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WHERE MOUNTAINS AND NEANDERTHALS MEET: THE MIDDLE PALAEOLITHIC SETTLEMENT OF SAMARINA IN THE NORTHERN PINDUS (WESTERN MACEDONIA, GREECE)

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Abstract

The surveys carried out since 2002 in the Northern Pindus of Western Macedonia (Greece), have led to the discovery of an impressive number of sites, lithic scatters, findspots and isolated artefacts, techno-typologically attributed to the Levallois Mousterian Middle Palaeolithic. The chipped stone artefacts are mainly distributed along the watersheds that surround the high-altitude Vlah town of Samarina up to ca. 2100 m, on the ridges of the Boghdani and Gurguliu mountains in the Smolikas massif. Apart from the aforementioned finds, outcrops rich in good quality chert have also been discovered. They are often associated with decortication areas located close to the extractive points. Important sites were found also along the southern terraces of the Samariniotikos River at some 1500 m of altitude. This paper describes the results so far achieved from the study of the landscape on which late Neanderthal groups moved, obtained knappable raw material for making tools from local sources, settled in base camps close to the river course, and practised hunting activities along the mountain open landscapes. According to the typological characteristics of the chipped stone artefacts, and the location at the top of morainic circles, the assemblages have been attributed to a recent period in the development of the Levallois Mousterian Middle Palaeolithic. The Samarina finds show that Neanderthal groups seasonally exploited the natural resources of the Pindus highland zones most probably after 70,000 BP, during a period of climatic amelioration of the OIS-3. The unique finds from the Northern Pindus chain help us understand some modes of behaviour of the Middle Palaeolithic groups within an activity radius of ca. 20 km between some 1350 and 2100 m of altitude.

Keywords: Western Macedonia, Pindus Mountains, Samarina, Levallois Mousterian Middle Palaeolithic, Chert exploitation, Lithic technology, Neanderthal hunting strategies

PREFACE (P.B. and N.E.)

This paper is a preliminary report of the research carried out jointly by Aristotle University, Thessaloniki (Greece), and Ca' Foscari University, Venice (Italy) between 2002 and 2015 in the mountains of northern Pindus (Western Macedonia, Greece; Fig. 1). The research, otherwise called "Grevena Project" was launched in October 2002 and is still in progress. Originally its first aim was to survey and explore the archaeological potential of the high altitude landscapes around the Vlach town of Samarina, at the foot of Mt. Gurguliu (Gorgul'u; Wace, Thompson, 1914:37), in search for the presence of Mesolithic stations in the area, following the discovery of dozens early Holocene hunter-gatherers sites of this period in the Italian Alps (Broglio, Lanzinger, 1990; Franco, 2011).

Our survey followed the fieldwork carried out by N.C. Wilkie and her team between 1985 and 1994 in the Grevena lowlands up to some 1000 m of altitude that is across a landscape absolutely different from that investigated after 2002. The above project, whose scope was to record archaeological evidence in a neglected part of the Greek countryside, led to the discovery of Historical, Bronze Age, and a few Early Neolithic sites, while evidence of Palaeolithic finds was missing (Wilkie, 1993; Wilkie, Savina, 1997). The 2002 survey was first carried out around small lake basins and watering holes, close to passes and saddles that, according to the experience gathered in many years of work in the Italian Alps (Biagi, 1992; Biagi, Starnini, 2015), represent ideal environments for seasonal settling of the last hunter-gatherers of the initial Holocene who moved from their valley bottom camps up to the alpine grasslands, for hunting purposes. This is the main reason why one of the first areas to be surveyed was a small glacial basin located at 1357 m of altitude, just above of the Vlach village of Smixi (Smiksi), which is partly delimited by the impressive moraines that slope down from the northern flanks of Mt. Vasilitsa (Fig. 2).This was considered as an ideal opportunity to return to the topic of the Mesolithic settlement in Greece, which has been lacking systematic field investigation in recent years, leaving room for speculation as to its extent and intensity and inevitably resorting to ideas of an idiosyncratic character (Galanidou, Perlès, 2003).

Although this preliminary survey did not yield any evidence of Mesolithic activity in the area, the unexpected discovery of a large, unretouched flake of whitish, patinated chert, along the southern shore of the aforementioned small lake (site name Vasilitsa-1: 1357 m), and its indubitable Middle Palaeolithic aspect, reminded me (P.B.) 1) of a lecture delivered in the late 1970s by J. Nandriş at the Institute of

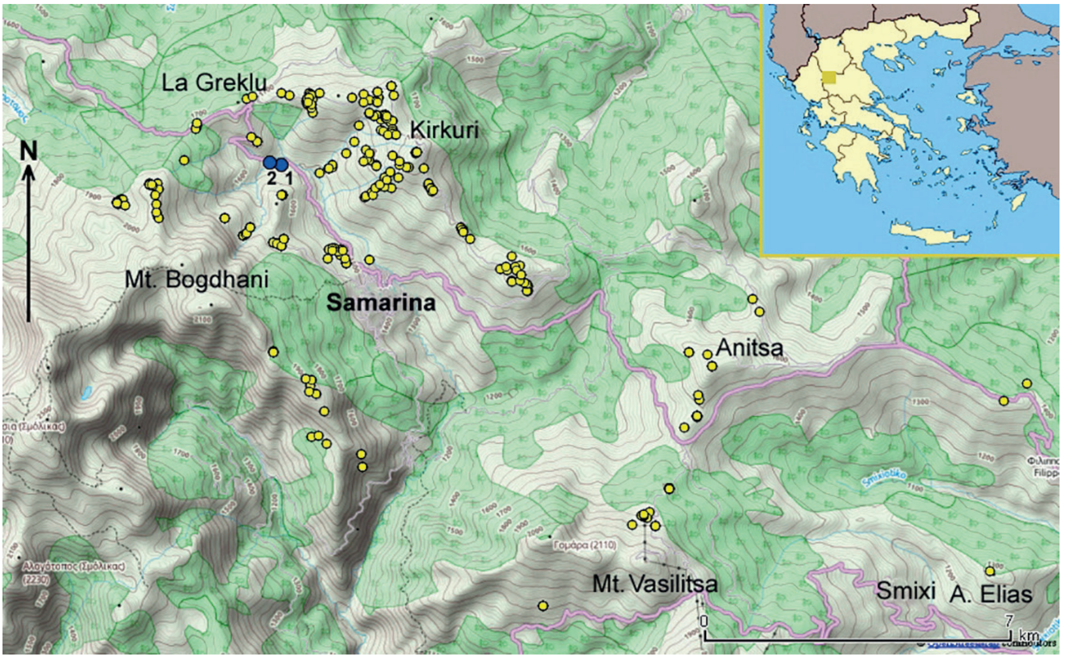


Fig. 1. Samarina basin with the indication of some of the most important geographic localities mentioned in the text, and the distribution of Levallois Mousterian Middle Palaeolithic sites discovered during the 2002-2015 surveys (yellow dots). The base camp sites of SMR-1 and SMR-2 are marked by numbers 1 and 2 respectively (blue dots) (Source of the topographic map: OpenStreetMap) (Drawing R. Nisbet)

Fig. 2. The small glacial basin above the village of Smixi, along the southern shore of which the first Middle Palaeolithic flake was recovered in the autumn of 2002 (Vasilitsa-1) (Photograph P. Biagi)

Archaeology, London University, during which he mentioned the presence of Middle Palaeolithic tools near Samarina, just a few kilometres from Smixi, and 2) of the fundamental role played by waterholes in the hunting activities and survival strategies of both human beings and animals (Binford, 1983). Given the above discovery, and the knowledge that the occurrence of three main elements which constitute the fundamental premises for the presence of high-altitude hunter-gatherers stations (water, sheltered areas close to passes of easy communication, and raw material resources) the research was soon extended to other "comparable" environments.The saddle of La Greklu marks the boundary between Western Macedonia and Epirus. Also on this occasion whitish chert flakes were recovered from both La Greklu Pass itself (site name Sam-1: 1689 m), and all around a small basin formed by the famous local spring (Wace, Thompson, 1914:204) located along the watershed just 1 km west-southwest of the pass (site name Sam-2: 1718-1756 m). Here 56 Middle Palaeolithic whitish chert artefacts were collected from 4 different spots (Fig. 3).

Given the importance of these discoveries, the watershed that elongates from La Greklu toward Delichmét, and farther east Mt. Kirkuri, was also explored during the same 2002 season. Surprisingly, several spots rich in whitish chert chipped stone artefacts were observed. They were especially numerous at the point later called Sam-6 (1782 m), where an excavation trench was opened the following year (Fig. 4) (Efstratiou *et al.*, 2006), and the neighbouring Sam-8 (1782 m) (Pl. 1). All the area around Sam-8 looked very promising because of four main reasons: 1) the surface of the earth road built along the watershed was literally covered with chipped stone tools, 147 of which were collected on the same day; 2) the profile of the section along the road when cleaned showed evidence of a thin archaeological horizon, some 25 m long, just below the topsoil at ca. 20 cm of depth. It contained small flint artefacts of various colours as well as charcoals; 3) the top of the ridge yielded the first evidence of whitish chert outcropping at several points, the same utilised to produce the chipped stone artefacts recovered from both Lake Smixi and

Fig. 3. La Greklu: the small basin formed by the local spring, where four main clusters of Levallois Middle Palaeolithic artefacts were recorded in the autumn of 2002 (Sam-2) (Photograph P. Biagi, 2002)

La Greklu; 4) the area was rich in perennial springs exploited by Vlach shepherds to water their flocks. Although the surveys carried out in the following years yielded very scarce evidence of Mesolithic activity in the Samarina highland zones (Biagi *et al*., 2015a), soon it became clear that the region had been intensively exploited during the Middle Palaeolithic, though traces of human activity of more recent periods, both the Pleistocene and the Holocene (Efstratiou *et al*., 2006), up to historical ages, were also recovered (Biagi, Efstratiou, 2008; Efstratiou, 2008).

During the following years the surveys were extended higher up to the ridges of Mts. Gurguliu and Bogdhani. They showed that groups of Middle Palaeolithic hunters had moved along the eastern and western watersheds of both mountains leaving evident traces of their passage up to some 2100 m of altitude. It is important to mention the recovery of a typical, retouched Levallois Mousterian point along the western upper slopes of Mt. Bogdhani at 2049 m of altitude (GRG-25: Fig. 5; Pl. 17:7), which illustrates the fact that Middle Palaeolithic hunting was practised even at very high altitudes.

Interestingly enough the region surveyed by the "Grevena Project" borders with Epirus. The researches and excavations carried out in the 1960s in the latter province by the Cambridge University Archaeological Mission (Dakaris *et al*., 1964; Higgs, Vita-Finzi, 1966), and more recent fieldwork (Sturdy *et al*., 1997; Papaconstantinou, Vassilopoulou, 1997; Ligkovanlis, 2011; Papoulia, 2011) led to the discovery of several Middle Palaeolithic sites, whose chrono-typological sequence had been preliminarily suggested in the 1960s, and later reassessed (Bailey *et al*., 1992; Gowlett, Carter, 1997; Tourloukis *et al*., 2015). It is important to point out that excavations in the region had been carried out mainly in caves and rock-shelters and, even in the case of open-air sites, the highland zones rarely have been considered important territories to investigate, if not only from a purely theoretical point of view (Green, 1997). According to other authors the Middle Palaeolithic hunters in Epirus "*exploited*

Fig. 4. Location of site Sam-8, along the Delichmét ridge between La Greklu and Kirkuri with the area where the first excavation trench was opened in the autumn of 2003 (a), and the profile of the deposits of the same site (b) (Photographs P. Biagi)

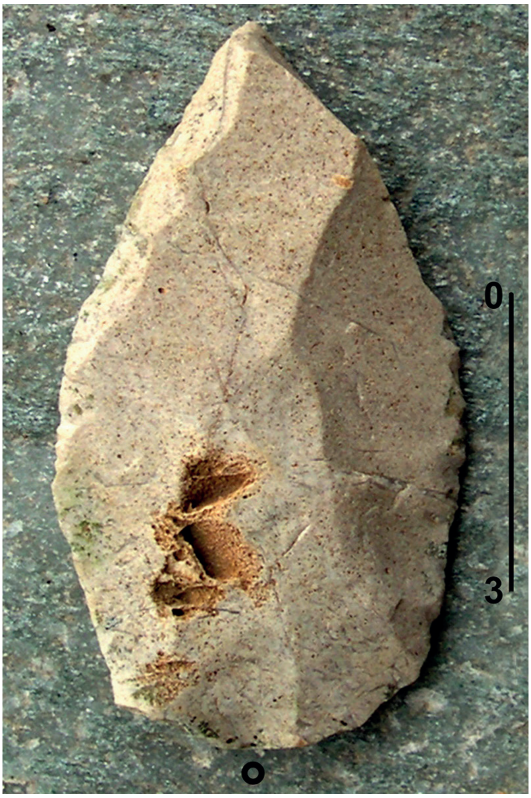


Fig. 5. GRG-25: Levallois point collected at 2049 m of altitude along the western ridge of Mt. Bogdhani (Photograph P. Biagi)

wetlands created by the characteristic karstic landscape that assured fixed wetland resources" (van Andel, Runnels, 2005:382; see also Runnels 1995:713; Papagianni, 2008:50). It is most probably also due to this pre-conceptual approach that Middle Palaeolithic chipped stone artefacts have never been searched for and recovered from mountain sites located above 1000 m of altitude (Papaconstantinou, Vassilopoulou, 1997:472). Our knowledge of the Middle Palaeolithic occurrences is quite scarce also in the valleys of Western Macedonia neighbouring the Pindus flanks. In effect, the surveys recently conducted along the course of the Aliakmon River yielded very poor evidence of Palaeolithic occupation (Panagopoulou *et al*., 2006; Harvati *et al*., 2008); while no site of this period has ever been reported from the Grevena lowlands (Wilkie, 1993).

ENVIRONMENTAL SETTING (R.N.)

The 2002-2015 fieldwork (Efstratiou *et al*., 2006; 2011; 2014; Efstratiou, 2008; Efstratiou, Biagi, 2009; 2011; Biagi *et al*., 2015a; 2015b) comprised a systematic survey of the uplands of Samarina, a territory which so far deserved little attention for its archaeological potential, with only two Hellenistic sites known until 2002 (Drougou, Kallini, 2003). The survey carried out mostly between 1350 m (Smixi, Filippei) and 2600 m of altitude (Mt. Mosia [Moasha], Smolikas [Zmolku] group), was intended to explore the profiles exposed by erosion, and take GPS coordinates of all discernible archaeological materials. This strategy contrasts with those employed for the recovery of Middle Palaeolithic surface assemblages in Epirus (Papagianni, 1999). At these altitudes Holocene soil formation has been slow, the resulting soil is thin, and centuries of pastoral activities (Chang, 1993) have frequently caused the exposure of the subsoil, enabling a good visibility of chipped stone artefacts. This region, covering an ellipsoidal area of about 60 km^2, broadly corresponds to the Samariniotikos River (sometimes referred as Yiotsa) catchment, consisting of this river, the only perennial stream, and its numerous seasonal tributaries. The basin is encircled by the widely arched watershed running along 360° from the southern slope of Mt. Gurguliu to Mt. Vasilitsa for a linear length of ca. 30 km (Fig. 6). The only major discontinuity in the otherwise rather continuous ridge is set in the deep erosional valley south of Samarina, for a width of some 3 km, between the south-eastern side of Mt. Gurguliu and the escarpments of the Mts. Vasilitsa and Gomara Group.

The basins main focus is the historical village of Samarina (ca. 1500 m asl), along the border of the Samariniotikos. The ridges above the town reach 2253 m at Gurguliu and 2238 m at Bogdhani tops (two of the lower summits around Mt. Smolikas, Greece second peak after Mt. Olympus), decreasing northward to 1689 m at La Greklu Pass that connects Western Macedonia to Epirus. The stream, cutting in its upper (SW-NE) course deep channels from the source on the steep slopes of Mt. Bogdhani at ca. 2100 m, bends to the south-west in its wider alluvial valley down to Samarina where, by now named Greko, it

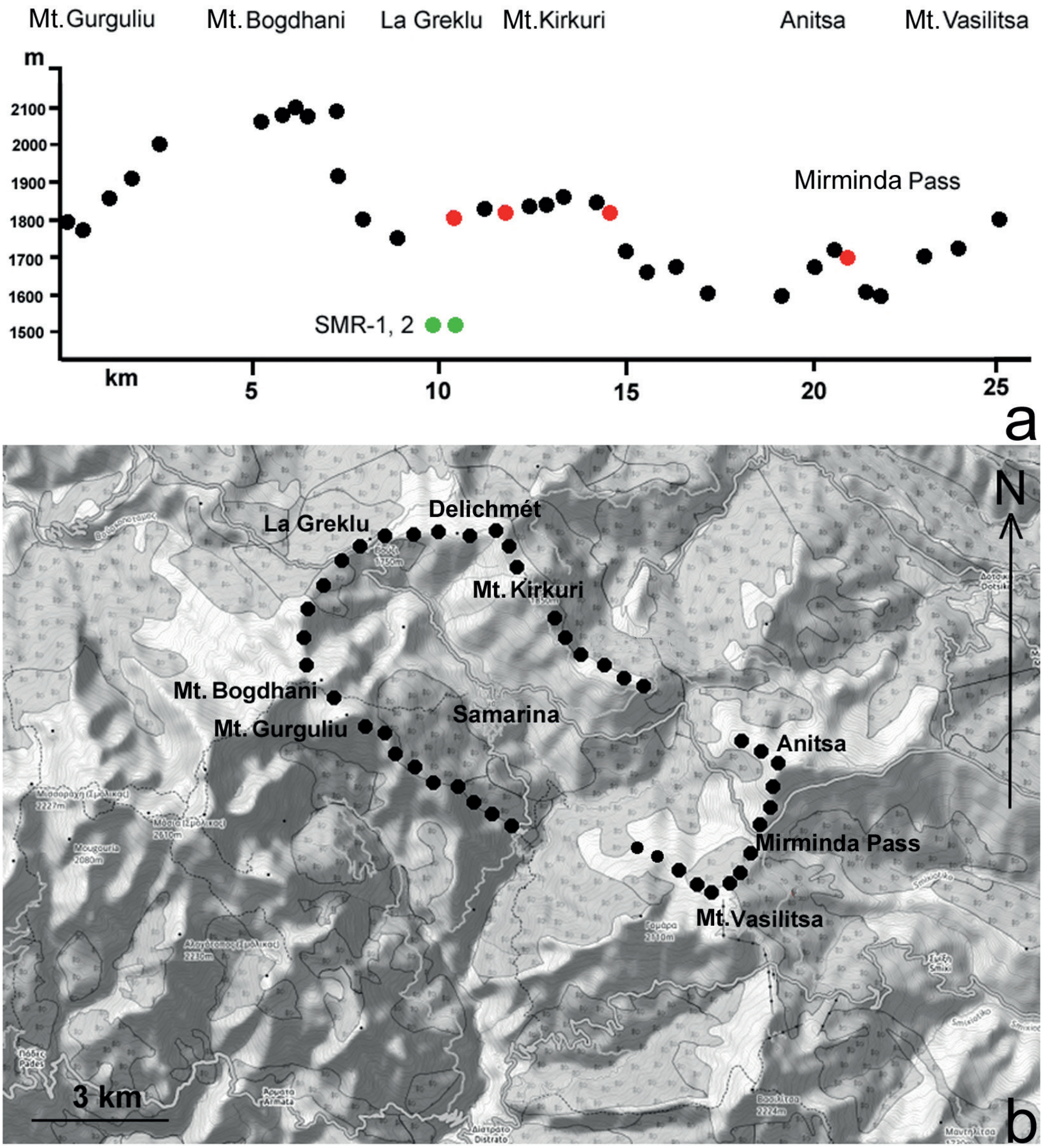


Fig. 6. Samarina basin: altimetric linear position of some of the artefact concentrations along the ridges (a): chert outcrops (red dots), SMR-1 and SMR-2 (green dots). The Samarina drainage catchment, mostly corresponding to the surveyed area, with its watershed (black dots), and some of the name-places mentioned in the text (b) (Source of the topographic map: OpenStreetMap) (Drawing R. Nisbet)

turns straight to the south along a very steep-sided valley of erosional and possibly tectonic origin, to its confluence into the Aoos (Aous) River. In fact, the drainage catchment belongs to the Ionian side, as its waters flow into the Adriatic on the Albanian seaside; but the whole area had, for centuries, much closer economic and demographic links with Western Macedonia than with Epirus. The course of the river partly depends on the nature of the local geology, partly on recent (Late Pleistocene and Holocene) tectonic activity. An uplift of the area and adjacent region for between 40 and 80 m in the last 100ka BP has been described (King, Bailey, 1985; King *et al*., 1994; Hughes, 2004), which accounts for the rejuvenation of both longitudinal and cross-cut profiles, with waterfalls, deep gullies along the slopes and terrace formation on the larger valley bottom.

The asymmetrical cross-section of the valley upstream Samarina (Fig. 7), particularly in the upper slopes, strictly depends on the local geology and the different lithologies (IGME, 1980). The area is dominated by two major structural units, with diverse, more or less stable morphologies (Fig. 8; Pe-Piper *et al*., 2004). The whole eastern and northern sector is formed by the Pindus Flysch, an Early Cenozoic heterogeneous formation corresponding to at least three different units and provenance (Vakalas *et al*., 2004; Konstantopoulou, Vacondios, 2006): sandstone and siltstone; limestone, embedding localized outcrops of whitish chert; silty-clayey unit, corresponding to turbiditic sequences.

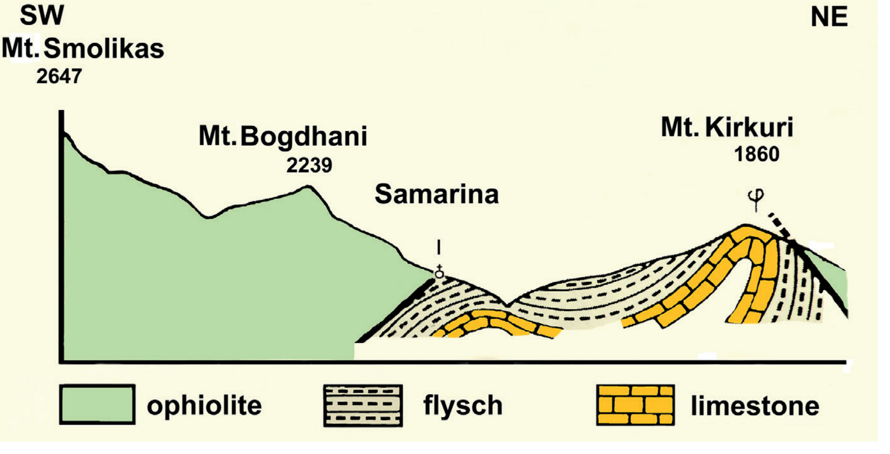


Fig. 7. Schematic geological profile of the Samariniotikos Valley (after Sivignons, 1968, modified R. Nisbet)

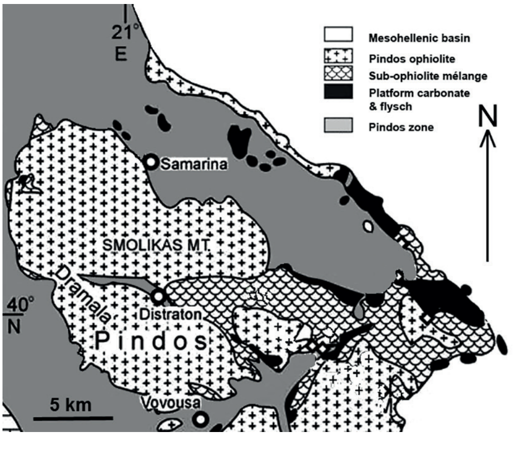


Fig. 8. Geological map of the Pindos Ophiolite Complex (after Pe-Piper *et al*., 2004, modified R. Nisbet)

Mixed sedimentary units with polymictic conglomerates (including pebbles of quartz, radiolarite, and serpentinite) are present also on both sides of the valley, at different altitude. In this area some outcrops of chert, occurring as nodules or seams interstratified in limestone and sandstone, or as large cobbles found occasionally in the erosions and in the outwash fans of the south facing slope, were exploited during the Middle Palaeolithic (Biagi *et al*., 2015c). In the western sector, corresponding to the relief above Samarina, the *flysch* is covered by the Upper Jurassic/Lower Cretaceous ophiolitic complex, comprising gabbros, peridotites and serpentinites. In the last decades these ophiolithes complexes attracted attention due to their origin, evolution and petrographic properties (Jones *et* *al*., 1991; Pe-Piper *et al*., 2004; Rassios, Dilek, 2009), but there is no clear evidence to date of any raw material exploitation by Neanderthals from this geological unit. The morphology of the basin is dictated by different causes. Due to the structure of the geological substratum, the right north facing side of the valley is much steeper than the opposite, which is smoother and lower; nevertheless, both flanks are dissected by deep incisions, whose action is partly connected with the rapid late Pleistocene and Holocene uplift; areal erosion favoured the setting of palaeo-landscapes (possibly Tertiary or Early Pleistocene) with isolated flat surfaces at different altitude, particularly in the Mosia-Bogdhani sectors. The fragility of the colluvial, glacial and periglacial sediments on the valley sides accounts for the frequently observed gravitative phenomena, with at least 30% of the slopes being subject to large landsliding (Konstantopoulou, Vacondios, 2006), particularly on the chaotic *flysch* formation. Debris flows occur mainly where the slopes have been cut by recent roads, or by the action of seasonal channels. According to recent research, the northern side of the Smolikas massif (with Mt. Vasilitsa) was influenced by at least three glacial sequences (Hughes, 2004; Hughes, Woodward, 2006; Hughes *et al*. 2006a; 2006b). The chronology of these glacial deposits has been determined using U-series dating, and soil analysis, mostly based on the southern close Tymphi range. The oldest unit (Skamnellian Stage in Hughes' terminology) pre-dates 350ka BP and has been found, with Levallois Mousterian industries on its eroded top, only above the village of Smixi (eastern slope of Mt. Vasilitsa, 1350 m asl) and Samarina (also with Late Palaeolithic chipped stone tools, 1540 m asl). This unit should correlate with the Mindelian stage of the Alps (OIS-12). A more recent (Hughes's Vlasian) Rissian unit (OIS-6) is present on the eastern and northern slopes of Mt. Vasilitsa, at an altitudinal belt of 1700-1800 m asl, with concentrations of Levallois Mousterian Middle Palaeolithic artefacts. The last (Hughes's Tymphian) phase, corresponding to the Alpine Würm, is located only in small glacial circles on the top of the massif, around and above 2200 m asl. During this period (OIS-5/OIS-2) the ridges around Samarina were therefore free from the ice masses and, what is more important for Neanderthal hunters, easily viable in all directions. The present-day vegetation cover depends on edaphic, climatic and altitudinal conditions as well as on human impact. Pastures are by far the more extended vegetal association (mainly Gramineae and Asteraceae), having been for centuries (up to the present), with their frequent sources and small ponds of excellent water, the main resource for Vlach shepherds (Chang, Tourtellotte, 1993). Nowadays the upper timberline in the Northern Pindus occurs at around 2000 m, with sporadic *Pinus leucodermis* (*P. heldreichii*) and *Pinus nigra* growing at higher altitude (2250 m on the southern side of Mt. Gurguliu), with the last species well adapted also to *flysch* (Debazec, 1971). Under the present climatic conditions (Fotiadi *et al*., 1999) arboreal vegetation might spread on ridges at 2200 m if grazing was absent. Beech forests (sometimes with *Abies borisii-regis*, the Macedonian fir) reach 1900 m, with stands occurring around 2000 m both north of Bogdhani and the southern ridges of Gurguliu. The upper slopes are dominated by pastureland and grasslands, with some protective reforestation of *Pinus nigra* promoted in the last decades, as on the slope above Samarina (Fig. 9) or by barren surfaces on the eroded steeper slopes. Overgrazing endorses local hydrological instability, loss of grass cover and prevents conifer seedlings to develop, thus only limited stands of juniper, protected by their thorns, can spread at the higher altitude.

