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Maltese chert: An archaeological perspective on raw material and lithic technology in the central Mediterranean

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The Maltese Islands in the central Mediterranean are renowned for their prehistoric archaeological record, particularly the megalithic 'temples' and associated ceramics and artwork. The temples were built by a society lacking metal technology, who relied on stone and organic materials. Knapped stone tool (lithic) technology, to produce sharp edged tools for tasks like cutting, hide working, and wood shaping offers insights into human behaviour in Malta, as well as into themes of exchange and connectivity. As well as imported chert and obsidian, local chert was widely used to make stone tools in prehistoric Malta. The local chert has generally been described as low-quality, yet relatively little research has been conducted on its distribution, characteristics, and use. In this paper I report a survey of chert sources, identifying a wider distribution of chert outcrops along the west coast of Malta than previously discussed. Some general macroscopic properties are outlined, as well as aspects of variability in the chert sources. Knapping experiments were then conducted on samples of chert collected, allowing clarification of its characteristics. These observations are used to offer some insights into lithic technology in Neolithic and Temple Period Malta, such as the hypothesis that the high frequencies of multidirectional flake production and subsequent 'scraper retouch' reflect adaptations to the characteristics of local chert.

Keywords: Malta; stone tools; lithics; knapping; prehistory; chert; technology

Introduction

The Maltese archipelago in the central Mediterranean (Fig. 1) has a justifiably famous archaeological record. As Renfrew put it, "for the prehistorian Malta is one of the most remarkable places on earth" (2004, 10). UNESCO World Heritage Sites such as Tarxien, Ħaġar Qim, Mnajdra, and Ġgantija temples reveal spectacular megalithic architecture, and a wealth of finds such as diverse pottery and various figurines and statues (e.g. Trump 1966, 2002; Evans 1971; Malone *et al.* 2009a, 2020b; Sagona 2015; Vella Gregory 2016; Bonanno 2017; French *et al.* 2020, among many others). For thousands of years, until the transition to the Bronze Age around 2000 BC, there is no evidence for the use of metal in Malta, so understanding stone (particularly knapped and ground stone) and organic (wood, bone, shell, etc.) technologies are crucial to elucidating early Maltese societies.

In this paper I investigate Maltese Neolithic and Temple Period stone tool technology in the sense of knapped (flaked) stone, where rocks with particular fracture properties were shaped and struck to produce sharp-edged flakes. Flakes (including elongated forms, called blades) may be modified by further small flaking of the edges ('retouch') to produce different sized and shaped tools. The earliest stone tools were made over three million years ago (Harmand *et al.* 2015), and stone tools provide the overwhelming majority of evidence for human behaviour until the last few thousand years. Stone tool technology illuminates early human society in a variety of ways: from how the raw material was transported; how sharp flakes were produced from cores (nodules of rock) according to culturally-inherited methods; through to how tools were used and abandoned. Understanding how ancient people in Malta were connected to neighbouring societies, how their behaviour changed over time, the nature of their subsistence, how they produced artwork and megalithic architecture, and many other things will all be illuminated by understanding the stone tool technology that people used.

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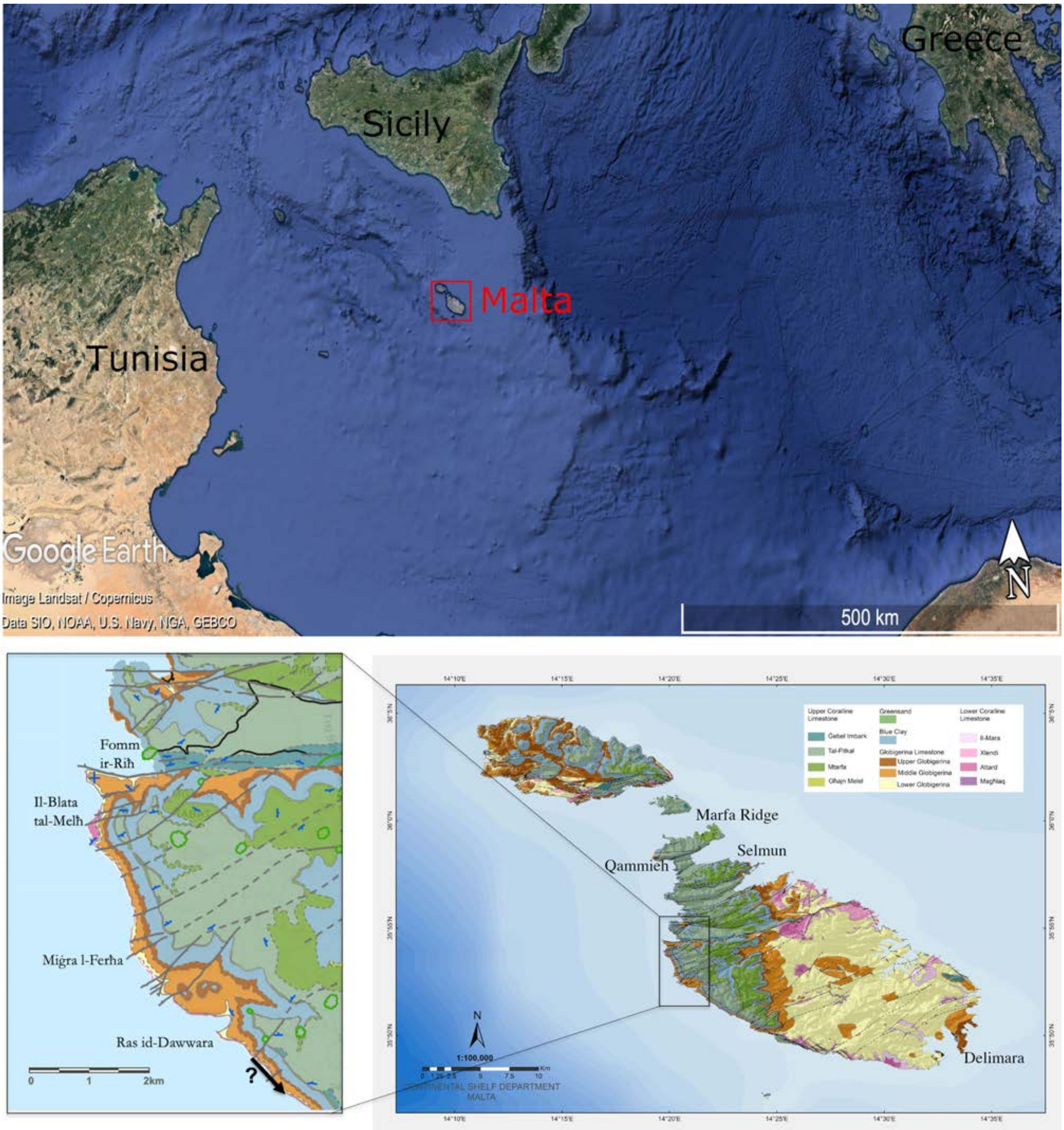

