	40.3	23.9	21.2	11.3	14.8	16.1	40.2	29.0	13.5	23.3
Core trimming elements	1.6	0.4	-	0.9	2.9	4.3	4.3	12.8	0.7	0.5	2.0	0.1	0.7
Primary element	-	-	-	5.9	8.7	18.3	-	-	-	6.8	6.6	-	-
Burin spalls	2.3	1.5	2.7	0.2	0.0	1.7	0.7	2.0	0.0	0.6	0.0	0.4	0.5
Microburin byproducts	0.0	0.2	0.3	6.2	0.0	0.0	0.5	0.3	3.7	0.8	2.5	0.0	3.2
Total debitage	91.4	94.8	85.7	89.7	83.4	84.9	92.5	81.9	94.2	92.3	93.4	96.3	89.1
Cores	1.1	0.9	1.1	2.1	2.5	4.3	1.5	3.0	1.1	1.6	1.6	1.1	1.4
Tools	7.5	4.3	13.2	8.3	14.2	10.7	5.9	15.1	4.7	6.0	5.0	2.6	9.4
Artefact no.	80,211	39,680	13,402	2,253	1,121	17,531	6,720	304	5,706	14,134	12,967	1,105	3,203
Reference	-	Edwards 2013e: 123	Valla 1984: 34	Byrd 1989a: 35	Nishiaki et al. 2017: 14	Belfer-Cohen 1988: 70	Klein 2012	Sharon et al. 2020: 48.	Olzewski 2013: 418-421	Byrd & Garrard 2013b: 245	Henry 1995: 324	Edwards et al. 1998: 26.	Olzewski 2013: 418-421

practices at each of these sites, resulting in large amounts of mostly unwanted flake debitage accumulating onsite in the course of procuring the desired blade and bladelet blanks.

More variation is exhibited in terms of debitage proportions between non-architectural sites. Jordan River Dureijat, Wadi Judayid 2, Wadi Khawwan 1 and the Wadi al-Hasa sites are all similarly characterised by flake-based assemblages, whereas Beidha and Wadi Jilat 22 exhibit more even ratios between flakes on one hand and blades and bladelets on the other (**Table 11.5**). This arrangement indicates that while some non-architectural sites exhibit greater emphases on blade/bladelet production more consistent with formalised reduction strategies of earlier Kebaran assemblages (Delage 2005), most present patterns consistent with those of architectural settlements.

The proportions of burin spalls at Wadi Hammeh 27 and El Wad Terrace remain almost identical to one another across each of their occupational sequences. Similarly high proportions of spalls are present at ‘Ain Mallaha (2.7%), Hayonim Cave (1.7%) and Jordan River Dureijat (2.0%) with this debitage type failing to reach 1% of any of the other comparative assemblages (**Table 11.5**). This situation fits neatly with high proportion of burins in each of these assemblages (**Table 11.6**), indicating that large burin assemblages were consistently manufactured onsite whenever they occur throughout the Early Natufian period.

The near-absence of microburin by-products at Wadi Hammeh 27 is consistent with other assemblages in the Mediterranean zone, with the Wadi al-Hasa sites providing the northernmost known Early Natufian assemblages to feature these pieces in any significant proportions (**Table 11.5**). This distribution is to be expected, given that extensive usage of this technique only spread into the northern reaches of the Southern Levant area during the Late Natufian period (Belfer-Cohen & Goring-Morris 2013: 550; Delage 2005: 231; Grosman 2013: 623).

The proportions of cores fluctuate considerably amongst Early Natufian architectural sites. Some regionalisation in knapping regimens and core disposal practices between sites in the Northern Jordan Valley and those along the Mediterranean coast are evident in this regard, with the exceptionally low proportions of cores at Wadi Hammeh 27 bearing the most similarity with `Ain Mallaha (1.1%), Hof Shahaf (1.5%) and Wadi Khawwan 1 (1.1%). The low percentages of cores at Wadi Hammeh 27 are also similar to the proportions from southern Jordanian non-architectural sites. In contrast, the El Wad Terrace, Hayonim Cave

Table 11.6: Proportions of retouched artefact groups between assemblages, in percentiles.

	Wadi Hammeh 27 (Phases 3-4)	Wadi Hammeh 27 (Phases 1-2)	`Ain Mallaha (IVa)	Azariq XV	Beidha (Area C-01)	Dederiyeh Cave (Phases 1-2)	Hayonim Cave (Phases 1-2)	Hof Shahaf	Jeftelik	Jordan River Dureijat (Layer 3c)	Shubayqa 1 (Phase 7)	Tabaqa	Wadi Jilat 22 (Upper Phase)	Wadi Judayid 2	Wadi Khawwan 1	Yutil al-Hasa (Area D)
Scrapers	3.0	4.6	2.0	9.8	5.9	8.2	7.1	4.0	18.4	15.2	8.7	8.5	14.8	1.9	10.3	1.3
Multiple tools	3.9	1.0	0.6	0.9	1.1	0.0	3.7	1.3	0.0	0.0	0.0	0.4	0.9	0.3	0.0	0.3
Burins	16.1	21.0	10.2	2.3	6.4	2.5	28.3	7.3	3.6	13.0	20.5	2.6	4.2	3.1	3.4	5.6
Truncations	4.0	1.9	3.0	0.9	8.1	1.3	2.1	4.5	3.6	0.0	4.6	3.0	3.3	5.2	10.3	2.3
Retouched blades & NGM	11.6	22.2	18.4	27.4	5.4	26.4	17.2	24.0	14.5	21.7	34.8	29.3	13.1	3.1	13.8	33.5
Geometric microliths	15.7	17.1	9.7	25.6	27.4	41.5	7.0	11.6	15.8	21.7	14.4	30.0	4.4	60.5	24.1	21.2
Notched & denticulated pieces	12.3	14.2	13.9	23.7	15.0	8.2	5.0	11.4	3.6	6.5	2.7	12.2	7.2	9.6	10.3	17.5
Awls and borers	0.8	2.0	3.1	0.0	1.6	2.5	3.3	3.8	2.8	4.3	1.5	0.4	0.0	1.8	3.4	1.3
Bifacial tools	0.2	0.4	0.3	0.0	0.0	0.0	0.9	0.3	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0
Retouched flakes	4.4	12.4	3.3	0.9	9.1	6.3	14.9	11.9	32.1	-	12.9	8.9	16.0	14.5	24.1	9.9
Informal tools / Varia	0.5	4.7	2.8	4.2	1.6	2.5	8.2	11.4	5.6	2.2	0.0	0.0	0.4	0.2	0.0	0.3
Retouched fragments	27.5	9.9	32.6	4.2	18.3	0.6	-	8.6	-	15.2	-	3.3	35.6	-	0.0	6.3
Artefact no.	5,052	2,657	1,764	215	186	159	1,876	396	468	46	264	270	542	651	29	302
Reference	-	-	Valla 1984: 40-42	Goring-Morris 1987: 488-489	Byrd 1989a: 53	Nishiaki et al. 2017: 16	Belfer-Cohen 1988: 80	Klein 2012: 32-46	Rodríguez et al. 2013: 67	Sharon et al. 2020: 49-50.	Richter & Mawla 2019: 365	Olszewski 2013: 420-421	Byrd & Garrard 2013b: 247	Henry 1995: 324	Edwards et al. 1998: 26.	Olszewski 2013: 420-421

and Dederiyeh Cave assemblages exhibit notably greater proportions of cores, suggesting a variation of knapping and core disposal practices between cave and open-air architectural sites.

Variation in core proportions is most apparent when comparing the El Wad Terrace and Wadi Hammeh 27 sequences in detail, where the percentage of cores at El Wad drops to a level similar to Wadi Hammeh 27 only in Phase W-3, which stratigraphically post-dates the main Early Natufian settlement at this site (**Table 11.3)**. On the other hand, Weinstein-Evron and colleagues' (2018) data from the El Wad Terrace architectural sequence suggests a slight drop in the percentages of cores between Structures II and I of this site, a pattern which is not attested to between the occupations of Structures 3 and 1 at Wadi Hammeh 27 (**Table 11.4**).

These patterns are reflected in the core to debitage ratios of each site, with the lower deposits of Wadi Hammeh 27 (1 : 84) and its final Phase 1 occupation (1 : 102), closest to `Ain Mallaha (1 : 81), Hof Shahaf (1 : 60) and then most of the non-architectural sites (**Table 11.7**). In contrast, much higher core : debitage ratios are present at Hayonim Cave (1 : 20), Dederiyeh Cave (1: 33) and each of the El Wad assemblages aside from Phase W-3 (**Table 11.8**).

Less similarity is apparent between Wadi Hammeh 27 and `Ain Mallaha when examining the cores by the types of debitage blanks being targeted, however. Both this site and Hayonim Cave feature far greater proportions of flake cores than any of the Wadi Hammeh 27 assemblages (**Table 11.10**). Instead, the core types between Phase 4 and Upper Phase 3 at Wadi Hammeh 27 bear the most similarity with Dederiyeh Cave, while Phase 2 at Wadi Hammeh 27 is more in line with the bladelet-oriented assemblages from Wadi Jilat 22 and the Wadi al-Hasa sites. The dominance of bladelet cores in Wadi Hammeh 27's final phase is unusual for an architectural Early Natufian site, with the only similar typological configuration being found at Beidha. This being said, the lack of quantifiable information so far regarding the typological composition of the cores at El Wad, Shubayqa 1, or Jeftelik make it difficult to determine whether Wadi Hammeh 27 is unique in this regard. The presence of the two-stage reduction sequence which dominates the later phases of Wadi Hammeh 27 is also far from unique for the Early Natufian period, with similar strategies also being reported at `Ain Mallaha (Valentin et al. 2013: 208), Jeftelik (Rodríguez et al. 2013: 66) and the Wadi al-Hasa sites (Olszewski 2013: 416).

Table 11.7: Debitage ratios from various Early Natufian assemblages (rounded). Flakes & bladelets under 2cm excluded from the Wadi Hammeh 27 assemblages.

	Debitage no.	Core no.	Tool no.	Cores: debitage	Tools: debitage	Cores: tools
Wadi Hammeh 27 (XX D Phase 1)	37,605	368	1,707	1:102	1:22	1:5
Wadi Hammeh 27 (XX F Phases 2-4)	73,337	872	6,002	1:84	1:12	1:7
\`Ain Mallaha (IVa)	11,496	142	1,764	1:81	1:7	1:12
Beidha (Area C-01)	2,025	42	186	1:48	1:11	1:4
Dederiyeh Cave (Phases 1-2)	934	28	159	1:33	1:6	1:6
Hayonim Cave (Phases 1-2)	14,902	753	1,876	1:20	1:8	1:2
Hof Shahaf	6,220	104	396	1:60	1:16	1:4
Jordan River Dureijat (Layer 3c)	249	9	46	1:28	1:5	1:5
Shubayqa 1 (Phase 7)	3,172	94	815	1:63	1:19	1:3
Tabaqa	5,391	62	270	1:87	1:20	1:4
Wadi Jilat 22 (Upper Phase)	13,370	222	542	1:60	1:25	1:2
Wadi Judayid 2	12,107	209	651	1:58	1:19	1:3
Wadi Khawwan 1	1,064	12	29	1:89	1:37	1:2
Yutil al-Hasa (Area D)	2,857	44	302	1:65	1:9	1:7

Table 11.8: Assemblage ratios between the El Wad Terrace and Wadi Hammeh 27 Early Natufian sequences. Flakes & bladelets under 2cm excluded from the Wadi Hammeh 27 assemblages.