Lacking any Middle Palaeolithic chronological indicator (e.g., paleosols, charcoal and faunal remains), the chronology of the local Levallois Mousterian industries remains unknown, though a date pertaining to the marine isotope stages OIS-4/OIS-3 is plausible, considering both the artefacts typology and their position in relation to the glacial morphologies. Local palaeoclimatic and environmental data for the period OIS-4/OIS-3, i.e. between 71 and 29ka BP, are totally missing (for dating methods see van Andel *et al*., 2003:28, note 2). However, exceptionally long and continuous lacustrine pollen records over a region of about 100 km from Samarina, such as at Lake Ohrid, 693 m asl (Wagner *et al*., 2009; Lézine *et al*., 2010; Sadori *et al*., 2015), Ioannina, 470 m asl (Tzedakis, 1994; Tzedakis *et al*., 2002) and Prespa, 849 m asl (Wagner *et al*.,

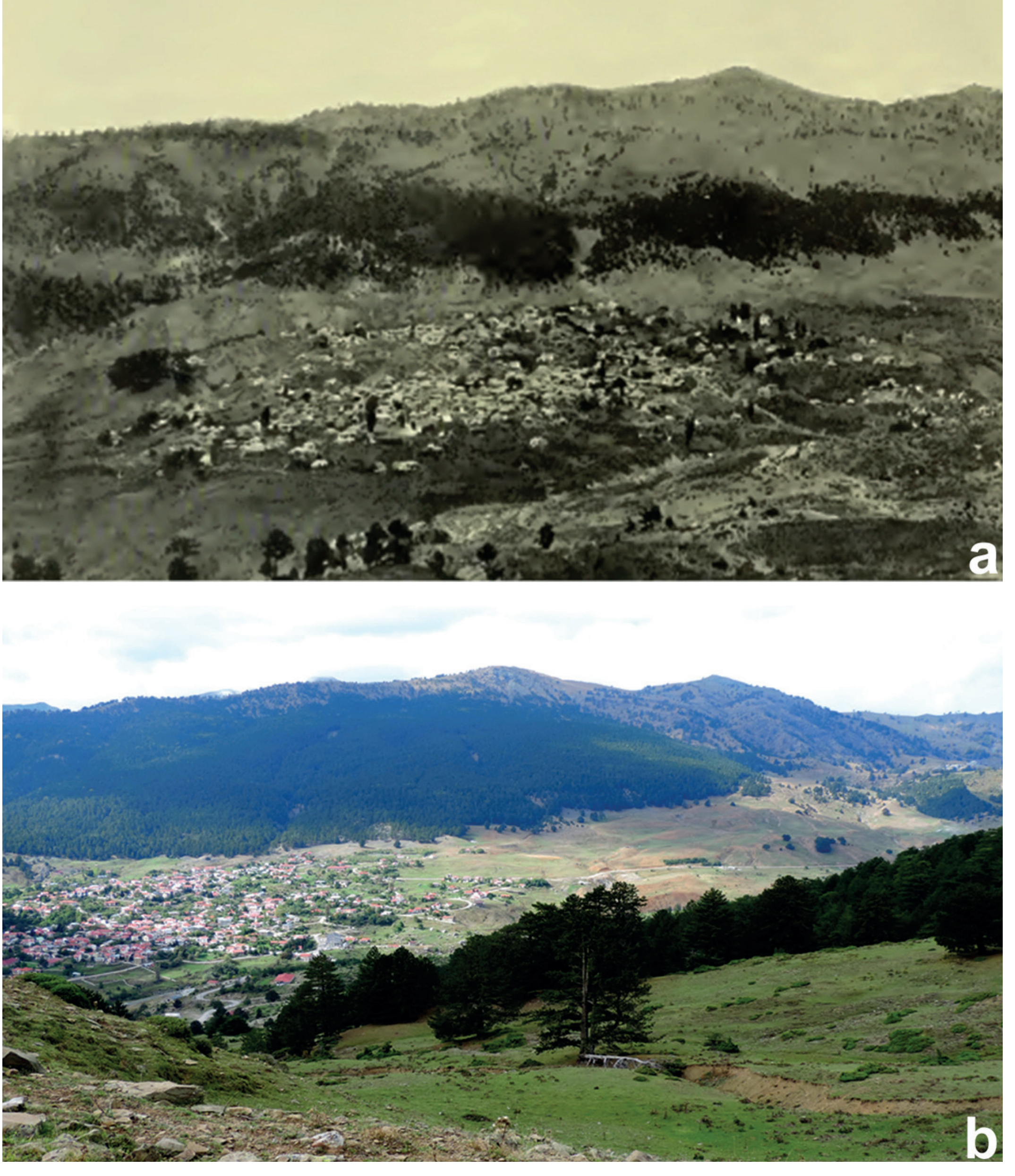


Fig. 9. The north-facing slope of Samarina, in an historical photography from A.J.B. Wace and M.S. Thompson (1914) (a) compared to a picture taken in 2014 (b). Note the ruinous conditions of the upper slope at the beginning of 1900, after centuries of both deforestation and grazing (Photograph R. Nisbet)

2010; Panagiotopoulos *et al*., 2014) can provide, together with other proxies (diatoms, sediments, biogeochemistry) and their exact chronology based on the numerous volcanic ash layers, some provisional, general indication of the landscape at the time of the Neanderthal presence also in the Samarina area, taking in consideration the different altitude and topography. An important aspect has been pointed out regarding the role of Epirus Mountains as suitable areas for sheltering, in some microenvironments of several arboreal *taxa* even during glacial periods, due to the highly humid conditions created by the winds from the Ionian Sea (Gerasimidis *et al*., 2009). This explains why even at higher altitude (i.e. Rezina, 1800 m asl: Willis, 1992) some tree species were present, though sparsely, in the early Postglacial; more doubtful, however, is the possibility of similar refugia at higher altitude, around the Smolikas massif during the full glacial. Changes in the oxygen isotope profile ($\delta^{18}O$) in the Greenland ice cores (GRIP, Greenland ice-core project 1993) provide a sound chrono-climatologic background that can be compared with regional, biological proxies (Grootes *et al*., 1993). Higher $\delta^{18}O$ values correspond to a higher temperature, reflecting warmer interstadials (IS), and the opposite is valid for cooler periods (Fig. 10). A temperature difference of 7-8°C has been suggested between high and low values, at a sudden change from stadial to interstadial conditions, while the return to stadial conditions is much more moderate (Johnsen *et al.*, 1992).

To sum up, from ca. 79ka BP well below an altitude of 1000 m some change in the previous deciduous mixed forests towards an open vegetation occurred gradually, though it was only between 71 and 64ka BP that real steppe conditions were established, with scattered pine and oak in fluctuating proportions. This situation lasted for the following 20 millennia, indicating that OIS-4 was a period of lowering tree line, with an open landscape (pine-dominated wooded-steppe), and a decline in temperature and moisture (at Ioannina: Tzedakis *et al*., 2002; at Ohrid: Sadori *et al*., 2015). A true cold phase occurred probably only between 68 and 59ka BP, corresponding to Interstadials 19 and 17 (Fig. 10).

Since grasslands have a higher carrying capacity for herbivores than woodlands (Sturdy *et al*., 1997), it can be inferred that one of the reasons that pushed Neanderthals to climb these mountains around the end of the OIS-4 stage was hunting. More temperate vegetation is documented in the high-resolution pollen record around Ioannina (Tzedakis *et al*., 2002), particularly at the beginning of the OIS-3 isotopic period (ca. 58-49ka BP) following a much colder phase between 69 and 60ka BP. The early OIS-3 more temperate phase has been described as an example of relative ecological biostasis as well as of a refugia site for temperate tree populations in the uplands of western Greece. These less severe, local conditions also occurred during the Interstadials 21-19 (83 to 68ka BP) and the Middle Pleniglacial (59 to 26ka BP) though characterised by frequent, abrupt climatic oscillations (see Fig. 10). The Pleistocene sedimentary sequences of the Voidomatis, a left tributary of the Aoos River, springing out of the western Tymphi range, can also provide information on some episodes of climatic change, with its events of alluviation (colder, lower precipitation, steppe vegetation) dated around 60ka BP and the subsequent erosion (warmer) phase 55ka BP (Macklin *et al.*, 2001). Both, the climatic consideration and chronologies, match well the GRIP curve. During the last glacial the Pindus range seems to have played an important role as a distinct boundary between the eastern arid and cold side, and the warmer, refuge mid-altitude western side. Higher

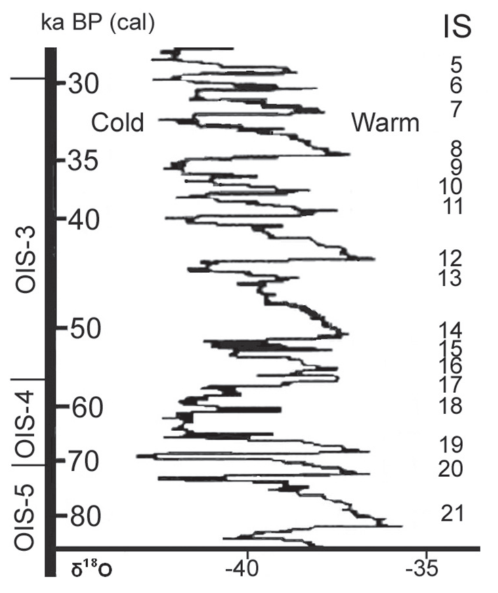


Fig. 10. Greenland GRIP ice-core: segment of the diagram, corresponding to a large part of the last glaciation (OIS-5/OIS-3). Higher $\delta^{18}O$ (‰) values indicate higher temperatures. IS: interstadials (after Dowdeswell, White, 1995, redrawn R. Nisbet)

altitude (as indicated by Prespa pollen records: Panagiotopoulos *et al*., 2014) seems to roughly represent the upper distribution limit of drought-sensitive trees, with possible conifer stands, around 60ka BP and the following millennia. It is therefore probable that in the much higher upper Samarina basin a substantially treeless, dry/cool *Artemisia*-steppe was the dominant landscape during the late OIS-4 and early OIS-3 stages. Small glacial circles formed around the highest Smolikas peaks probably only during the Tymphian glacial maximum stage (OIS-2 according to Hughes, 2004) when Neanderthal groups had disappeared.

SITES LOCATION (R.N.)

The first years surveys were aimed to explore some critical topographies, in particular the saddles along the ridges and around small lakes, ponds and springs, where a few trial trenches were also opened (Efstratiou *et al*., 2003; 2004). This strategy quickly disclosed the importance of the whole sequence of the watersheds, which were thereafter carefully investigated. Nevertheless, the most surprising and largest sites were found, at the end of the 2010 survey, on two close alluvial terraces (SMR-1along the right, inner side of the Samariniotikos, and SMR-2, along its left one) (see Figs 25 and 26). In the last years, one of the most important field activities was to localise the chert outcrops exploited by Neanderthals. Although the first outcrops were discovered already in 2002 along the Delichmét ridge (between La Greklu saddle and Mt. Kirkuri), more chert outcrops were mapped in 2011 and the following years along the same ridge towards the east, and smaller spots were also present 1) along the upper part of the north-northwestern, left, slope of the upper Samariniotikos Valley, south of Delichmét; 2) on the south-western slope of Mt. Kirkuri (Fig. 11a), along the riverbeds and deposits of two tributaries on the left bank of the Samariniotikos (Fig. 11b). More chert deposits and primary nodules were discontinuously found all along the Holy Cross Church area and near the top of Mt. Anitsa (Fig. 12).

The general distribution of the Levallois Mousterian Middle Palaeolithic activity area seems now to be clearly defined, with the aforementioned two main larger working sites; there were other smaller concentrations of artefacts both close to the bottom of the valley and on the upper slopes; as well as hundreds of very localised spots, with scattered flakes of problematic interpretation (Schofield, 1993) often continuously spread for hundreds metres along the upper ridges. Altogether currently at least 2,500 flakes and 90 tools (mostly side scrapers) and cores have been collected outside the two main sites, where little less than 2,000 cores, tools and flakes have been recorded (see Pl. 14). SMR-1, with a well-preserved site surface of ca. 3,000 sqm, though the extent of the archaeological site is undoubtedly larger beneath the present grass cover, and SMR-2, much smaller, steeper and less preserved, are located on the top of two terraces, cut by the Samariniotikos where the stream, abandoning its torrential upper course enters the larger alluvial valley, about 3 km upstream Samarina (see Figs 27 and 30). The two sloping terraces are part of a long alluvial/colluvial foot-slope sedimentary unit, which follows the right side of the stream, about 20 m above the present riverbed. In both sites the erosion of the thin grass cover, due to intense flock movement and grazing, has unearthed several hundred chert artefacts, over a discontinuous area of ca. 400 sqm (SMR-1) and 100 sqm (SMR-2) respectively. A third, much smaller concentration of chipped stone artefacts on the valley floor is present in a larger area, in the so-called “historic camp” located ca. 1 km upstream Samarina, on the ancient (Skamnellian?) moraines. Here, a number of pits filled with charcoal have been dated, from 2940±35 BP (GrA-65415) to 1700±30 BP (GrA-65417). The 2016 survey has led to the location of a third major concentration of artefacts on the river terraces just above le village of Samarina. On both sides of the valley some dozens of chert flakes were collected, though without any clear evidence of a workshop. Similar smaller concentrations of artefacts have been found on the slopes and along the ridges, along or without connection with the chert outcrops. We define “concentration” as a small, well-defined area with some ten or twenty (exceptionally more) flakes, scattered over a radius of no more than 15 m. However, sites like Skopià, La Greklu,

Fig. 11. Mt. Kirkuri south-eastern slopes: chert boulders from the local outcrop (a), and large chert boulder inside a small, seasonal, left tributary of the Samariniotikos (b) (Photographs P. Biagi and D.E. Angelucci)

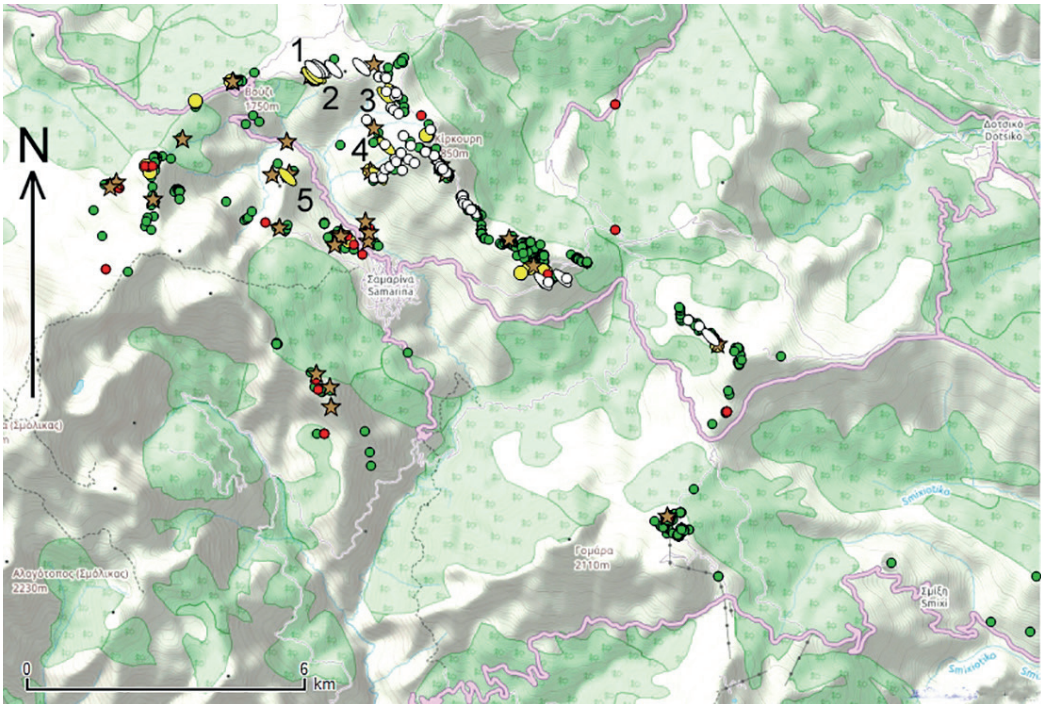


Fig. 12. Samarina basin: location of spots with Levallois Mousterian Middle Palaeolithic lithic finds and chert outcrops. Chert outcrop (white oval), chert nodules (white dot), decortication areas (yellow ovals, nos. 1-5: see Table 1), scrapers (red dots), points (yellow dot), cores (brown stars); flakes (green dots). Some categories have been omitted (crested blades, end scrapers, foliates, bifaces) (Source of the topographic map: OpenStreetMap) (Drawing R. Nisbet)

Vasilitsa and a few others discovered along the SW ridge Kirkuri-Holy Cross Church-Stani of Renda, certainly cannot fall within this definition. Though very different from the two valley bottom sites (SMR-1 and SMR-2), which show some characteristics of residential- or field-camps (*sensu* Binford, 1980; 1982), the aforementioned smaller sites seem more related to the immediate extractive activities, through the presence of chert nodules or outcrops (possibly Skopià, and some sites around the Holy Cross Church, and Anitsa), and/or to game presence. In particular, the whole Delichmét ridge with its frequent chert outcrops was undoubtedly involved in quarrying processes which overlapped with other, less specific activities, as well as hunting (Binford, 1979). At La Greklu, where so far no outcrops have been found, the hilltop is covered by hundreds flakes over an area of about 1000 sqm as if it was a knapping area (Fig. 13). The location of the site, with an excellent view over the whole upper Samariniotikos Valley and the surrounding ridges (the site is located only 1700 m away from SMR-1 as the crow flies), the obvious and easy passage to the northern (Epirus) side as well as to southern and eastern ridges, certainly made this hilltop a preferred area for the Neanderthal hunters.

In spite of the presence of nodules and small outcrops of good quality chert, Mt. Anitsa seems to have played a secondary role in the Neanderthal routes, as no large concentrations of flakes have been so far found around this otherwise important hilltop. Nevertheless, its importance is undisputable, connecting the Kirkuri-Renda Stani ridge to one of the most important strategic and topographic points of the Samarina basin, the Mirminda (Mormide) Pass at 1566 m of altitude (N40°04’49.2”-E21°04’52.4”), opposite

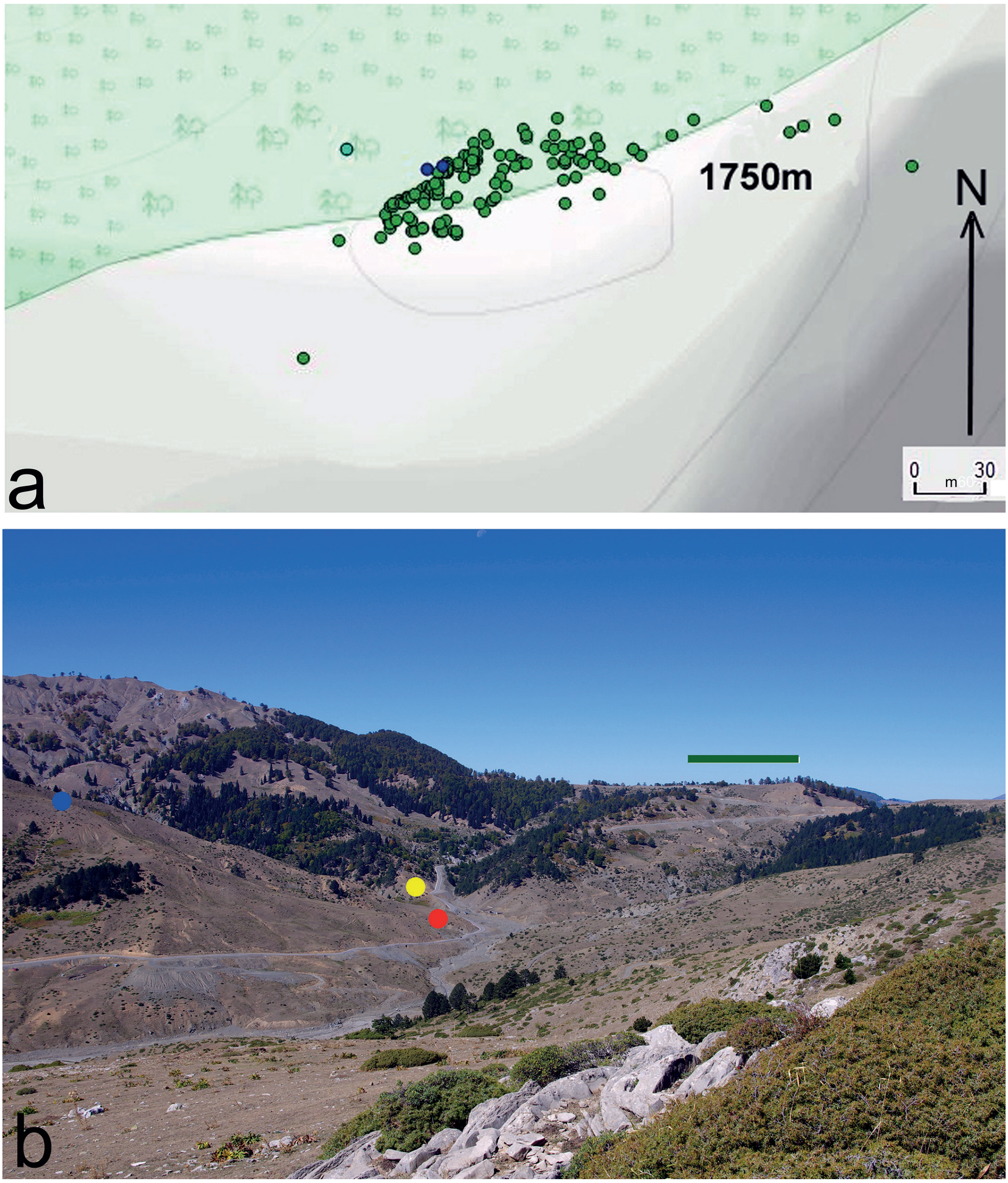


Fig. 13. La Greklu: distribution map of the chipped stone artefacts recorded from the surface (green dots) and Bronze Age potsherds (blue dots) (a); view of the upper Samariniotikos Valley with the location of La Greklu (green line), SMR-1 (red dot), SMR-2 (yellow dot), and Skopià (blue dot) (b) (Drawing R. Nisbet, photograph P. Biagi)

to La Greklu, at a distance of 12.7 km along the NW-SW long axis of the elliptical Samarina basin (see Fig. 6). The recent construction and widening of routes at the pass that destroyed the original morphology of the landscape, unfortunately prevent us from any possibility of a further careful inspection of this important spot. From here, however, it is still possible to follow the Mousterian movements toward the sites on the northern side of Mt. Vasilitsa. Here several concentrations are present, over a span of some hundred metres, frequently on the surface of small moraines (Vlasian/Rissian according to Hughes, 2004) and around small lakes or springs. The western side of the basin is dominated by the steep and rocky (in its upper part) flanks of the Gurguliu-Bogdhani range. Large parts of this area are densely forested, with rare open pastoral spaces up to the ridge, except where steepness, erosion and consequent soil loss prevented trees to grow. Under such conditions the whole surface could not be surveyed. Nonetheless, several scattered flakes, some scrapers, points and cores have been found on the ridge above Samarina, at an altitude of 1915 m, broadly following the watershed trail. Of particular interest, for its proximity to the main chert outcrops, is the slope from the ridge around Kirkuri and the Samariniotikos, with some of its draining gullies. In this large area many nodules of chert, up to 80 cm in diameter and several kgs of weight, are found all along some of the streams down to their mouth, within 0.5 km from SMR-1 (Fig. 14). In several spots of the upper slope, large areas scattered with flakes and cores are not infrequent. In-between them some decortication areas have been found.

Most of the decortication areas have been discovered along the upper southern slopes of the watershed extending between La Greklu and Kirkuri (Biagi *et al*., 2015c:fig. 2), where most of the Neanderthal activity seems to have taken place close to the raw material outcrops. Here the decortication areas consist mainly of primary and secondary flakes sometimes scattered around tested boulders (Fig. 15), and a few large cores from which flakes have been detached by hard hammering (Pl. 2) (see Binford, O'Connell, 1984). The precise location and the main characteristics of four decortication areas are provided in Table 1.

While all these knapping areas are close to, or directly on the routes on the ridges, an interesting exception is Skopià, along the northern slopes of Mt. Bogdhani, some 1 km south of SMR-1, between 1647 m and 1674 m of altitude (Fig. 16). Skopià is the only dense concentration of debitage flakes so far discovered in this part of the valley. It was surveyed and mapped in 2014 and 2015. 419 flakes were concentrated as a central, C-shaped oval cluster some 20 x 12 m wide, around which single flakes were scattered, covering a total surface of ca. 30 x 40 m. Some 20 m east-southeast of the decortication area a large chert boulder was found almost totally embedded in the soil (Fig. 16). This decortication area greatly differs from those discovered along the watershed just in front of Skopià that are incredibly rich in raw material available for testing due to the abundance of chert boulders and seams in the whole area (Fig. 17).

The Samarina basin, surrounded by a mountainous 'crown' over nearly 360°, is quite an isolated zone, as already noticed by several authors (i.e. Wace, Thompson, 1914; Hammond, 1967:266; Sivignon, 1968). In this respect, the presence of saddles and passes is of particular importance as regards movements of hunters and raw materials. First of all, we should point out that, in spite of years of research, so far very little evidence of Middle Palaeolithic chipped stone artefacts has been found for kms outside the mentioned area. That said there are no more than 4 (or 5) possible easy passages between Samarina basin and the surrounding regions. La Greklu Pass (1869 m) is the way to the Epirus side, and the far Ionian/Adriatic coast. It links the two diverging ridges, south toward Mt. Bogdhani, east to Kirkuri and the main chert outcrops (Fig. 18).