Figure 1: The location and geology of the Maltese Archipelago. Geological Map of the Maltese Islands courtesy of the Continental Shelf Department, Malta (available online: https://continentalshelf.gov.mt/en/Pages/Geological-Map-of-the-Maltese-Islands.aspx). Inset areas shows focus of survey discussed in this paper. The chert outcrops extend from Fomm ir-Riħ to south of Ras id-Dawwara, and were continuing south at first point reached (marked by question mark).

Maltese lithic technology

Stone tools have long been recognised in the Maltese archaeological record (e.g. Ashby *et al.* 1913; Zammit 1930, 120-121; Trump 1966; Evans 1971). Trump (1966, 29), for instance, commented that at Skorba lithics were abundant, and indeed that several layers produced “more flakes than potsherds”. It is only in recent years that detailed work on Maltese lithic assemblages has begun to be conducted. Studies of Maltese lithic assemblages are reported by Malone and colleagues (2009b, 2020b), from sites such as the

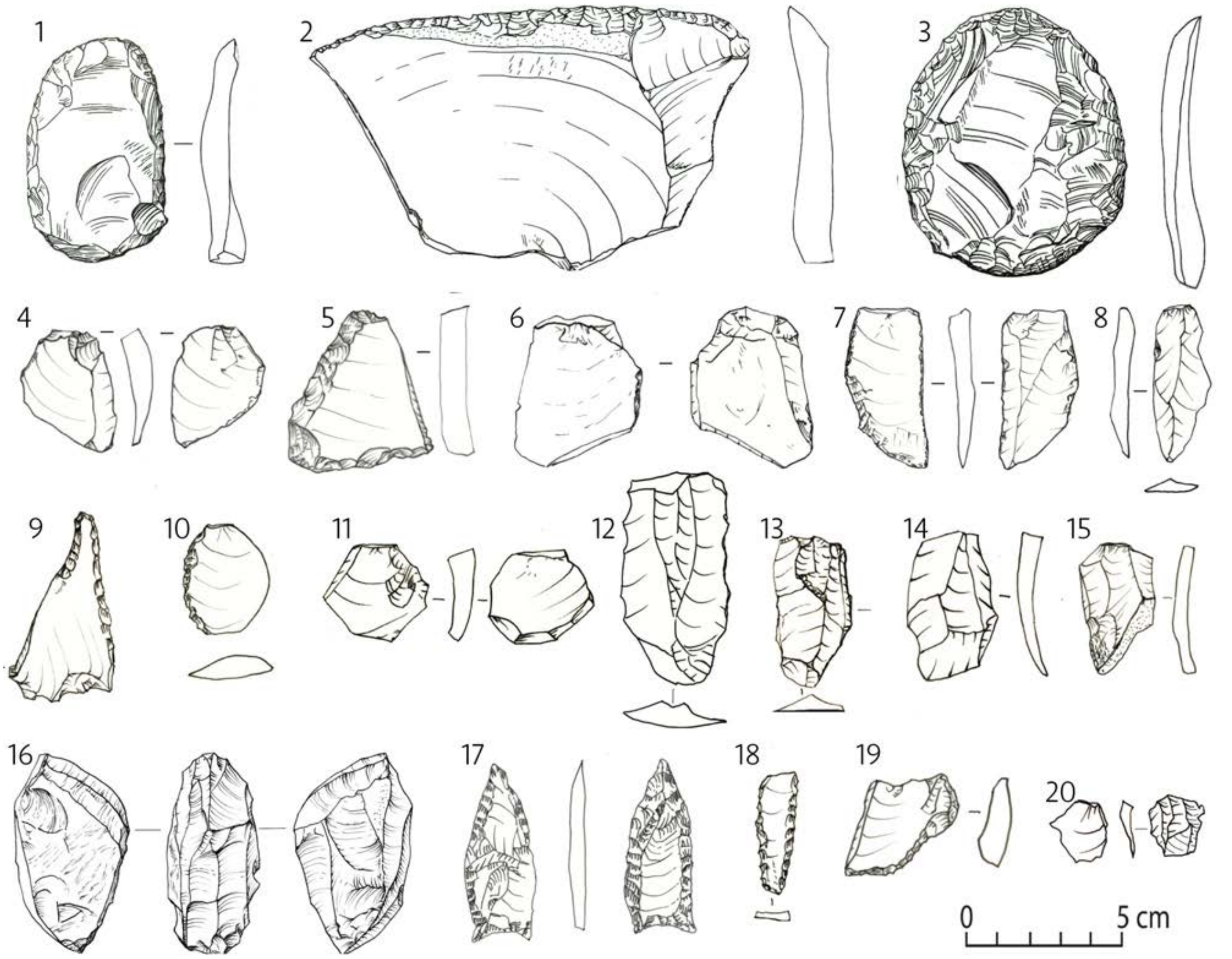

Figure 2: Examples of Maltese lithics from sites in Malta and Gozo: 1-3) large scrapers of local chert from the Xagħra Circle (modified from Malone et al. 2009b); 4-8) chert lithics from Santa Verna; 9-15) chert lithics from Taċ-Ċawla; 16-20) obsidian lithics from Taċ-Ċawla and Santa Verna (Images reproduced from Malone et al. 2020b, 2020c).

Xagħra Circle, Santa Verna, and Taċ-Ċawla, all of which have produced hundreds of stone tools. Vella (2008a, 2008b, 2009, 2011a, 2015, 2016) reports on lithic assemblages from several sites, such as Ta' Ħaġrat, Tas-Silġ, and Skorba (Vella 2009). While most assemblages are from temples and other seemingly ritual sites, there are also insights from the wider landscape, with, for instance, extensive surface surveys in central Gozo, which identified hundreds of lithics (Grima *et al.* 2020).