	El Wad Terrace (Kaufman et al. 2015)							**Wadi Hammeh 27**					
Phase	Architectural				Post-architectural			Cemetery	Architectural				
	W7	W6	W5	**Total**	W4	W3	**Total**	4	Lower 3	Upper 3	2	1 (XX D)	**Total**
Debitage	9,675	18,219	12,714	**40,608**	3,756	2,807	**6,563**	10,234	25,673	24,432	11,998	37,605	**100,708**
Cores	259	486	271	**1,016**	88	37	**125**	121	278	307	166	368	**1,119**
Tools	718	1,602	825	**3,145**	334	140	**474**	927	1,945	2,180	950	1,707	**6,782**
Cores : debitage	1 : 37.4	1 : 37.5	1 : 46.9	**1 : 40.0**	1 : 42.7	1 : 75.9	**1 : 52.5**	1 : 84.6	1 : 92.3	1 : 79.6	1 : 72.3	1 : 102.2	**1 : 90.0**
Tools : debitage	1 : 13.5	1 : 11.4	1 : 15.4	**1 : 12.9**	1 : 11.2	1 :20.1	**1 : 13.8**	1 : 11.0	1 : 13.2	1 : 11.2	1 : 12.6	1 : 22.0	**1 : 14.8**
Cores : tools	1 : 2.8	1 : 3.3	1 : 3.0	**1 : 3.1**	1 : 3.8	1 : 3.8	**1 : 3.8**	1 : 7.7	1 : 7.0	1 : 7.1	1 : 5.7	1 : 4.6	**1 : 6.1**

Table 11.9: Lithic ratios between the El Wad Terrace and Wadi Hammeh 27 architectural sequences. Flakes & bladelets under 2cm excluded from the Wadi Hammeh 27 assemblages.

	El Wad Terrace (Weinstein-Evron et al. 2018)										**Wadi Hammeh 27**					
Phase	Structure II				Structure I						Structure 3			Structures 1 & 2		
	XI	IX-X	VIII-VIIIB	**W7 total**	VIIA	VII	VI	V	IV	**W6 total**	Lower 3	Upper 3	**Total**	2	1 (XX D)	**Total**
Debitage	937	1,609	3,781	**6,327**	1,789	3,144	2,110	2,094	2,921	**12,058**	25,673	25,432	**51,105**	11,998	37,605	**49,603**
Cores	26	54	110	**190**	33	46	38	40	44	**201**	278	307	**585**	166	368	**534**
Tools	125	180	302	**607**	152	257	137	198	205	**949**	1,945	2,180	**4,125**	950	1,707	**2,657**
Cores : debitage	1 : 36.0	1 : 29.8	1 : 34.4	**1 : 33.3**	1 : 54.2	1 : 68.3	1 : 55.5	1 : 52.4	1 : 66.4	**1 : 60.0**	1 : 92.3	1 : 79.6	**1 : 87.4**	1 : 72.3	1 : 102.2	**1 : 92.9**
Tools : debitage	1 : 7.5	1 : 8.9	1 : 12.5	**1 : 10.4**	1 : 11.8	1 : 12.2	1 : 15.4	1 : 10.6	1 : 14.2	**1 : 12.7**	1 : 13.2	1 : 11.2	**1 : 12.4**	1 : 12.6	1 : 22.0	**1 : 18.7**
Cores : tools	1 : 4.8	1 : 3.3	1 : 2.7	**1 : 3.2**	1 : 4.6	1 : 5.6	1 : 3.6	1 : 5.0	1 : 4.7	**1 : 4.7**	1 : 7.0	1 : 7.1	**1 : 7.1**	1 : 5.7	1 :4.6	**1 : 5.0**

Table 11.10: Proportions of cores at Early Natufian and contemporaneous assemblages based on main type of blank production. In order to maximise consistency with the Wadi Hammeh typology, flakes with a combination of negative flake and bladelet scars have been reassigned as bladelet cores wherever possible.

	Wadi Hammeh 27 (Phases 3-4)	Wadi Hammeh 27 (Phase 2)	Wadi Hammeh 27 (Phase 1; Area XX D)	`Ain Mallaha	Beidha	Dederiyeh Cave (Phases 1-2)	Hayonim Cave	Tabaqa	Wadi Jilat 22 (Upper Phase)	Yutil al-Hasa (Area D)
Flake	43.1	27.1	1.9	63.8	4.4	42.9	57.6	32.5	27.1	29.0
Blade/bladelet	56.9	72.9	98.1	36.2	95.6	57.1	42.4	67.5	72.9	71.0
N	476	107	260	141	342	28	622	40	188	31
Reference	-	-	Edwards 2013: 128	Valentin et al. 2013: 208	Byrd 1989a: 38.	Nishiaki et al. 2015: 14	Belfer-Cohen 1988: 74	Olzewski 2013: 419	Byrd 2013: 246	Olzewski 2013: 419

Finally, the decline in the percentage of artefacts with dual lustre over time at Wadi Hammeh 27 (see Chapter 4) is consistent with the overall disappearance of heat treatment practices in the Southern Levant by the Late Natufian period, continuing only in the Hayonim Cave and Ain Mallaha assemblages at this time (Delage & Sunseri 2004: 164). This pattern suggests that the abandonment of heat treatment practices was a gradual process within the course of the Early Natufian rather than an abrupt shift at its conclusion. Furthermore, the final two phases at Wadi Hammeh 27 are also associated with a notable upturn in the proportion of sickle elements and lunates featuring pressure-flaked Helwan retouch (see Chapter 6). This is supportive of the notion that no correlation exists between the disappearance of heat-treatment and the shift to abruptly-retouched microliths in the Late Natufian (at least in the case of the Pella region), and that the heating of raw materials was not a prerequisite to the application of Helwan retouch (Delage and Sunseri 2004: 164, 168-9). At the same time, the lack of heat treatment in conjunction with increased emphasis on bladelet production at Wadi Hammeh 27 is curious, given that one of the primary benefits of heat treatment is the reduction of tensile strength in hard cherts, increasing the ease of knapping longer debitage blanks (Patterson 1995: 72).

11.4.2 Retouched artefact assemblages

The percentages of artefacts featuring retouch in Early Natufian assemblages fluctuate considerably, with no apparent correlation between architectural and non-architectural sites (Tables **11.3-11.4**, **11.5**, **Fig. 11.2**). Of the architectural sites, the comparatively low percentages of retouched tools at Wadi Hammeh 27 bear the most similarity with El Wad Terrace and Hof Shahaf, whereas retouched pieces comprise considerably greater shares of the `Ain Mallaha, Dederiyeh Cave and Shubayqa 1 assemblages. In particular, the Shubayqa 1 assemblage exhibits an unusually high percentage of retouched pieces (20.0%; **Fig 11.2**), which was undoubtedly driven in part by the unique economic circumstances of this site (see Chapter 11.5.1). In contrast, the vast divide between the percentages of retouched tools at Wadi Khawwan 1 (2.6%) and Jordan River Dureijat (15.1%) demonstrates that no environmental explanation can be made for ephemeral sites in the Jordan Valley.

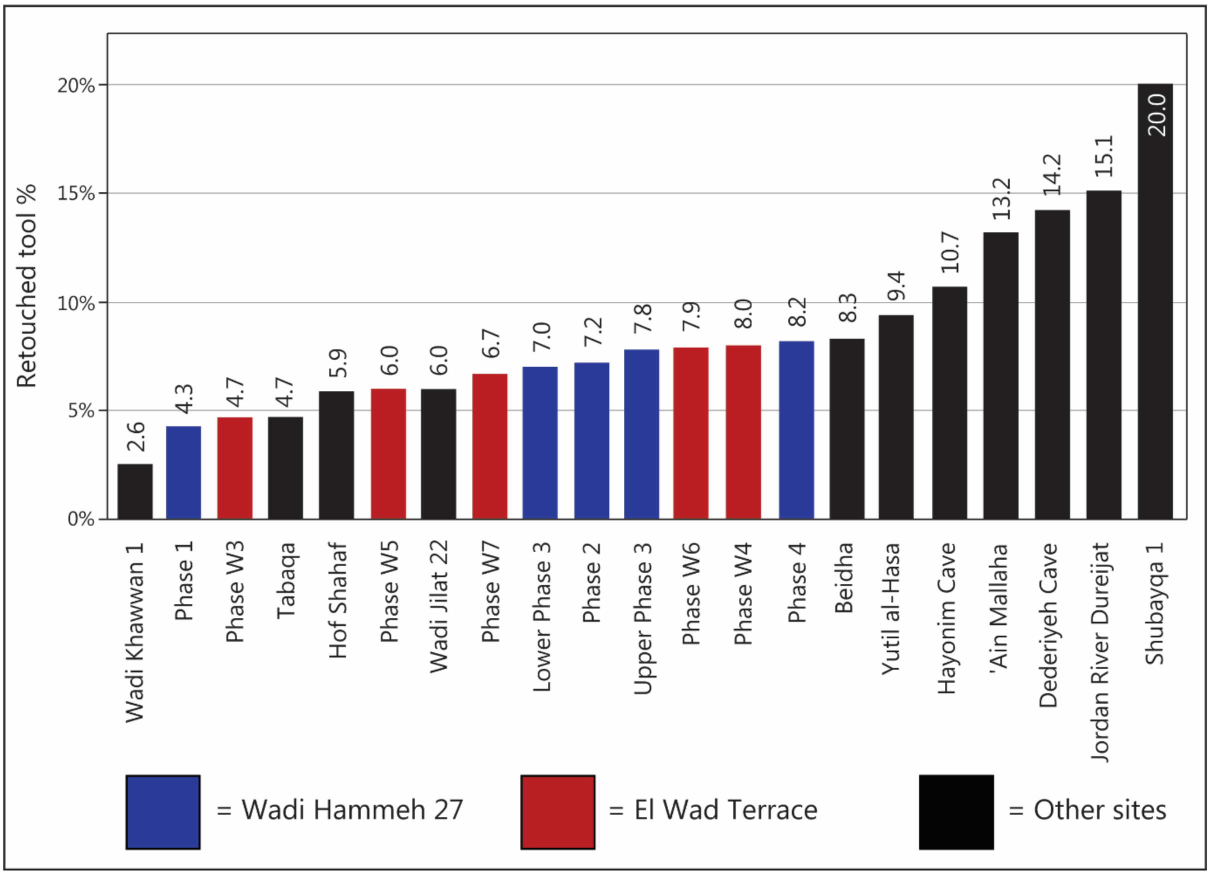


Figure 11.2: Percentage of retouched tools at Wadi Hammeh 27 and other Late Epipalaeolithic assemblages, debris excluded.

11.4.2.1 El Wad Terrace

Scrapers remain less common at El Wad Terrace than Wadi Hammeh 27 throughout its entire occupation sequence, with an abrupt drop in number between the architectural and post-architectural strata (**Table 11.11; Fig 11.3**). The proportions of burins similarly plummet in the post-architectural phases at El Wad, whereas burins in the architectural strata comprise either equal (**Table 11.11; Fig. 11.4**) or greater proportions (**Table 11.12**) than the earlier Wadi Hammeh 27 assemblages. The decline in multiple tool proportions seen at Wadi Hammeh 27 is not reflected in the El Wad Terrace sequence, with these artefacts instead remaining scarce throughout time (**Fig. 11.5**).

Geometric microliths generally occur in greater proportions at El Wad than in each phase at Wadi Hammeh 27 other than Phase 2, particularly in the post-architectural deposits (**Fig. 11.6**). In contrast, the architectural strata analysed by Weinstein-Evron and colleagues (2018) feature consistently lower proportions of geometric microliths more in line with the other Wadi Hammeh 27 assemblages. The proportions of truncated pieces and awls and borers both remain consistently low over time at either site, albeit with similarly minor inter-assemblage fluctuations (**Figs. 11.7-11.8**).