Opposite, the low and wide Pass Mirminda (1566 m) connects the Samarina basin with the Grevena Plain and the Aliakmon River, no more than 40 km eastward and 2 days' walk. Some concentrations of chert flakes were found on this side, not far from the village of Philippei, and Aghios Elias (Pl. 16:7). Besides, this pass joins the Kirkuri-Anitsa ridges with the important Vasilitsa-Gomara Group, rich in springs and small glacial lakes. A third passage, still awaiting further exploration, is located in the short valley (Valia Niniza, Milas stream), which opens between the Kirkuri and Anitsa ranges. This valley and its easily reached top are probably the easiest path to the Venetikos catchment, an important tributary of the Aliakmon. The last, less obvious pass, is the saddle between Mts. Gurguliu and Bogdhani, where IX century AD potsherds (F. Curta, pers. comm. 2012) have been recovered on the surface. At a much higher elevation (2144 m), it provides

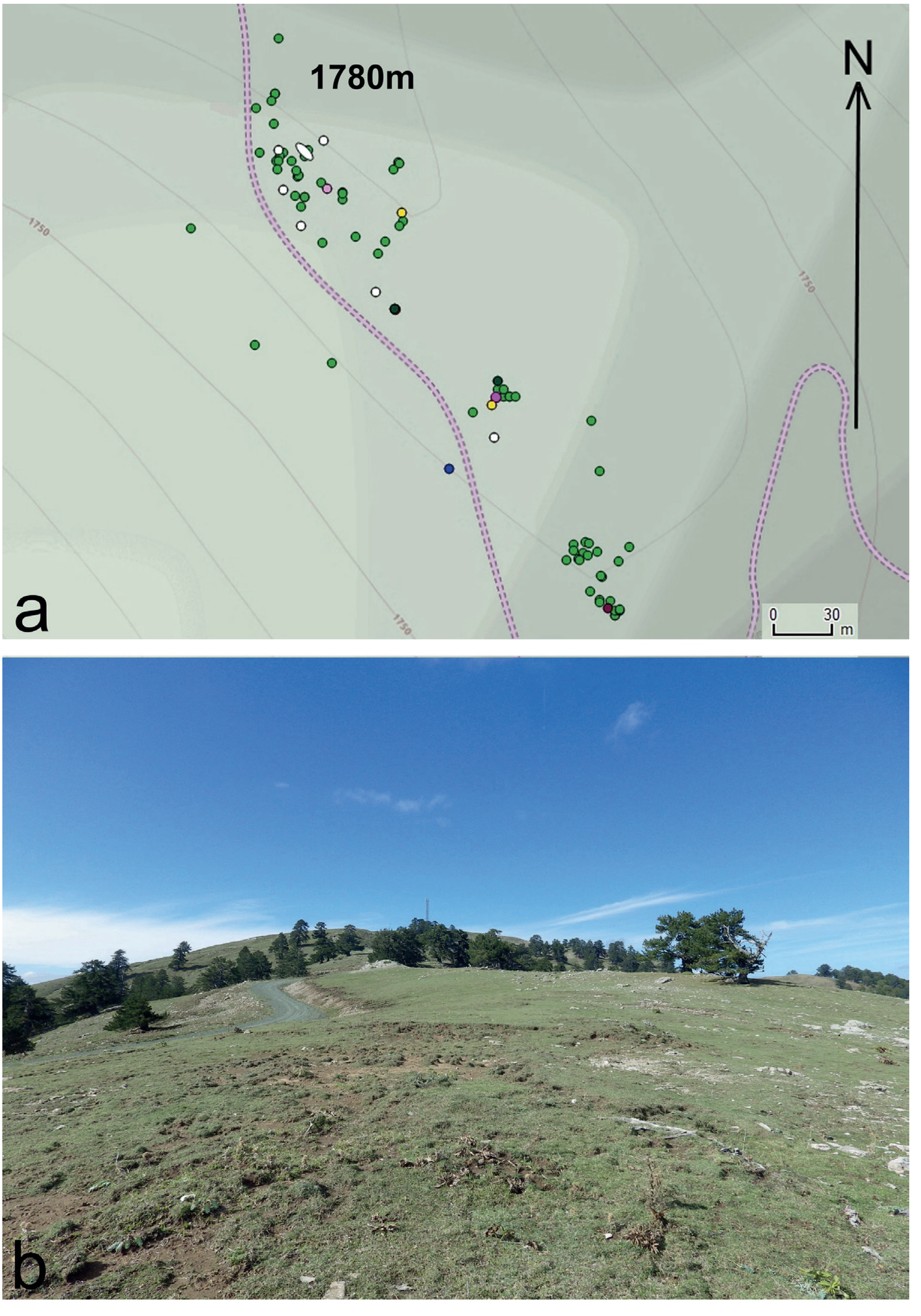
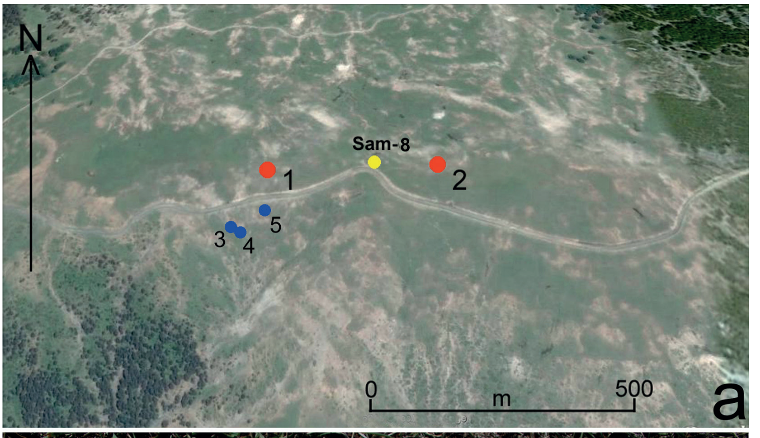


Fig. 14. Kirkuri B (KRK-B): the ridge south-east of the mount with the location of chipped stone artefacts. Scrapers (yellow dots), foliate (violet dot), biface (dark green dot), cores (blue dots), flakes (light green dots), chert outcrops (white ovals), nodules (white dots) (Source of the topographic map: OpenStreetMap) (Drawing R. Nisbet, photograph P. Biagi)



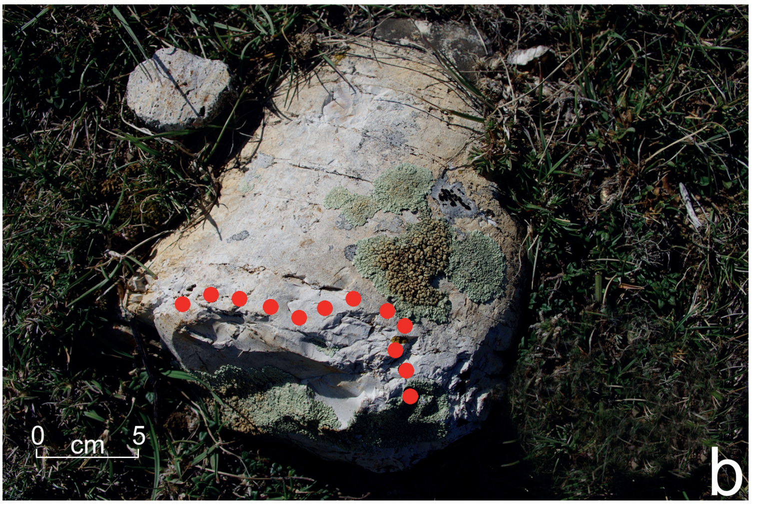


Fig. 15. Delichmét: location of the characterised chert samples (nos. 1 and 2) in relation to site Sam-8, and the three pre-cores illustrated in Pl. 2 (n. 3 = pre-core n. 1, n. 4 = pre-core n. 2, n. 5 = pre-core n. 3) (a); local chert boulder with testing traces (b) (Drawing and photograph P. Biagi)

Table 1. Geographic locations and characteristics of the decortication areas discovered south of Delichmét (see Fig. 12)

Site	Coordinates	Altitude (m)	Radius (m)	Pieces	100% cortex	75% cortex	50% cortex	25% cortex	No cortex	Figure (yellow ovals)
Dec. Area 1	N40°07'58.7"-E21°01'08.1"	1776	ca. 5x5	30	15	2	2	0	11	12, n. 1
Dec. Area 2	N40°07'58.7"-E21°01'02.6"	1746	ca. 5x5	30	13	0	2	0	15	12, n. 2
Dec. Area 3	N40°07'30.0"-E21°01'02.8"	1739	ca. 5x5	30	1	4	3	0	22	12, n. 3
Dec. Area 4	N40°07'14.2"-E21°00'57.0"	1664	ca. 10x10	52	17	1	8	3	23	12, n. 4
Skopià	N40°07'13.6"-E20°59'54.0"	1647-1674	ca. 20x13	51	1	1	2	0	47	12, n. 5

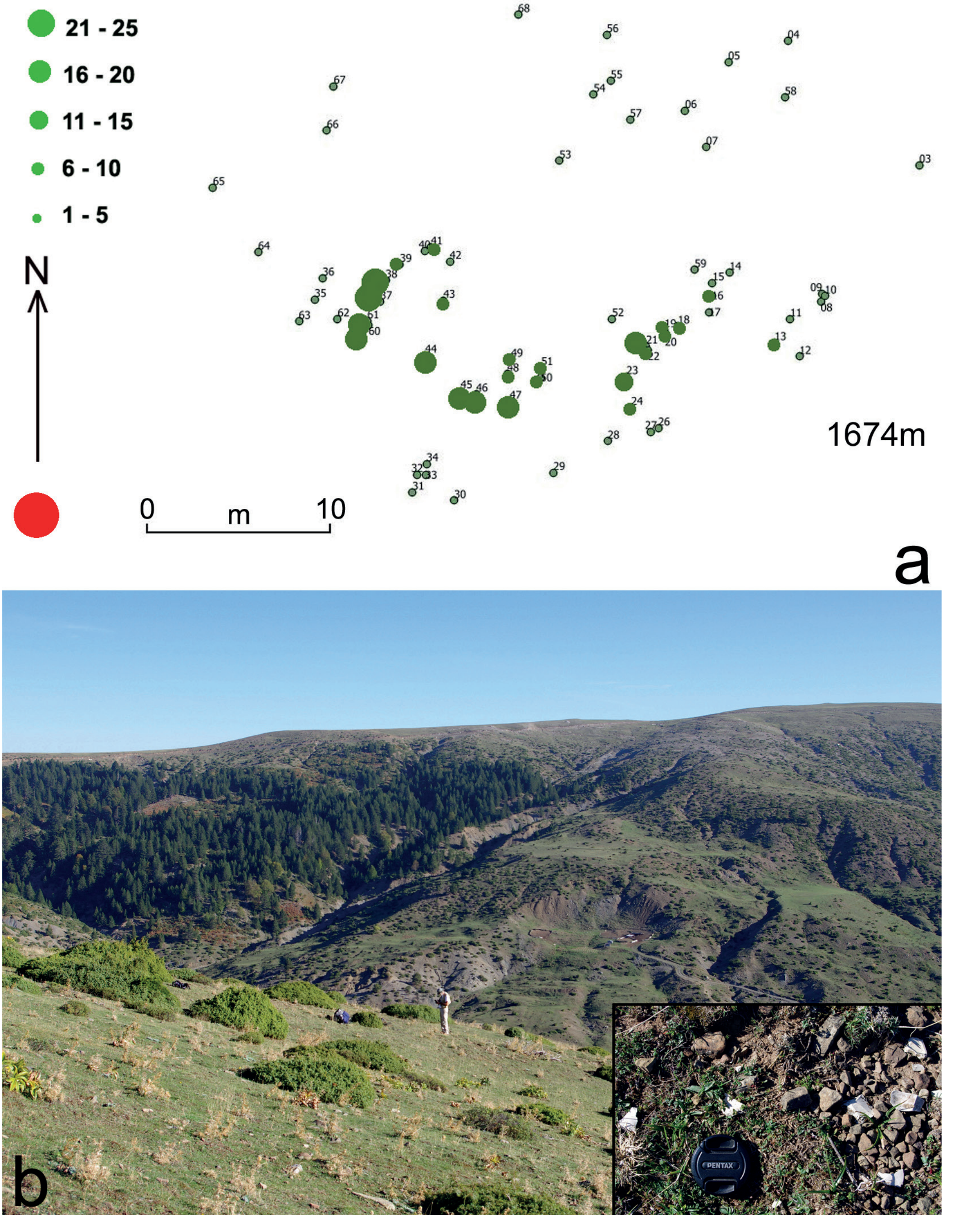


Fig. 16. Skopià: distribution map of the chipped stone artefacts mapped on the site's surface and their number (green dots) in respect to the only chert boulder (red dot). Note the C-shaped cluster of the central area (a); the site, along the northern slope of Mt. Gurguliu at 1647-1674 m of altitude, from the south-east (b) (Drawing R. Nisbet, photograph P. Biagi)

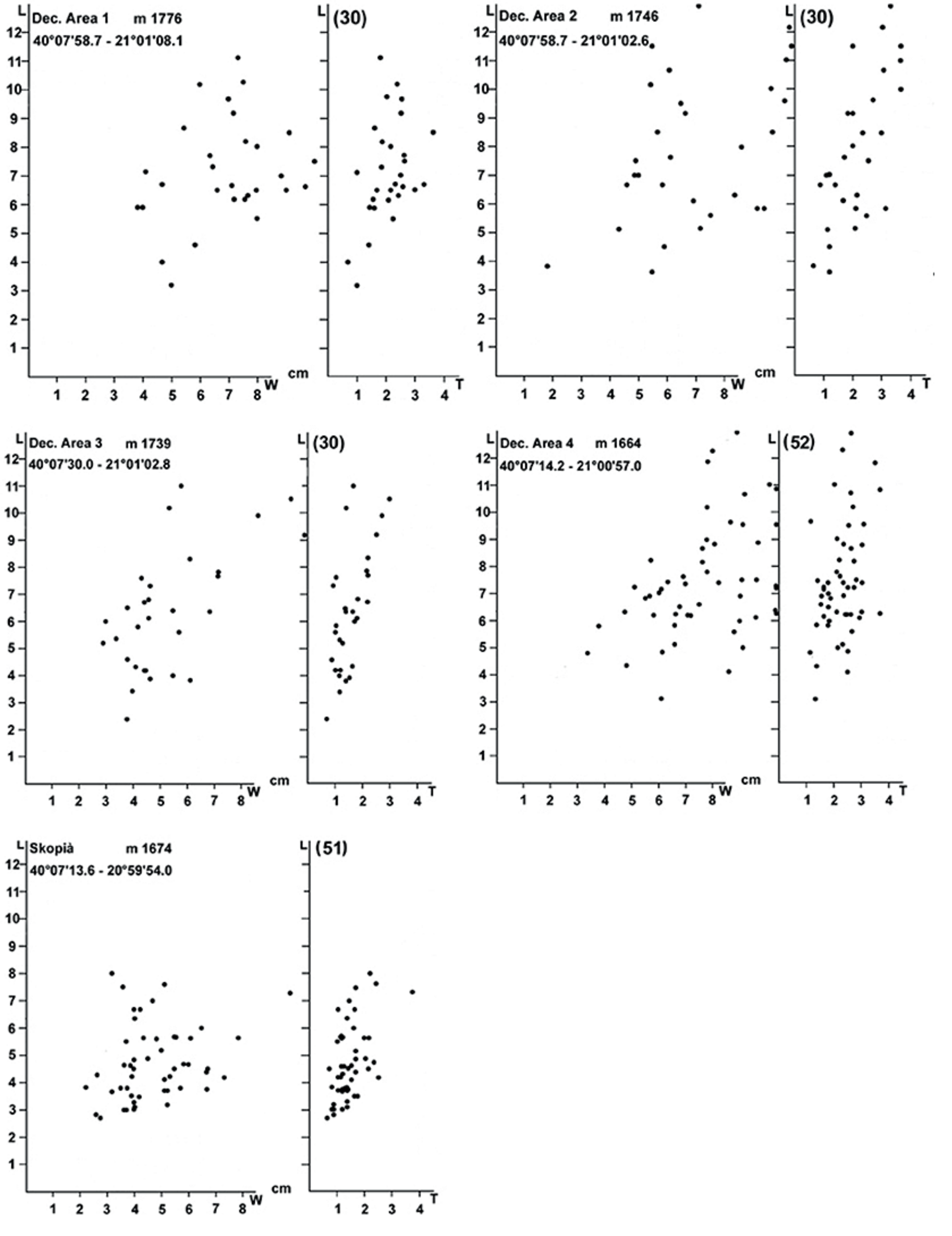


Fig. 17. Length/width and length/thickness scatterplots of the unretouched artefacts from the five decortication areas of Table 1 and Fig. 16 (Drawings P. Biagi)

Fig. 18. The watershed that elongated from La Greklu Pass, on the left (west), to Mt. Kirkuri, in the centre, and Mt. Anitsa, on the right (east) from the upper slopes of Mt. Bogdhani (Photograph P. Biagi)

other paths towards Epirus and the northern and eastern flanks of Mt. Smolikas, with their numerous springs and lakes. A few gaps along the ridges remain to be explored in detail during the next surveys. The steep and slipping northern and eastern sides of Gomara, along the Mirminda torrent, precipitously facing the River Greko, represent very unfavourable conditions for the preservation of pre-Holocene sediments. On the contrary, the short Valia Niniza, separating the Kirkuri/Renda and the Anitsa, should provide further information on Neanderthal presence along the ridges, closing a circle of almost 30 km in the uplands.

ANALYSIS OF THE RAW MATERIAL SAMPLES FROM TWO OUTCROPS (R.M.)

Siliceous rock samples very similar to the raw material exploited by the Neanderthals were collected in 2013 from two outcrops not far from areas scattered with chipped stone artefacts and remains of decortication activity (Fig. 19). The samples have been analysed by one of the authors (R.M.) at the Institute of Geological Sciences of the Polish Academy of Sciences in Warsaw (PL) with optical polarizing microscope and Scanning Electron Microscope (SEM).

Sample 1

One siliceous rock sample collected from the locality named Samarina-outcrop 0 (coordinates: N40°08'11.0"-E21°00'12.3": 1770 m) (Fig. 15a:1) located along the Delichmét watershed between La Greklu and Kirkuri, has been analysed to characterize the raw material from a petrographic point of view. The rock sample is not uniform in its mass. It is not a homogeneous sedimentary rock. Macroscopically, it consists of darker and lighter parts divided by sharp boundaries that seem to be identical, though differing in colour: the first is dark grey, the second cream yellow reflecting different mineralogical compositions. However, these parts of different shade do not result from

Fig. 19. Decortication flakes at (N40°07’14.2”N-E21°00’57.0”) (a) and a chert boulder with removed flakes recorded at N40°07’30.0”-E21°01’02.8” (b) south of La Greklu-Kirkuri watershed (Photographs P. Biagi)

depositional processes. The sample contains (from the outside inwards): limestone, siliceous limestone, calcareous chert, non calcareous chert, and chalcedony. The classification is based on the quantitative proportions of the carbonate minerals ($CaCO_3$ – e.g. microcrystalline calcite) and amorphous or cryptocrystalline silica (SiO_2 – e.g. opal, cristobalite, tridymite and cryptocrystalline quartz).

Dark part of the rock – siliceous limestone

The thin-section analysed under optical polarizing microscope, portrays a large quantity of carbonates (Fig. 20:1-3). Silica (SiO_2) is scattered through the rock with no clear concentrations. This diffusion of silica causes the considerable hardness of the rock. Its marine origin is confirmed by the presence of foraminifera ‘ghosts’ (Fig. 20:3).

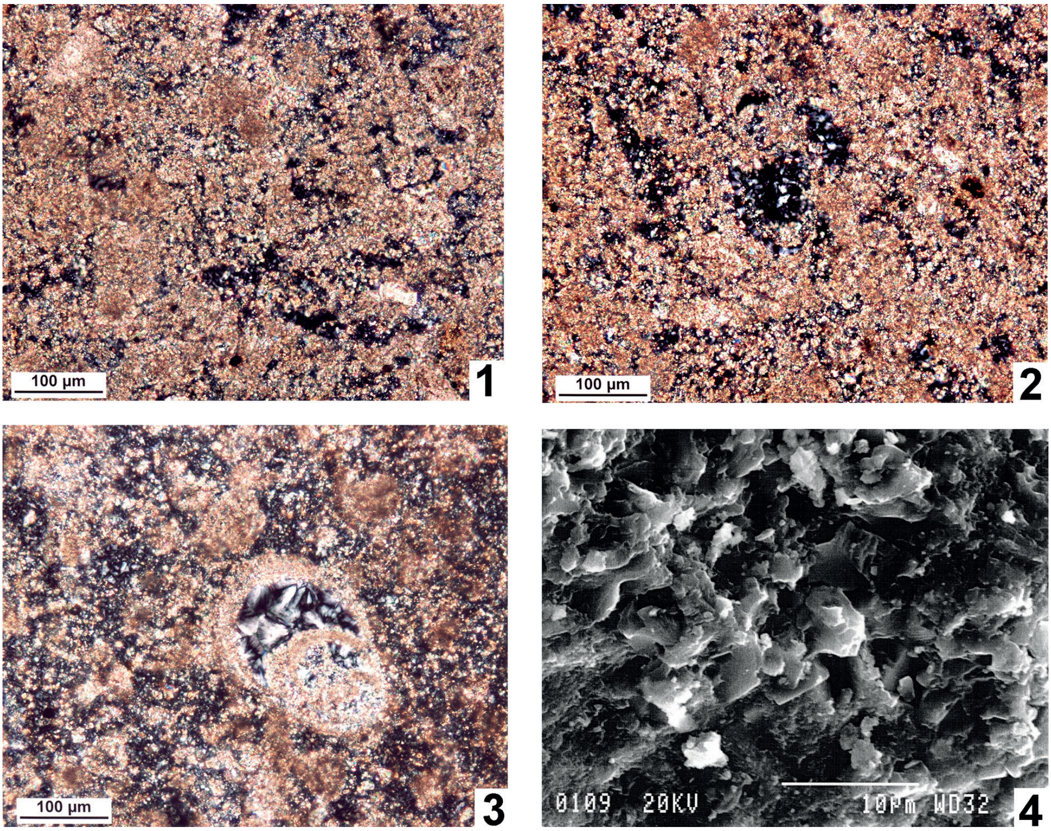


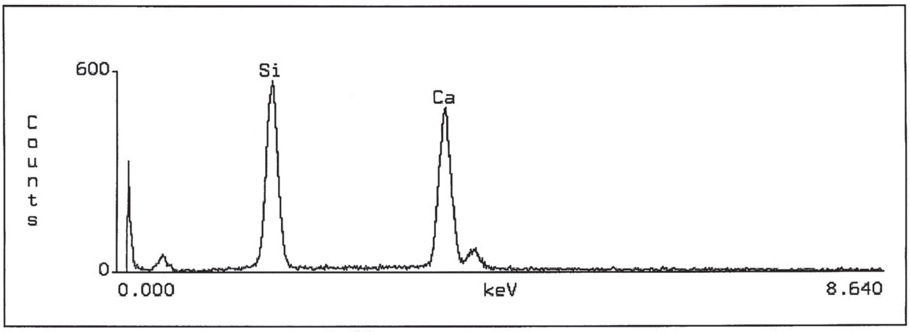
Fig. 20. Sample 1 (Samarina-outcrop 0): siliceous limestone, dark part of the rock; thin sections under polarizing microscope (crossed nicols) (nos. 1-3); SEM image at 3000X (n. 4) (Photographs R. Michniak)

The calcite microcrystals can be observed under a scanning electron microscope (SEM, see Fig. 20:4) at 3000X. Microprobe analyses (SEM-EDS) in window mode (area of ca. 1170 μm^2) are reported in Fig. 21 and Table 2. The two spectra (Fig. 21a-b) show the presence of Si and Ca peaks in different amounts. The analyses confirm the compositional grading of the rock. To sum up, from the petrographic point of view, the darker parts can be described as siliceous limestone.

Light part of the rock – non calcareous chert

The light part of the rock, observed under optical polarizing microscope (Fig. 22:1-2), turns out to be completely different, to some extent contrasting the dark part. Also this part can be referred to as of a marine environment, because of the presence of foraminifera, which are hard to identify because they are entirely silicified (Fig. 22:2).

The differences start to be clearer only under optical polarizing microscope, where the light part shows the features of an almost pure siliceous rock (Fig. 22:1-2). The observed under SEM brown precipitates in the dominating siliceous material, should be secondary Fe-bearing carbonates.Two SEM pictures (Fig. 22:3-4) show the empty holes left after the extraction of mineral particles. The SEM-EDS microanalysis in window mode of the entire surface presented in Fig. 22:4, shows a spectrum characterised by a silicon (Si) peak, without any other significant peaks (Fig. 21). The calculated silica (SiO_2) content (Fig. 21c) reaches 98.13%, and calcium and iron oxides are present in low percentages (<1%). Thus, the lighter parts

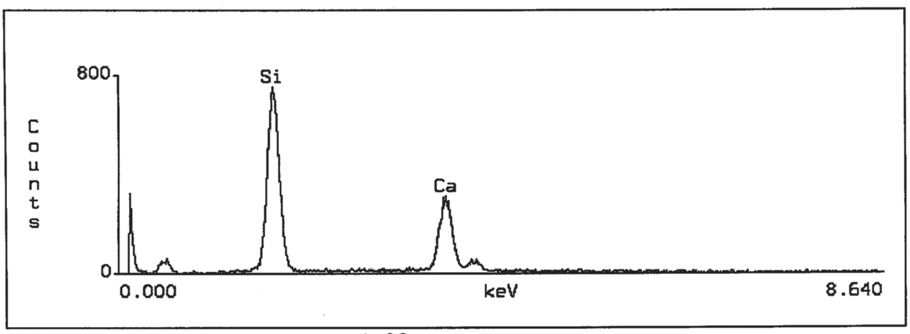


1-03

Accelerating Voltage: 15 KeV
Live Time: 60 seconds

Take Off Angle: 40°
Dead Time: 0.622

a

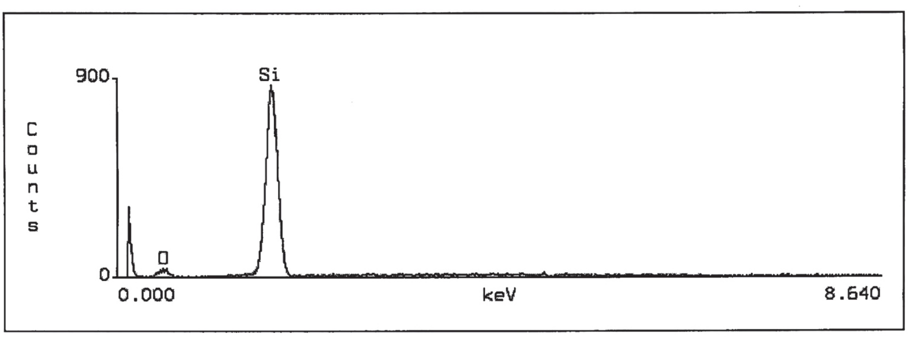


1-02

Accelerating Voltage: 15 KeV
Live Time: 60 seconds

Take Off Angle: 40°
Dead Time: 0.704

b



1-01

Accelerating Voltage: 15 KeV
Live Time: 60 seconds

Take Off Angle: 40°
Dead Time: 0.627

c

Fig. 21. Sample 1 (Samarina-outcrop 0): spectra of SEM-EDS analysis (window mode, 3000X): a) siliceous limestone, dark part of the rock (area represented in Fig. 20, n. 4, ca. 1170 μm^2); b) siliceous limestone, dark part of the rock, ca. 1170 μm^2; c) chert, light part of the rock (area represented in Fig. 22, n. 4, ca. 1170 μm^2)

Table 2. Sample 1 (Samarina-outcrop 0): table with calculated quantitative chemical analysis (window mode, ca. 1170 µm^2, standard-less, normalised at 100%): a) siliceous limestone, dark part of the rock (corresponding spectrum in Fig. 21a); b) siliceous limestone, dark part of the rock (corresponding spectrum in Fig. 21b); c) chert, light part of the rock (corresponding spectrum in Fig. 21c)

Wt % oxides	**a) pole 1-03 dark part**	**b) pole 1-02 dark part**	**c) pole 1-01 light part**
SiO_2	45.42	62.07	98.13
TiO_2	0.00	0.49	0.29
Al_2O_3	0.00	0.00	0.00
Cr_2O_3	0.00	0.00	0.21
FeO	0.00	1.44	0.56
MnO	0.21	0.00	0.22
MgO	0.30	0.00	0.00
CaO	53.85	35.72	0.58
Na_2O	0.16	0.00	0.00
K_2O	0.06	0.27	0.00
Total	100.00	100.00	100.00

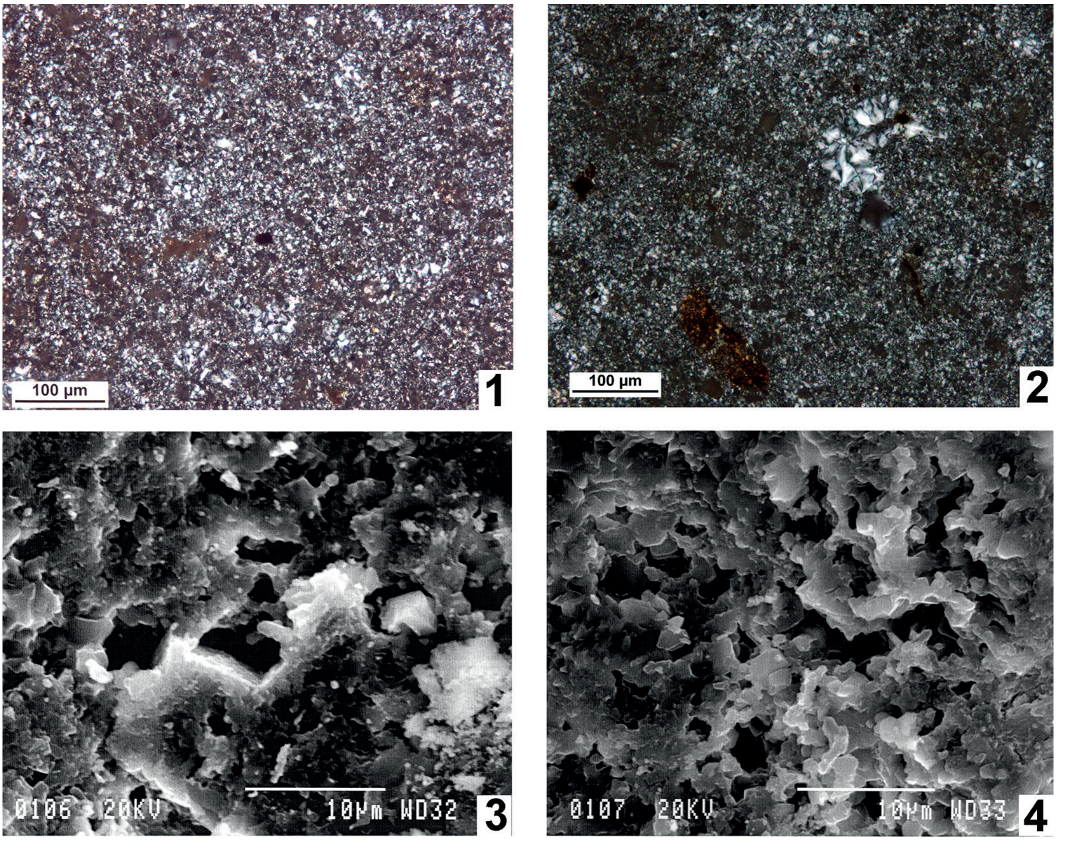


Fig. 22. Sample 1 (Samarina-outcrop 0): chert, light part of the rock in thin section under polarizing microscope (crossed nicols) (nos. 1 and 2); SEM pictures magnified at 3000X (nos. 3 and 4) (Photographs R. Michniak)

of the rock could be identified as a typical non calcareous chert, a medium-quality raw material vis-à-vis its knapping properties.To sum up, the studied sample in both of its colour varieties is a microcrystalline, compact rock. From a textural point of view, the rock is quite homogeneous, neither crystallization micro-pockets, nor secondary mineral precipitations are visible; the colour variability is due to a different mineral composition.

Sample 2

A second sample of siliceous rock was collected in the locality named Samarina-outcrop 4 (N40º08'11.0"-E21º00'26.1": 1790 m) (Fig. 15a:2), again located at Delichmét, along the La Greklu-Kirkuri watershed, analysed for the same purpose as the first sample.

Non calcareous chert

The analysed specimen is a clast collected from the surface of the outcrop. It exhibits a strongly weathered outer part (ca. 1 cm thick) and an inner part clearly affected by a post-lithification mobilization of manganese (probably) and iron forming compounds, which are not detectable by means of optical examination. The thin-section analysis using optical polarizing microscope shows absence of carbonates (Fig. 23:1-3). Also the foraminifera are completely silicified, and the rock is made only of cryptocrystalline quartz and minor brownish minerals (probably due to water circulation during weathering phases).