While most analyses have focussed on typological classification, some technological characteristics are clear. In terms of core reduction methods, there is a general focus on flake, rather than blade, production. Vella (2009) for instance emphasises multidirectional flaking, and the "largely expedient and informal" character of Maltese lithic technology (Vella 2011a). Likewise, Vella described the "largely expedient" character of local chert reduction, "with no sign of unidirectional knapping and suggestive of a relatively informal production process" (2016, 10). It is also worth pointing out that this "expedient and improvised character" seems to not only characterise the use of local chert, but also imported chert and obsidian (Moscoloni and Vella 2012). There is, however, sometimes also a blade component to the assemblages (e.g. Trump 1966; Malone *et al.*

1995, 2009b, 2020b), both on local chert and with other raw materials (Fig. 2). The recent suggestion that there is Levallois technology in the Maltese assemblages (Chatzimpaloglou 2019) seems to be a case of mistaken identity, based on the images provided.

From published reports on Maltese lithic assemblages, a consistent feature is the paucity of cores, the remnant nodules of material from which flakes were removed (e.g. van der Werf 2013). There are a few sites that have produced a moderate number of cores, such as 11 chert cores and two obsidian cores from Taċ-Ċawla, but compared to the 362 chert flakes, that is still not many (Malone *et al.* 2020b). At Santa Verna, among hundreds of lithics, only a single core was recovered. Likewise, compared to many hundreds of flakes, only a single core, of supposedly imported chert, was found at Ta' Ħaġrat (Vella 2009). From over three hundred lithics recovered from the University of Malta's excavations at Tas-Silġ, just three cores were recovered (Vella 2015). This paucity of cores suggests a spatial fragmentation of lithic reduction across the landscape, with cores removed from sites after flaking and/or primary flaking occurring at currently unknown localities and flakes being imported into the known sites. Aspects of spatial variability in the distribution of lithics can be also be observed at an intra-site level (e.g. Vella 2008a). While it therefore appears valid to describe a focus on rather amorphous, multidirectional, flake production, factors such as the paucity of cores which could add further information on core reduction methods, should be noted.

In terms of the retouched component, the central observation has been high levels of 'scraper' retouch (e.g. Ashby *et al.* 1913; Evans 1971; van der Werf 2013). Indeed, scrapers have been described as the "ubiquitous tool of Temple Period Malta" (Malone *et al.* 2009b, 243) (Fig. 2). Vella (e.g. 2008a, 2008b, 2011b, 2015) offered suggestions on the function of stone tools by looking at the shape of tools and the kind of retouch, with scrapers being for scraping and various other functional types linked to particular morphologies. Vella (2009) highlights some differences between sites in terms of features of the lithic assemblages, the meaning of which is currently unclear, such as Skorba scrapers typically only being retouched on one lateral edge, compared to commonly on two edges at Ta' Ħaġrat. It should be noted that many recent studies emphasise the complex relationship between lithic form and function (see, for example Odell 2001; Andrefsky 2012; Douze *et al.* 2020), and so the notion that 'scrapers' are for 'scraping', for instance, should be seen as a hypothesis to be tested. Function is best clarified by use-wear and residue analyses, rather than overall artefact morphology. When it comes to retouch in general, there is a conceptual ambiguity between retouch to influence the overall shape of a tool, and retouch to specifically shape an edge. The notion of 'scraper' retouch could instead be seen as a focus on retouch of a medium steepness. This is a specific technological choice, as opposed to other options such as applying very steep retouch ('backing') to blunt an edge. In addition, very occasionally other retouched forms such as apparent arrowheads have been found in Temple Period contexts in the Maltese islands (e.g. Evans 1971, pl. 68). While it is of course possible that some are intrusive, their genuine association with the Temple Period seems likely. These occasional arrowheads and other seemingly more sophisticated forms therefore appear as a somewhat exotic element in the lithic assemblages, just as in terms of core reduction technology the blade component is a minor feature compared to the dominant flake production.

While long distance import of exotic raw material such as obsidian has often been mentioned (e.g. Tykot 2017), it should be emphasised that these normally make up a small proportion of lithic assemblages. In the Neolithic Temple Period, obsidian typically makes up around 10-20% of Maltese lithic assemblages by number (Malone *et al.* 2020b, 408). It is, however, important to also consider the form in which obsidian occurs; mostly as very small flakes and fragments, perhaps suggesting intense reworking of a limited original supply of material. As noted by Vella, this implies that the import of obsidian was either irregular and/or controlled (2008b, 2016). The import of chert from Sicily, and perhaps mainland Italy, is again often mentioned. As discussed below, however there is often uncertainty about what is, and is not imported as opposed to local chert. A cautionary warning here comes from the discovery that ochre at Maltese sites, long discussed as a supposedly key long-distance import (e.g. Robb 2001), is actually consistent with local sources (Attard Montalto *et al.* 2012). While it is often unclear how large a proportion of each assemblage is made up of local chert, it is clearly extremely common, and yet little work has been done on describing its sources and characteristics from an archaeological perspective. Evidently local chert is abundant in most Maltese lithic assemblages (e.g. Chatzimpaloglou *et al.* 2020), yet, as discussed further in the following section, a lack of knowledge on the range of variability of Maltese chert means caution must be exercised in diagnosing other material as not being of local origin.

A final point which can be made in passing is that Maltese Neolithic lithic technology seems very distinct from that in Sicily, where forms such as backed blades, sickle-blades, and arrowheads are common (e.g. Nicoletti 1997). While this may partly reflect pragmatic aspects, such as raw material variation, it might also reflect social differentiation between the islands.