The collective retouched flakes, retouched blades and non-geometric microliths consistently comprise greater proportions of the El Wad Terrace toolkit in Kaufman and colleagues' (2015) analysis than at Wadi Hammeh 27, although this dominance is offset somewhat when the high proportions of retouched fragments at Wadi Hammeh 27 are taken into consideration. A comparison of the Wadi Hammeh 27 sequence with Weinstein-Evron and colleagues' (2018) analysis of the architectural phases similarly demonstrates that the collective retouched blades and non-geometric microliths are consistently more common at El Wad than each phase of Wadi Hammeh 27 aside from Phase 1 (**Tables 11.12; Fig. 11.9**). Likewise, the retouched flakes from the El Wad architectural sequence occur in greater proportions and exhibit a more pronounced degree of inter-phase variation than at Wadi Hammeh 27 (**Fig. 11.10**). Finally, the El Wad assemblages also contain far lower shares of notched and denticulated pieces than Wadi Hammeh 27, whether or not their associated phases are associated with stone architecture (**Fig. 11.11**).

Table 11.11: Comparison of retouched tool assemblages between the El Wad Terrace and Wadi Hammeh 27 Early Natufian sequences.

	El Wad Terrace (Kaufman et al. 2015)							**Wadi Hammeh 27**					
Phase	Architectural				Post-architectural			Cemetery	Architectural				
	W7	W6	W5	**Total**	W4	W3	**Total**	4	Lower 3	Upper 3	2	1 (XX D)	**Total**
Scrapers	1.8	1.5	1.2	**1.5**	0.3	0.0	**0.2**	4.1	2.3	3.2	3.3	5.4	**3.5**
Multiple tools	0.1	0.2	0.2	**0.2**	0.3	0.0	**0.2**	4.6	4.3	3.3	2.2	0.3	**2.7**
Burins	16.7	15.7	13.9	**15.5**	5.4	8.6	**6.3**	13.6	14.6	18.6	16.5	23.4	**18.4**
Truncations	2.8	2.4	1.8	**2.4**	4.2	1.4	**3.4**	2.3	4.7	4.0	1.5	2.2	**3.4**
Retouched pieces & NGM	57.5	53.2	52.2	**53.9**	61.1	54.3	**59.1**	17.3	15.2	16.2	16.2	32.8	**20.1**
Geometric microliths	14.9	20.8	25.9	**20.8**	20.7	30.0	**23.4**	15.9	16.0	15.4	21.2	14.8	**16.2**
N&D	3.3	2.7	2.1	**2.7**	3.6	4.3	**3.8**	12.6	11.5	12.8	15.6	13.4	**12.9**
A&B	1.9	2.0	1.9	**2.0**	3.0	1.4	**2.5**	1.3	0.7	0.6	2.0	2.0	**1.2**
Retouched fragments	-	-	-	**-**	-	-	**-**	27.0	30.3	25.2	21.5	3.5	**20.7**
Bifaces & Varia	0.8	1.4	0.6	**1.1**	1.5	0.0	**1.1**	1.4	0.5	0.5	0.1	2.3	**0.9**
Artefact no.	718	1,602	825	**3,145**	334	140	**474**	927	1,945	2,180	950	1,707	**6,782**

Table 11.12: Comparison of retouched tool assemblages between the El Wad Terrace and Wadi Hammeh 27 architectural sequences.

	El Wad Terrace (Weinstein-Evron et al. 2018)										**Wadi Hammeh 27**					
Phase	Structure II				Structure I						Structure 3			Structures 1 & 2		
	XI	IX-X	VIII-VIIIB	**W7 total**	VIIA	VII	VI	V	IV	**W6 total**	Lower 3	Upper 3	**Total**	2	1 (XX D)	**Total**
Scrapers	3.8	0.0	3.3	**2.4**	3.8	2.9	1.0	0.7	3.6	**2.5**	2.3	3.2	**2.8**	3.3	5.4	**4.6**
Multiple tools	2.9	0.0	1.2	**1.2**	0.0	0.0	0.0	0.7	0.6	**0.3**	4.3	3.3	**3.8**	2.2	0.3	**1.0**
Burins	19.2	24.8	22.6	**22.6**	17.6	21.0	16.3	24.2	18.0	**20.0**	14.6	18.6	**16.7**	16.5	23.4	**21.0**
Retouched blades & NGM	22.1	35.2	23.5	**26.6**	25.2	25.4	18.4	23.5	24.0	**23.7**	10.8	11.8	**11.3**	12.7	27.5	**22.2**
Truncations	6.7	3.4	4.9	**4.9**	4.6	4.9	5.1	3.9	4.2	**4.5**	4.7	4.0	**4.3**	1.5	2.2	**1.9**
Geometric microliths	13.5	9.0	12.8	**11.8**	16.0	13.2	17.3	11.8	18.6	**15.1**	16.0	15.4	**15.7**	21.2	14.8	**17.1**
N&D	1.9	3.4	5.3	**4.1**	6.1	4.9	4.1	5.2	1.8	**4.4**	11.5	12.8	**12.2**	15.6	13.4	**14.2**
A&B	1.0	1.4	3.7	**2.4**	2.3	2.4	5.1	3.3	0.6	**2.5**	0.7	0.6	**0.7**	2.0	2.0	**2.0**
Retouched flakes	7.7	6.2	11.1	**8.9**	6.9	7.3	17.3	9.2	12.0	**9.9**	4.4	4.4	**4.4**	3.5	5.3	**4.7**
Retouched fragments	11.5	11.7	5.3	**8.5**	14.5	15.1	11.2	10.5	14.4	**13.4**	30.3	25.2	**27.6**	21.5	3.5	**9.9**
Bifaces & Varia	9.6	4.8	6.2	**6.5**	3.1	2.9	4.1	7.2	2.4	**3.8**	0.5	0.5	**0.5**	0.1	2.3	**1.5**
Artefact no.	104	145	243	**492**	131	205	98	153	167	**754**	1,945	2,180	**4,125**	950	1,707	**2,657**

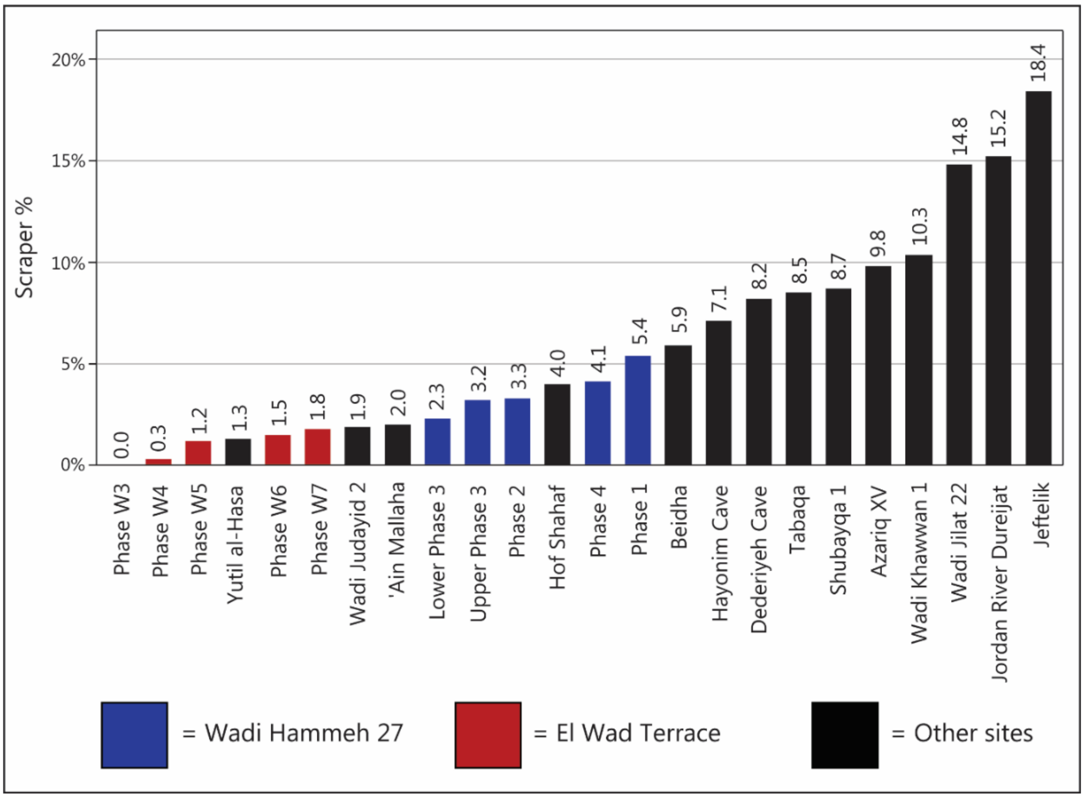


Figure 11.3: Percentage of scrapers at Wadi Hammeh 27 and other Late Epipalaeolithic tool assemblages.

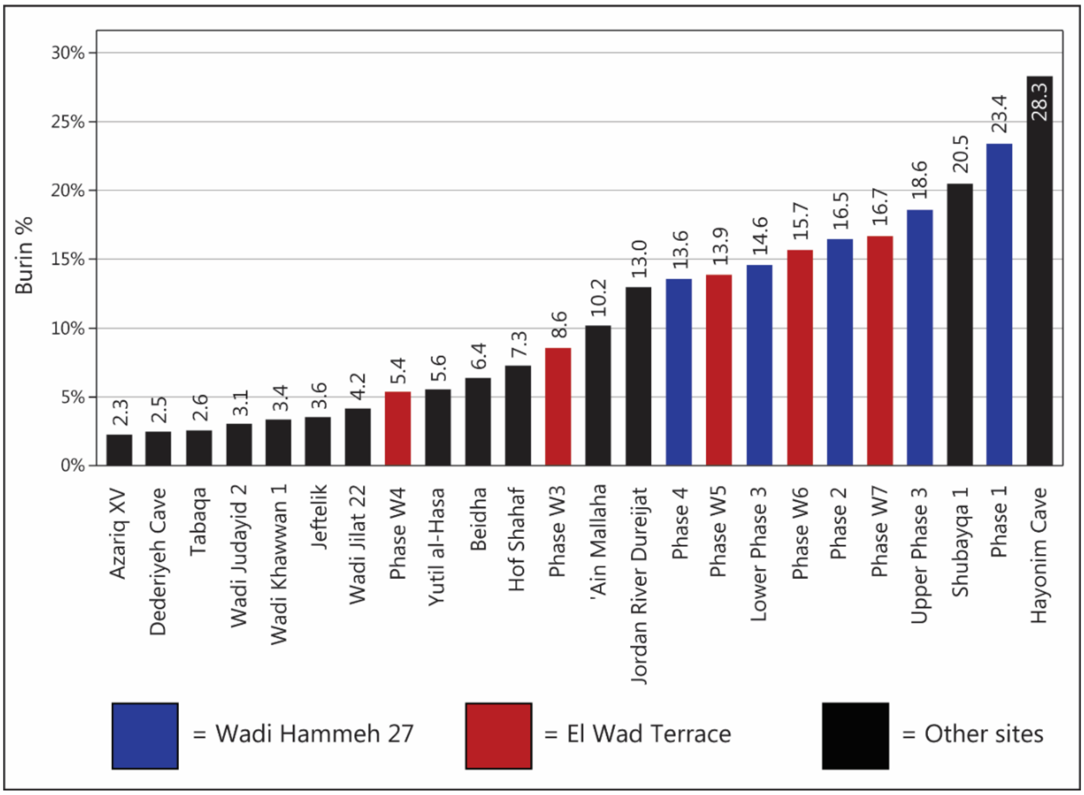


Figure 11.4: Percentage of burins at Wadi Hammeh 27 and other Late Epipalaeolithic tool assemblages.