Nevertheless, observing the SEM images the presence of carbonates in the primary deposits, during the times of the rock's lithification, can be suggested. In Fig. 23:5 (magnified at 1000X), some rhombohedric 'holes' can be clearly observed. They are the traces of the euhedral calcite microcrystals possibly dissolved during the diagenetic processes. The SEM-EDS spectrum and microanalysis (Fig. 24) evidence the presence of high amounts of silicon (98.23% of SiO_2) with lower amounts of iron (FeO=1.23%) and calcium (CaO=0.06%). The presence of iron and the nearly absence of calcium could be related to diagenetic mobilization processes. At lower magnification under SEM (200X) the aforementioned 'holes' are visible (like nests) in larger agglomerations. Such a microtexture, which is rarely met in the siliceous rocks, could be the main typomorphic feature of the rock from which the sample derives.

The rock consists of nearly pure cryptocrystalline silica. The observation by SEM (3000X) confirmed that the silica (SiO_2) is pure, without any mineral admixtures or contaminations. The spectrum and the calculated analysis obtained by EDS in a window at the same magnification (area of ca. 1170 μm^2) are shown in Table 3. Only the silicon (Si) peak is notable, though in the reported analysis (Table 3), there are, besides the silica (SiO_2=97.41%) also some different elements in trace amounts: titanium dioxide (TiO_2), calcium oxide (CaO), iron oxide (FeO), magnesium oxide (MgO), potassium oxide (K_2O), and sodium oxide (Na_2O), which occurred in the rock after the diagenetic stages, possibly during weathering processes.

On the basis of the whole chemical analysis, we are not capable to identify the species of minerals present in trace amounts in the analysed sample, though they are undoubtedly connected with the brownish precipitations observed in all the rock mass shown in Fig. 23:1-3. The siliceous rocks are generally of a great interest for petrographers, because the amorphous and/or cryptocrystalline stage of such compounds represent the very first stage, 'an embryo', of crystallization processes during the transition from an amorphous state. The observation of the surface of the sample, magnified to 10000X under SEM, does not add anything new to our description. The results of SEM-EDS analysis on a window at this magnification (area of ca. 115 μm^2) are reported in Fig. 24c and Table 3c. Only the peak of silicon (Si) is appreciable in the spectrum, and the calculated silica content is very high (SiO_2=99.30%). The other chemical elements are present only in trace amounts.To sum up, from the petrographic point of view, the analysed rock can be described as non-calcareous chert, which, if not weathered, could be considered a very good quality knapping material.

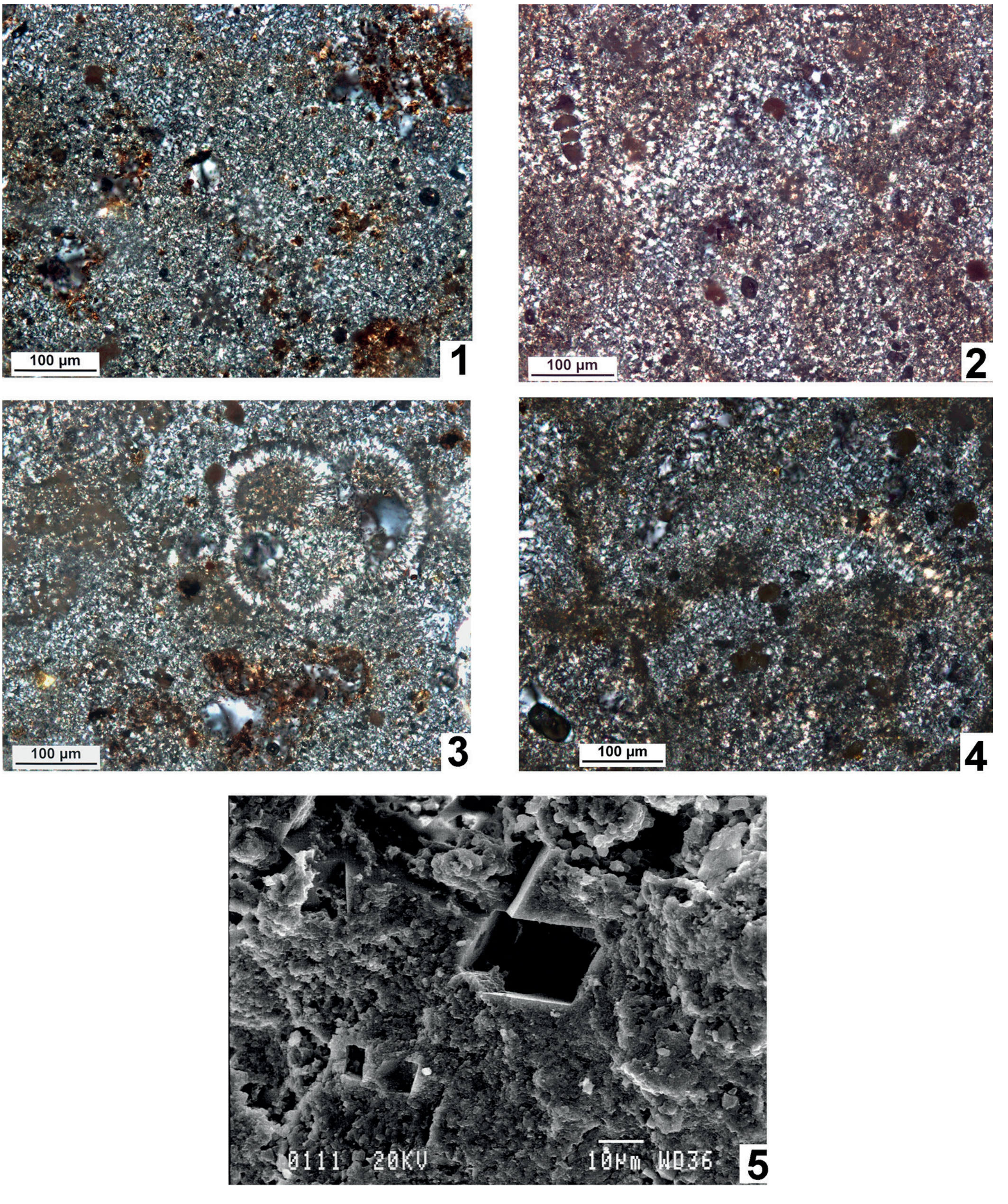


Fig. 23. Sample 2 (Samarina-outcrop 4): non-calcareous chert: thin sections under polarizing microscope (crossed nicols) (nos. 1-4); SEM image at 1000X (n. 5) (Photographs R. Michniak)

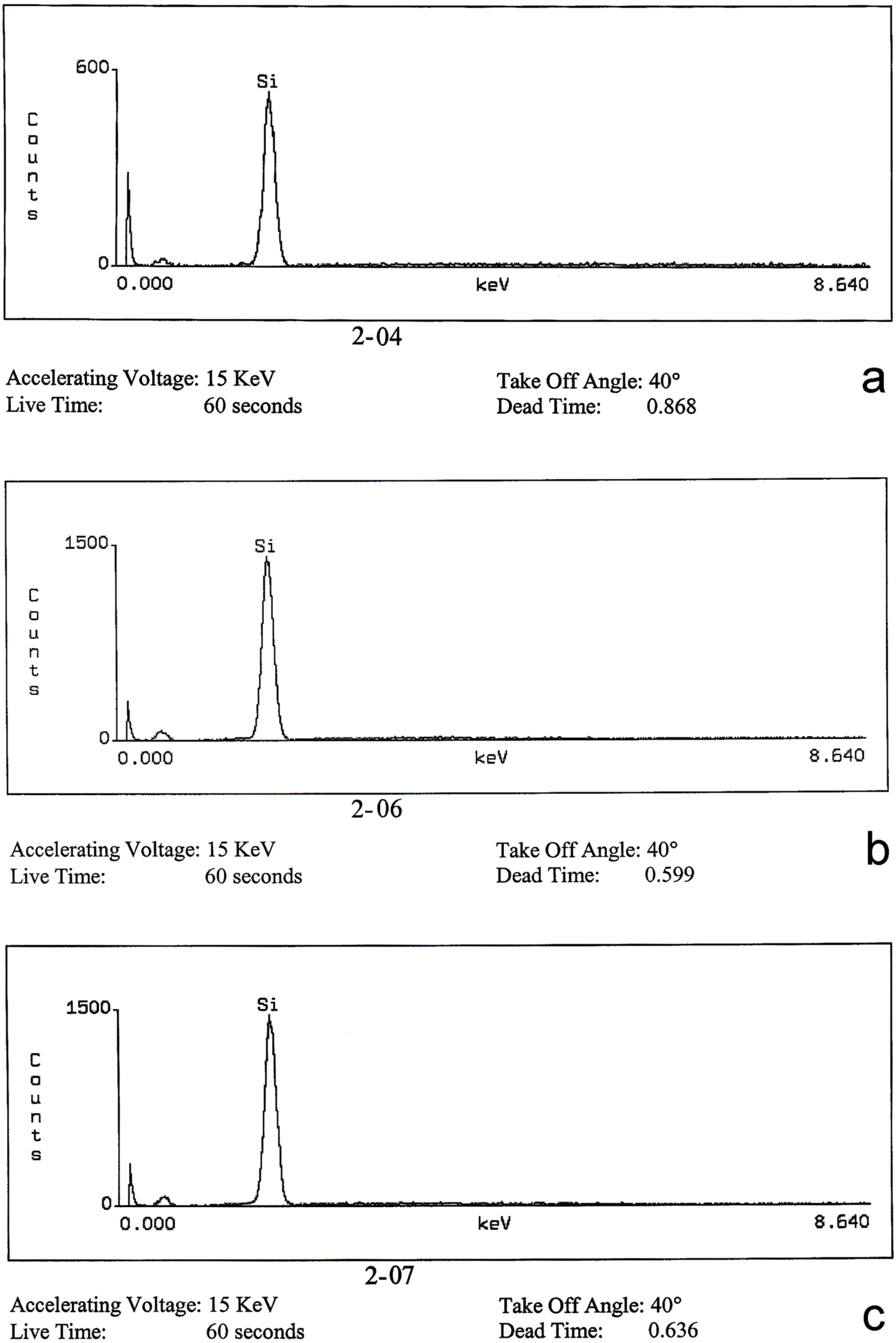


Fig. 24. Sample 2 (Samarina-outcrop 4): non-calcareous chert: spectra of SEM-EDS analysis (window mode): a) area represented in Fig. 23, n. 5, ca. 11484 μm^2; b) small area ca. 1170 μm^2; c) very small area, ca. 115 μm^2

Table 3. Sample 2 (Samarina-outcrop 4): non calcareous chert: table with calculated quantitative chemical analysis (window mode, standard-less, normalised at 100%): a) area represented in Fig. 23, n. 5, ca. 11484 μm^2 (corresponding spectrum in Fig. 24a); b) small area, ca. 1170 μm^2 (corresponding spectrum in Fig. 24b); c) very small area, ca. 115 μm^2 (corresponding spectrum in Fig. 24c)

Wt % oxides	**a) pole 2-04**	**b) pole 2-06**	**c) pole 2-07**
SiO_2	98.23	97.41	99.30
TiO_2	0.48	0.41	0.00
Al_2O_3	0.00	0.00	0.00
Cr_2O_3	0.00	0.26	0.00
FeO	1.23	0.23	0.06
MnO	0.00	0.66	0.00
MgO	0.00	0.26	0.33
CaO	0.06	0.25	0.00
Na_2O	0.00	0.34	0.00
K_2O	0.00	0.19	0.31
Total	100.00	100.00	100.00

THE VALLEY BOTTOM SITES SMR-1 AND SMR-2 (R.N. and P.B.)

SMR-1 and SMR-2 are located in the Samariniotikos Valley at the point where three watercourses converge, and determine the widening of the valley, the bottom of which is filled with coarse sediments that form a narrow alluvial plain (Fig. 25).

SMR-1 lies on a wide, well-preserved terrace along the right (southern) bank of the Samariniotikos River. Its top is ca. 19 m above the present riverbed (N40°07'31.9"-E020°59'53.6": 1522 m) (Fig. 26). SMR-2 is located just west of SMR-1, along the left (western) flank of the same watercourse (N40°07'32"-E020°59'44": 1535 m). It rests on a vertical ridge of sandstone. The geomorphologic position and sedimentary data of both sites suggest that they were originally part of the same system. Their separation was caused by young erosional episodes.

Most of the morphological terrace of SMR-1 consists of Pleistocene deposits on which a soil profile developed during the same period, with some younger slope sediments on top. The site succession can be summarised as follows (from top to bottom) (Fig. 27):

a) Upper slope complex that outcrops upslope. A very poorly-developed soil profile formed on it, most probably of Late Holocene age;

b) Lower slope complex that outcrops in the central part of the terrace. It rests on the truncated surface of the buried soil. It consists of a silty loam with a few stones, mostly derived from the local Pindus *flysch*. It was probably deposited during the Late Glacial Maximum (OIS-2). It partly extends to:

c) Buried (palaeo)soil developed during the Late Pleistocene (OIS-3) from the same alluvial deposit. The soil is truncated, strongly acidified, and characterised by clay migration and slight hydromorphism. The Middle Palaeolithic Levallois Mousterian artefacts are located at the upper, truncated, boundary of this soil at ca. 55 cm of depth in square K-15 (Fig. 27). They were retrieved from the contact between the lower slope complex and the buried soil, distributed over a thin depth range with a random orientation pattern. Their stratigraphic position is pristine though the artefacts were originally located a bit further away at a short-distance, probably slightly disturbed due to Pleistocene soil formation processes. During the Middle Palaeolithic the site was already a morphological terrace. It developed on:

d) "Alluvial" deposit that composes most of the terrace. At its base, a deposit of gravel ca. 2 m thick is found. It rests on:

e) Erosional surface cut into the *flysch*, ca. 10.5 m above the present Samariniotikos riverbed.

Fig. 25. Location of sites SMR-1 (red dot) and SMR-2 (yellow dot) from the opposite watershed around Delichmét (Photograph P. Biagi)

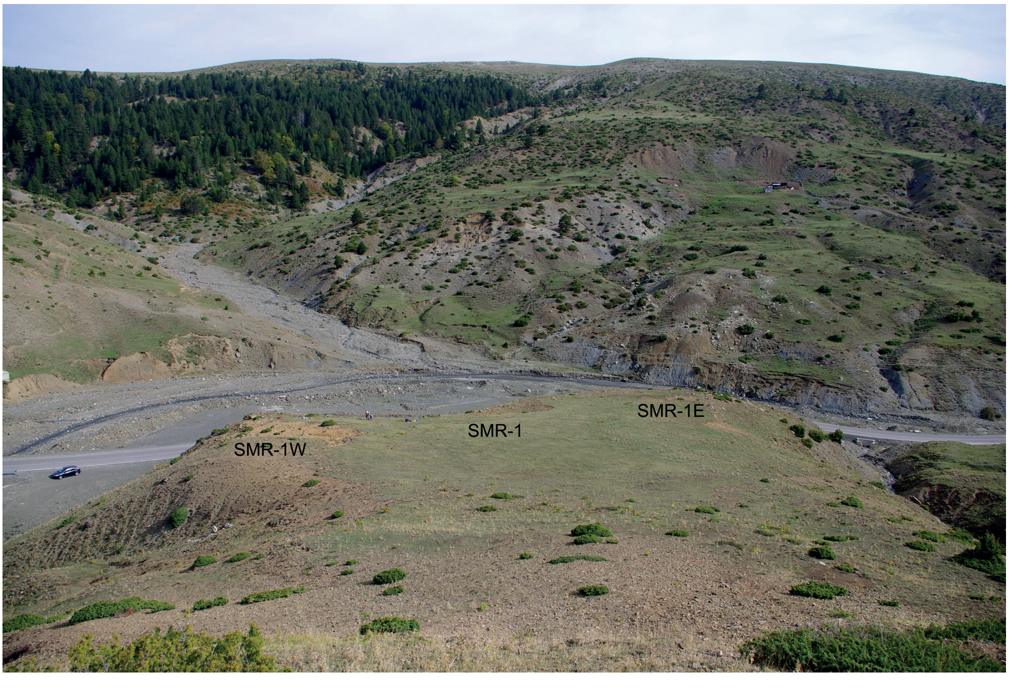


Fig. 26. SMR-1: the terrace at the confluence of the three rivers where the site was discovered with the three main settlement areas photographed from the south. Note, on the opposite slope, upper right corner, a large palaeo-landslide with a clearly cut carved scar (Photograph P. Biagi)

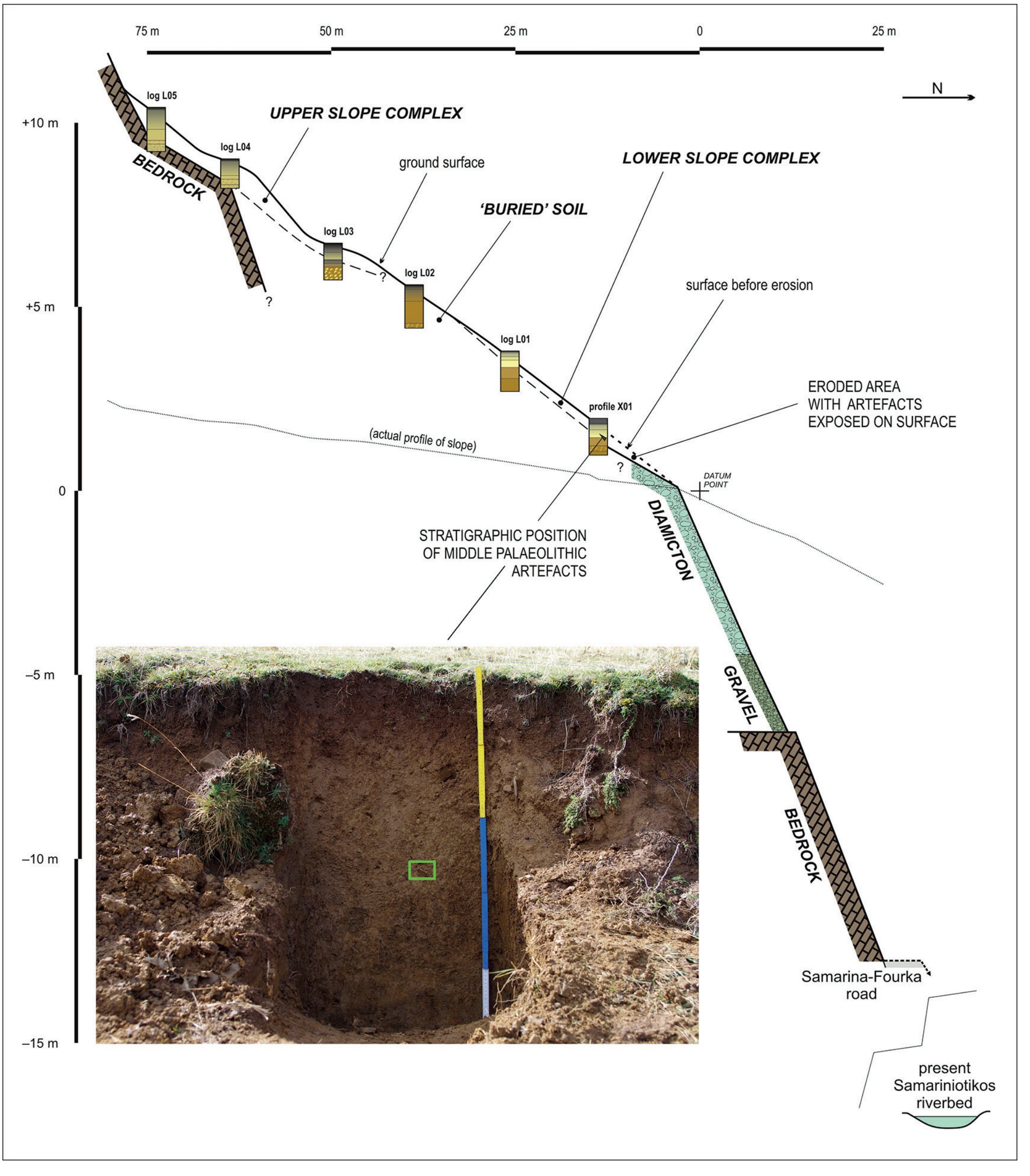


Fig. 27. SMR-1: schematic profile of the site with location of the lithic finds from the section opened in square K-15 (Drawing from Angelucci, 2011, photograph P. Biagi)

SMR-2 has the same stratigraphic succession as SMR-1, though its upper part is poorly preserved because of the stronger erosion that affected this site (Fig. 28) (see Angelucci, 2011).

When both sites were discovered in October 2010, their surfaces were literally covered with chipped stone artefacts, which were clearly visible on the eroded parts of the terrace. In the autumn of 2011 all the terrace of SMR-1 was subdivided into a grid of 1m squares in order to collect *in situ* all the artefacts visible on the surface of the three main clusters (see below) into which the site was later

Fig. 28. SMR-2: position of the site on a terrace at the confluence of the Samariniotikos and its affluent. The red spot shows the main concentration of chipped stone artefacts (Photograph P. Biagi)

subdivided (Fig. 29). More precisely, the eastern part of the site was labelled SMR-1E, the central one SMR-1, and the western SMR-1W. The systematic collection continued also during the three following fieldwork seasons (2012-2014).

THE CHIPPED STONE ASSEMBLAGES
(P.B. and E.S.)

The occurrence of abundant workable raw material, namely the chert sources described above that permit the production of any desired blank, with evidence of human exploitation, is a fact of primary importance. The questions that arise are whether or not 1) the abundance of sites discovered in the Samarina basin (Figs 1 and 12) can be related to occupations due to the presence of rich chert outcrops; 2) the different characteristics of the find-spots can enable the reconstruction of the lithic reduction sequence, from raw material to finished products.

A preliminary analysis of the debitage products recovered from the different sites offers the possibility to answer the above questions, as well as to reconstruct the models of territory exploitation and behaviour of the Neanderthal groups which "*carried tools and raw material with them when they moved across the landscape*" (Kuhn, 2011:100).

The procurement method is inferred from the scars noticed at some areas of the outcrops. The raw material was gathered either quarrying the outcropping chert or exploiting the large, partly naturally loosened, large chert boulders (see Figs 11 and 15b). The suitable raw material nodules were later decorticated, and most probably prepared as rough-outs at the decortication areas located close to the outcrops (Fig. 30). Some of the aforementioned sites can be interpreted as decortication areas, since only cortical, or partly corticated flakes detached by hard hammering have been recovered (Table 1 and Fig. 17). Although so far we do not have any evidence for

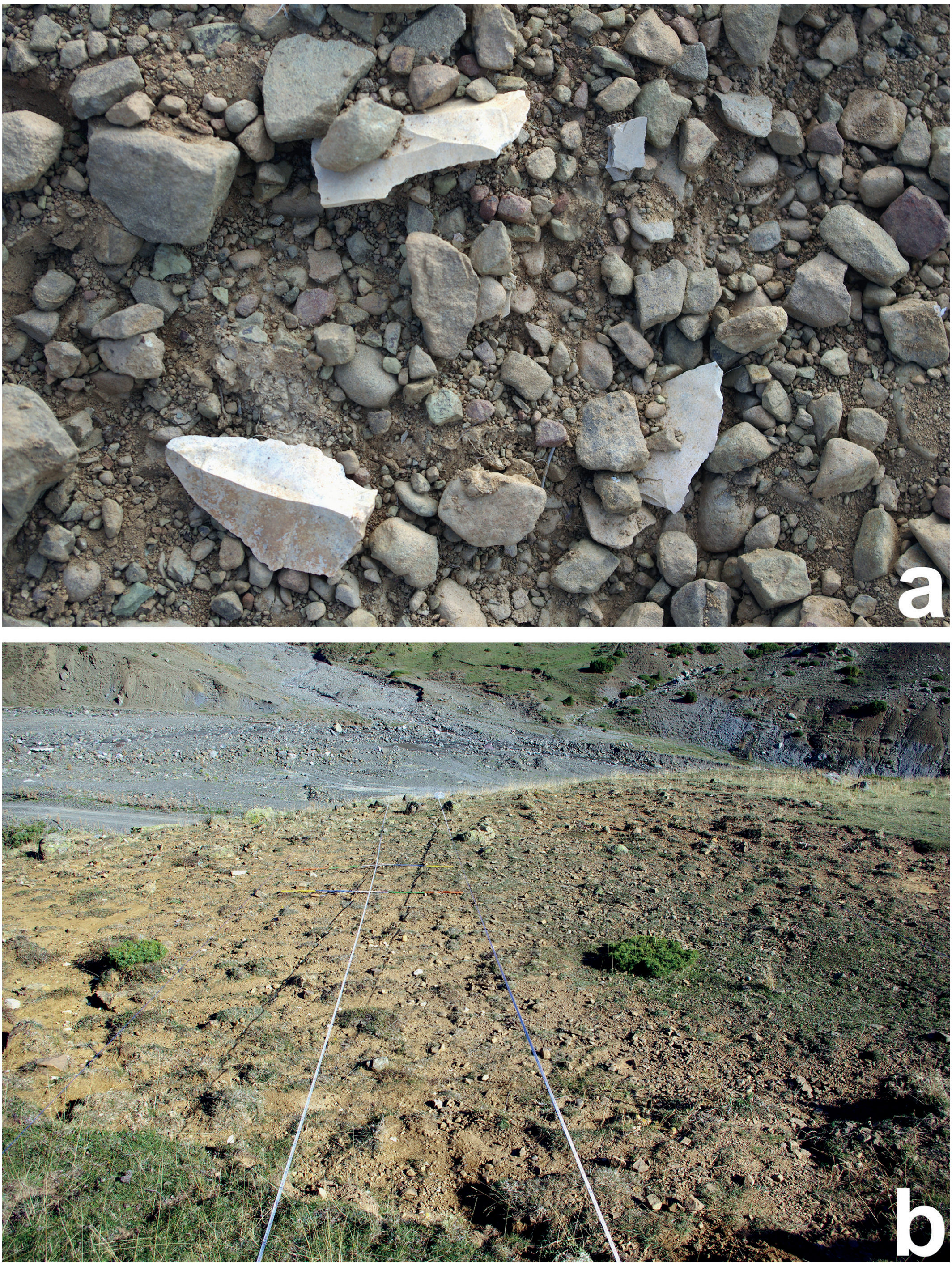


Fig. 29. SMR-2: Levallois artefacts on the site's surface (a); SMR-1: the site with the surface collection grid (b) (Photographs P. Biagi)

Fig. 30. View of the decortication area 4 (N40°07’14.2”-E21°00’57.0”: 1664 m, blue square) from the watershed with a close view of its surface (bottom right). The sites SMR-1 (red dot) and SMR-2 (yellow dot) are visible in the background (Photograph R. Nisbet)

prepared rough-outs, the occurrence of large pre-cores might be indicative in this respect (Pl. 2). The raw material, either in the form of pre-cores or rough-outs, was later carried down to the base camps discovered at a distance of ca. 2 km as the crow flies from the outcrops (e.g. SMR-1 and SMR-2: see Fig. 25). The very low percentage of cortical surfaces, ranging from 3.31 to 10.74% (see Table 4), and the presence of fragments of raw material blocks retrieved from the aforementioned sites favours such a hypothesis.

It must be pointed out that besides the (predominant) use of local chert, a smaller occurrence of other raw materials (radiolarite, quartzite and varicoloured chert) of unknown provenance has been recorded from both SMR sites in the form of finished artefacts. Their presence is significant, since the eventual discovery of their sources and precise provenance in the future might help to shed light on what has been defined as local hominid networks and social landscape (Gamble, 1995). Distances of raw material transfer have been already assessed for the Middle Palaeolithic (Geneste, 1988a; 1988b; Gamble, 1995:23, table 1; Mellars, 1996:147, table 5.2). According to the above authors, local means within a radius of 5 km from the site, regional within 5-20 km and exotic/distant within 30-80/100 km.

The paragraphs that follow are a preliminary assessment and interpretation of the lithic assemblages recovered from both open-air sites SMR-1 and SMR-2. The several Mousterian cores, Levallois products and finished tools indicate the nature of knapping and tool preparation areas with a discrete spatial organization. The typology used for these finds is that proposed by Debénath and Dibble for the Middle Palaeolithic (1993).

SMR-1

As mentioned above, SMR-1 has been subdivided into three main clusters corresponding to the eroded surfaces of the site where chipped stones were first noticed in 2010, and later recorded *in situ*. The number of chert artefacts collected from the three clusters, and the extension of their surfaces are reported in Table 4. The lithic artefacts from SMR-1E and SMR-1 were recovered in a horizontal position lying on a roughly horizontal surface. Those from SMR-1W come from a gentle slope whose grass cover is partly eroded away by grazing and seasonal rains. All the artefacts are slightly patinated, though in a good state of preservation. Very rarely they show small *concassage* detachments, most probably due to recent trampling.

The activities performed in the three different areas of the site are inferred following the method proposed by Binford and Binford (1966:264).