Maltese chert geology and geochemistry

The geology and landscapes of the Maltese islands have been described in detail by many authors (e.g. Felix 1973; Pedley *et al.* 1976, 1978, 2002; Baldassini and Di Stefano 2016; Gauci and Schembri 2019). In basic terms, the geological structure of the archipelago consists of a succession of marine sedimentary carbonates formed in the Oligocene and Miocene, approximately 30-5 million years ago (Fig. 1). The oldest is the Lower Coralline Limestone, a pale coloured and hard limestone that often forms spectacular coastal cliffs. This is overlain by the Globigerina Limestone. This is subdivided into yellow coloured Lower and Upper beds, and the white Middle Globigerina bed between them, in which chert occurs. Two phosphoritic conglomerate beds occur within the Globigerina Limestone, separating the three formations. This is overlain by the Blue Clay, a soft clay/marl layer. Finally, after a thin 'Greensand Formation' known for its abundant fossils, the sequence is topped by the Upper Coralline Limestone, similar in its characteristics to the Lower Coralline Limestone Formation. In summary, the Coralline Limestones represent shallow water conditions, with the Globigerina limestone between them representing deeper water, although with the latter interrupted by shallowing and strong current episodes indicated by the phosphoritic horizons. However, additional complexity comes from two factors. Firstly, tectonic activity has had a considerable impact on the landscapes of the islands, with some very dramatic faulting meaning abrupt changes in geology. Secondly, there is considerable lateral variability in the different beds of rock. This variability concerns both the thickness and subtle characteristics of the formations.

The Middle Globigerina (Kaħla or Turbazz in Maltese [Scerri 2019]), dating to about 16-20 million years ago, is the formation of most interest in the present context, given that it is the chert-bearing formation in the Maltese islands (see Fig. 1) (e.g. Pedley *et al.* 2002; Bianco 2020). It is a white to grey coloured limestone, rich in planktonic foraminifera. It has long been known that there were chert outcrops in this formation (e.g. Cooke 1893). Further studies added detail about the chert deposits (e.g. Felix 1973). It is interesting to note that in studies such as these, even basic points such as the colour described for the chert are highly varied (such as Zammit 1930; Pedley *et al.* 1978; Sagona 2015).

Maltese chert has often been described as being low-quality, both in terms of how it can be knapped and how it can be used (e.g. Ashby *et al.* 1913, 49; Zammit 1930, 121; Malone *et al.* 1995, 323; Moscoloni and Vella 2012, 65; Sagona 2015, 31; Malone *et al.* 2009b, 242; Malone *et al.* 2020b, 406). As far as I am aware though, no real

Figure 3: Two geological sections in western Malta, with red marker showing stratigraphic level of chert. Top, looking north at the point where Wied Ir-Rum meets the sea. Large sea cliffs of Lower Coralline Limestone are overlain by the Lower Globigerina Formation, visible as a distinct small yellow cliff. Above this is the Middle Globigerina Formation containing chert. Bottom: Il-Blata tal-Melh. Photo taken from Lower Coralline shore platform. Lower cliff is the Lower Globigerina Formation. Above it is the Middle Globigerina Formation, containing chert. Above this is the yellow-coloured Upper Globigerina Formation (H. Groucutt).

knapping experiments have been conducted on Maltese chert. In contrast to the dominant notion of Maltese chert being low-quality, others have suggested a different perspective. Trump described Maltese chert as "good" (2004, 240), and "only slightly inferior to flint" (2004, 17). To him, this is a key argument against their being early (i.e. pre-Neolithic) humans in Malta, as given the apparently good chert available in the islands, stone tools of any early people would surely have been found. Likewise, Ferguson (1991, 18), argued that the chert was of "satisfactory quality", with Vella likewise choosing a middle ground, describing Maltese chert as "medium quality" (2011a). In terms of the distribution of chert, Vella (2009, 2011) reports chert as occurring below Qlegħja Hill (just south of Ras ir-Raħeb), in the Fomm ir-Riħ bay, and at Ġnejna. Chatzimpaloglou (2019) suggested that in Malta chert was mostly found around Fomm ir-Riħ (Fig. 1).

The recent work of Chatzimpaloglou (2019, 2020; Chatzimpaloglou *et al.* 2020a, 2020b) has added valuable geochemical data on Maltese chert. This provides an explanation for the apparently 'low-quality' nature of Maltese chert, as these studies showed that the chert contains high levels of soft opal, rather than quartz, the hard, crystalline form of silicone dioxide. Chatzimpaloglou (2019, 2020; Chatzimpaloglou *et al.*, 2020a, 2020b) added further information on Maltese chert sources at Fomm ir-Riħ in Malta and Dwerja in Gozo. Using a variety of analytical techniques, they describe the variability of chert at these localities and from Maltese archaeological sites. This research identified aspects such as high levels of variability in the amount of silicon dioxide the sampled cherts contain, as well as trace element characteristics which the authors use to suggest that some chert samples show a Sicilian origin. Many samples, however, remain of unclear provenance, not matching either known Maltese nor Sicilian sources. Interestingly, Chatzimpaloglou (2019) reported a previously unknown kind of chert from near Dwerja, Gozo, where a fine-grained translucent white chert was identified. This suggests higher levels of variability in local chert characteristics than previously known. Chatzimpaloglou also suggested that small white spots are the "trademark of the Maltese chert" (2019, 209). Key here is that while Maltese chert was certainly widely used to produce stone tools, and is well represented at Maltese archaeological sites, a lack of certainty on the range of variability of Maltese chert makes it currently challenging to say with certainty, which material is local and which is imported.

A final point to make is that the word 'flint' is often used in the literature. This is commonly used in certain regions (such as Northwest Europe) and in relation to certain geological contexts (i.e. in chalk). In a Maltese setting, 'flint' is sometimes used to describe high-quality imported chert, as opposed to purportedly local chert. Flint is therefore sometimes used as a particular sub-category of the more general category of chert. This division is not considered useful by the present author, and the general term 'chert' is used.

Methods

The aims of this study were two-fold: firstly, field survey was conducted to explore the distribution of chert outcrops and evaluate their character; and secondly, knapping experiments were conducted to elucidate the characteristics of Maltese chert.

In terms of distribution, several areas of Malta where the Middle Globigerina Formation is present were visited for pedestrian survey; namely Delimara Point, the Selmun Peninsula, and Qammieh. The key area for focus though was from Fomm ir-Riħ southwards along the west coast, with the furthest point studied at 35.866910 N, 14.357428 E (Fig. 1). South of this point, the Middle Globigerina formation is present, but access is challenging. As an additional component of this study, a locality at the far eastern end of the Marfa ridge in northern Malta was visited. This had been identified in 2018 by Prof. Chris Hunt (Liverpool John Moores University). He had found some possible flakes, but it was unclear if they were lithic artefacts or geofacts (i.e. rocks fractured by natural processes or actions such as ploughing, which can resemble purposeful lithics).