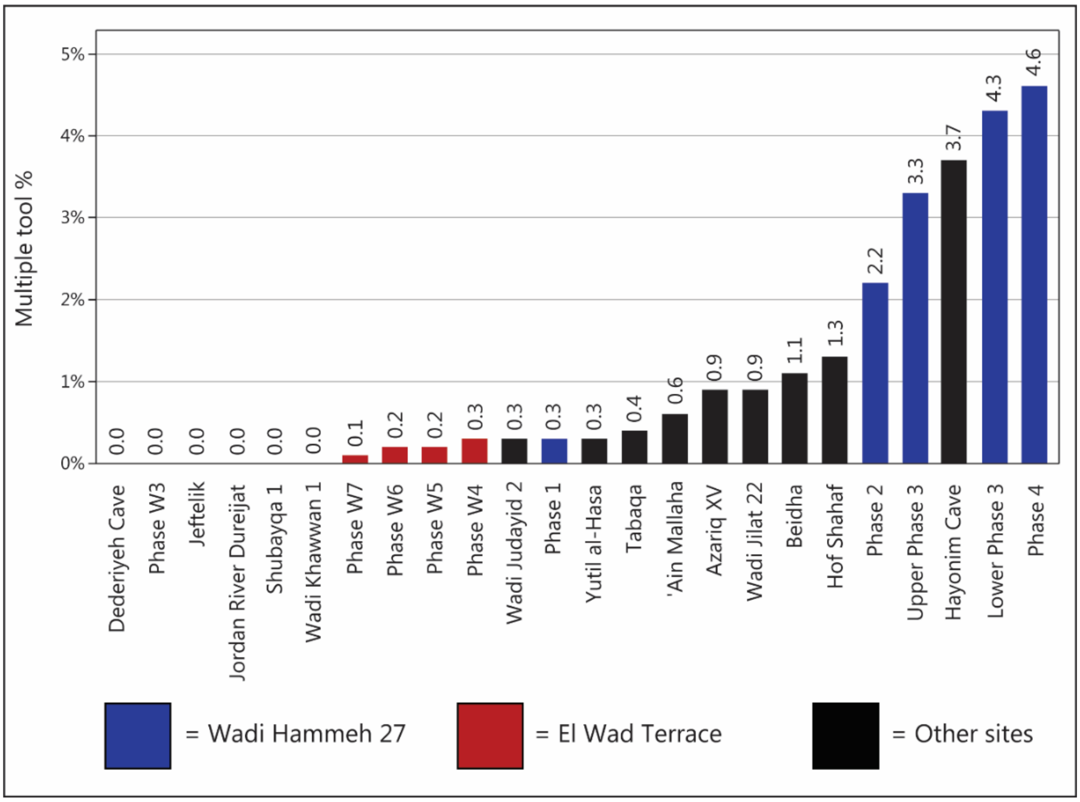


Figure 11.5: Percentage of multiple tools at Wadi Hammeh 27 and other Late Epipalaeolithic tool assemblages.

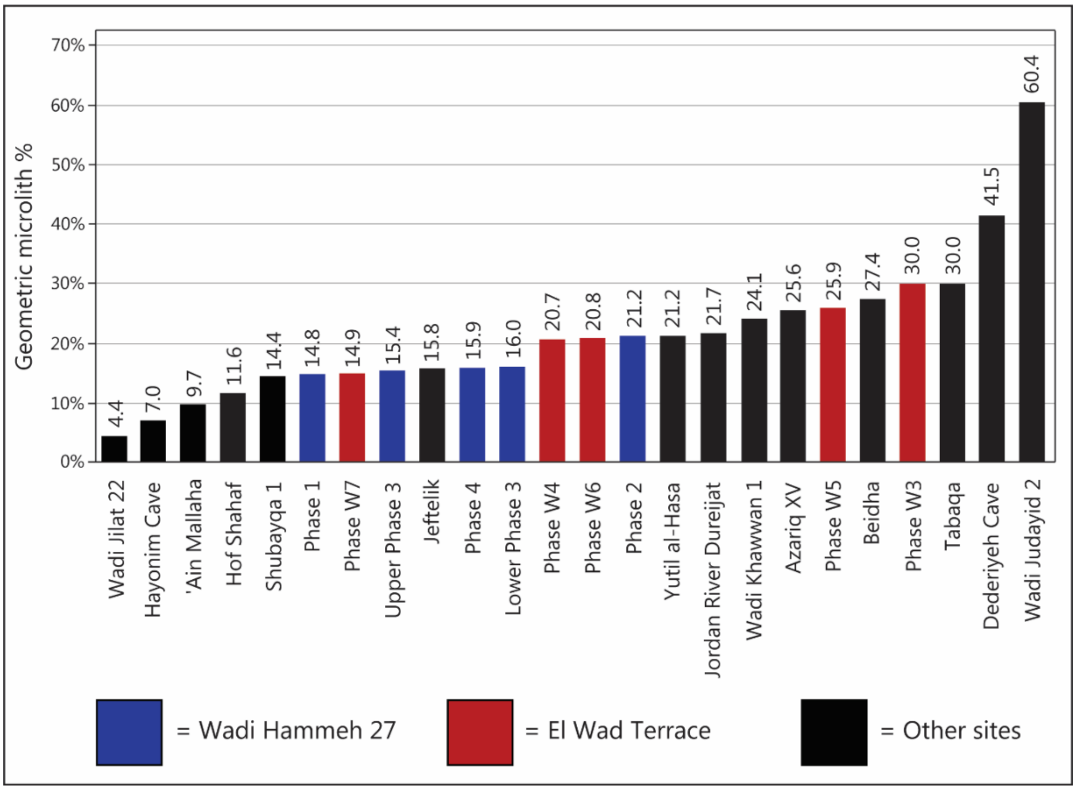


Figure 11.6: Percentage of geometric microliths at Wadi Hammeh 27 and other Late Epipalaeolithic tool assemblages.

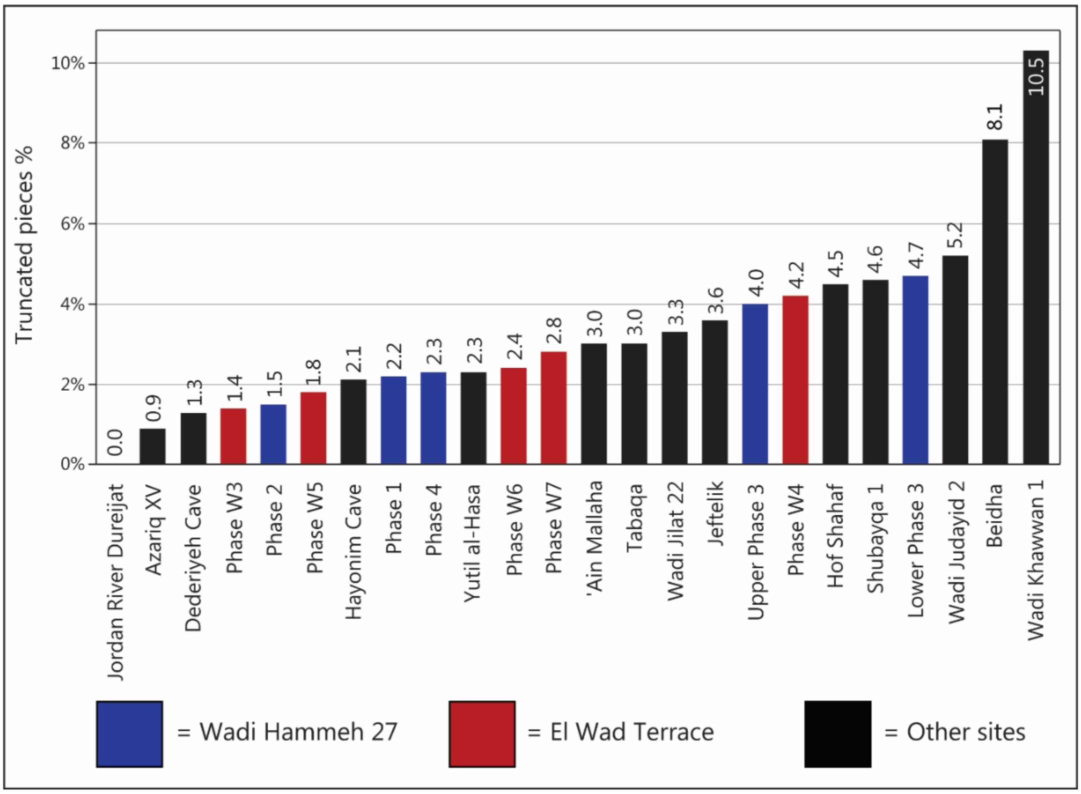


Figure 11.7: Percentage of truncated pieces at Wadi Hammeh 27 and other Late Epipalaeolithic tool assemblages.

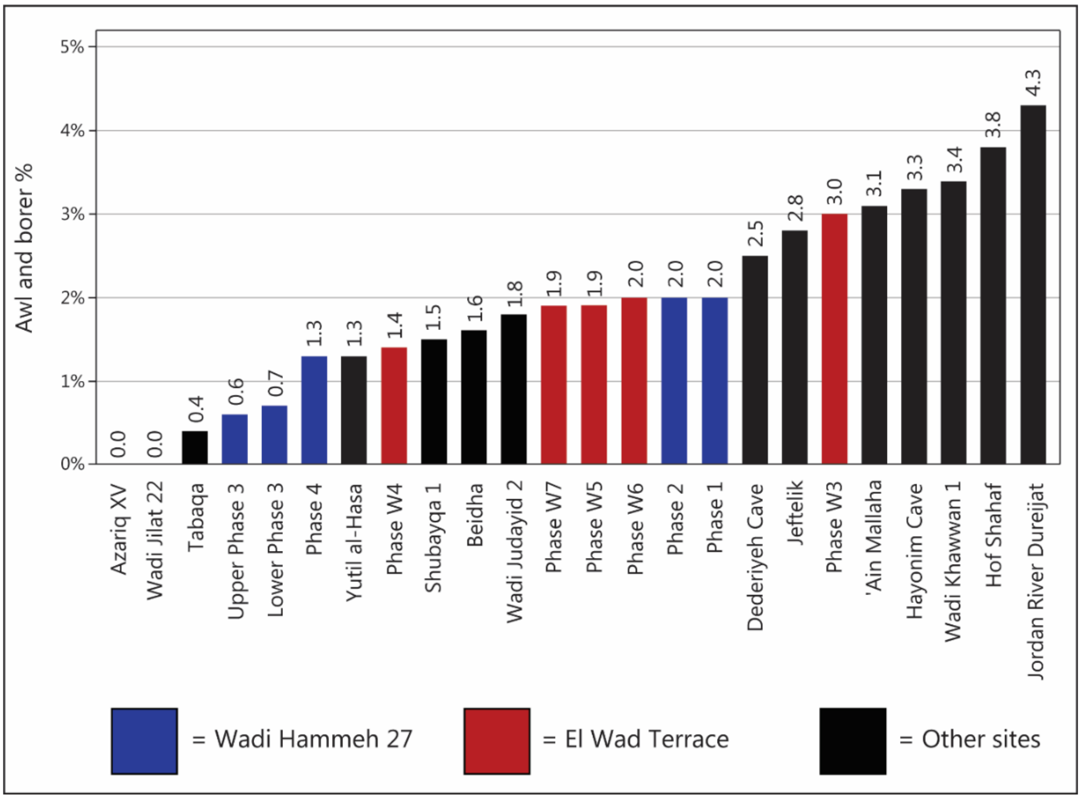


Figure 11.8: Percentage of awls and borers at Wadi Hammeh 27 and other Late Epipalaeolithic tool assemblages.