SRM-1E yielded the poorest assemblage (Table 4). It can probably be interpreted as a small manufacturing area, given the presence of a few cores, small blocks and one crested blade (Fig. 31). In contrast, SMR-1 yielded the richest assemblage. The lithics were retrieved from a rounded/oval cluster, the central area of which showed the highest concentration of both detached items and cores (Fig. 32). This is most probably a knapping area, or workshop, for the manufacture of Levallois flakes and blades, due to the presence of tested chert nodules, small blocks, flake and blade cores, core tablets and crested flakes (Pls 3-6 and Fig. 33). It is important to remark that this cluster did not yield any retouched tool.

In comparison, SMR-1W looks as a site of quite a different nature (Fig. 34). It yielded a few tools among which are 19 side scrapers of different types, and two Mousterian points of type 6 (Debénath, Dibble, 1993:5.7 and 5.11 respectively) (Pl. 7 and Pl. 8). The number of Levallois blanks is also remarkable, representing 43.3% of the total assemblage. The distribution of the finds shows that they coincide mainly with a partly eroded slope.

The ratio of cores and various products collected from the different SMR-1 spots is reported in Table 5, and attests once again that the central spot SMR-1 was a manufacturing area.

The techno-typological features of this site are 1) the presence of the Mousterian disc-core technique (Debénath, Dibble, 1993:29) characterised by a recurrent, centripetal flaking around the entire core margin (Pl. 4 and Pl. 5); 2) typical Levallois cores, i.e. bearing clear evidence that the surface morphology of the core, specially prepared to achieve a blank of a particular form, are very few (Pl. 4:10 and Fig. 33:3). However, several characteristic flakes, and especially points (Pls 3:5-12 and 6:6-7) testify for the use of the Levallois method and technique.

The platforms are of various types, often dihedral (Pl. 3:2, 4, 7, 9) and facetted (Pl. 3:3, 5, 10-12), the latter sometimes of *chapeau de gendarme* type (Pls 3:8 and 6:7). The formal tools, i.e. pieces intentionally shaped by retouch are few, though significant. Among them are two Mousterian points of type 6 (according to the typology of Debénath, Dibble, 1993:58; inv. SMR-1W, nn. 206 and 801) shaped with a scalar retouch (Fig. 33:1 and Pl. 7:4-5), and several

Table 4. Table of distribution of the lithic finds collected from SMR-1 and SMR-2

	Unretouched flakes/blades (Levallois)	Side scrapers	Levallois points	Mousterian points	Levallois cores	Small blocks	Tested nodules	Tablets	Crested flakes/ blades	Chips	Corticated	Hammerstones	Totals	Surveyed area m^2
SMR-1	755 (184)	0	6	0	12	31	3	4	2	61	29 (3.31%)	0	**875**	**180**
SMR-1W	416 (180)	19	0	2	5	31	4	0	0	0	49 (10.27%)	0	**477**	**270**
SMR-1E	230 (33)	0	5	0	4	11	0	0	1	6	10 (3.89%)	0	**257**	**168**
SMR-2	210 (106)	21	5	0	6	0	0	0	0	0	26 (10.74%)	1	**242**	**ca. 250**

Table 5. SMR-1: ratios of the following pairs of items according to Binford and Binford (1966:265): cores to Levallois blanks (C/LB), cores to non-Levallois blanks and bi-products (C/Bi), cores to tools (C/T), Levallois blanks to tools (LB/T), Levallois blanks to bi-products (LB/Bi), non-Levallois blanks and bi-products to tools (Bi non-LB/T)

SITES	C/LB	C/Bi	C/T	LB/T	LB/Bi	Bi non-LB/T
SMR-1	0.06	0.02	2.00	30.60	0.32	95.00
SMR-1E	0.12	0.02	0.80	6.60	0.16	39.40
SMR-1W	0.02	0.03	0.23	8.50	1.32	11.23

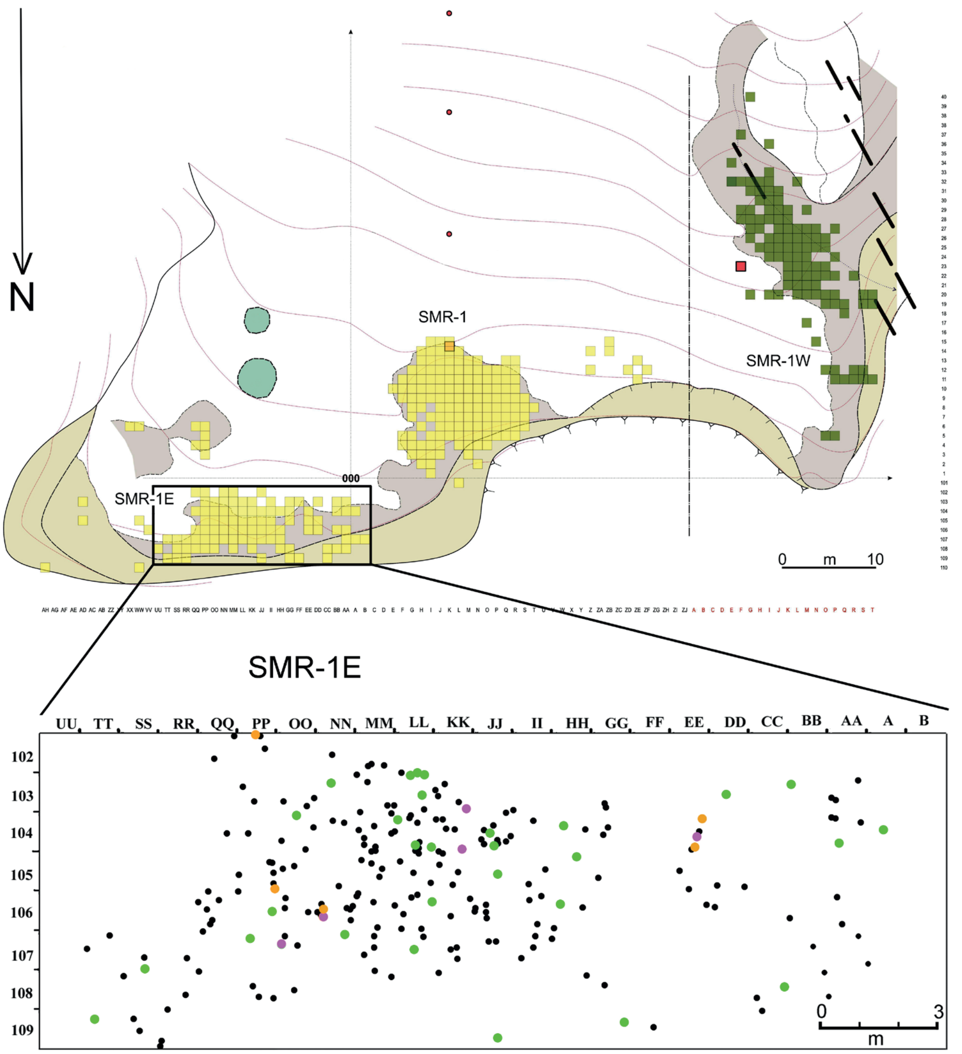


Fig. 31. SMR-1E: location of the site, surface collection grid, and distribution map of the artefacts. Colours: cores (brown), Levallois points (violet), Mousterian points (blue), scrapers (red), Levallois flakes (green), others (black) (Drawing by D.E. Angelucci, R. Nisbet and E. Starnini)

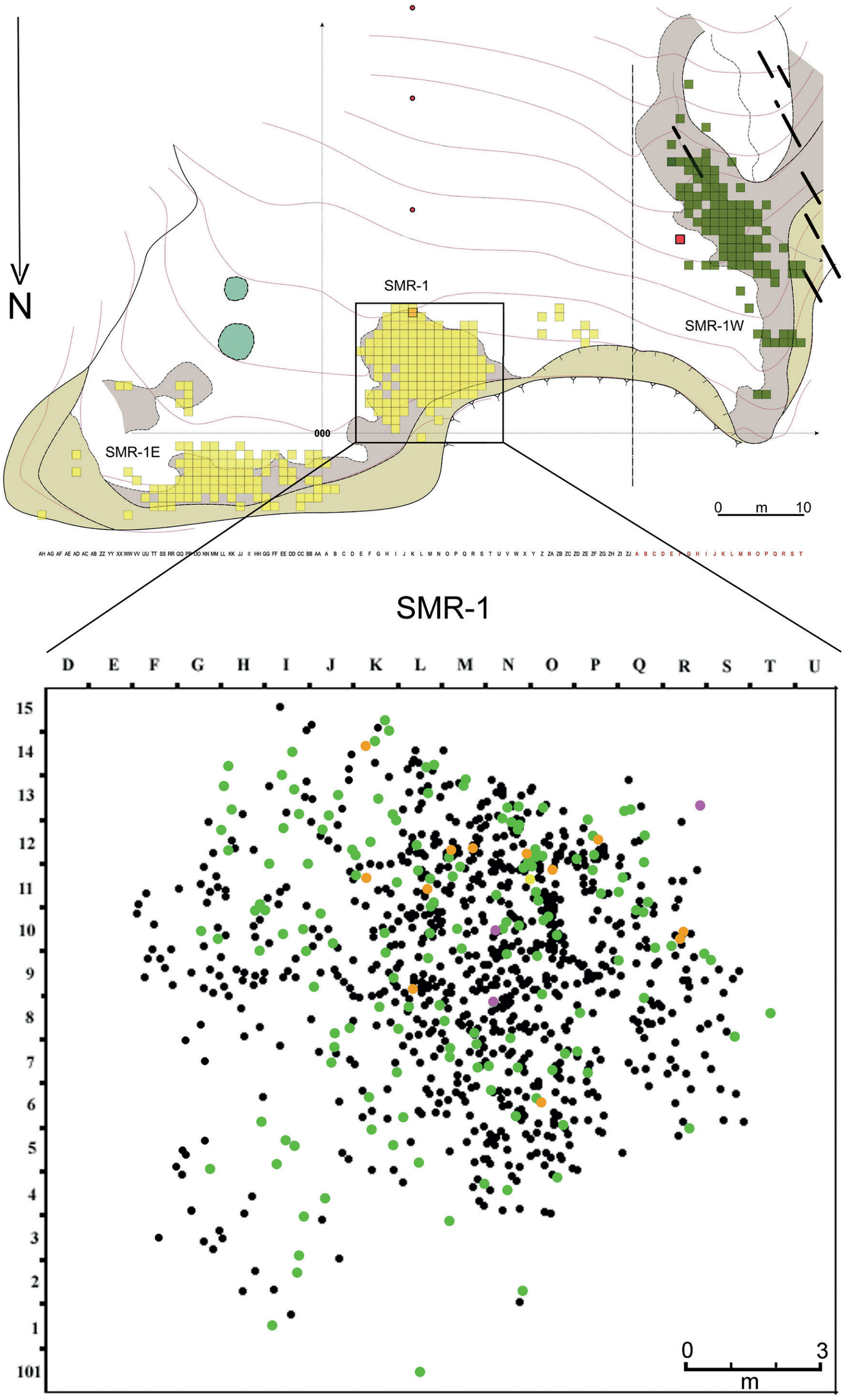


Fig. 32. SMR-1: location of the site, surface collection grid, and distribution map of the artefacts. Colours: cores (brown), Levallois points (violet), Mousterian points (blue), scrapers (red), Levallois flakes (green), others (black) (Drawing by D.E. Angelucci, R. Nisbet and E. Starnini)

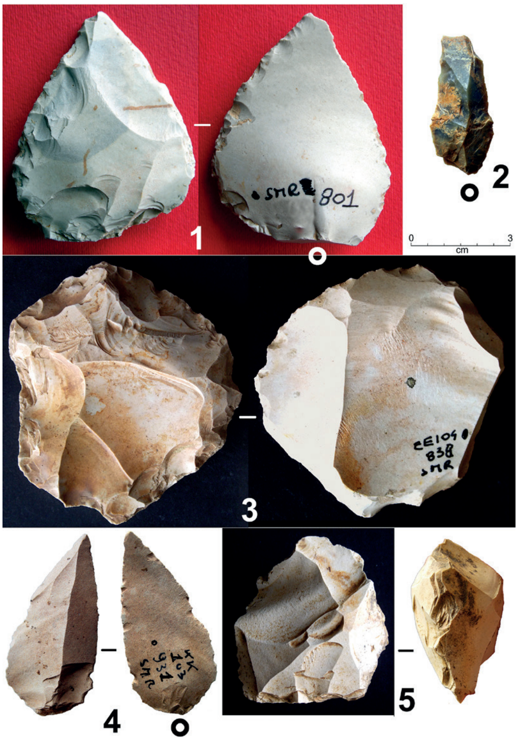


Fig. 33. SMR-1: Levallois bladelet of raw material of unknown source (n. 2), Mousterian disc-core (n. 5); SMR-1W: Mousterian point type 6 made from local chert (n. 1), Levallois core from local chert (n. 3), pseudo-Levallois point, first order from local chert (n. 4) (Photographs E. Starnini)

scrapers (inv. SMR-1W, nos. 235, 202, 112 and 234; Pl. 7:1-3, 6).

There are also a few artefacts made from raw materials (radiolarites, quartzites, varicoloured cherts) different from the local chert. At present we are not able to provide their precise provenance, thus to establish with some certainty whether they are regional or from more distant sources.

SMR-2

The chipped stone assemblage from SMR-2 was collected mainly in 2012 and 2014 from a rectangular area of ca. 200 sqm selected in the central part of the slope because of the visible high concentration of artefacts, between N40°07'32.2"-E20°59'43.5" (NE), N40°07'31.9"-E20°59'43.1" (NW), and N40°07'31.7"-E20°59'43.8" (SE), N40°07'31.5"-E20°59'43.5" (SW). Other artefacts were found lying out of the above area, mainly along the eastern slope. The site is heavily eroded. Nevertheless, the lithic finds look "fresh", only slightly white-patinated, in a very good state of preservation. Very rarely they show small *concassage* detachments (Fig. 29a). One side scraper obtained from a red radiolarite Levallois flake was analysed microscopically revealing traces of use (Pl. 10: 4). A red radiolarite Levallois blade-like flake was re-conjoined from two fragments recovered ca. 10 m apart (Pl. 10:1 and Fig. 36:2). The site yielded Levallois points, flakes and blades, some of which very finely manufactured and thin (see Pl. 9:9; Figs 35:8 and 39b). Among the other finds is an elongated sandstone pebble with traces of hammering (Pl. 9:11). The number of specimens obtained with Levallois method is very high (ca. 50%) (Pls 9-13 and Figs 35-37).

Among the techno-typological features to be mentioned is the presence of the Mousterian disc-core technique (Debénath, Dibble, 1993:29) characterised by a recurrent, centripetal flaking around the entire core circumference (Pl. 12); the inverse surface of these cores is often cortical (Pl. 12:1, 3, 6-7). Although true Levallois cores are missing, the presence of several Levallois points testifies to the use of this method (Pl. 13). We can hypothesise that the Levallois cores, after the removal of the predetermined product were re-prepared and turned into centripetal flake cores.

Formal tools are mostly represented by side and transversal scrapers, single or double, straight or convex (Pl. 11), and a few convergent, convex scrapers of type 19 according to the typological classification of Debénat and Dibble (1993) (Pl. 10:9 and Fig. 36:1).

DISCUSSION (P.B., R.N. and E.S.)

The chipped stone assemblage from SMR-2 differs from those from the three SMR-1 clusters because of the abundance of retouched tools, one probable hammerstone, and the absence of technological pieces related to core preparation and maintenance. The occurrence of tools obtained

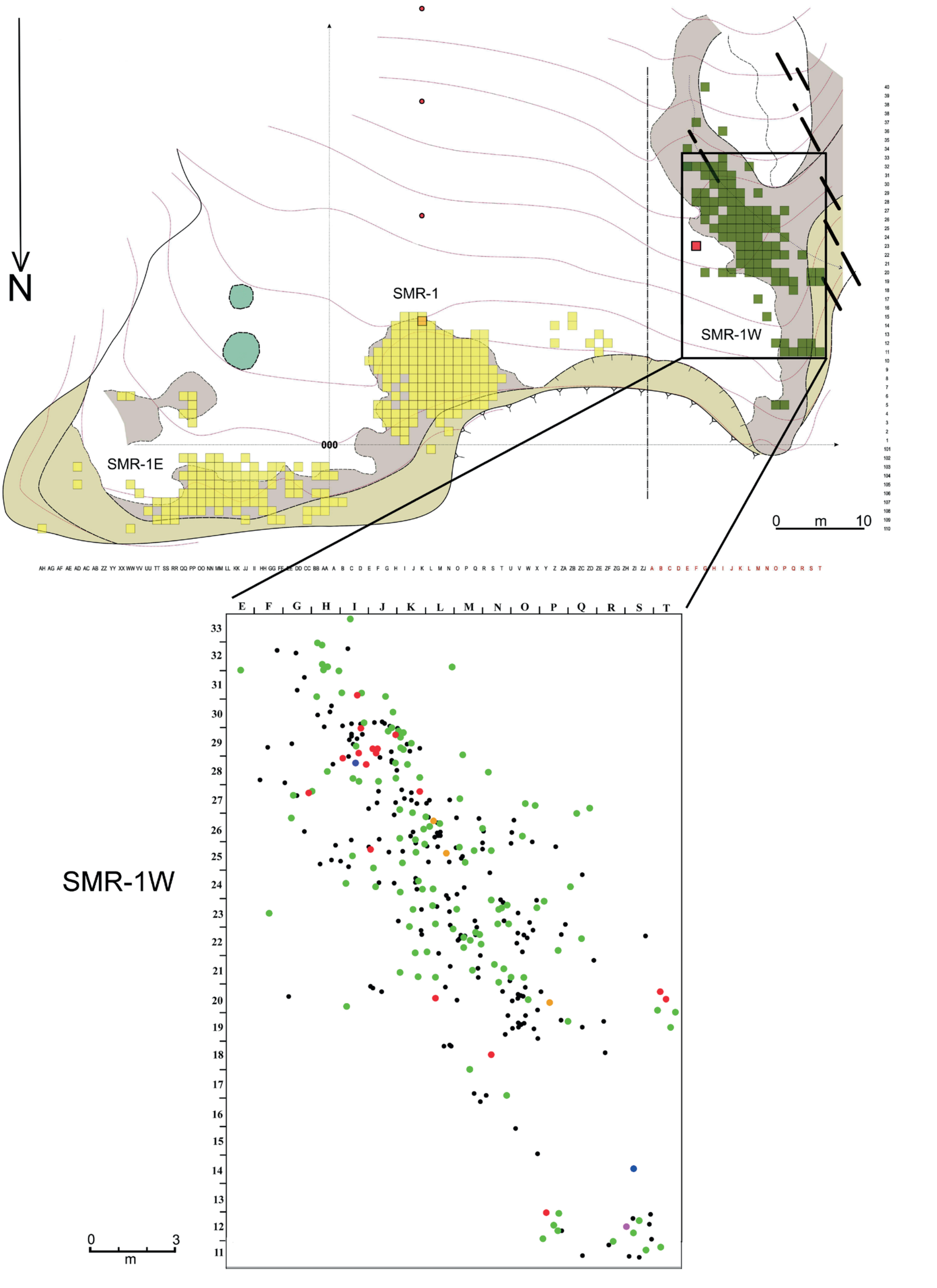


Fig. 34. SMR-1W: location of the site, surface collection grid, and distribution map of the artefacts. Colours: cores (brown), Levallois points (violet), Mousterian points (blue), scrapers (red), Levallois flakes (green), others (black) (Drawing D.E. Angelucci, R. Nisbet and E. Starnini)

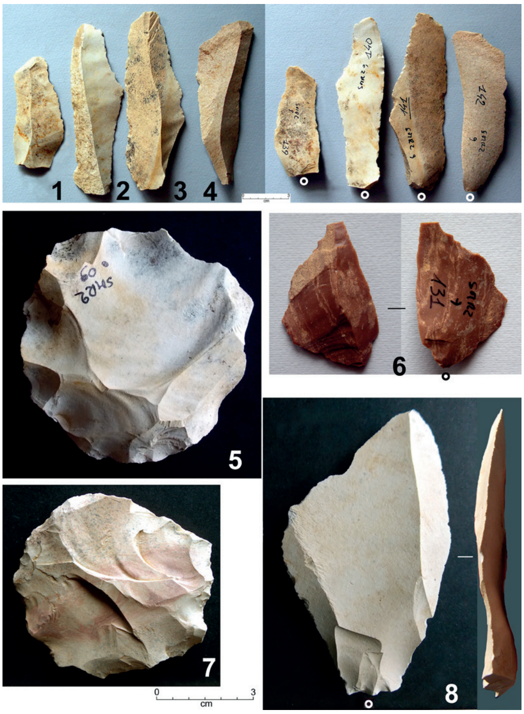


Fig. 35. SMR-2: Levallois blades of local chert (nos. 1-4), Levallois flake core of local chert (n. 5), flake made on red radiolarite of unknown source (n. 6), Mousterian disc-core characterised by centripetal, recurrent flaking of local chert (n. 7), Levallois thin flake of local chert (n. 8) (Photographs E. Starnini)

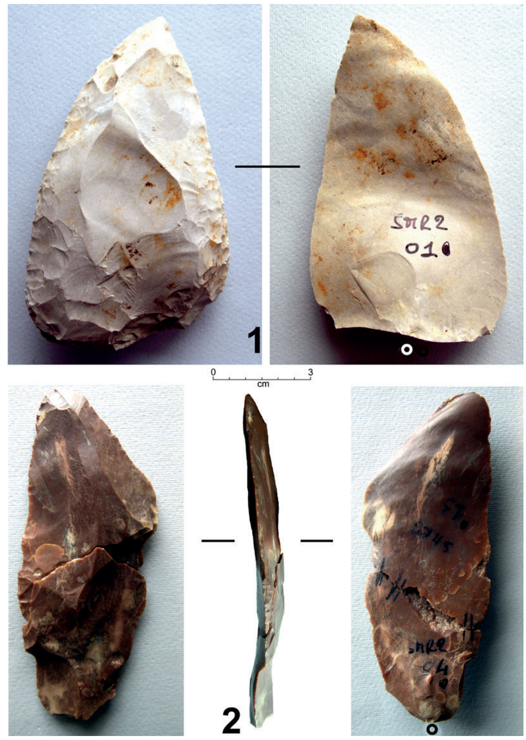


Fig. 36. SMR-2: Mousterian convergent scraper of local chert obtained through scalar retouch (n. 1), partly burnt Levallois blade-like flake side scraper conjoined from 2 fragments, obtained through red radiolarite of unknown source (n. 2) (Photographs E. Starnini)

from non-local raw material is remarkable (Figs 36:2 and 37:3-5).

The dimensional scatterplot of the complete, unretouched artefacts is rather different from those of the three SMR-1 clusters, especially with the higher occurrence of narrower and thin blanks (Figs 38 and 39). The same can be said of the characteristics of the platforms that are very variable in both sites. The high percentage of facetted and *chapeau de gendarme* platforms at SMR-1 would again point to the interpretation of this cluster as a knapping area (Table 6). The different nature and distribution of the artefacts from the aforementioned find-spots might be interpreted as evidence of a discrete spatial organisation.

The reduction sequence stages (Mellars, 1996:58, table 3.1) took place according to behavioural models most probably conditioned by the Samarina mountain landscape. The first test stages were carried out close to the outcrops, later at the quarry decortication sites located a few metres below the watershed, and then completed at the valley bottom camps (see Binford, Binford, 1966:264). The chert working floors of SMR-1 (and SMR-1E?) can be considered geologically *in situ*, as well as the other two sites on the same (?) terrace (SMR-1W and SMR-2). This is suggested by several proxies, among which are: 1) the nature of the artefact assemblage that is homogeneous in terms of raw material type, (slight) degree of patination and typo-chronological traits; 2) the artefacts show sharp edges and look freshly knapped; 3) their distribution on the sites surface is horizontal. However, in the future, only proper excavation, geopedological analysis, careful spatial analysis and refitting (Cziesla, 1990), can assess whether the artefacts are also archaeologically *in situ*, namely that they have been retrieved at or close to their original place of discard. The dimensional scatterplots developed measuring the complete, unretouched artefacts from both sites show evident differences between the general distribution trends of the SMR-1 clusters and SMR-2. This is especially clear observing the different number of the microlithic and narrow artefacts, the first being better represented in SMR-1, the second in SMR-2 (Figs 38 and 39). Great differences are to be noticed also in the variable number and percentage of platform types. This is especially evident at SMR-1, where the facetted platforms are more frequent than the dihedral ones, and the percentage of flat-platformed specimens is very low (Table 6). This also would point to the interpretation of the latter site as a manufacturing area. The same can be said comparing the dimensional scatterplot of the cores, with those from SMR-1 showing a greater dimensional variability that contrasts with that of the cores from SMR-1W, and even more with that of SMR-2, all grouped into a much smaller cluster (Fig. 40b). In contrast, the dimensions of the Levallois points look rather similar (Fig. 40a).

Regarding the distribution of the chipped stone artefacts collected along the Samarina watersheds (Pls 14, 15 and 16:2-3), while cores (Fig. 41a) and scrapers (Fig. 41b) would point to the presence of other manufacturing/working areas or sites, the points (Fig. 41c) show that hunting was practised in different places of the watersheds.