During the survey, where outcrops were identified they were photographed and notes taken. The initial aim was not to systematically identify and report all chert outcrops, but to explore the spatial distribution at a landscape scale and gain insights into the kind of range of variability of these chert outcrops.

To evaluate the characteristics of the chert from an archaeological/lithic technology perspective, pieces of chert were collected for knapping experiments. Tabular chert was collected from Fomm ir-Riħ and just south of Miġra l-Ferħa. Nodular chert was collected from Miġra l-Ferħa. Knapping was done by the author, using hard hammer stones made of coralline limestone or quartzite. The aim of the knapping experiments was firstly to explore the general fracture properties of Maltese chert, such as how easy it is to flake in terms of hardness and predictability, and whether specific features associated with knapping such as bulbs of percussion and eraillure scars formed. Secondly, the 'Levallois method' – an approach to stone tool manufacture commonly associated with Neanderthals and early *Homo sapiens* – was used in the knapping experiments. This is of interest as it relates to the apparent absence of Palaeolithic lithic assemblages in Malta; for instance, have no Levallois-dominated assemblages been found in the Maltese islands because of an absence of Pleistocene humans in the area, or rather because the local chert is not amenable to the methods used by these groups? More widely, Levallois knapping (here using the centripetal preferential method) focusses on producing relatively large flakes, so offers a useful way to evaluate the possibilities of the local chert, such as whether the material is homogenous enough to produce flakes over a large area of the core.

Description of chert sources

Confirming early reports (e.g. Chatzimpaloglou 2019), chert was not identified away from the west coast of Malta, for instance, none was identified in the Middle Globigerina at Delimara, the Selmun Peninsula, and Qammieh. There should be a caveat here that some areas are intensely developed, and access is often challenging in heavily agricultural areas. The major finding in terms of the distribution of chert is that outcrops continue for several kilometres south of the Fomm ir-Riħ/Ras ir-Raħeb area that has been emphasised in recent studies (e.g. Chatzimpaloglou 2019) (Figs 1, 5-9). This wider distribution was hinted at in earlier work (Felix 1973), but not discussed in more recent studies.

In terms of overall landscape characteristics, it is important to emphasize that most of these chert outcrops occur in rdum settings, – on the steeply sloping land that occurs above the Lower Coralline Limestone –, which form cliffs down to the sea level in this part of western Malta (Fig. 3), and below the Upper Coralline Limestone which forms an upper-level escarpment. The rdum, between the Coralline formations, consists of the Globigerina and Blue Clay Formations. The latter often drapes the underlying Globigerina beds, as does scree and boulder material fallen from the Upper Coralline Limestone. An example of this rdum landscape which characterizes the western coast is shown in Fig. 4. Given that chert has a narrow exposure, in the Middle Globigerina Formation, this topography and geological sequence mean that it is often physically challenging to access possible chert sources, and in many cases they are buried. A second factor is that extensive agricultural terracing has transformed the landscape of the area (Fig. 4). Again, given the limited size of chert outcrops, one or two terraces could completely hide a chert source. A point that can be mentioned here, though, is that in my experience wherever chert is to be found in the bedrock, small pieces occur downslope, giving good clues as to what will be found upslope.

There is, however considerable variability in this landscape. In some places (Fig. 3) the Middle Globigerina Limestone occurs as a cliff or very steep terrain, and chert outcrops are located high up in hard-to-access settings. In other places the Globigerina beds are less steep than in rdum or cliff settings (Fig. 7). Some of the prominent chert sources – such as at Fomm ir-Riħ and Wied ir-Rum – occur where faulting and valleys interrupt the steep terrain typical of the west coast. In both cases the chert is relatively accessible. An interesting observation is that at Fomm ir-Riħ a small block of Middle Globigerina containing chert is found directly on the beach (35.9066 N, 14.3415 E) – in one of the few bays offering relatively sheltered conditions for boats on the west coast, and therefore in a highly visible position.

Beyond these general points, some more specific points can be made. Moving south from Ras ir-Raħeb, small paths lead over steep terrain and reveal chert sources continuing to the south. Outcrops were examined at several points, with variable fracturing and other characteristics (Fig. 5). To the south, towards Il-Blata tal-Melh, the slant of the land means that the chert layers gradually become higher in the cliff face, and therefore hard to access. Some ‘typical’ characteristics can be seen here though. For instance, at 35.900238 N, 14.331159 E where it is possible to, with caution, scramble up the steep slope, nodular chert occurs lower down and tabular chert higher up. This is the predominant pattern seen across the study area. The nodular

Figure 4: Two examples of typical scenery on the west coast of Malta. Left: steep rdum terrain near Dingli. Note Lower and Upper Coralline limestone cliffs, and considerable amount of scree and colluvium draping the Globigerina Formation. Right: Highly terraced landscape at Fomm ir-Riħ. A chert outcrop shown in figure 6 is located beside the path in the centre of the image (H. Groucutt).

Figure 5: Examples of chert outcrops on the west coast of Malta. Right: just south of Miġra l-Ferħa. Left: just south of Ras ir-Raħeb. Scale: 10 cm (H. Groucutt).

chert typically occurs as small nodules, while the tabular chert often forms retreating exposures (Fig. 5), with large numbers of broken chert fragments immediately underneath. Towards Il-Blata tal-Melh, the chert outcrops themselves were not accessed, but could be seen high above in the cliffs, and the ground surface below the cliffs has abundant chert fragments (Fig. 7).

Moving south, chert outcrops were identified between Il-Blata tal-Melh and Miġra l-Ferħa. At 35.883369 N, 14.338472 E, for instance, the chert shown in Fig. 8 is located, in a less steeply sloping rdum area than along much of this coast. This outcrop shows another form seen in several places, where a chert capping, and perhaps partial silicification of the underlying limestone, leaves 'tower-like' formations.

At Miġra l-Ferħa, a track along the southern side of the valley to the east provides excellent exposures of chert. This track has been cleared,

Figure 6: Further examples of chert outcrops: Clockwise from top left, 1) Ras ir-Raħeb; 2) eastern side Wied Ir-Rum; 3) western side of Wied Ir-Rum on edge of terraces on hill; 4) Miġra l-Ferħa on base of track. Note the diversity of colours and textures, and frequent breakage into smaller nodules. Scale: 10 cm (H. Groucutt).