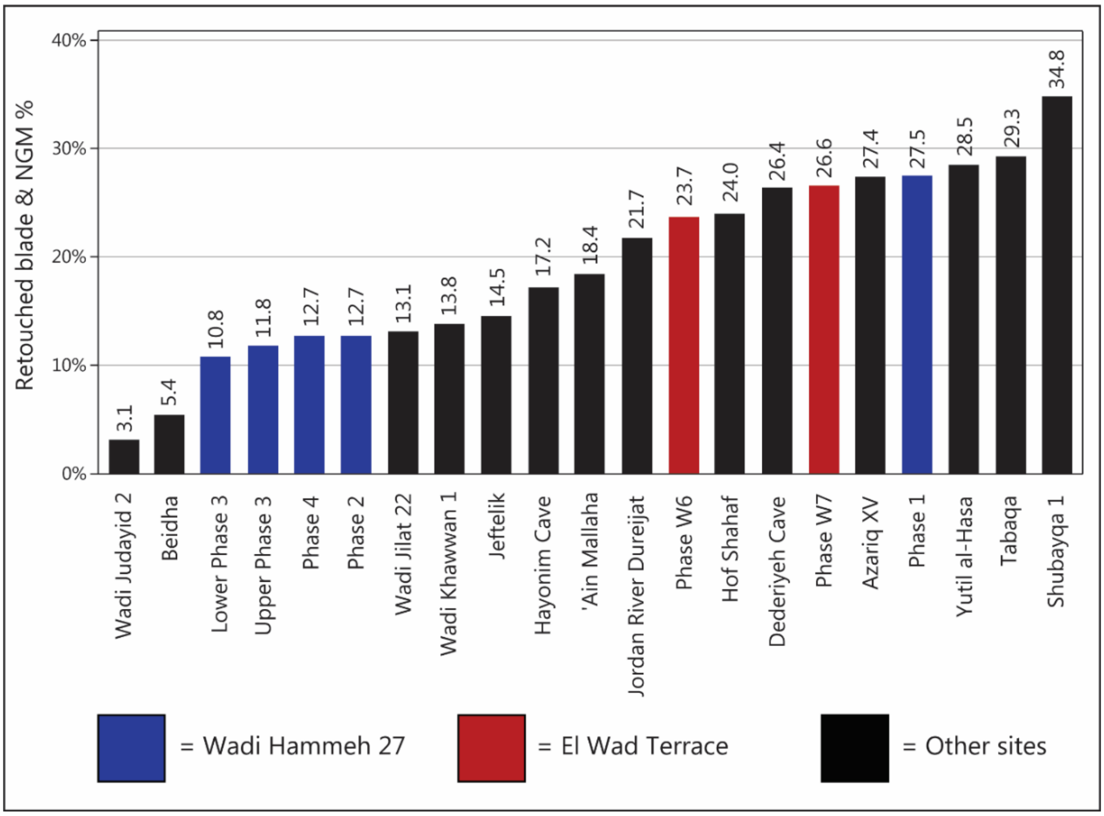


Figure 11.9: Percentage of retouched blades and non-geometric microliths at Wadi Hammeh 27 and other Late Epipalaeolithic tool assemblages.

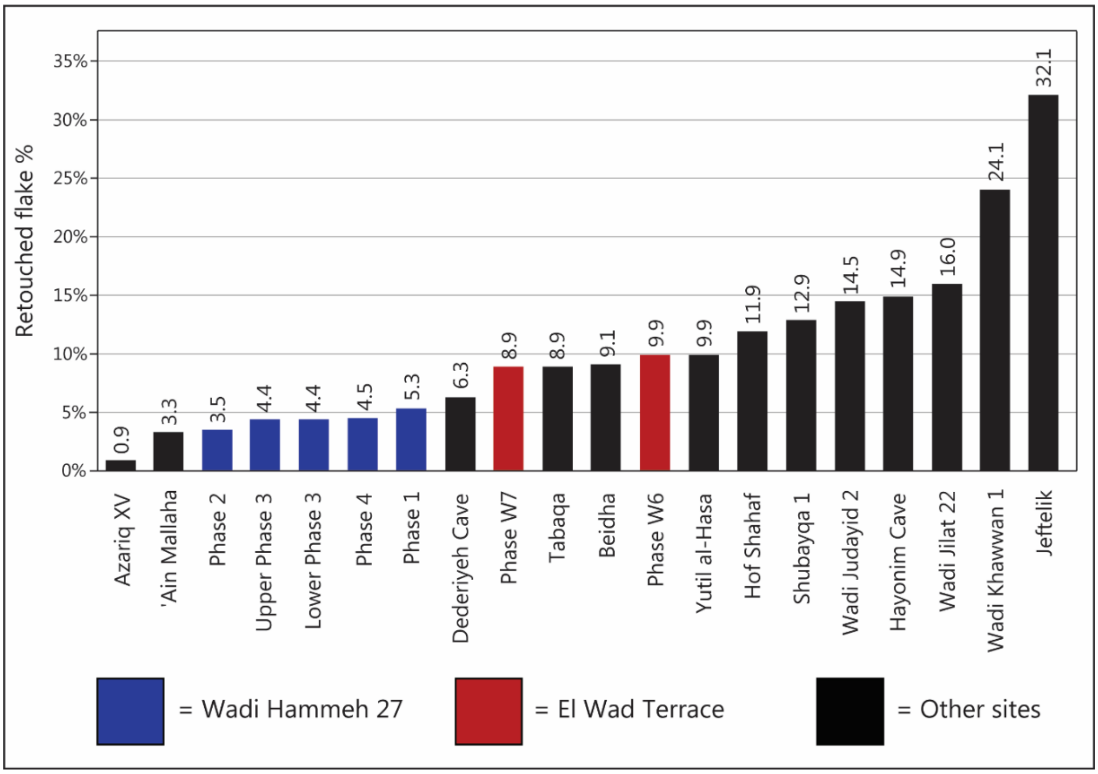


Figure 11.10: Percentage of retouched flakes at Wadi Hammeh 27 and other Late Epipalaeolithic tool assemblages.

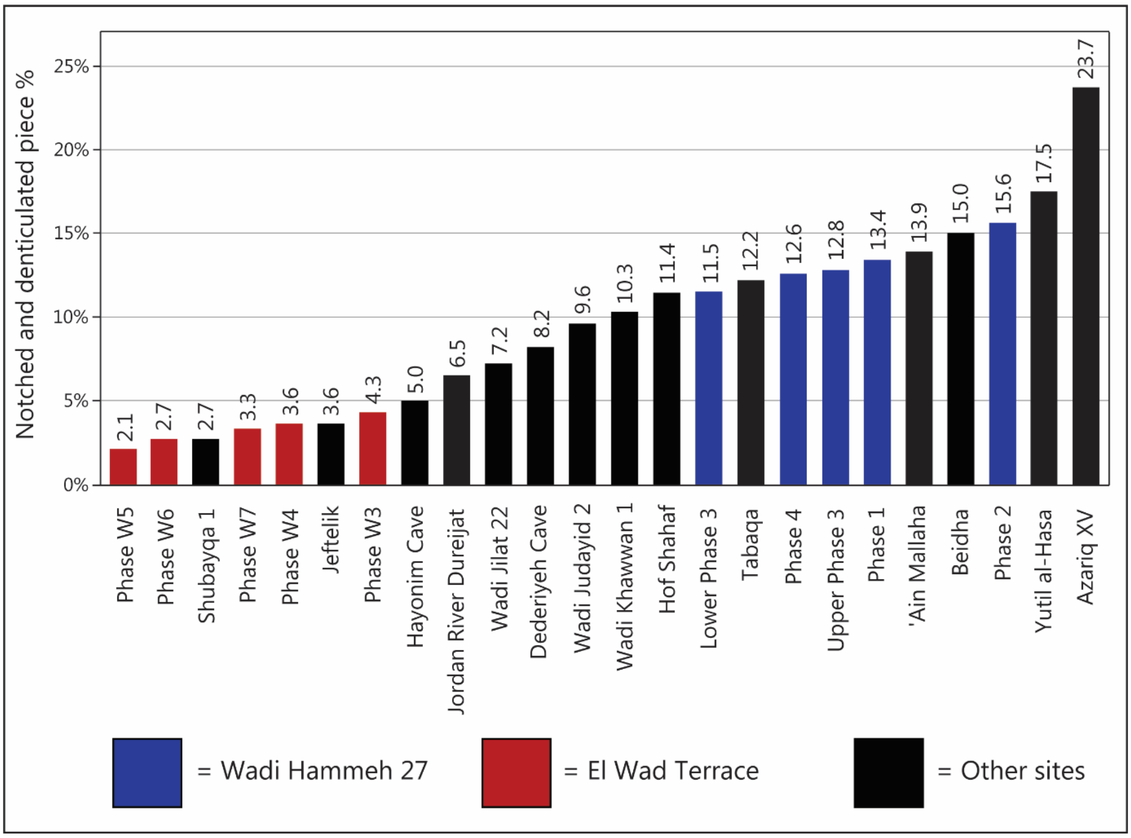


Figure 11.11: Percentage of notched and denticulated pieces at Wadi Hammeh 27 and other Late Epipalaeolithic tool assemblages.

The retouch modes applied to the retouched blades and non-geometric microliths vary considerably between the architectural sequences of Wadi Hammeh 27 and El Wad Terrace (**Table 11.13**). Pieces with Helwan retouch are consistently more common at Wadi Hammeh 27, with even the lower proportions of these types in the deposits associated with Structure 3 being almost three times as high as the proportions within either Structures I or II at El Wad Terrace. On the contrary, the El Wad assemblages display broader typological distribution for these artefacts, with pieces with abrupt or inverse retouch often being more common than Helwan blades and bladelets. It is thus clear that the diachronic intensification in the manufacture of Helwan-retouched sickle components seen at Wadi Hammeh 27 is not attested to in the contemporaneous El Wad Terrace sequence.

11.4.2.2 Other sites

The proportions of scrapers, notched and denticulated pieces, and retouched flakes at Wadi Hammeh 27 all remain similar to one another when contrasted against those of other assemblages, suggesting that the occurrence of these tool groups are more influenced by region and site function than temporality (**Table 11.5; Figs. 11.3, 11.10-11.11**) Wadi Hammeh 27 subsequently bears the closest affiliation with `Ain Mallaha and Hof Shahaf in terms of the proportions of scrapers and notched and denticulated pieces being utilised at each site, suggesting a common functional association amongst architectural sites in the upper Jordan Valley. The percentage of retouched flakes at `Ain Mallaha is also similar to those over time at Wadi Hammeh 27, although the same cannot be said for Hof Shahaf given its substantially higher share of this tool group. The proportions of scrapers at Wadi Hammeh 27 are also similar to the Beidha assemblage, while its percentages of notched and denticulated pieces bear a strong affinity with both Beidha and the Wadi al-Hasa sites.

The percentages of burins at Wadi Hammeh 27 remain clustered together in the higher range compared to other Early Natufian sites, even when the overall increase over time is factored in (**Fig 11.4**). In general, higher percentages of these tools occur almost exclusively at architectural settlements situated in the Mediterranean coastal zone between the upper Jordan Valley and Mount Carmel, with Wadi Hammeh 27 fitting neatly within this pattern. This regional bias is further strengthened when the high proportion of burins at Jordan River Dureijat is taken into consideration, as are the relatively low shares of burins within the northern Levantine settlements of Jeftelik and Dederiyeh. The only exception to this

Table 11.13: Comparison of retouched blade and non-geometric microlith lithic assemblages between the El Wad Terrace and Wadi Hammeh 27 architectural sequences. Partially retouched pieces and pieces with only truncated ends excluded.