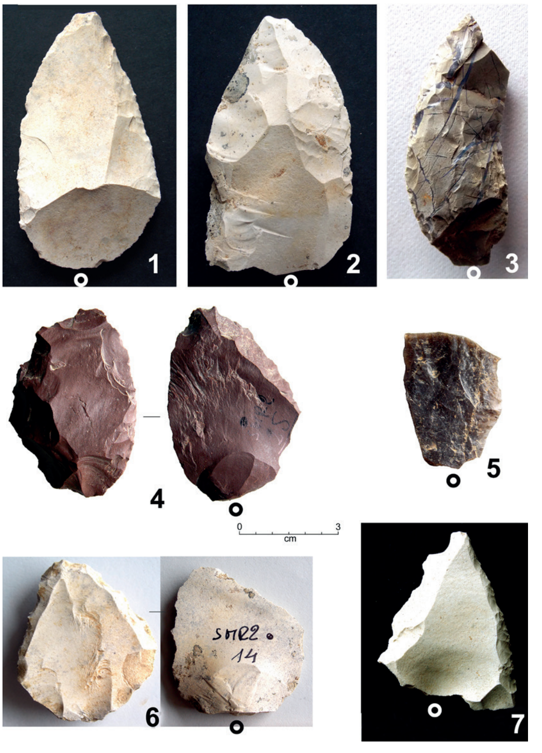
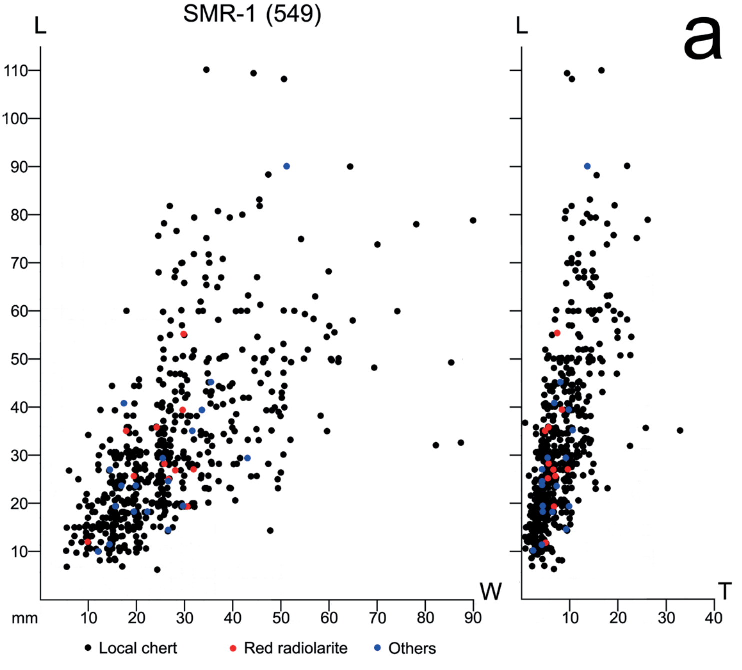


Fig. 37. SMR-2: scrapers made from local chert (nos. 1, 2 and 6), simple convex scraper type 10 made from raw material of unknown source (n. 3), simple convex scraper type made from red radiolarite of unknown source (n. 4), blade fragment made from raw material of unknown source (n. 5), retouched Levallois point made from local chert (n. 7) (Photographs E. Starnini)

Table 6. Table showing the occurrence of the different platform types of the chipped stone artefacts from sites SMR-1 and SMR-2

PLATFORM TYPES	SMR-1	SMR-1E	SMR-1W	SMR-2
Dihedral	250 (34.5%)	51 (29.3%)	162 (48.5%)	65 (29.9%)
Facetted	286 (39.5%)	0 (0.0%)	33 (9.9%)	55 (25.2%)
Flat	8 (1.1%)	75 (43.1%)	98 (29.3%)	56 (25.7%)
Chapeau de gendarme	63 (8.8%)	14 (8.1%)	8 (2.4%)	30 (13.8%)
Thinned by retouch	114 (15.8%)	32 (18.4%)	25 (7.5%)	8 (3.6%)
Natural	2 (0.3%)	2 (1.1%)	8 (2.4%)	4 (1.8%)
TOTALS	**723 (100.0%)**	**174 (100%)**	**334 (100.0%)**	**218 (100.0%)**



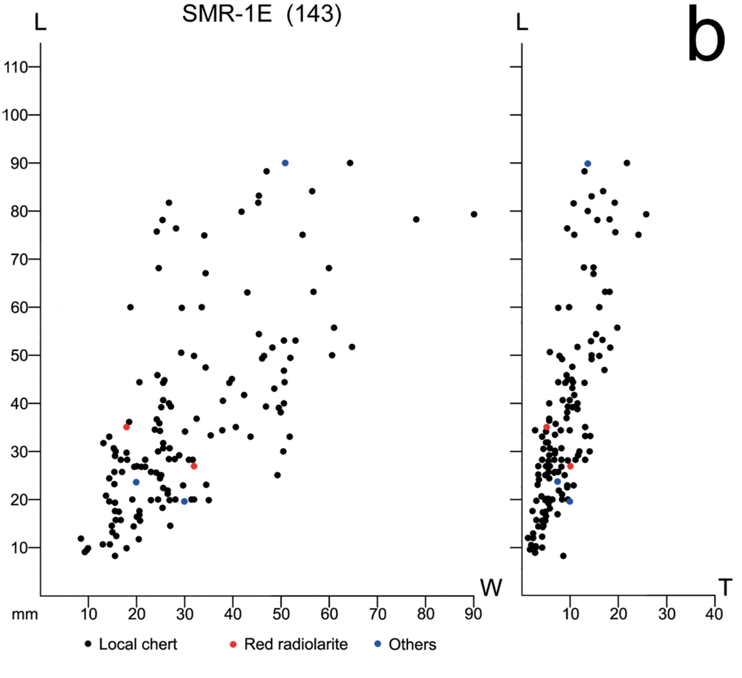


Fig. 38. Length (L)/width (W) and length (L)/thickness (T) scatterplots of the complete unretouched artefacts from SMR-1 (a) and SMR-1E (b) (Drawing P. Biagi)

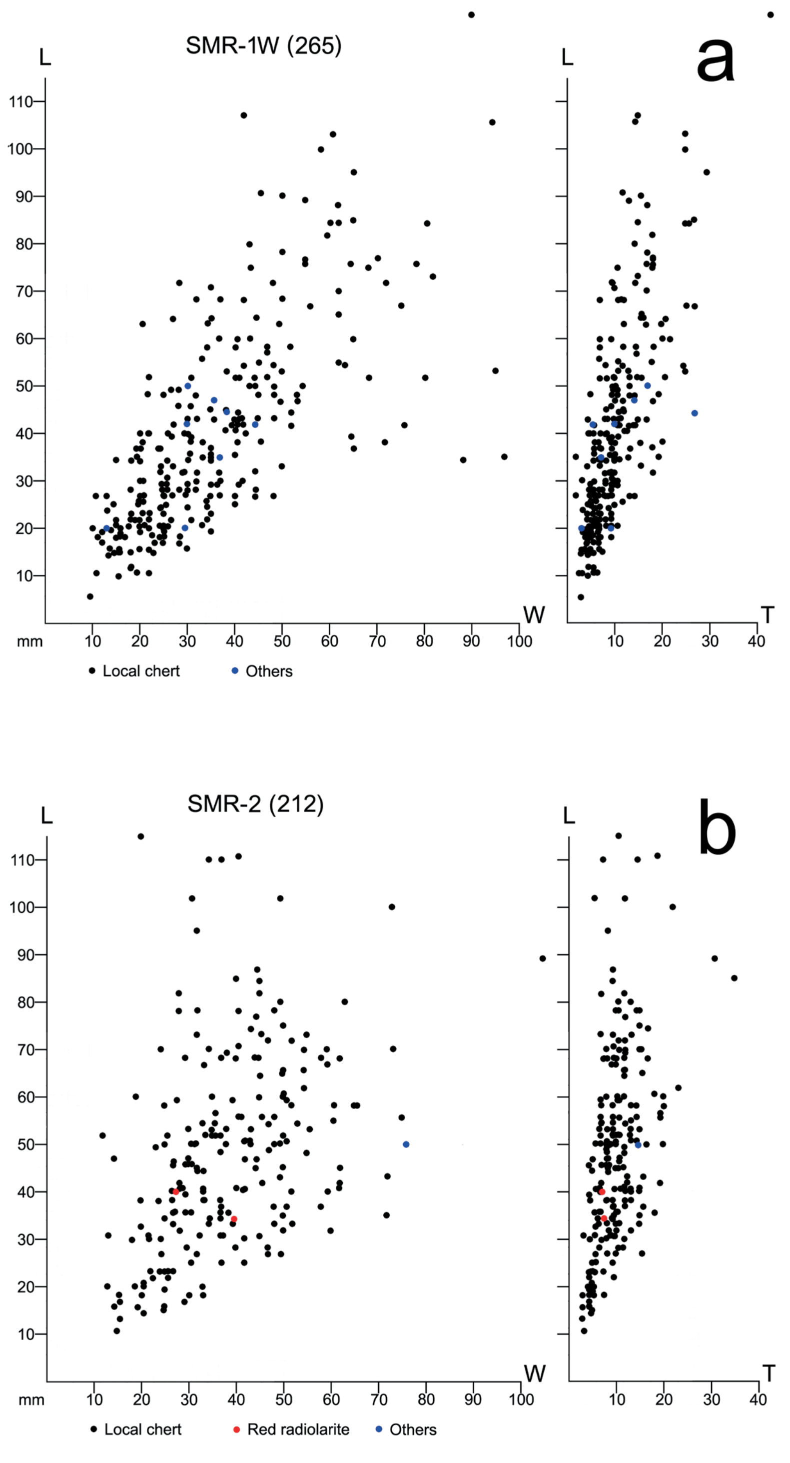


Fig. 39. Length (L)/width (W) and length (L)/thickness (T) scatterplots of the complete unretouched artefacts from SMR-1W (a) and SMR-2 (b) (Drawing P. Biagi)

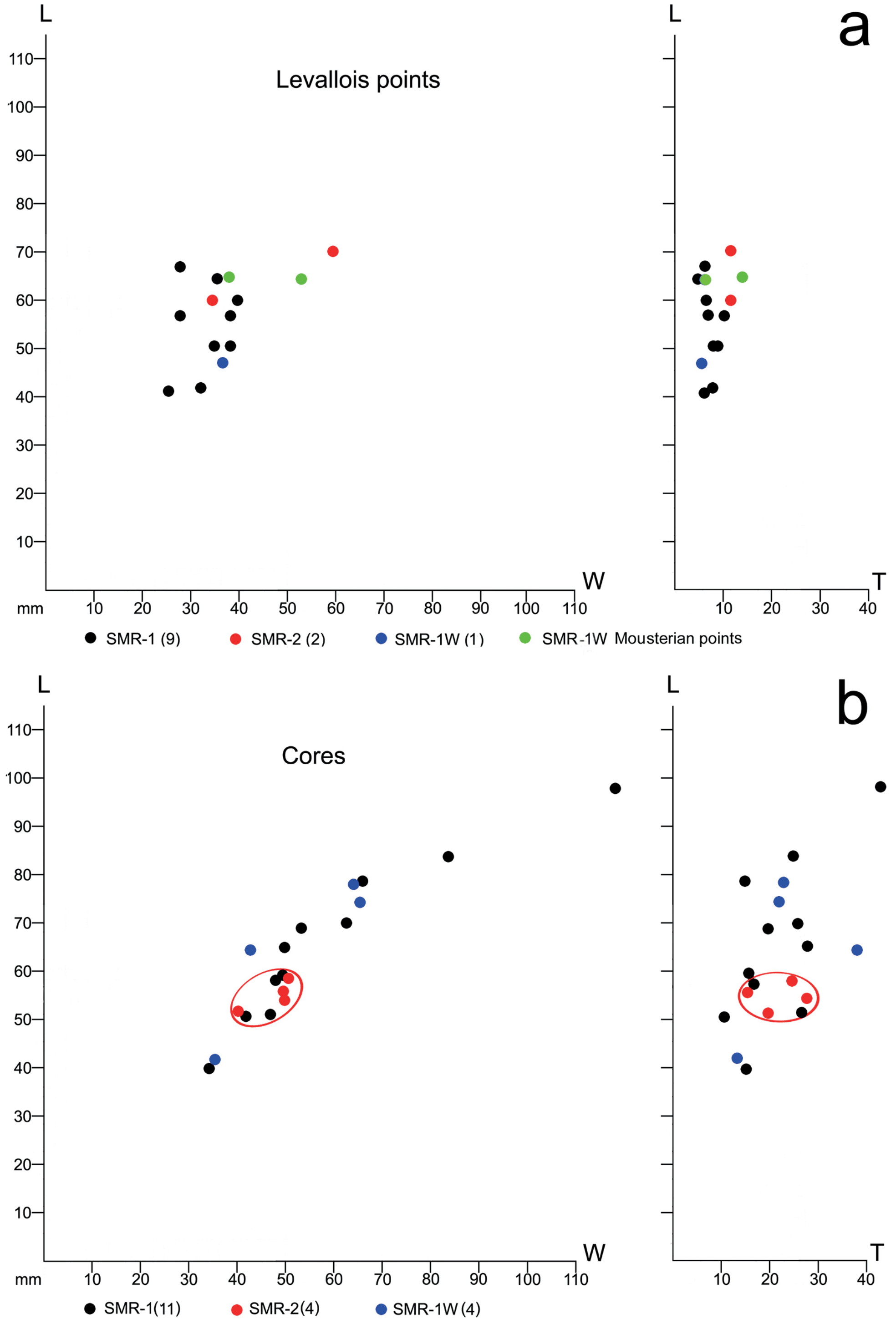


Fig. 40. Length (L)/width (W) and length (L)/thickness (T) scatterplots of the Levallois and Mousterian points (a) and different types of cores (b) from sites SMR-1 and SMR-2 (Drawing P. Biagi)

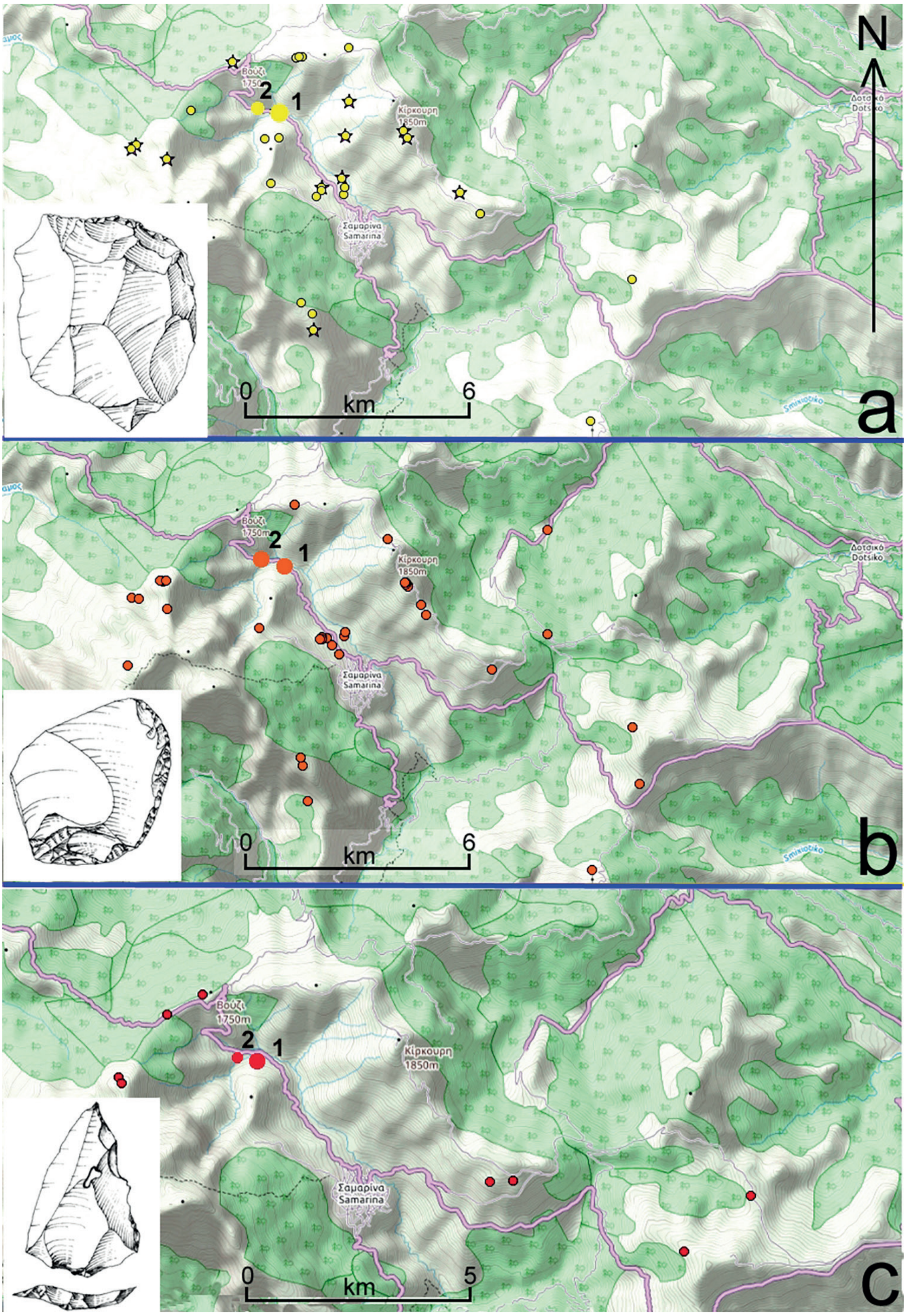


Fig. 41. Distribution map of different types of Mousterian (dots) and Levallois (stars) cores (a), scrapers (b) and Levallois points (c) along the watersheds surrounding Samarina, and location of sites SMR-1 (n. 1) and SMR-2 (n. 2) (Drawing R. Nisbet and P. Biagi)

The survey strategy was designed bearing in mind that data collection methods play an important role in our understanding and interpretation of the lithic findspots (Spikins, 1995). Other researchers (Dunnell, 1992) have already clearly demonstrated that the interpretation of the sites' locations from surface distributions would change with each field season, due to variations in the locations of lithics, their number and visibility in relationship with atmospheric conditions and, as a consequence, the variability of erosional processes (Hauck, 2016). Thus, a truly representative pattern could be generated only over six successive years (Spikins, 1995:96). Given the above premises many visits were paid to every locality where lithics had been found. Consequently, the Grevena Project involved the walking over the same areas and paths almost every year. The position of the finds has been recorded with the aid of a precision GPS (Garmin 60CSx), and the distribution maps have been generated with proper software (QGIS Open Source). The survey was carried out by a small team of two to five people. Its aim was to collect and record all the chipped stone artefacts visible on the surface. Over all the surveyed area the visibility was usually excellent, since we walked mostly above the tree-line, in a grassland environment frequently affected by recent erosional processes. Unfortunately, given that we are dealing with surface collections from open-air sites, several limitations and problems are implicit: first of all, we do not have stratigraphic data, and no absolute dates are currently available for the Pleistocene sites. The few charcoal spots AMS-dated from the open profiles have yielded results falling between the late Atlantic and historical periods of human exploitation of the Samarina highlands. Furthermore, as usual, the mountain environment did not preserve any organic material such as bones, neither on the surfaces nor in the profiles of all the sites that have been intensively surveyed (SMR-1 and SMR-2). However, we are convinced that the study of open-air site distribution has much to contribute concerning industrial variability and regional human adaptation, complementing the knowledge achieved from the study of cave and rock shelter deposits (Papagianni, 1999; Papoulia, 2011). In spite of those limitations, several proxies can help contextualize the environment during the OIS-4 and OIS-3 stages, the periods when the Samarina highlands most probably were visited by the Neanderthals, thus possibly narrowing the time-span involved. In particular, of outstanding importance for our purposes are the several high-resolution profiles obtained from the Greenland ice cap cores (Dowdeswell, White, 1995). At present we know that these two phases are characterised by short and cold periods. The first occurred during the late OIS-4 (74-60ka BP), lasting no longer than five or six thousand years (van Andel, 2003). Nevertheless, during the entire period, the Alps, and all the more so the Pindus range, were probably free of large ice caps. Stage OIS-3 started around 49ka BP with a series of mild phases, followed by a cold period between 42 and 38ka BP, and later on by progressively lowering of temperature toward the harsher conditions of the Late Glacial Maximum (35ka BP). Regarding the chronology of the lithic artefacts, the technological, typological and dimensional analyses undoubtedly point to a Middle Palaeolithic date, and the Levallois Mousterian culture for most of the sites. We have also to mention that during the survey other more recent artefacts (arrowheads, potsherds etc.) have been recovered (Efstratiou *et al*., 2006; Biagi *et al*., 2015a; 2015b). Although many of those are isolated specimens, they will be discussed in depth in another paper. This report focuses exclusively on the behaviour, landscape use and subsistence strategies of the Neanderthals, since a striking element of the results of the survey was the high frequency of Mousterian and Levallois lithic artefacts.Broadly speaking the Samarina Levallois Mousterian assemblages greatly differ not only typologically but also chronologically from those retrieved from the two main Middle Palaeolithic horizons of Asprochaliko rock-shelter sequence (Higgs, Vita-Finzi, 1966; Gowlett, Carter, 1997), and the other Middle Palaeolithic industries at present known from other sites in north-western Epirus (Bailey *et al*., 1992; Papaconstantinou, Vassilopoulou, 1997; Runnels, van Andel, 2003; Papoulia, 2011) and also the Peloponnesus (Tourloukis *et al*., 2016). The differences are clearly visible for example in the absence of foliates, bifacial tools, and denticulated scrapers, the abundance of unretouched and partly retouched Levallois points, the general thinness of tools and blanks, as well as the systematic occurrence of blade products that are known to make their appearance at the beginning of the OIS-4 all over southern Europe (Moncel, 2011:261). These observations can be extended to all the sites so far recovered along the fringes and ridges of Mts. Gurguliu and Bogdhani (Pl. 17), as well as to other areas of the Samarina basin investigated so far (Pl. 18).

At present the only Samarina sites that show some differences within the general trend of the lithic assemblages of the region are those recovered from Kirkuri B (KRK-B) (Fig. 14 and Pl. 18:1-6), from which we have the only evidence of bifacial, foliate tools (Pl. 18:1, 2, 4), and one long end scraper (Pl. 18:3), and possibly Mt. Anitsa, from the surface of which unusually thick and large side scrapers have been collected (Fig. 16:8-9). In fact, the occurrence of bifacial tools is better represented from the low-land and middle-altitude sites of north-western Epirus and coastal Albania in general (Papaconstantinou, Vassilopoulou, 1997; Francis, Vulpi, 2005; Gjipali, 2006), as well as Thessaly (Panagopoulou, 1999). These assemblages undoubtedly are older than those characterising the Samarina sites; while those from Elis seem even more difficult to attribute to a clearly defined period (Chavaillon *et al*., 1967; 1969). Another problem consists in the provenance of the Neanderthal groups that settled the Samarina territory. In this respect it is important to point out the unexpected scarcity of Middle Palaeolithic finds from the neighbouring regions of Western Macedonia, the Aliakmon River basin for instance (Harvati *et al*., 2008; Galanidou, Efstratiou, 2014). There is no doubt that the easiest way to ascend to Samarina is along the gentle slopes that from Grevena move up to the Mirminda Pass, and across it the entire study region; while the road from Epirus is undoubtedly much steeper and troubled to walk. Another problem to deal with, which soon emerged with the increase in the number of single "locations" and quantity of materials, was the meaning and definition of "findspot" and "site". The use of such terms is self-evident if we consider the territory from a statistical point of view. Nevertheless, bearing in mind that we deal with hunter-gatherers it became quickly important for us to interpret the whole territory as a unit with its different specialties and characteristics, in which it is not easy to decide where the "borders" of the settlement are. What is now clearly emerging, is that 1) the whole territory was exploited at different moments and for different purposes, and 2) that even our larger "concentration areas", like SMR-1, SMR-2 and possibly La Greklu, are simply "*centres of activities carried out within different zones around the dwellings. Some zones may be enormous, such as those used for hunting, whereas others may be relatively restricted, such as those used for collection of firewood*" (Grøn, Kuznetsov, 2004:47). Following these concepts, we could consequently adjust our survey methodology to specific morphologies in a "difficult" territory, such as the one in question, with its altimetry range of about 1000 m, from ca. 1300 m to 2200 m, steep slopes and deeply carved gullies. According to some authors (Mussi, 2001:138) the reason why the development of archaeological research in mountain ranges has been hindered is due to the difficult access and general poor preservation of the archaeological evidence in this unique environment. According to others the mountain zones of Greece are simply not suitable for archaeological research as unfavourable landforms for the burial and the preservation of materials (Tourloukis, 2010:152). The results so far achieved by the Grevena Project contradict the aforementioned opinions. In contrast they demonstrate that, despite the great investment needed in terms of survey efforts, the highland zones are actually very promising environments for archaeology (Nandris, 1990; Della Casa, Walsh, 2007; Stirn, 2014). Regarding Middle Palaeolithic human presence at high altitude in the Mediterranean world it should be remembered that, already in the 1960s, A.M. Radmilli (1965) published important Palaeolithic evidence from the Italian Apennine range. Although mostly undated surface collections, the open-air sites found in the Abruzzi Mountains between ca. 1000 m and 2000 m of altitude have been interpreted as evidence for seasonal patterns of occupation by Neanderthal groups. Quite a different picture is at present known from the Alpine chain, where the Middle Palaeolithic are known mainly from middle altitude sites (Tillet, 2003) and few from high altitude caves, above

1500 m, in the Swiss Alps (Jéquier, 1975). Again during the 1960s researches were undertaken also in the Caucasus. They led to the recovery of many Middle Palaeolithic sites located at even slightly higher altitudes (Gasparyan *et al*., 2014).

CONCLUSION (P.B., R.N., E.S. and N.E.)

The impressive discoveries made by the Grevena Project confirm some of the insufficiently known models of behaviour of the Neanderthals, who appear used to ascend mountains and able to extract proper raw material from sources available at high altitude, not far from the areas selected for settling. In addition to local siliceous limestone and non-calcareous chert, the Neanderthals exploited other non-local raw materials, as indicated by the recovered finished artefacts (Pl. 6:3-5, 7; Figs 33:2; 35:6; 36:2; 37:3-5). The actual sources of those raw materials (red radiolarite, quartzite [Pl. 16:1-2, from Vasilitsa-7δ and Sam-29, respectively] and different varieties of chert), whether regional or exotic, are at present unknown. Their location deserves further research investment.

Similar strategies underlying the procurement of lithic raw materials by Neanderthals have been inferred in several other studies (Kuhn, 1995; Mellars, 1996; Féblot-Augustins, 1999). In general, Neanderthal groups exploited locally available sources, retrieved from the immediate surroundings of the sites (see Turq, 1992; Svoboda *et al*., 1996:93; Lebègue, 2010), with a limited supply of non-local, good quality, siliceous rocks; it appears that they transported artefacts even from long distances, well beyond their daily activity radius (Kuhn, Stiner, 2001; Spinapolice, 2012). Also, evidence for Middle Palaeolithic quarrying activity has been already documented in Europe and beyond (Vermeersch, Paulissen, 1997; Ringer, Szakáll, 2005; Negrino *et al*., 2006; Gopher, Barkai, 2014). The raw material exploitation recorded along the Delichmét ridge, between La Greklu saddle and Mt. Kirkuri is impressive. It re-confirms the well-known capacity of Neanderthals of mining at needs. As far as raw material is concerned, we should point out that Levallois technology is very demanding (Böeda, 1995; Mussi, 2001:145): size and quality are indeed important because only a limited number of flakes and points can be obtained from one single core (Böeda, 1990; Baumler, 1995; van Peer, 1995). From this perspective the presence of a high percentage of Levallois products obtained from just a few cores (Schlanger, 1996) at SMR-1 (184:12), SMR-1E (33:4) and SMR-1W (180:5; see Table 4) should be explained through the abundance of raw material of good quality from chert outcrops available in the surroundings of the sites, the nearest one some 2 km to the north, as the crow flies. The ability by Neanderthal populations to plan specific, coordinated activities like hunting has been sometimes questioned, and alternative hypotheses (scavenging *versus* hunting) were set out (Binford, 1981; 1984; 1985). At present it is widely accepted that Neanderthals were quite sophisticated in their resource exploitation strategies (Marean, Kim, 1998; Kuhn, Stiner, 2006; Ready, 2010), and consequently in their patterns of land-use, contra previous assumptions (Farizy, David, 1992; Burke, 2000). Case studies on the mobility of Neanderthals, based on raw material economy, have shown their capability to circulate through different physical environments, between the coasts and the mountains (Porraz, 2009). In the Samarina area, we are facing an impressive network of long-distance hunting pathways, with its observation points, its localised springs and small intermorainic ponds, and its well-known spots for chert procurement. Evident differences are clearly observable between the compositional and lithotechnical features of the chipped stone assemblages found along the ridges, and the two main sites (SMR-1 and SMR-2) located in the Samariniotikos Valley floor terraces that we perceive as residential camps (Fig. 42).

Regarding the stratigraphic position of the chipped stone tools from SMR-1, we have to remark that this is not the only site from which buried material was retrieved. The same stratigraphic situation had already been observed at Sam-8 (N40°08’14.8”-E21°00’23.5”: 1782 m), Sam-5 (N40°08’13.7”-E21°00’54.7”: 1779 m), Sam-23 (N40°05’46.1”-E21°05’10.3”: 1704 m) along Mt. Anitsa north-western slope, and the recently discovered Buried Site (N40°06’38.6”-E21°02’43.1”) east of the Holy Cross Church, at 1676 m of altitude (Pl. 18:7- 9).

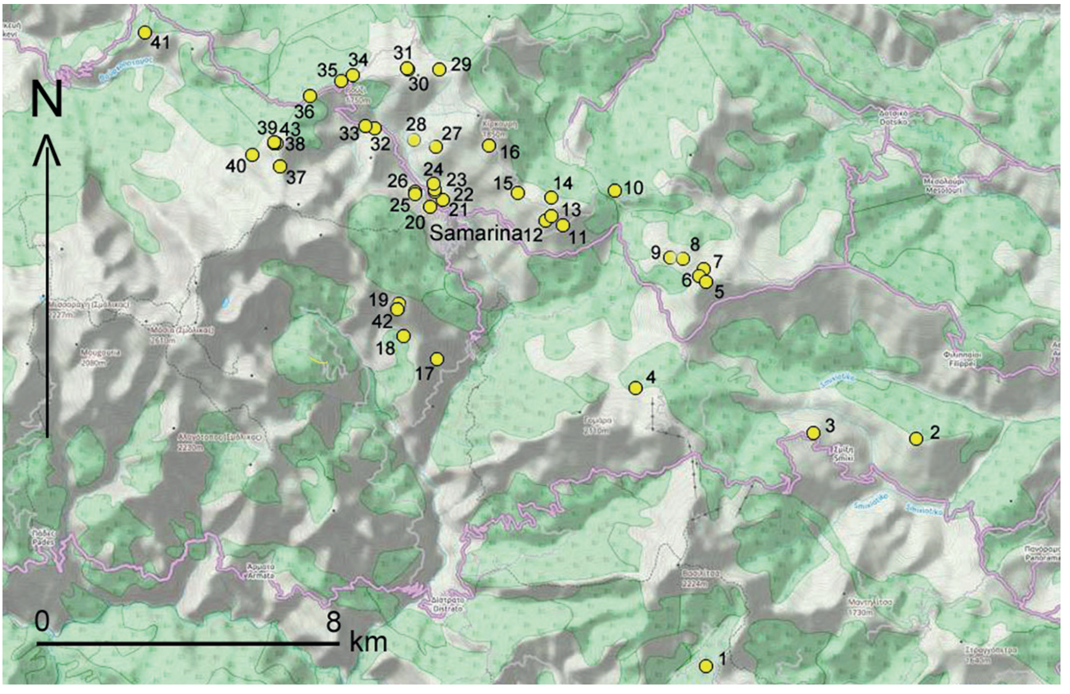


Fig. 42. Distribution map of sites or finds mentioned in the text and captions: Koleo-1 (1), A. Elias-1 (2), Vasilitsa-1 (3), Vasilitsa-7δ (4), Sam-29 (5), Sam-27 (6), Sam-23 (7), Sam-29 (8), Anitsa top (9), Sam-36 (10), GRG-80 (11), GRG-74 (12), GRG-72 (13), Buried Site (14), Sam-13 (15), Sam-58 (16), Sam-18 (17), Sam-7 (18), GRG-2 (19), Sam-62 (20), Sam-55 (21), Sam-56 (22), Sam-57 (23), Sam-60 (24), Sam-43 (25), Sam-40 (26), Sam-58 (27), SMR-4 (28), Sam-5 (29), Sam-6 (30), Sam-8 (31), SMR-1 (32), SMR-2 (33), Sam-1 (34), Sam-4 (35), Sam-2 (36), GRG-56 (37), GRG-26 (38), GRG-23 (39), GRG-49 (40), Fourkas-2 (41), GRG-1 (42), GRG-25 (43) (Drawing R. Nisbet)

In spite of the above proxy data, we should point out the limits in the results obtained in our 15-years long surveys. The more evident relates to 1) the Neanderthal demography. In north-western Greece, speculative data have suggested a population of 500-1000 individuals for Epirus (Sturdy *et al*., 1997:612), though its real number is not known; 2) the present impossibility to establish a more definite chronological frame, both relative and absolute. Therefore the question whether the whole archaeological evidence was the result of frequent short-term visits, protracted over many centuries on the same routes, or rather the consequence of a more intensive land-use for shorter periods remains at present unresolved; 3) the absence of any direct or indirect local evidence about the exploitation of fauna and vegetation, as well as more precise information on the climate; 4) the uniqueness of the high-altitude territory where the Grevena Project is carried out, given the importance of the "*kind of landscape we conduct our analysis in*" (Gamble, Gaudzinski, 2005:173) for the understanding of some adaptive patterns of exploitation by Neanderthal groups. Even so, our approach is an example of territorial research as a whole (Fig. 42). Its goal, among many others, is to contribute to the interpretation of the variability of the distribution pattern of Middle Palaeolithic sites (Rolland, 1990), and shed light on the behaviour of some Neanderthal groups that exploited the environment and landscape of a remote highland zone, and ultimately, on the archaeology of a Pleistocene landscape absolutely unknown until just fifteen years ago. To achieve the goal we used methods, aims and prospects quite different from those attained in some previous research in Epirus (Bailey *et al*., 1983; Bailey, 1999). In this sense we accept Burke's suggestion (Burke, 2000:284) that it is necessary to study Neanderthal "*hunting patterns as a means of understanding a holistic system of land-use. Perhaps one of the most valuable lessons to be gained […] is that the interpretation of subsistence strategies at single sites, or small numbers of sites, should not be extrapolated to whole regions*".