Figure 7: An example of profuse chert on the surface, below chert outcrops in cliff at Il-Blata tal-Melh. Scale: 10 cm (H. Groucutt).

but not covered, and so provides a cross section through the Globigerina Formation. Here a thin brown bed of tabular chert is first observed (Fig. 6). This shows that while in general the tabular forms are the upper chert deposits, this is not always the case. Following the track east (around 35.875973 N, 14.343813 E) nodular chert is next encountered, and then tabular chert, including in some large 'tower-like' masses. Back towards the coast, continuing south, chert can be observed in multiple places (for example at 35.873596 N, 14.345560 E). Some chert outcrops are profusely broken into angular chunks, which could potentially be mistaken for lithics in some cases, but lack eraillure scars and other such diagnostic features. The nodular chert occurs as both protrusions from rockfaces, and in more shattered forms where boulders have broken away from cliffs. An example of the nodular chert from just south of Miġra l-Ferħa is shown in Fig. 9.

Continuing south, chert was found at several locations between Miġra l-Ferħa and Ras id-Dawwara. For instance, at 35.872481 N, 14.346104 E, chert occurs in an area of terraces. Here a sequence of (from the lowest) tabular to nodular to tabular can again be seen (the nodular bed here is shown in Fig. 6). An important observation here is that within the top of the chert sequence, light brown translucent chert occurs as a thin bed in places (Fig. 10). This is a very fine-grained material, which is a matrix joining small angular chunks of limestone. Translucent chert has not previously been reported from Malta, and this finding joins the recent identification of white translucent chert in Gozo, discussed above. Chert continues to outcrop moving to the south, around the edge of the top of the terraced hill (e.g. at 35.871355 N, 14.353265 E) (Fig. 6).

Continuing south, the coastal escarpment is interrupted by a valley, Wied ir-Rum. Several chert sources are found in this area, and these are easily accessible as they are found in the somewhat flatter terrain in the valley, compared to the sources found in the near-coast rdum settings. Prominent chert outcrops, with lower nodular and upper tabular forms, can be found

Figure 8: ‘Tower-like’ chert exposures, where a capping of fractured tabular chert prevents erosion of the underlying limestone, north of Miġra l-Ferħa. Right image shows top down view of chert just in front of the person. Human scale: 107 cm high (H. Groucutt).

Figure 9: Nodular chert, left: between Miġra l-Ferħa and Ras id-Dawwara, right: Miġra l-Ferħa. Scale bar on left: 50 cm, on right: 10 cm (H. Groucutt).

at coordinates 35.873371 N, 14.354419 E and 35.872256 N, 14.355294 E. In both cases, chert is visible both in the bedrock (Fig. 6) and as nodules on the ground. As well as at the outcrops themselves, chert fragments are found downslope in many places. This included one fragment of translucent fine-grained chert as a matrix holding together angular clasts (Fig. 10), similar to the material from slightly further north described in the previous paragraph.

Continuing south to Ras id-Dawwara, chert outcrops continue (for instance at 35.868274 N, 14.355168 E). Once again, there is darker brown nodular chert beneath lighter coloured tabular chert. In this location, it looks possibly like the chert has been quarried, but it is hard to tell if digging was for some other purpose (terrace formation, stone quarrying, etc.). The furthest chert source visited to the south in this study was 35.866910 N, 14.357428 E. The chert presumably continues beyond this point, but in very steep terrain with a large sea cliff, and further south, around Dingli, ways down to the relevant locations to check for chert are gated shut.

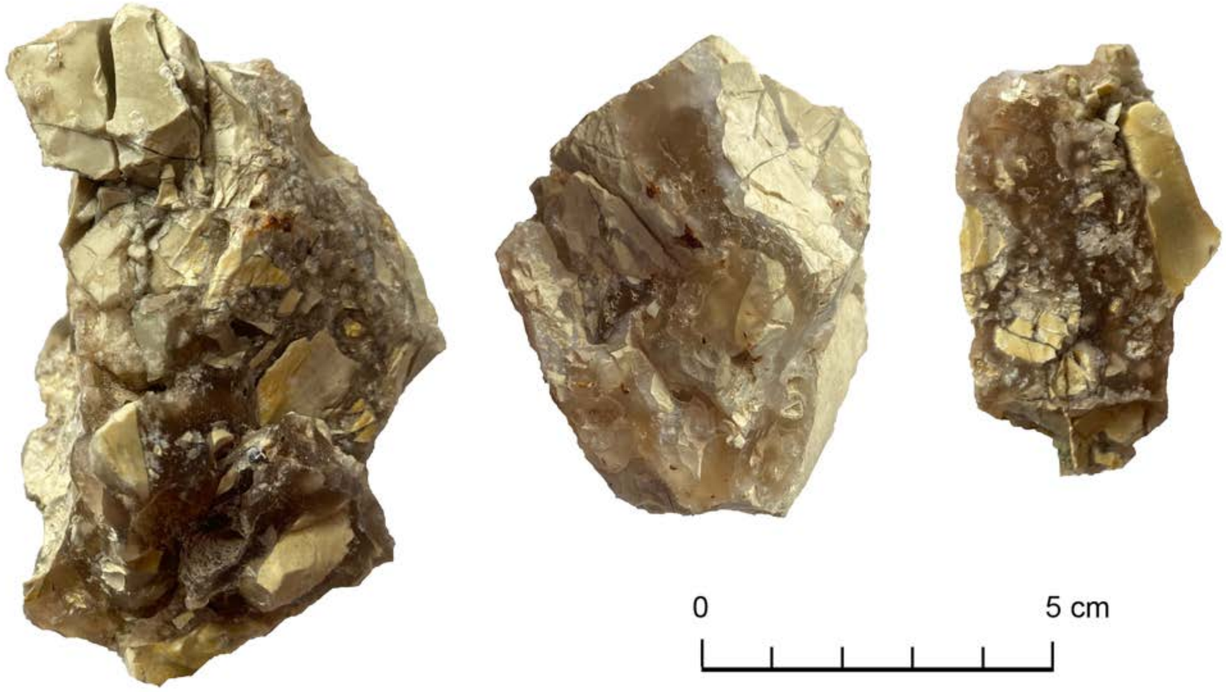

Figure 10: Examples of translucent fine-grained chert matrix, with abundant angular limestone clasts. From between Miġra l-Ferħa and Ras id-Dawwara (H. Groucutt).