	El Wad Terrace (Weinstein-Evron et al. 2018)										**Wadi Hammeh 27**					
Phase	Structure II				Structure I						Structure 3			Structures 1 & 2		
	XI	IX-X	VIII-VIIIB	**W7 total**	VIIA	VII	VI	V	IV	**W6 total**	Lower 3	Upper 3	**Total**	2	1 (XX D)	**Total**
Semi-steep	15.8	13.6	14.8	**14.7**	6.9	12.5	5.6	5.9	16.7	**10.3**	2.4	10.1	**6.7**	5.6	2.9	**3.4**
Inverse	5.3	4.5	18.5	**12.6**	10.3	20.8	16.7	20.6	11.1	**16.4**	22.4	15.1	**18.3**	16.9	28.5	**26.5**
Alternating	10.5	9.1	5.6	**7.4**	3.4	2.1	22.2	5.9	2.8	**5.5**	8.0	8.2	**8.1**	12.4	1.7	**3.6**
Helwan	15.8	13.6	20.4	**17.9**	3.4	29.2	5.6	14.7	5.6	**13.9**	38.4	41.5	**40.1**	49.4	51.2	**50.9**
Abrupt	36.8	45.5	14.8	**26.3**	51.7	20.8	27.8	29.4	25.0	**29.7**	9.6	9.4	**9.5**	6.7	11.5	**10.6**
On both sides	0.0	0.0	7.4	**4.2**	3.4	2.1	0.0	2.9	2.8	**2.4**	11.2	5.7	**8.1**	2.2	0.0	**0.4**
'Sickle blades'	10.5	9.1	3.7	**6.3**	3.4	0.0	11.1	14.7	16.7	**8.5**	-	-	**-**	-	-	**-**
Other	5.3	4.5	14.8	**10.5**	17.2	12.5	11.1	5.9	19.4	**13.3**	8.0	10.1	**9.2**	6.7	4.1	**4.6**
Artefact no.	19	22	54	**95**	29	48	18	34	36	**165**	125	159	**284**	89	410	**499**

configuration is the exceptionally high proportion of burins at Shubayqa 1, suggesting possible cultural affiliations between the Harrat al-Sham and Mediterranean zones in this regard. Alternatively, large proportions of burins may reflect Shubayqa 1's status as a potential functional predecessor to the 'Burin Neolithic' of this region, whereupon burins are believed to have served primarily as cores (Finlayson & Betts 1990; Rollefson et al. 2016: 6-7), although this possibility is less probable if Neolithic burin sites reflect the adoption of caprine herding (Wasse et al. 2020). Amongst the Early Natufian sites with large burin assemblages, Wadi Hammeh 27 is more similar to Hayonim Cave, Shubayqa 1 and the earlier phases of El Wad Terrace than to `Ain Mallaha and Hof Shahaf. The Phase 1 assemblage from Wadi Hammeh 27 in fact possesses the third greatest percentage of burins out of all the comparative assemblages, being narrowly exceeded only by Hayonim Cave and Shubayqa 1.

The decline in multiple tools over time at Wadi Hammeh 27 is most noticeable when compared to the shares of these tools at other Early Natufian sites. The percentages of multiple tools in Phases 4 and Lower Phase 3 at Wadi Hammeh 27 represent the highest shares for the Early Natufian period (**Fig. 11.5**). The reduced proportion of multiple tools in Upper Phase 3 is subsequently slightly lower than that of Hayonim Cave, while the percentage of multiple tools in Phase 2 is only twice that of the Hof Shahaf and Beidha assemblages. Finally, the scarcity of multiple tools in Phase 1 is more in line with proportions seen at `Ain Mallaha, El Wad, Wadi Judayid 2 and the Wadi al-Hasa sites. Multiple tools are entirely absent from Dederiyeh Cave and Jeftelik, an unsurprising find given the low proportions of regular burins at these sites. The absence of multiple tools from Jordan River Dureijat is also notable given the relatively high number of burins at this site, suggesting that the comparatively short occupation of this site resulted in fewer tools being recycled to serve a secondary function.

The fluctuation of truncated pieces at Wadi Hammeh 27 and El Wad Terrace is particularly noticeable compared to the other sites (**Figure 11.7**). At the same time, these artefacts remain scarce in most assemblages, only exceeding 5% of the total tool assemblage in the cases of Beidha, Wadi Judayid 2 and Wadi Khawwan 1. As such, little information may be obtained regarding the broader importance of these tools over time at architectural Early Natufian sites.

The assemblages from Phases 4 to 2 at Wadi Hammeh 27 exhibit the lowest shares of retouched blades and non-geometrics out of all the architectural sites (**Fig. 11.9**). However, these proportions exclude the large quantities of retouched fragments in their respective assemblages, the vast majority of which likely represent fragments of sickle components. Similar fragments were not recorded as separate types at Hayonim Cave and Jeftelik, instead presumably being incorporated into their relatively small share of retouched blades and non-geometric microliths. It is thus clear that these tools comprise a much greater share of the Wadi Hammeh 27 assemblages than at either of these sites. Instead, the earlier Wadi Hammeh 27 assemblages are far more similar to the assemblage from Level IVa of `Ain Mallaha in this respect, which likewise exhibits a relatively low proportion of identifiable retouched blades and bladelets (18.4%)m and a much larger proportion of retouched fragments (32.6%; **Table 11.5**)

The greater share of identifiable retouched blade and non-geometric types and lower proportion of retouched fragments in Phase 1 of Wadi Hammeh 27 conversely exhibits a higher degree of similarity with Hof Shahaf, Dederiyeh Cave and the architectural phases of El Wad Terrace. Phase 7 at Shubayqa 1 exhibits the highest proportion of retouched blades and bladelets (34.8%) out of the comparative assemblages, although this figure may also include large quantities of pieces which would be classified as retouched fragments at Wadi Hammeh 27 (Richter & Mawla 2019: 364). All-in-all, it is clear that retouched blades and non-geometric microliths comprise comparable shares of the assemblages at `Ain Mallaha, Dederiyeh Cave, El Wad Terrace, Hof Shahaf, Shubayqa 1 and Wadi Hammeh 27, while less emphasis was placed at them at Hayonim Cave and Jeftelik. The proportions of retouched blades and bladelets vary considerably between non-architectural sites, being scarce at Wadi Judayid and Beidha, yet occurring in proportions similar to Wadi Hammeh 27 at Azariq XV and the Wadi al-Hasa sites.

The proportions of geometric microliths at Wadi Hammeh 27 are particularly stable through time when compared with other sites, even when the increased proportions in Phase 2 are factored in (**Fig. 11.6**). Their shares are consistent with most of the other architectural sites, particularly Shubayqa 1, Jeftelik, Hof Shahaf and Phases W7, W6 and W4 of El Wad Terrace. In contrast, these tools are much less prominent at Hayonim Cave and `Ain Mallaha, whereas Dederiyeh Cave exhibits a far greater proportion of geometric microliths than any other architectural site, being outmatched amongst the other comparative assemblages only by Wadi Judayid 2.

Dederiyeh Cave aside, the percentages of geometric microliths are generally higher at non-architectural sites than architectural ones. The only exceptions to this rule are at Jordan River Dureijat and Yutil al-Hasa, where geometric microliths instead occur in equal proportions to Phase 2 at Wadi Hammeh 27 and Phases W4 and W6 of El Wad Terrace. Wadi Jilat 22 also presents a far smaller proportion of geometric microliths than the other non-architectural sites, although this discrepancy is easily explained given Jilat 22's Mushabian attribution.

While the jump in awl and borer proportions at Wadi Hammeh 27 between Upper Phase 3 and Phase 2 is notable, their overall proportions still remain low for an Early Natufian site (**Fig. 11.8**). The awl and borer proportions in Phase 4 of Wadi Hammeh 27 are closest to Phase 7 of Shubayqa 1, whereas the Lower and Upper Phase 3 assemblages present the lowest percentages for any architectural site. In contrast, the Phase 2 and 1 assemblages present near-identical proportions of awls and borers as the architectural strata of El Wad Terrace.

11.5 Time, regionalisation, site structure and toolkit variation

<u>11.5.1 Assemblage composition and residential mobility</u>

The lack of consistency between Early Natufian site structure and the percentage of retouched tools in the corresponding assemblages runs contrary to Clark's (2020) assertion that ephemeral sites with a low level of residential stability will exhibit higher proportions of retouch relative to their debitage and tool components. This incongruity is exemplified by the similarly low percentages of retouched tools between Wadi Hammeh 27 and Wadi Khawwan 1, despite the substantial differences in size, depth and structure between the two sites. Furthermore, the Early and Middle Epipalaeolithic assemblages of the Wadi al-Hammeh sequence display similarly low percentages of retouch as Wadi Hammeh 27 (**Table 11.14**), despite the fact that none of these earlier sites approach the Early Natufian settlement in terms of evidence of residential stability. As such, it is clear that Clark's model is neither applicable to the Epipalaeolithic of the Pella region, or to Early Natufian period as a whole. A similar level of incongruity is evident when the model of Barton (1998) and Riel-Salvatore and Barton (2004) is applied to the Wadi al-Hammeh sequence (**Fig. 11.12**). In this case, the Early Natufian assemblages of Wadi Hammeh 27 display no shift towards the expected

Table 11.14: The composition of the collective Wadi Hammeh 27 assemblages compared with those of earlier Epipalaeolithic sites in the Wadi al-Hammeh sequence.

	Period	Flakes	Blades/ Bladelets	CTEs	Other	Cores	Tools	Artefact no.	Reference
WH 27	Early Natufian	66.2	25.4	0.9	1.6	0.9	5.0	202,487	Chapter 4; Edwards 2013e.
WH 50	Middle Epipalaeolithic	75.6	19.7	0.7	1.1	1.0	1.9	1,748	Edwards et al. 1996: 128.
WH 31	Early Epipalaeolithic	25.5	64.5	0.9	0.5	2.9	5.6	549	Edwards et al. 1996: 128.
WH 51	Early Epipalaeolithic	61.6	28.6	1.8	3.6	1.1	3.3	276	Edwards et al. 1996: 128.
WH 52	Early Epipalaeolithic	67.6	20.0	1.1	3.8	1.1	6.5	185	Edwards et al. 1996: 128.
WH 33	Early Epipalaeolithic	38.1	42.9	2.4	0.0	11.9	4.8	42	Edwards et al. 1996: 128.
WH 26	Early Epipalaeolithic	61.7	29.6	1.0	2.4	0.8	3.9	4,976	Edwards et al. 1996: 128.

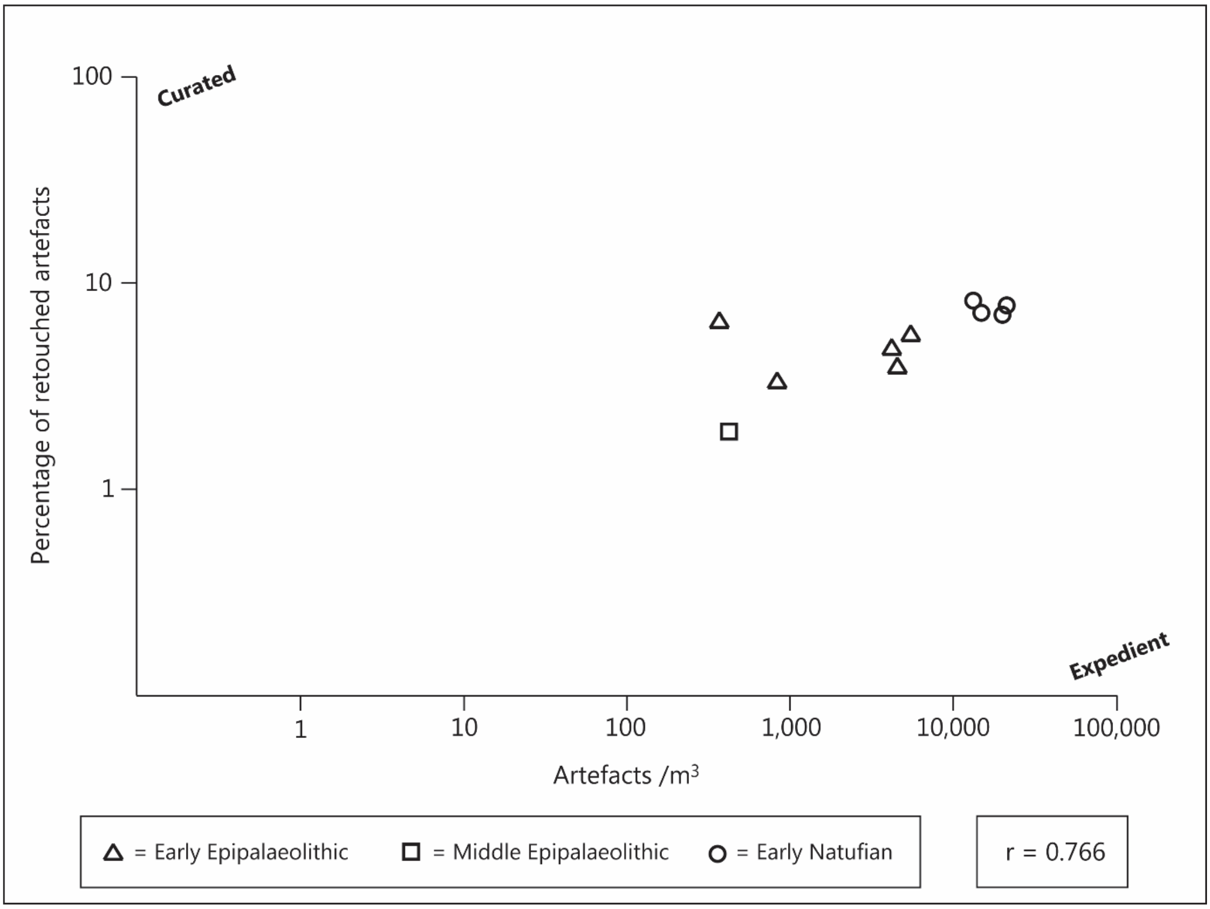


Figure 11.12: Site artefact density plotted against percentages of retouched artefacts for the Wadi al-Hammeh sequence, following Barton (1998) and Riel-Salvatore and Barton (2004).