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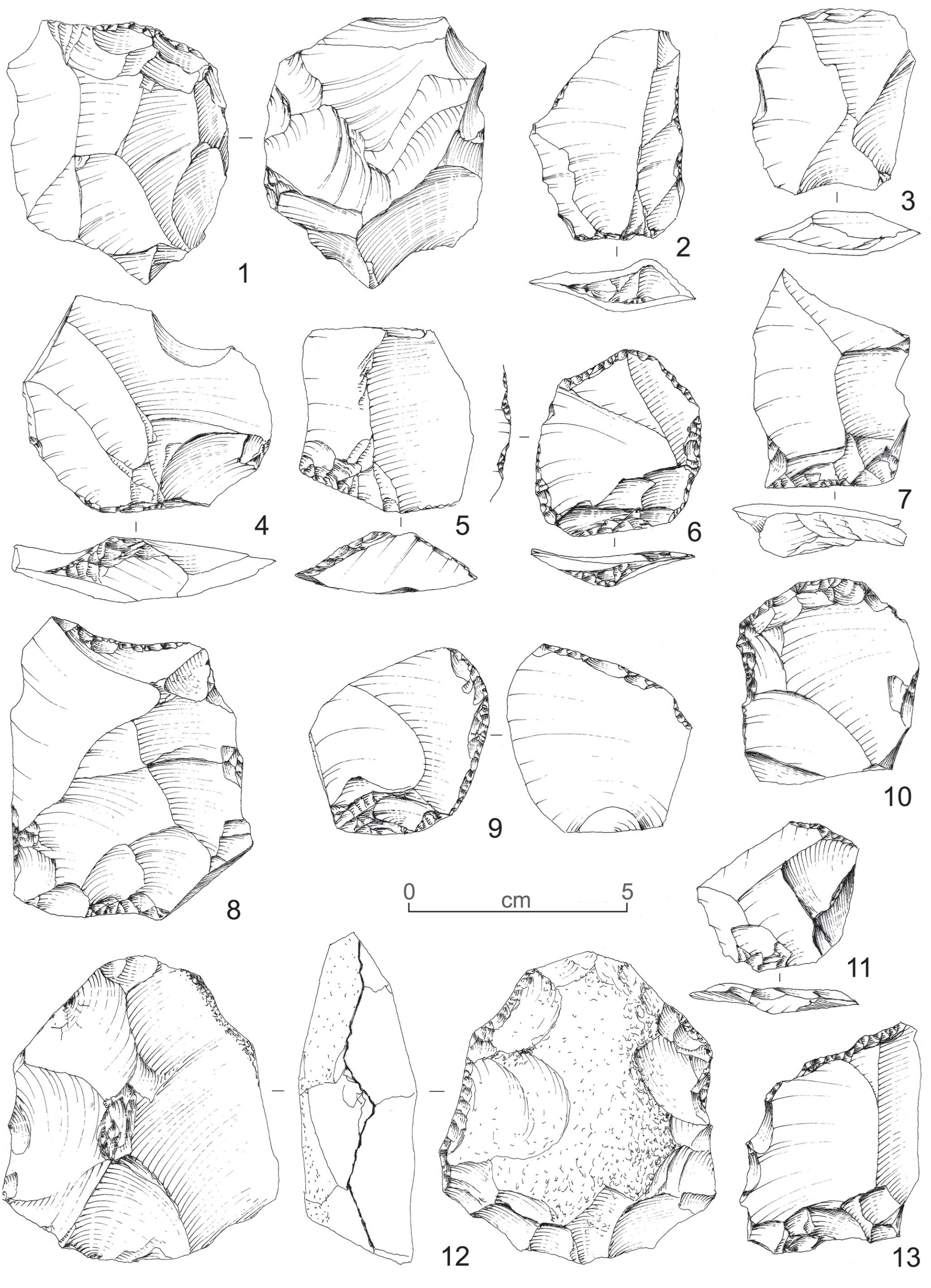
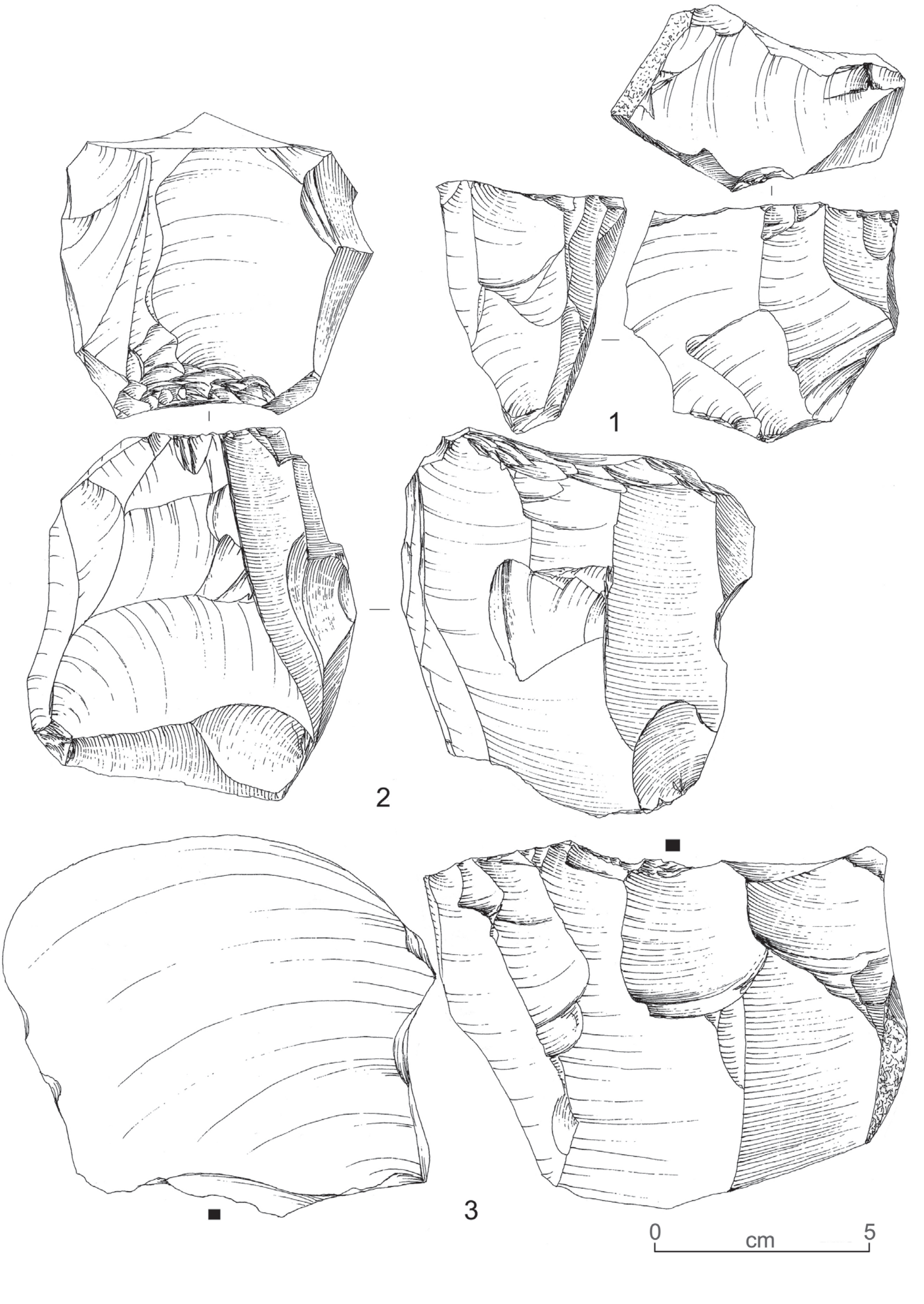
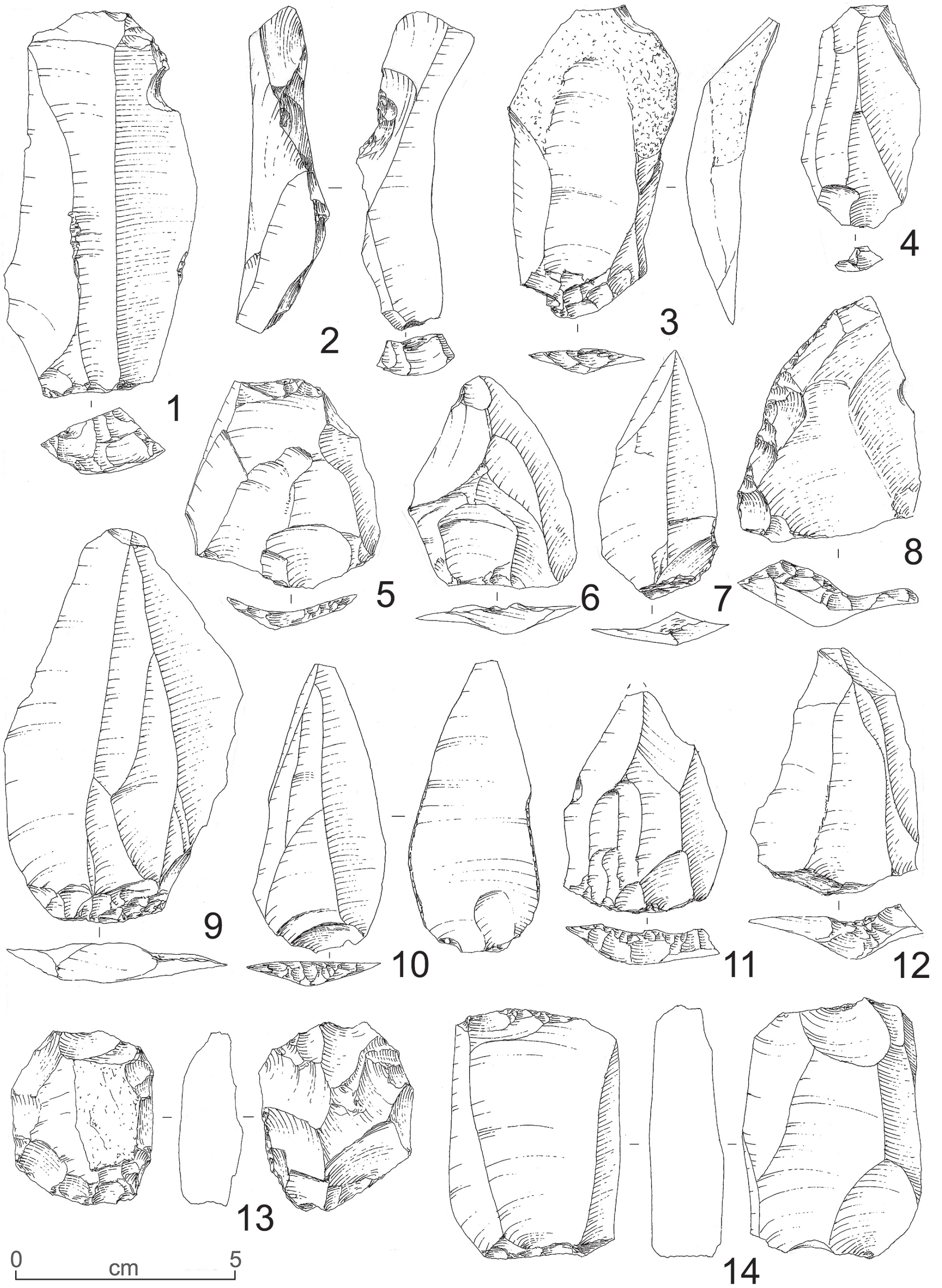


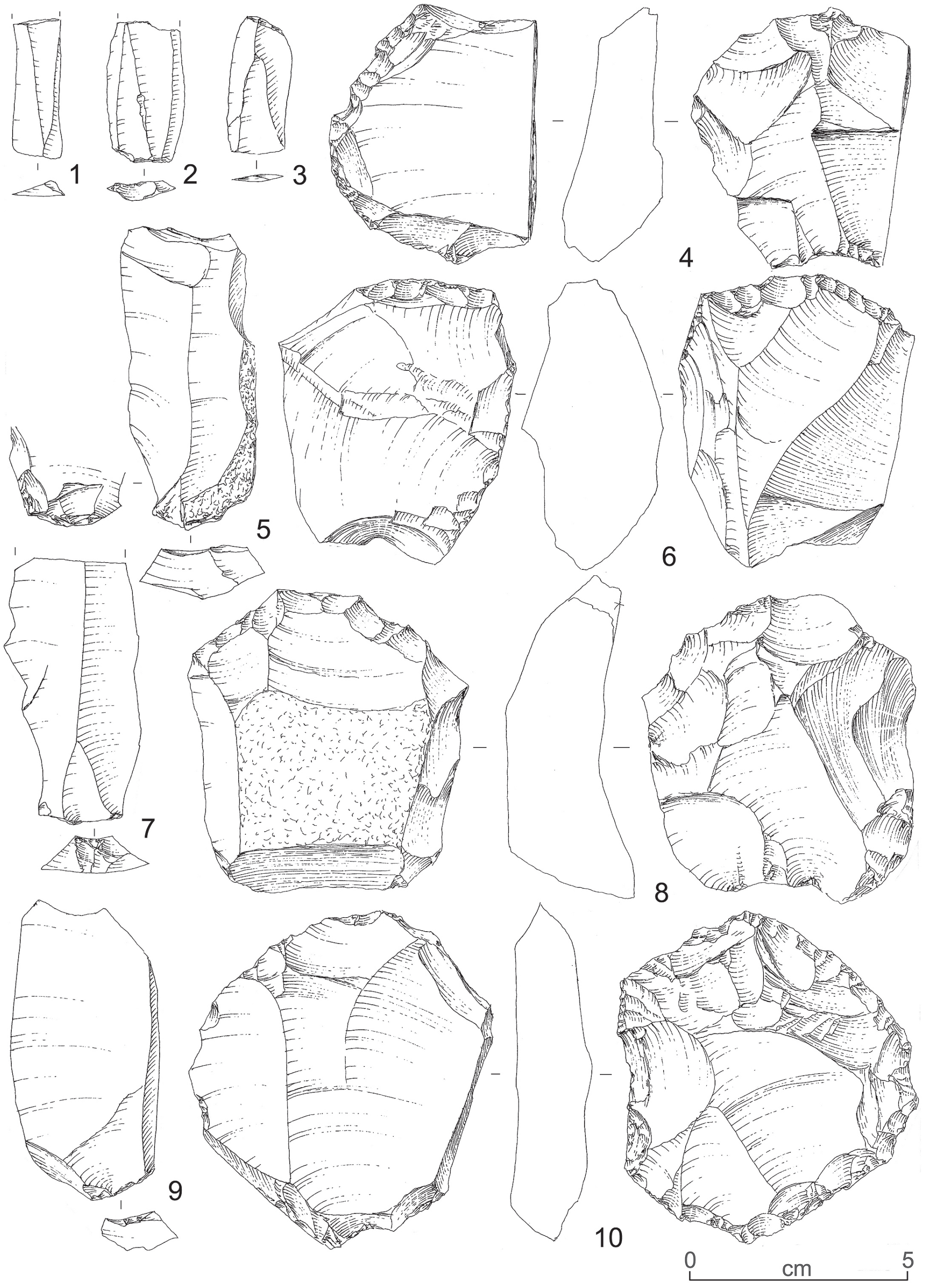
Pl. 1. Sam-6: chipped stone artefacts collected from the surface: cores (nos. 1 and 12), Levallois flakes (nos. 2-5 and 7), side and transversal scrapers (nos. 6, 8-11 and 13) (Drawing P. Biagi, inking G. Almerigogna)



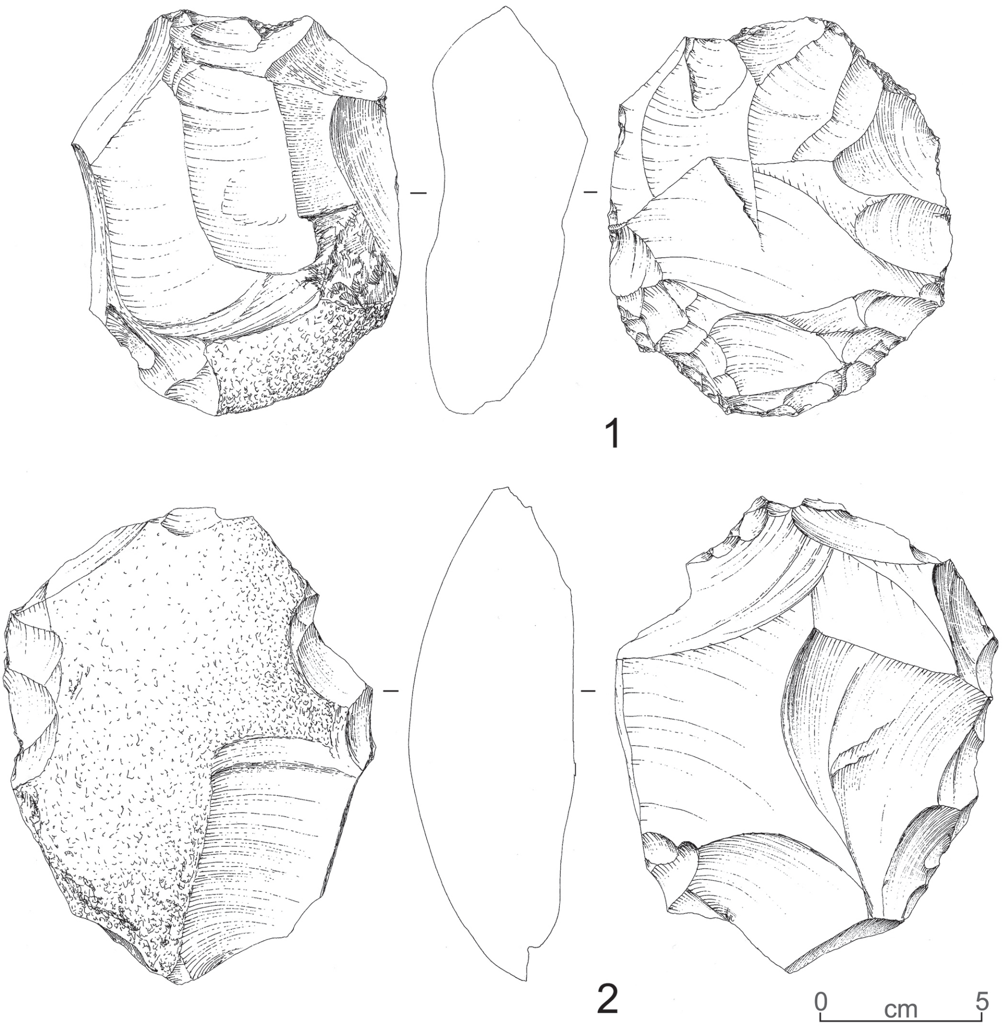
Pl. 2. Pre-cores from the large decortication area south of Delichmét: N40°08'07.3''-E21°00'10.0'': 1769 m (n. 1), N40°08'07.2''-E21°00'10.1'': 1756 m (n. 2), N40°08'08.1''-E21°00'12.8'': 1758 m (n. 3) (Drawings P. Biagi, inking G. Almerigogna)



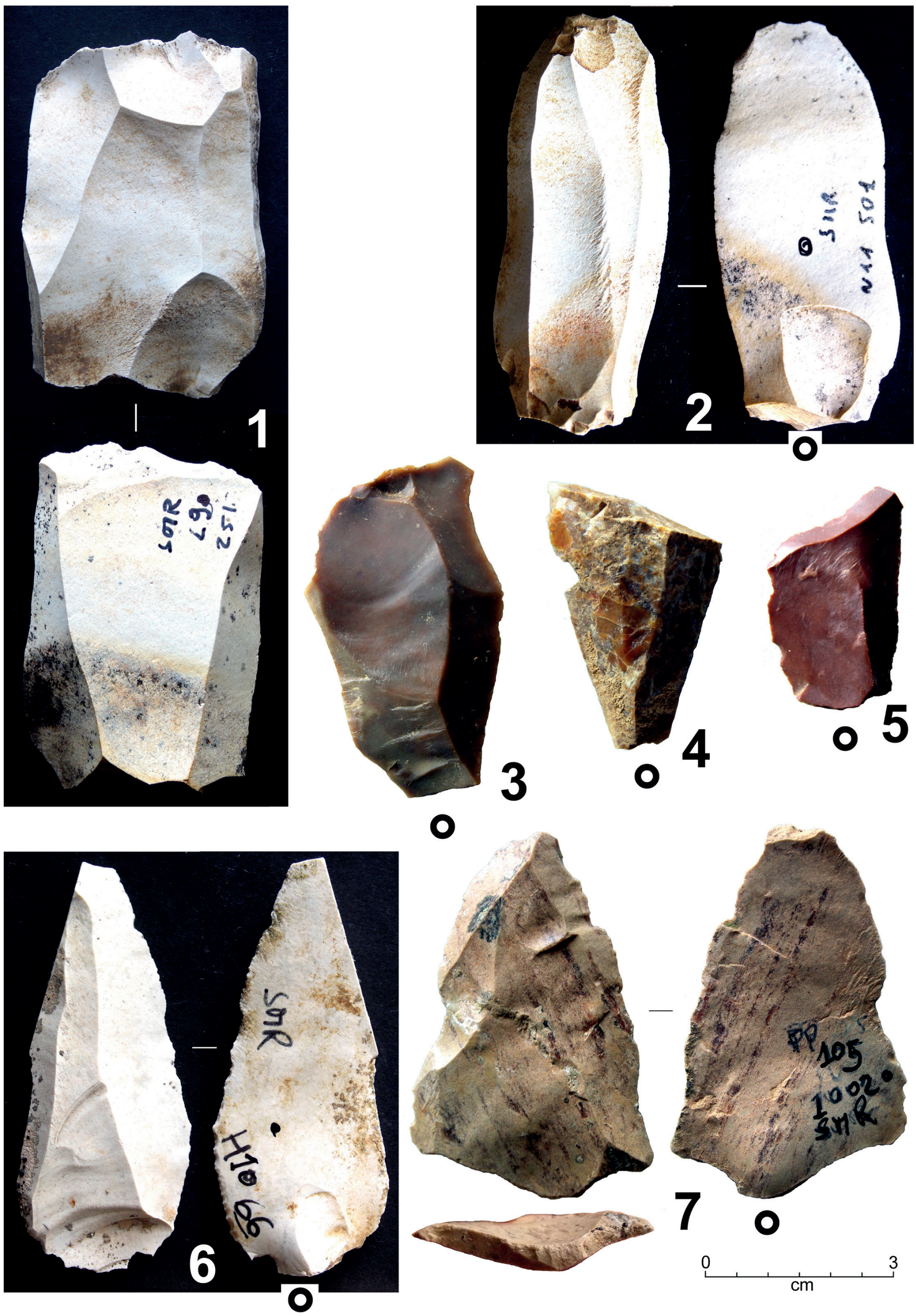
Pl. 3. SMR-1: blades (nos. 3 and 4), elongated Levallois point (n. 10), Levallois point (n. 11), Mousterian disc-core characterised by centripetal, recurrent flaking (n. 13), Levallois blade core (n. 14); SMR-1E: Levallois blade (n. 1), crested blade (n. 2), Levallois flakes (nos. 5 and 6), Levallois points (nos. 7, 9 and 12); SMR-2: convex, single side scraper (Drawings P. Biagi, inking G. Almerigogna)



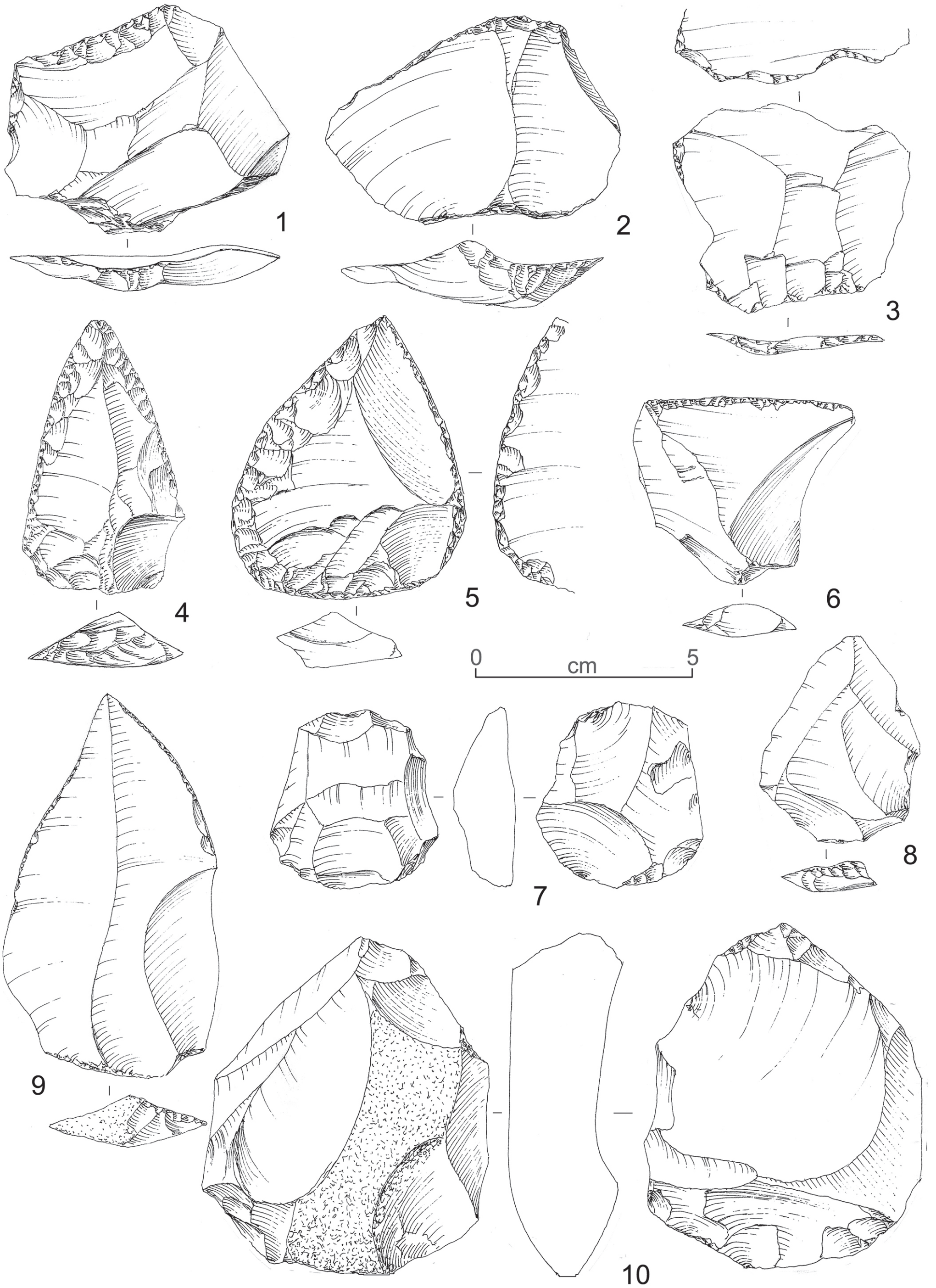
Pl. 4. SMR-1: bladelet (n. 1), Mousterian, recurrent centripetal disc-cores (nos. 4 and 8), Levallois blades (nos. 5, 7, 9); SMR-1E: bladelets (nos. 2 and 3), Mousterian, recurrent centripetal disc-core (n. 6), Levallois core (n. 10) (Drawings P. Biagi, inking G. Almerigogna)