Some general observations can be made on the findings of the survey. The chert is quite varied in its colour and characteristics. While some examples feature the white spots described by Chatzimpaloglou (e.g. 2019) as being characteristic of Maltese chert, not all do. Chert at some outcrops seems to be more fractured than others, but a general point is that even where it occurs in large volumes, the chert is rather fractured, typically into relatively small chunks. The most prominent cherts are the lower brown nodules and the upper grey/brown tabular cherts, but there is added complexity in places, such as there sometimes being a basal tabular layer, and sometimes a translucent light brown capping.

Finally, the locality at the eastern end of Marfa ridge was visited (35.989479 N, 14.374572 E). The site is a flat area just inland from a steep cliff down to the sea, and is characterised by Upper Coralline Limestone. Upon visiting the site, a few possible flakes were found on the surface, but these appear to be geofacts, or accidental flakes from spalling rock in recent wall building. There is a layer of rock which appears to be more fine-grained crystalline than the rest of the Coralline Limestone. This seemed to have formed a very subtle 'scarp' which had been recently dug up to build dry stone walls in the immediately adjacent area. It seems that in the process of this, whether digging up the rock or shaping the rocks for the walls, a few 'flakes' were accidentally produced. A sample of the rock was collected for analysis.

Knapping experiments

To evaluate the characteristics of the chert from an archaeological/lithic technology perspective, pieces of chert were knapped by the author, using a hard hammer technique. Hammer stones of both local coralline limestone and an imported quartzite pebble were effective at flaking the material.

Two reduction methods were used on the tabular chert. Firstly, a single-platform method to produce somewhat laminar debitage with unidirectional flaking was conducted on chert from Fomm ir-Riħ. This was easy to achieve and shows that relatively elongated flakes can be made with this material. It is also clear that

Figure 11: Flakes produced by hard hammer unidirectional reduction of chert from Fomm ir-Riħ, showing dorsal and ventral surfaces (H. Groucutt).

classic indications of knapping, such as ripples, bulbs of percussion, and eraillure scars, are common with this material (Fig. 11).

Secondly, chert from both Fomm ir-Riħ and just south of Miġra l-Ferħa was flaked using the Levallois technique. Figure 12 shows the residual core and both sides of the Levallois flake produced from Fomm ir-Riħ chert. The core was flaked centripetally and the striking platform facetted. The large Levallois flake produced shows that large flakes like this can be produced with this chert. Figure 12 also shows a residual core and three Levallois flakes produced from it, primarily using unidirectional-convergent flaking, using chert from Miġra l-Ferħa. This was again easy to flake, and shows that several Levallois flakes can be produced from a relatively small original core.

As a general point on the tabular chert, it is generally fairly homogenous and easy to flake. However, in some cases there are small internal flaws and fracture planes, and these subsequently interrupt flaking and prevent the production of long flakes. This seems to be more of an issue with some chert outcrops than others, and certainly encourages the knapper towards a more multidirectional approach as long unidirectional removals will often be impeded by the flaws.

Figure 12: Two examples of hard-hammer reduction of Maltese chert using the Levallois method: 1) preferential Levallois core and 2) refitting flake (left: dorsal, right: ventral) on Fomm ir-Riħ chert, with centripetal preparation; 3) residual core surface; and 4-6) three Levallois flakes produced from it using primarily unidirectional-convergent method, chert from Miġra l-Ferħa (H. Groucutt).

Often, when struck, a relatively large core will break into several pieces along these flaws and weaknesses. The material is then relatively homogenous, but the split cores are now relatively small, and so a focus on flake production is encouraged.

Next, the nodular chert was knapped. This occurs as relatively small nodules surrounded by a limestone matrix. In some cases, upon flaking the chert separates entirely from the surrounding limestone, while in other cases flakes continue from the chert and into the limestone (Fig. 13). The nodular material is also relatively easy to flake, but there is again an 'impetus' to multidirectional flake production from the character of the nodules.

While future studies will more formally examine the functional properties of Maltese chert lithics, it is fitting to make some basic points in passing. The edges of the chert flakes produced are not particularly sharp, and the edges are easily blunted by applying force on

Figure 13: Examples of flakes produced on nodular chert from Miġra l-Ferħa, showing dorsal and ventral surfaces (H. Groucutt).

them against hard materials. Small flakes can be snapped by hand. The nodular chert feels harder and perhaps sharper than the tabular chert, although this impression needs to be formally tested in future. Compared to raw materials that the author has flaked from areas such as Southwest Asia and Britain, these characteristics of the Maltese chert are striking.