signature of expediency compared to the relatively ephemeral Early and Middle Epialaeolithic occupations of the wadi. In any case, the ability of small numbers of palaeolithic hunter-gatherers to produce large amounts of waste in relatively short periods of time (Edwards 1992: 47) suggests that artefact density is an unreliable means of determining levels of site mobility. Likewise, the advent of organised refuse disposal practices in the Neolithic period (Hardy-Smith & Edwards 2004: 282-4) severely limits the inter-period applicability of this approach in the context of the broader neolithization process.

The site of Shubayqa 1 provides an intriguing contrast to Wadi Hammeh 27 in several ways. Unlike at Wadi Hammeh 27, raw knapping materials could not be gathered from nearby sources whenever required, as the nearest source of chert is situated at a distance of 60-70km from the site (Richter & Mawla 2019: 361). This separation resulted in cores being transported to the site in a lighter, tertiary state of reduction as part of an anticipated cycle of mobility, after which they were thoroughly exhausted prior to their disposal (Richter & Mawla 2019: 361-3). Richter and Mawla (2019: 361-3) argue that the unusually low debitage to tool ratio at the site further points to a high rate of retouch at the site, while the many of the burins were interpreted as burin-cores, indicative of a high rate of raw material recycling. The Shubayqa 1 case-study serves to illustrate that while settlements situated in the Jordan Valley and Mount Carmel Regions may have had ready access to raw materials, either through their setting or through exchange networks, this was not necessarily the case for Early Natufian settlements in the Harrat al-Sham. The variable of raw materials procurement is evidently an important one, and so must be taken into consideration when comparing the sequences of different regions.

11.5.2 Early Natufian toolkit regionalisation

In terms of the retouched component, this analysis confirms previous estimations of a strong functional connection between Wadi Hammeh 27 and `Ain Mallaha (Edwards 2013e), to which we may add a similar proximity in the case of the Hof Shahaf assemblage. This idea of assemblage regionalisation is supported by the fact that proportions of all the relevant tool groups (scrapers, retouched blades, non-geometric microliths, geometric microliths, notched and denticulated pieces and retouched flakes) all remain static or exhibit minor fluctuations over time at Wadi Hammeh 27. These patterns suggest that these proportions represent persistent configurations for settlements in the Upper Jordan Valley/Galilee region, at least for the duration of the Early Natufian period.

The similarity of the Jordan River Dureijat toolkit to those of `Ain Mallaha, Hof Shahaf and Wadi Hammeh 27 is also intriguing, and suggests that this regionalisation is not necessarily tied to a 'base-camp' site structure. However, given the short distances involved, it is possible that that Jordan River Dureijat was visited by the inhabitants of `Ain Mallaha or another permanent settlement in the Hula Valley, and if so many of the artefacts deposited there may have been tied to activities carried out in one of these larger sites.

The similitude between the lithic assemblages of Wadi Hammeh 27, `Ain Mallaha, Hof Shahaf and Jordan River Dureijat is consistent with Edwards' (2015) model of a Natufian sub-culture localised in the Jordan Valley. The exact reasons for this toolkit regionalisation can thus be explained through a combination of similar environmental functions as lakeside settlements, and through the inflated rate of social contact between these communities - and thus the horizontal transmission of information - facilitated by the use of watercraft (Edwards 2015: 279-80).

While exhibiting a strong link with other local sites, the increasing proportions of burins at Wadi Hammeh 27 show the most familiarity with the El Wad Terrace and Hayonim Cave assemblages. Indeed, the similarly high proportions of burins and multiple tools represent the only key specialisation shared by Hayonim Cave and Wadi Hammeh 27, with only the Northern Syrian retouched tool assemblages of Dederiyeh and Jeftelik having less typological similarity. In contrast, El Wad Terrace also has similar proportions of geometric and non-geometric microliths as Wadi Hammeh 27, with the rise in awls and borers in the later phases of Wadi Hammeh 27 providing an additional parallel.

The percentages of burins between Early Natufian toolkits closely mirrors Major's (2018: 141) clustering of Natufian sites based on the numbers of art objects, suggesting that these tools can be functionally linked with the production of mobiliary art during the Early Natufian period. Sites in the Upper Jordan Valley and Mount Carmel (Major's Zone 1) possess far greater proportions of burins than the comparative assemblages from western and northern Syria (Zones 3 and 4), and southern Jordan and the Negev (Zone 5). The only exception to this pattern is presented by Shubayqa 1, although this discrepancy can be explained through the aforementioned burin-core function of these tools. The notably high proportions of burins at Hayonim Cave and the later occupational phases of Wadi Hammeh

27 also correspond with the numbers of decorated art objects at both sites (Major 2018: 138). The number of art objects per cubic metre is in fact slightly lower at Hayonim Cave (0.3/m^3) than at Wadi Hammeh 27 (0.4/m^3; Major 2018: 138), despite the higher percentage of burins at the former site. At the same time, burins would have likely also been utilised in the creation of bone tools and pendants, as well as the whittling of perishable wooden artefacts. This latter function provides a secondary explanation as to why burin proportions are generally highest in sites situated within a Mediterranean woodland setting, at least in the case of the Southern Levant.

The consistent dominance of flakes in the debitage assemblages of Early Natufian sites - even in cases where bladelets were targeted as tool blanks – is unsurprising when placed in a broader temporal context (**Table 11.15**). Similar patterns are present at sites characterised by extended domestic occupations from the Early Epipalaeolithic onwards, suggesting that the production of large quantities of unwanted knapping waste is an inherent characteristic of sedentary Near Eastern flaked stone assemblages through time. Neither is there a straightforward link between the percentage of retouched artefacts in an assemblage and the residential stability of a site. The retouch indices of Epipalaeolithic sites vary on an intra-site basis to a comparable extent as later, agrarian Neolithic, Chalcolithic and Bronze Age townships (**Table 11.15**). It is thus clear that the influences behind the composition of lithic assemblages cannot be viewed as the result of a single, overarching influence such as degree of mobility, but are rather the result of a combination of site-specific functional roles, economic needs and refuse disposal practices (Staples 2005: 30).

11.5.3 The functional relationship between Wadi Hammeh 27 and Wadi Khawwan 1

The close proximity of Wadi Hammeh 27 and Wadi Khawwan 1 provides an ideal opportunity to directly compare the assemblages of two sites situated within an identical environmental setting, yet which exhibit opposing site structures. The toolkits of the two sites have some similarities, namely in the proportions of retouched blades and non-geometric microliths, geometric microliths and notched and denticulated pieces. The main deviations between the two toolkits are the near-absence of burins at Wadi Khawwan 1, which are instead replaced by greater proportions of scrapers and retouched flakes, as well as the lack of multiple tools, bifacial tools and retouched fragments. In short, the two sites exhibit an overall similar range of activities, with the retooling of composite sickles and excavation of

Table 11.15: The composition of the collective Wadi Hammeh 27 assemblages compared to a variety of southern Levantine sites, ranging in date from the Early Epipalaeolithic to Middle Bronze Age. Debris excluded.

	Period	Flakes	Blades/ Bladelets	CTEs	Other	Cores	Tools	Artefact no.	Reference
Ein Gev I	Early Epipalaeolithic	37.6	38.0	9.6	1.2	3.8	10.0	19,533	Bar-Yosef 1970: 112, 120.
Kharaneh IV	Early Epipalaeolithic	51.8	28.5	6.1	2.7	3.0	7.8	5,614	Macdonald et al. 2018: 446.
Ohalo II	Early Epipalaeolithic	25.2	56.4	3.8	10.1	0.2	4.3	16,436	Nadel 2003: 217.
Kharaneh IV	Middle Epipalaeolithic	52.1	37.4	3.5	1.5	0.4	5.1	52,526	Macdonald et al. 2018: 446.
Neve David	Middle Epipalaeolithic	47.2	35.3	3.9	0.3	2.0	11.4	7,381	Liu et al. 2020: 7.
Uyun al-Hammam	Middle Epipalaeolithic	57.6	28.7	0.2	0.0	0.4	13.1	71,098	Macdonald 2013: 73-74.
Wadi Hammeh 27	Early Natufian	66.2	25.4	0.9	1.6	0.9	5.0	202,487	Chapter 4; Edwards 2013e.
Ein Gev II	Late Natufian	55.3	11.9	2.2	19.3	1.3	10.0	9,076	Grosman et al. 2016: 15.
Rosh Zin	Late Natufian	48.7	25.3	1.7	14.0	1.1	9.1	19,516	Henry 1976: 325, 330.
\`Ain Mallaha	Final Natufian	64.1	20.0	1.2	1.7	1.1	12.0	8,743	Valla et al. 2004: 128.
Netiv Hagdud	PPNA	47.6	31.0	1.2	11.0	0.8	8.4	48,220	Nadel 1997: 72.
Wadi Faynan 16	PPNA	63.6	21.6	1.5	0.6	1.6	11.1	18,805	Mithen et al. 2018: 531.
Zahrat adh-Dhraʿ 2	PPNA	61.3	19.4	2.0	0.0	3.8	13.5	12,154	Sayej 2004: 93.
\`Ain Ghazal	MPPNB	38.3	49.2	2.9	1.4	0.6	7.5	60,069	Rollefson et al. 1992: 454.
Ghwair I	MPPNB	38.7	43.4	1.8	0.7	2.9	12.6	41,140	Simmons & Najjar 2006: 86.
Yiftahel	MPPNB	53.5	17.2	2.9	23.6	0.8	1.9	84,152	Garfinkel 2012: 77.
\`Ain Ghazal	LPPNB	53.2	34.2	2.6	1.4	0.8	7.9	7,860	Rollefson et al. 1992: 454.
Wadi Shuʿeib	LPPNB	46.7	37.7	3.5	2.5	0.8	8.9	2,257	Simmons et al. 2001: 10.
\`Ain Ghazal	PPNC	57.5	33.3	1.4	1.3	1.3	5.3	40,639	Rollefson et al. 1992: 454.
Beisamoun	PPNC	50.9	30.0	0.8	11.0	2.0	5.2	21,664	Bocquentin et al. 2014: 41.
Wadi Shuʿeib	PPNC	46.9	35.2	2.6	1.7	1.2	12.3	20,433	Simmons et al. 2001: 10.
Munhata	Pottery Neolithic	48.6	21.8	2.4	1.8	6.9	18.5	6,667	Gopher 1989: 86.
Wadi Shuʿeib	Pottery Neolithic	52.4	35.3	2.2	1.6	2.0	6.5	4,999	Simmons et al. 2001: 10.
Gilat	Chalcolithic	78.8	4.8	5.3	0.0	3.8	7.3	56,379	Rowan 2006: 526.
Horbat ʻIllit B	Chalcolithic	49.1	23.5	10.1	10.0	1.4	5.9	43,028	Milevski et al. 2013: 108.
Beqoʿa	Early Bronze Age	68.7	8.5	0.7	12.1	3.5	6.6	1,185	Khalaily 2018: 55.

Tel Megiddo	Early Bronze Age	37.9	17.1	7.7	4.8	3.6	29.0	784	Shimelmitz & Adams 2014: 58.
Tell el-Hayyat	Middle Bronze Age	80.5	9.8	0.0	0.0	1.4	8.3	723	Staples 2005: 16, 22.
Zahrat adh-Dhraʿ 1	Middle Bronze Age	76.9	14.6	0.0	0.0	2.9	5.6	342	Staples 2005: 16, 22.

pits being the only tasks not attested to at Wadi Khawwan 1. The recovery of a single incised limestone plaque from Wadi Khawwan 1 (Edwards et al. 1998: 26-7) suggests that mobiliary art have also been produced at this site, albeit to a far lesser extent than at Wadi Hammeh 27.

Assuming that Wadi Hammeh 27 and Wadi Khawwan 1 were indeed contemporaneous at some point in time, the question must turn to the nature of their functional relationship. An identification of Wadi Khawwan 1 as an overnight campsite for hunter-gatherer expeditions can be safely ruled out, given that the distance between two sites is hardly a fifteen minutes' walking distance. A more persistent occupation of the site is also supported by the evidence of regular core reduction being carried out onsite, as demonstrated by its comparatively large debris and debitage assemblages (Edwards et al. 1998: 25).

Wadi Khawwan 1's location on the south-west edge of the Plain of Fahl may offer some insight as to its function. This position would allow anyone camped in its vicinity to maintain a vigilant watch over both the entrance to the Wadi Jirm al-Muz and a section of the Jordan Valley floor outside the viewshed of Wadi Hammeh 27. As such, it is likely that a small contingent of inhabitants from Wadi Hammeh 27 stationed themselves at Wadi Khawwan 1 on a semi-regular basis in order to keep watch of and maintain their claim over the resources in these locales over neighbouring communities. The function of Wadi Khawwan 1 in this model is thus comparable to Yutil al-Hasa, which is hypothesised to have served as an elevated, upstream lookout for monitoring the movement of game utilised by the inhabitants of Tabaqa (Clark et al. 2017: 323).

11.5.4 Shifting parallels for an evolving settlement

The drop in burin numbers that accompany the transition between the architectural and post-architectural strata at El Wad Terrace provides an illustration of the relationship between shifts in site structure and activity priorities. This case shows less emphasis being placed on the manufacture of bone tools and mobiliary art with the reduced sedentism of later occupations. Assuming this connection is prevalent throughout the Southern Levant, it should then be possible to correlate many of the functional shifts seen at Wadi Hammeh 27 with other Early Natufian settlements.

As discussed in previous chapters, many of the major changes in the lithic assemblages of Wadi Hammeh 27 are associated with significant modifications in the nature and layout of the associated architectural features, particularly in regards to the break between the occupation of Structure 3 and Structures 1 and 2. The Upper Phase 4 ‘squatter’ occupation at Wadi Hammeh 27 has numerous parallels elsewhere in the Southern Levant, most notably in the form of the earliest occupations of `Ain Mallaha and Hayonim Cave, with all three ephemeral occupations being followed by the construction of an architectural settlement at the same location. The high number of reliable radiocarbon dates from these strata at Wadi Hammeh 27 sheds further light on this phenomenon, revealing in this case that the squatter occupation between the burial deposits and the foundation of Structure 3 likely spanned no longer than two or three decades.

While this short duration at Wadi Hammeh 27 provides a handy explanation as to why the composition of the associated lithic assemblages remain stable, it does not take into account the massive changes in site layout. While it is possible that the primary area of the settlement at Wadi Hammeh 27 was situated outside the area sampled at this point in time, it is more likely that it functioned in much the same way as in the earliest Natufian occupations of `Ain Mallaha and Hayonim Cave, or the enigmatic domestic occupation associated with the Early Natufian burials at Kebara Cave. However, the lack of comparably detailed, inter-phase lithic analyses from these sites as yet-hinders insight into whether such functional continuity is unique to Wadi Hammeh 27.

The break between the occupation of Structure 3 and the much larger Structure 1 at Wadi Hammeh 27 also has a clear parallel with Structures II and I at El Wad Terrace, in this case with well-published lithic assemblages for comparison. The fact that the El Wad architectural sequence is accompanied by none of the lithic trends seen at Wadi Hammeh 27 is telling, and suggests that the increasing emphasis on the production and maintenance of composite sickles may have only occurred in the Jordan Valley.

Finally, the discovery of an unplanned abandonment event at Wadi Hammeh 27 also has significance for inter-site comparisons. The demise of Structure I at El Wad Terrace is accompanied by none of the de facto refuse clusters or lithic signatures seen at Wadi Hammeh 27. This discrepancy is unsurprising, however, for the simple fact that El Wad Terrace was not abandoned at this stage, instead being followed by two non-architectural phases in the form of Phases W4 and W3, and subsequently by the extensive Late Natufian occupation (Kaufman et al. 2015).

11.6 Conclusions

This comparison confirms Edwards' identification of the `Ain Mallaha lithic assemblage as a close analogue to that of Wadi Hammeh 27, with the addition of links to Hof Shahaf giving credence to the idea of sites in the Jordan Valley comprising a distinct region in the Early Natufian period (Edwards 2015). This suggestion is supported by the lack of diachronic continuity between Wadi Hammeh 27 and El Wad Terrace over time, despite the remarkably similar, roughly contemporaneous, architectural sequences at both sites.

The influences behind the composition of Early Natufian flaked stone assemblages are undoubtedly numerous and interrelated with one another, rending reconstructions of their broader geographical and diachronic patterning within the Early Natufian *koine* a daunting prospect. The manufacturers of Early Natufian assemblages would have operated with a range of considerations in mind, such as their functional requirements, raw material availability, mobility patterning, environmental setting and occupational length, with the extent to which each of these influences affected the resulting assemblage composition likely varying on a site-by-site basis. This matter is further complicated by the Wadi Hammeh 27 sequence demonstrating the extent to which an abandonment assemblage can diverge from the 'regular' archaeological signature of an Early Natufian settlement.

If any progress is to be made at unwinding this quandary, a simple, yet time consuming approach must be undertaken – the assemblages from additional Early Natufian sites need to be analysed in detail, ideally with a diachronic approach. The excavation of a similarly rich sequence of superimposed Early Natufian strata at Shubayqa 1 is thus particularly promising, with the potential to compare technological trends between three distinct regions (Mount Carmel, the Upper Jordan Valley and the Harrat al-Sham) once the lithic assemblages from this site have been fully analysed.

Chapter 12: Summary and significance for future research

12.1 Summary of results

This thesis has quantitatively characterised complex diachronic change across the occupational span of a large, multi-phase, Early Natufian settlement. While most aspects of the flaked stone artefact assemblages at Wadi Hammeh 27 either remain static or fluctuate variably over time, several clear unidirectional shifts have been identified. This final chapter serves as a summation of these investigations, summarising their significance, their limitations and suggesting future approaches to further explore their findings.

The architectural sequence of Wadi Hammeh 27 excavated between 2014 and 2016 provided an ideal framework for tracing Early Natufian technological, typological and cultural taphonomic in hitherto unparalleled detail. This study represents one of a limited number of such detailed approaches for the Early Natufian period, paralleling the recent excavations of the sequences at El Wad Terrace and Shubayqa 1, and thus further promotes Wadi Hammeh 27 as an important site in our understanding of the critical juncture between the comparatively mobile hunter-gatherers of the earlier Epipalaeolithic, and subsequent horticultural and agricultural Neolithic village life.

Each of the lithic assemblages at Wadi Hammeh 27 were comprehensively analysed through a combination of typological and technological approaches. Most notable among the observed changes over time is the elevated emphasis on bladelet core production in later phases, particularly single platform types with convergent scar patterns, which were used to knap a combination of bladelets and bladelet-like microflakes. At the same time, the increasing implementation of a two-stage reduction sequence involving the recycling of larger cores into specialised bladelet cores supplied the larger flakes and blades needed to create most of macro-tool classes in later phases. This archaeological signature is unique amongst the case-studies utilised: although the presence of similar two-stage strategies are attested to in other Natufian assemblages, this study represents the first instance of this approach rising to dominance over time.

The increased emphasis on bladelet production in the later phases occurs in conjunction with an increased standardization of their associated microlith products. In the case of the sickle elements, this configuration points to an overall increased emphasis on the harvesting of wild cereals, likely in the context of resource depletion within increasingly delineated territorial units. The fact that both of these trends occur abruptly between the occupation of Structures 3 and 1 is further significant, although the actual explanation of this jump hinges on whether or not a break in occupation existed between these two structures. This study thus provides complementary evidence for the entrenchment of a broad-spectrum economy as part of the broader neolithization process. At the same time, however, Helwan retouch remained the dominant retouch mode for the microliths from its earliest deposits, demonstrating that the Early Natufian cultural complex was already well-established by the time of Wadi Hammeh 27's foundation.

The composition of the tool assemblages similarly remain largely consistent over time, suggesting a consistent range of activities were performed onsite at Wadi Hammeh 27 from its establishment through to its abandonment. A rise in burins and decline in multiple tools may indicate either a decline in recycling burins, while burin types also become more diversified over time. Other artefact types and attributes fluctuate over time in a seemingly random fashion, without any obvious connection with each other or the broader architectural changes.

Attempts to link the archaeological patterning at Wadi Hammeh 27 with broader models of cultural evolution are hindered by the fact that Natufian cultural change likely transpired on a regional scale due to the existence of numerous and extensive conduits for the horizontal transmission of information between communities. Additional, similarly detailed, analyses must be undertaken at other sites in order to differentiate between these broader cultural influences and changes driven by localised functional considerations.

The deposition of each flaked stone assemblage was reconstructed using a series of GIS-aided spatial distribution plots. This study represents the first such approach conducted on a multi-phase basis for the Early Natufian period, allowing for the spatial analysis to also be conducted on a diachronic basis. Even though each phase at Wadi Hammeh 27 represents a series of multiple, extended occupations, clear spatial relationships between artefacts distribution and architectural features in each phase are discernible. These patterns are robust and supported by inferential statistical tests. The analysis revealed that each assemblage is largely composed of primary refuse yet distinct clusters of artefacts are present in each phase identifiable with both specific and generalised activities.

Finally, the comparatively greater proportions of intact debitage in the final Phase 1 assemblage is identified as representing an extant stockpile of tool blanks, suggesting that this assemblage represents an unplanned final abandonment. This explanation is supported by the unusually high amount of *de facto* refuse present on the Phase 1 surface in a functional context. The abandonment signature at Wadi Hammeh 27 represents the first of its kind for the Natufian period, and is unique within the existing literature on settlement abandonment for the late Pleistocene in South-west Asia. Despite our understanding that lithic assemblages with not necessarily paint a complete picture of a site, this identification has been of paramount importance for the interpretation of Wadi Hammeh 27 specifically, for the Natufian period more generally, and beyond that, for complex prehistoric hunter-gather societies as a whole.

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