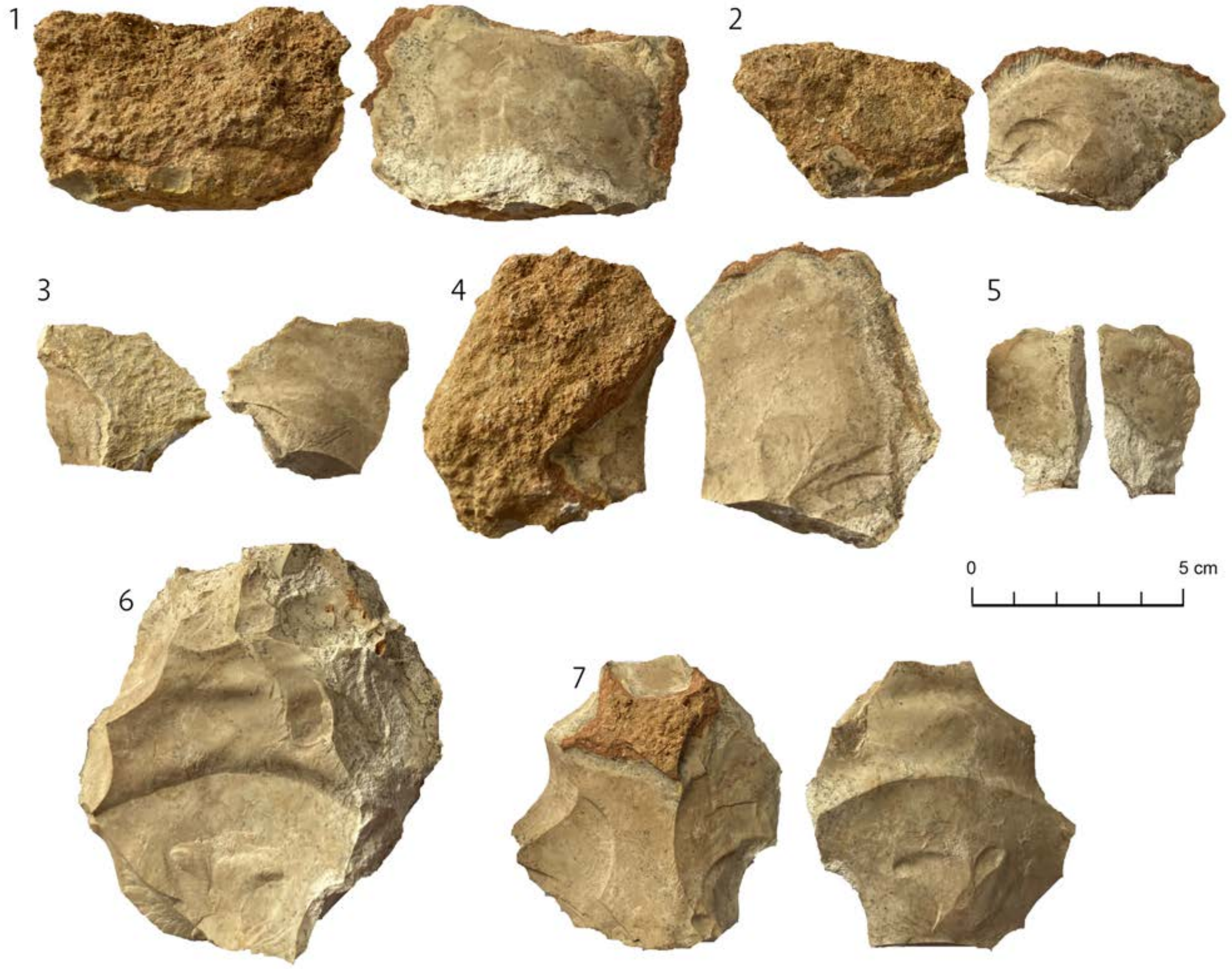

Figure 14: Products of Levallois reduction of Coralline Limestone from eastern end of Marfa ridge: 1-5) various preparation flakes, showing dorsal and ventral surfaces; 6) core, showing centripetal preparation preferential removal; 7) dorsal and ventral views of Levallois flake removed from core (H. Groucutt).

Finally, the Upper Coralline limestone from Marfa ridge was knapped. All the pieces shown in Fig. 14 were from a single block of rock. The cortex is very hard, and forceful blows were required to remove it. Flaking was easier on the more internal parts of the rock, and the material does conchoidally fracture. The nodule was shaped into a Levallois core with centripetal preparation, and a relatively large Levallois flake successfully removed. While not particularly sharp-edged, flakes from this material could seemingly be used for some tasks, and its hardness is interesting. Future studies should evaluate the Coralline Limestone formations for knappable materials.

Discussion and conclusion

While the long-distance transport of raw materials such as obsidian has featured prominently in discussions of Mediterranean prehistory, in areas such as the Maltese islands there remains a lack of certainty about which materials were imported and which were not. Likewise, the implications of imports are unclear, with some authors suggesting that they demonstrate regular contact with areas such as Sicily, yet the available data are also consistent with much more episodic contact (see Groucutt *et al.* 2022 for further discussion of these themes).

Here it has been demonstrated that chert outcrops occur over a considerable distance of the west coast of Malta, at least five kilometres as the crow flies, more like ten kilometres in reality, and possibly continuing further south. The characteristics of the chert have been described, such as it typically occurring in a very fractured form, such as that even a large outcrop of chert will consist of many small clasts. Along with other recent studies (e.g. Chatzimpaloglou 2019), these findings both describe the dominant trends observed, and highlight aspects of variation such as occasional examples of translucent chert being identified. Evaluating the macroscopic character of chert at the outcrops, and of the knapping characteristics of the material, bring some new perspectives to knowledge on Maltese lithic technology. These new findings suggest that Maltese chert is more varied than traditionally thought, and therefore caution is needed on classifying chert at archaeological sites as local or imported. This perspective extends recent research which have analysed and quantified chert geochemistry at Maltese sites (e.g. Chatzimpaloglou 2019; Chatzimpaloglou *et al.* 2020). The key point here is that further characterisation of the chert at its sources is required, as is the integration of geochemical/ microscope and macroscopic/fracture mechanics perspectives.

The notion of lithic raw material 'quality' is complicated, as ease of manufacture and characteristics in terms of use are not the same thing (see also Groucutt *et al.* 2017). In terms of the act of flake production, Maltese chert is easy to flake. In some cases, however, flaws within the chert nodules mean initial cores break into smaller chunks, which encourages a more multidirectional kind of flake production. However, as the knapping experiments conducted show, both laminar flakes and Levallois flakes can be produced with Maltese chert. As mentioned above, Trump (2002, 240) argued that the lack of evidence for characteristic early prehistoric artefacts in Malta reflected an absence of early humans. It has been demonstrated here, for the first time, that it is possible to make these artefact forms with Maltese chert, and this can be factored into discussions on the absence of evidence for early stone tools.

Particularly pertinent in terms of the quality of Maltese chert is the character of the edges produced. These are generally not particularly sharp, and blunt very easily. Rather than a cultural preference for typological 'scrapers', this may explain the frequent use of 'scraper' retouch in Maltese assemblages. By applying semi-steep retouch the edges can be made much stronger than the natural margins produced by flaking. This perspective only becomes clear when knapping experiments are conducted, and technological rather than typological approaches to lithic analysis are emphasised.

In summary, the 'ad hoc' character of Maltese chert lithic assemblages may actually represent sensible adaptations to the characteristics of the local raw material. This can be evaluated through future formal experimental work, as can the extent to which chert was imported into the islands by continued geochemical analyses of diverse samples. Previous studies have emphasised the 'simple' character of Maltese lithic technology, with an emphasis on ad-hoc flake production and retouched tools dominated by 'scrapers'. The findings reported here suggest a need to better integrate the character of local chert raw material into analyses of Maltese lithic technology.

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