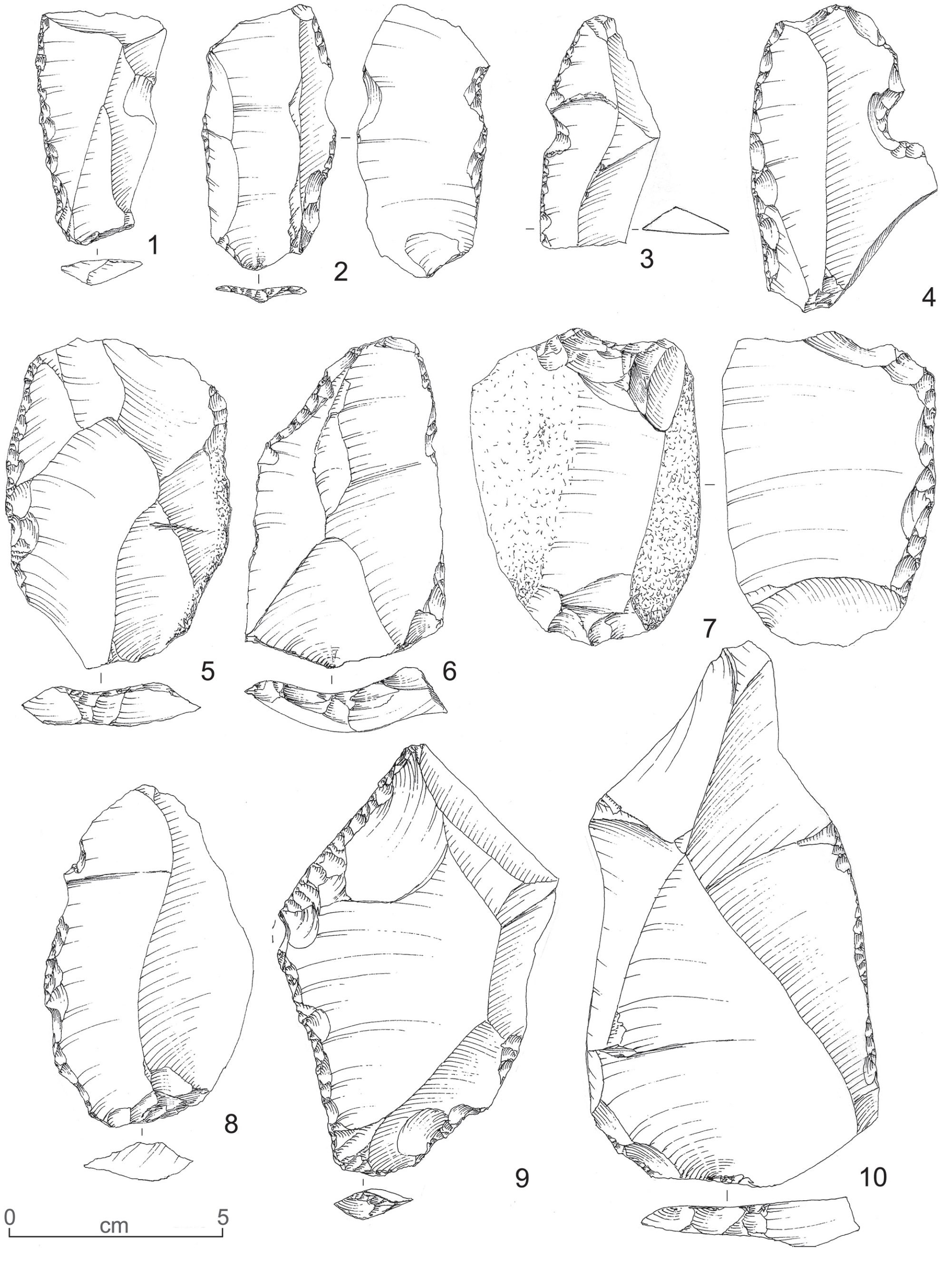
Pl. 5. SMR-1: Mousterian, recurrent centripetal disc-cores (nos. 1 and 2) (Drawings P. Biagi, inking G. Almerigogna)



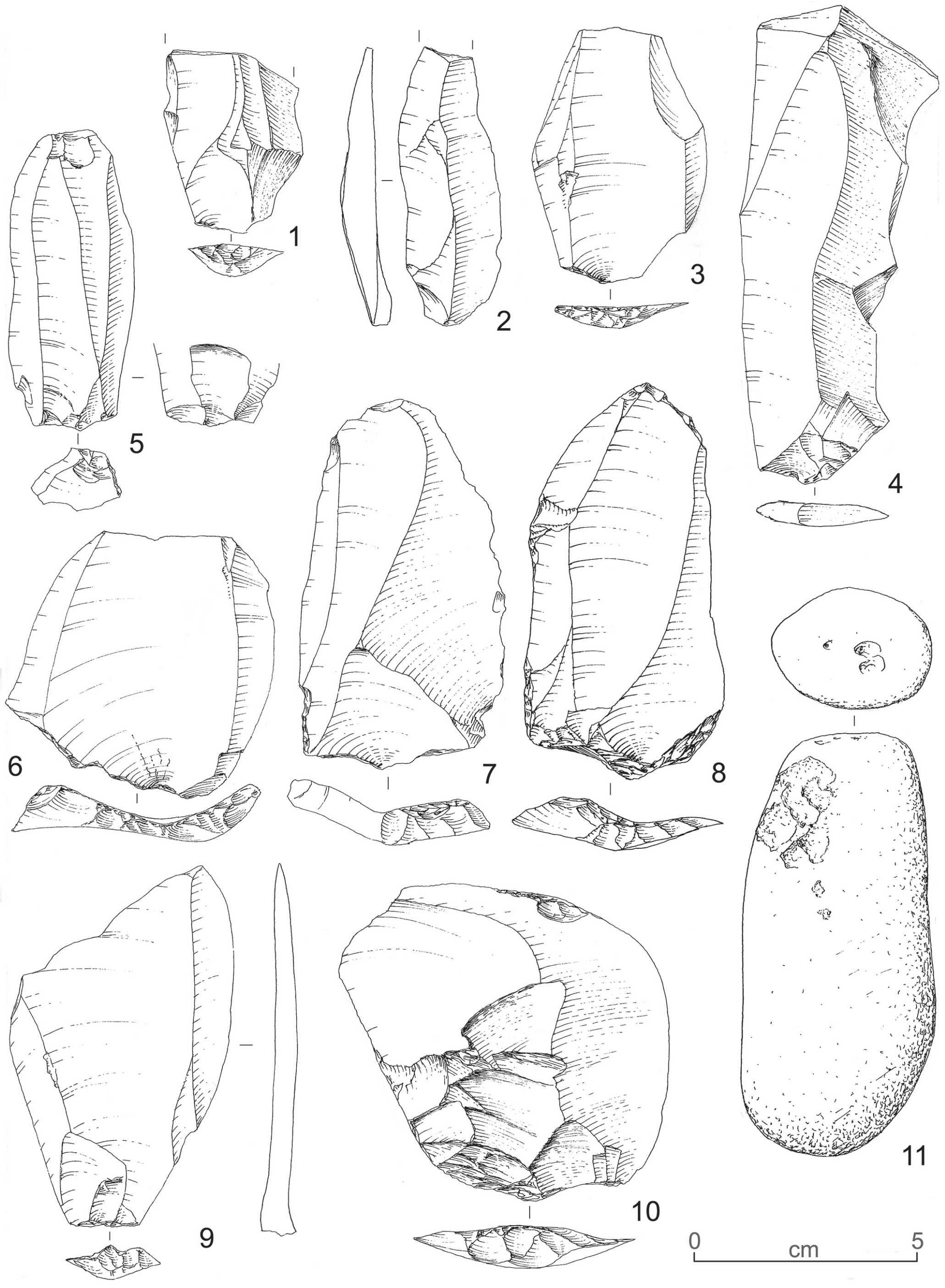
Pl. 6. SMR-1: Levallois blade core of local chert (n. 1), Levallois blade of local chert (n. 2), flakes of non-local raw material (nos. 3-5), elongated Levallois point type 3 of local chert (n. 6); SMR-1E: Levallois point of non-local chert (n. 7) (Photographs E. Starnini)



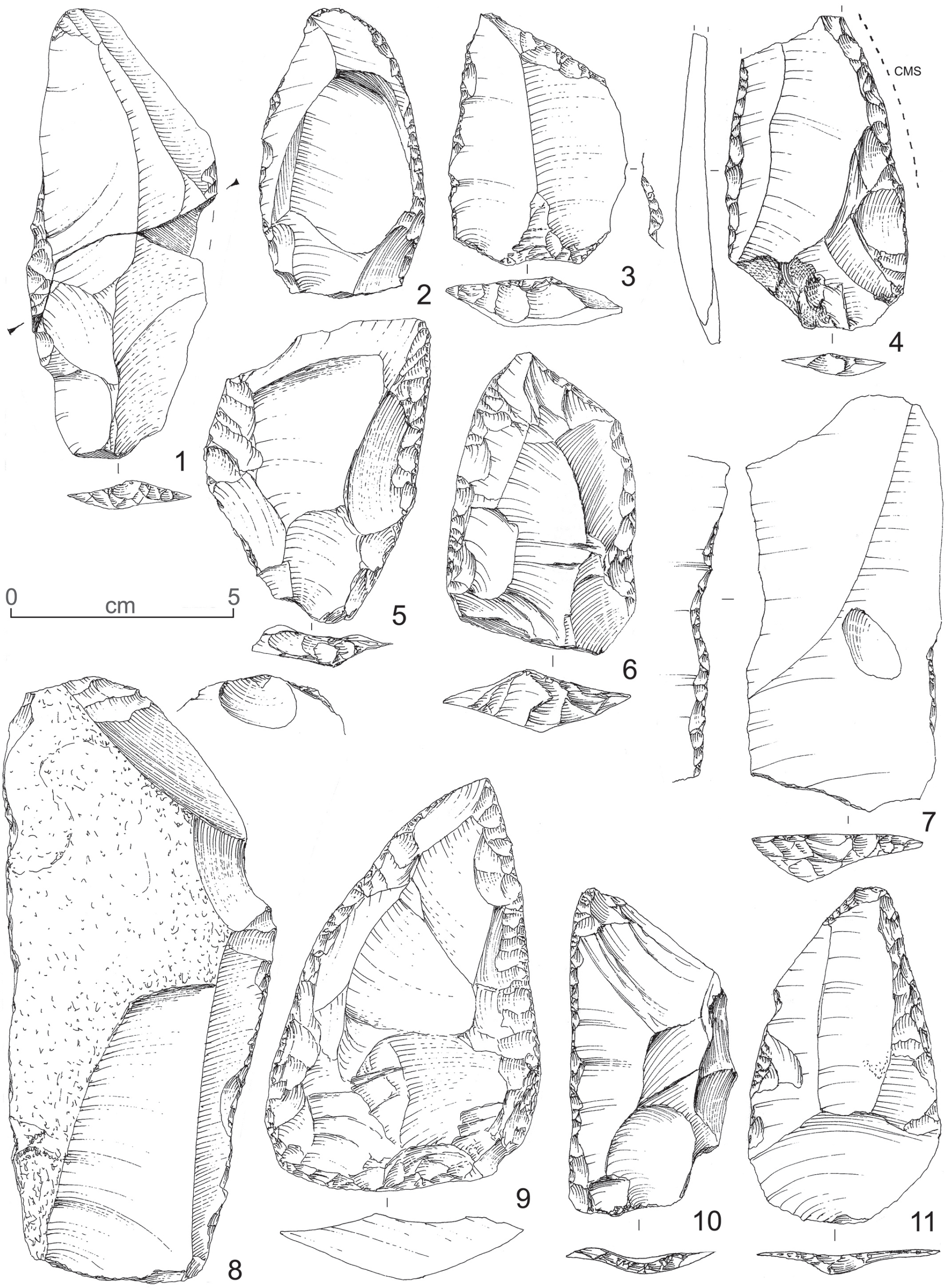
Pl. 7. SMR-1W: single, transverse, concave scraper type 24 (n. 1), transverse scrapers (nos. 2 and 3), Mousterian points type 6 (nos. 4 and 5), single, transverse, straight scraper type 22 (n. 6), Mousterian disc-core (n. 7), Levallois points (nos. 8 and 9), Levallois core (n. 10) (Drawings P. Biagi, inking G. Almerigogna)



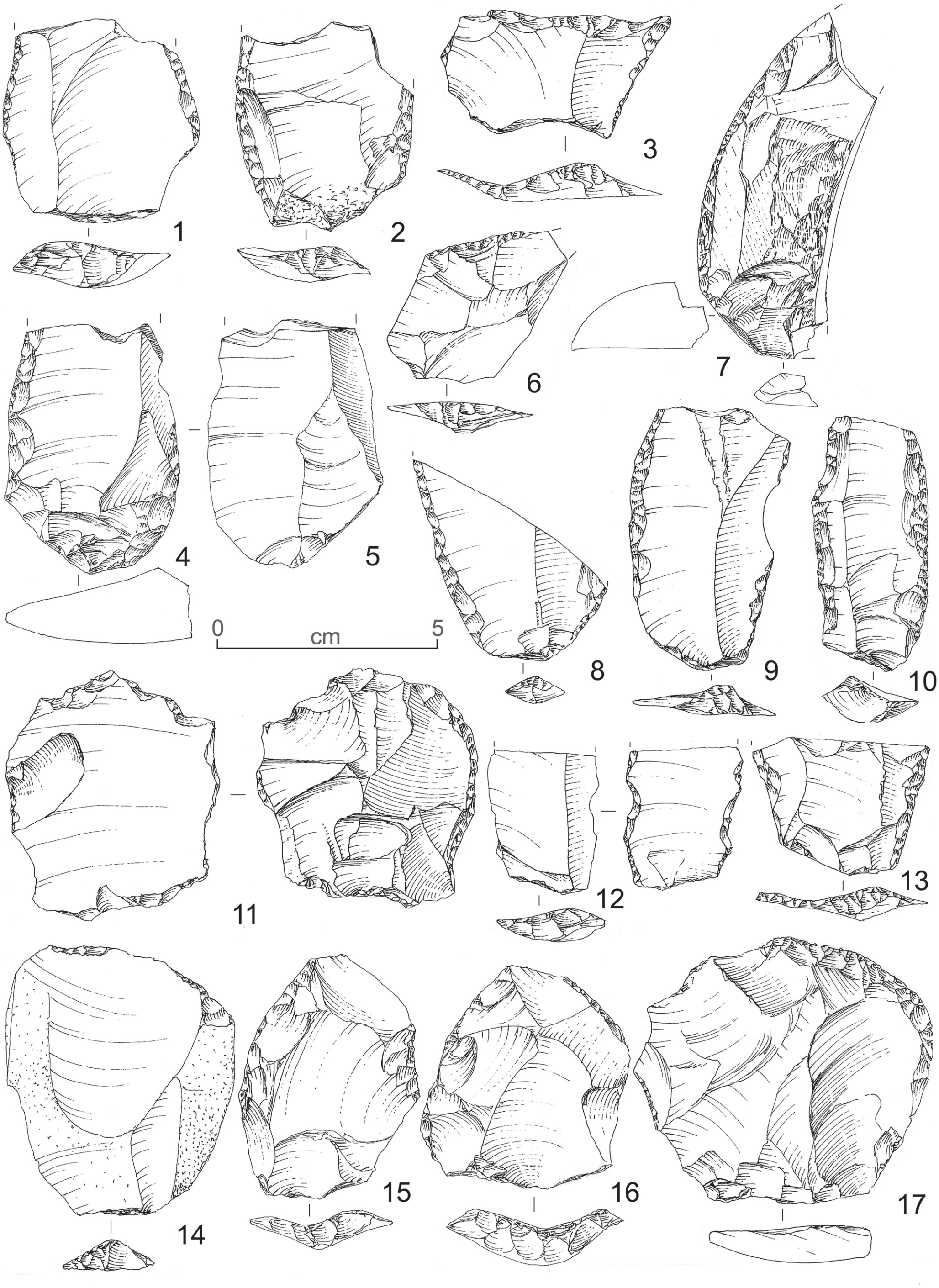
Pl. 8. SMR-1W: different types of scrapers (nos. 1-6, 8-10); SMR-2: side scraper (n. 7) (Drawings P. Biagi, inking G. Almerigogna)



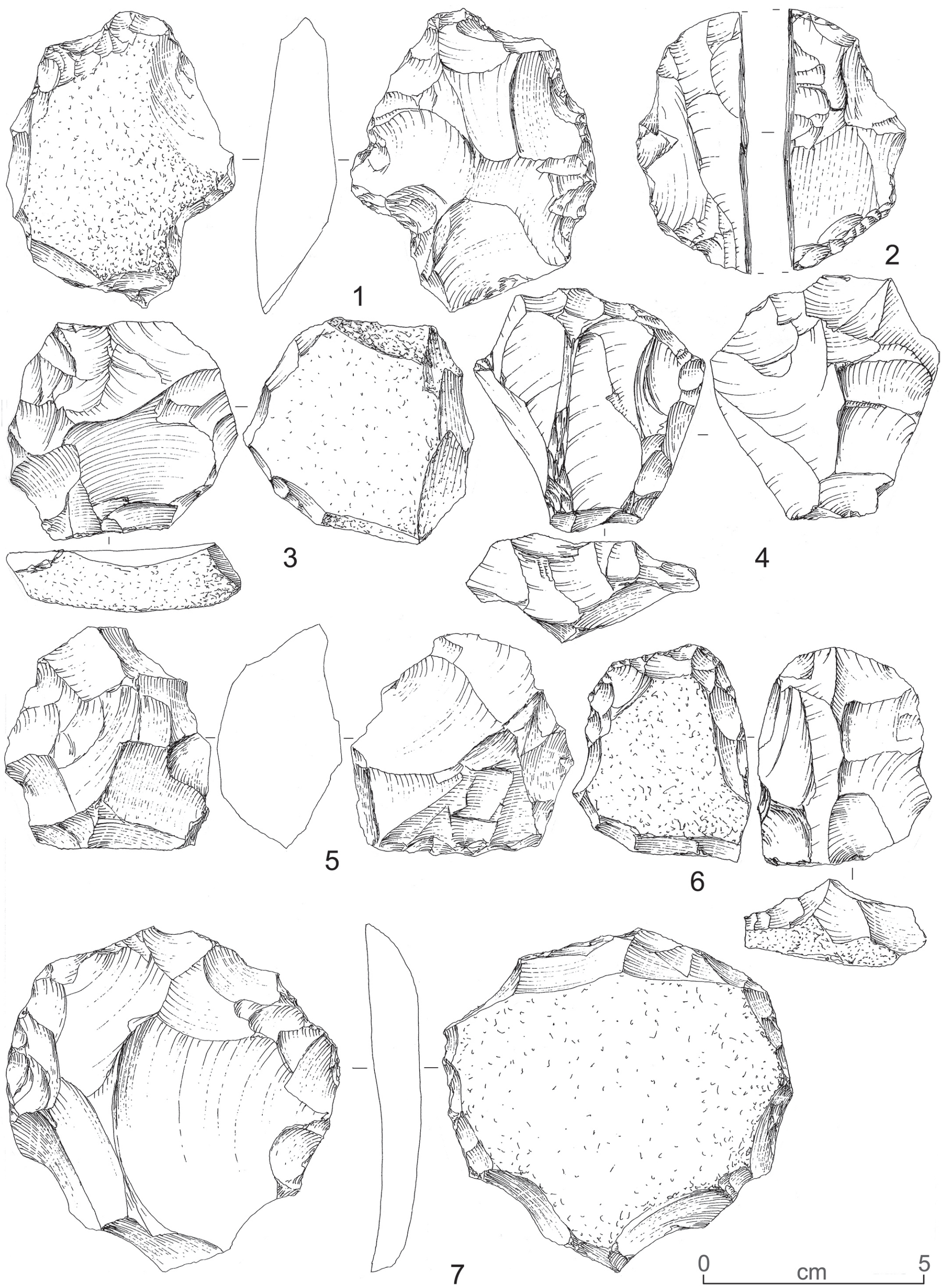
Pl. 9. SMR-2: Levallois blades (nos. 1-4), Levallois flakes (nos. 6-10), hammer on pebble (n. 11); SMR-1: Levallois blade (n. 5) (Drawings P. Biagi, inking G. Almerigogna)



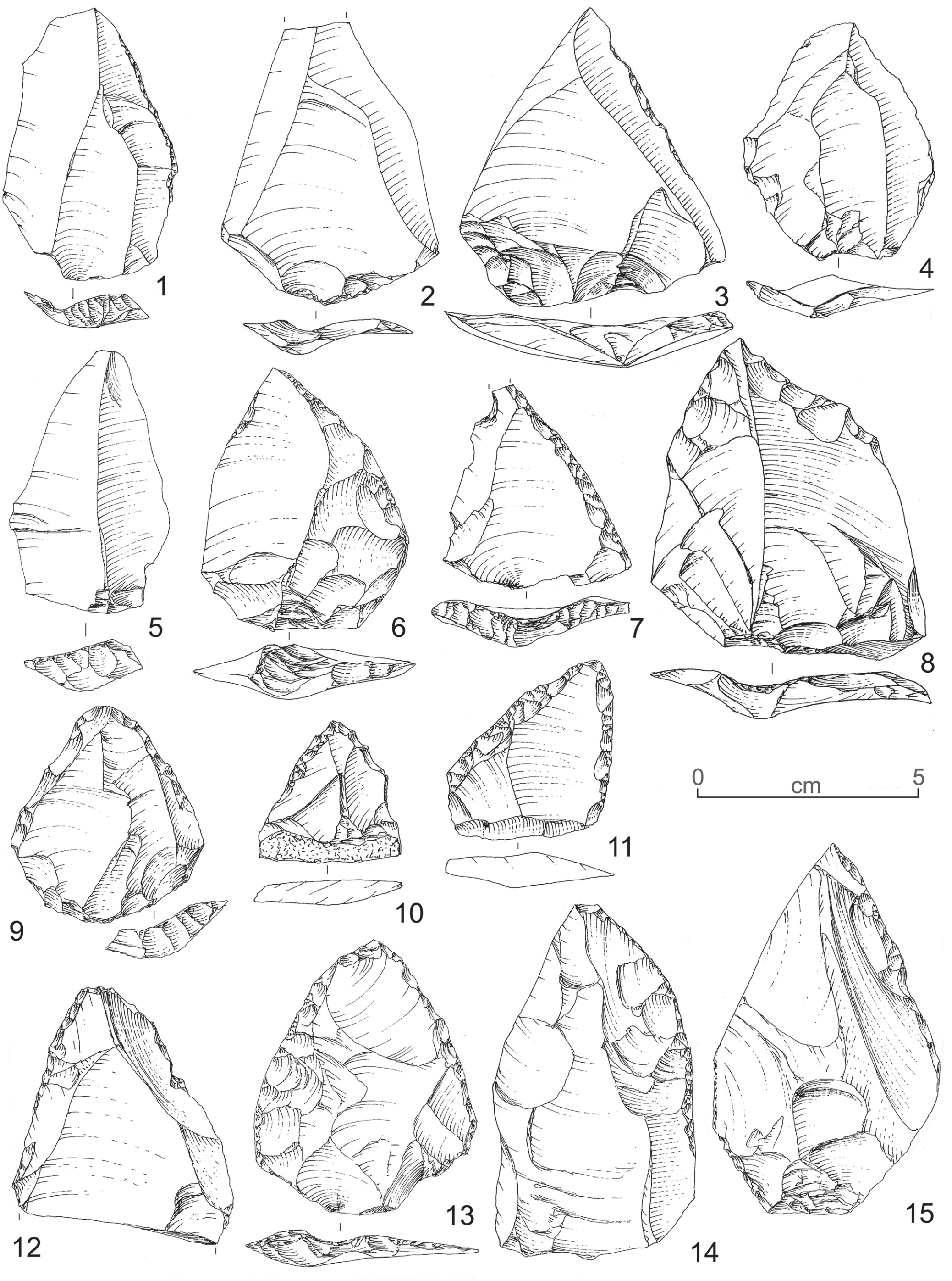
Pl. 10. SMR-2: partly burnt Levallois blade-like flake side scraper conjoined from 2 fragments, obtained from red radiolarite of unknown source (n. 1), double scraper with use-wear traces (CMS = cut medium soft) obtained from red radiolarite of unknown source (n. 4), various types of scrapers (nos. 2, 3, 5-8, 10 and 11), Mousterian convergent scraper of local chert obtained through scalar retouch (n. 9) (Drawings P. Biagi, inking G. Almerigogna)



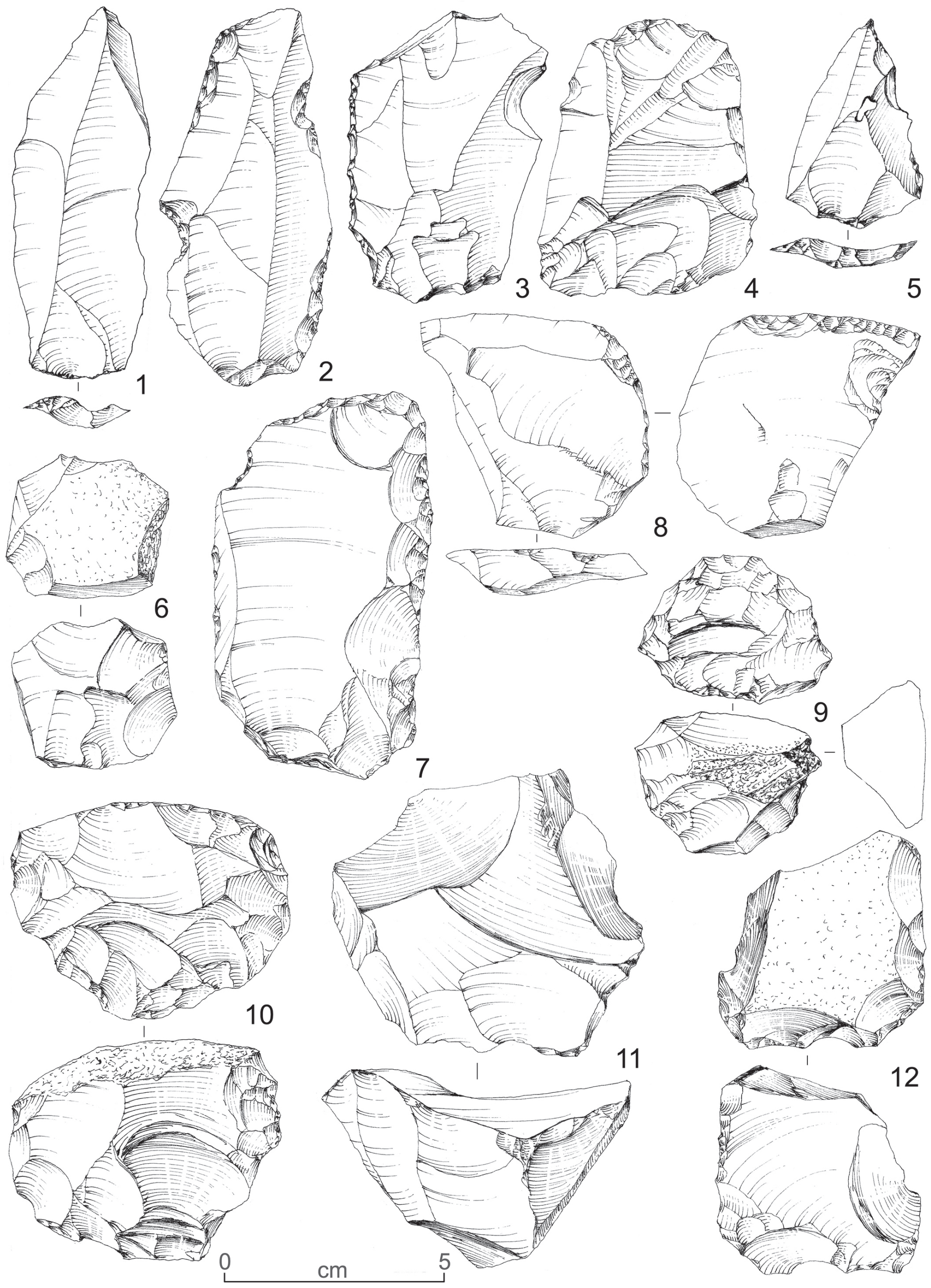
Pl. 11. SMR-2: different types of scrapers (nos. 1-17) (Drawings P. Biagi, inking G. Almerigogna)



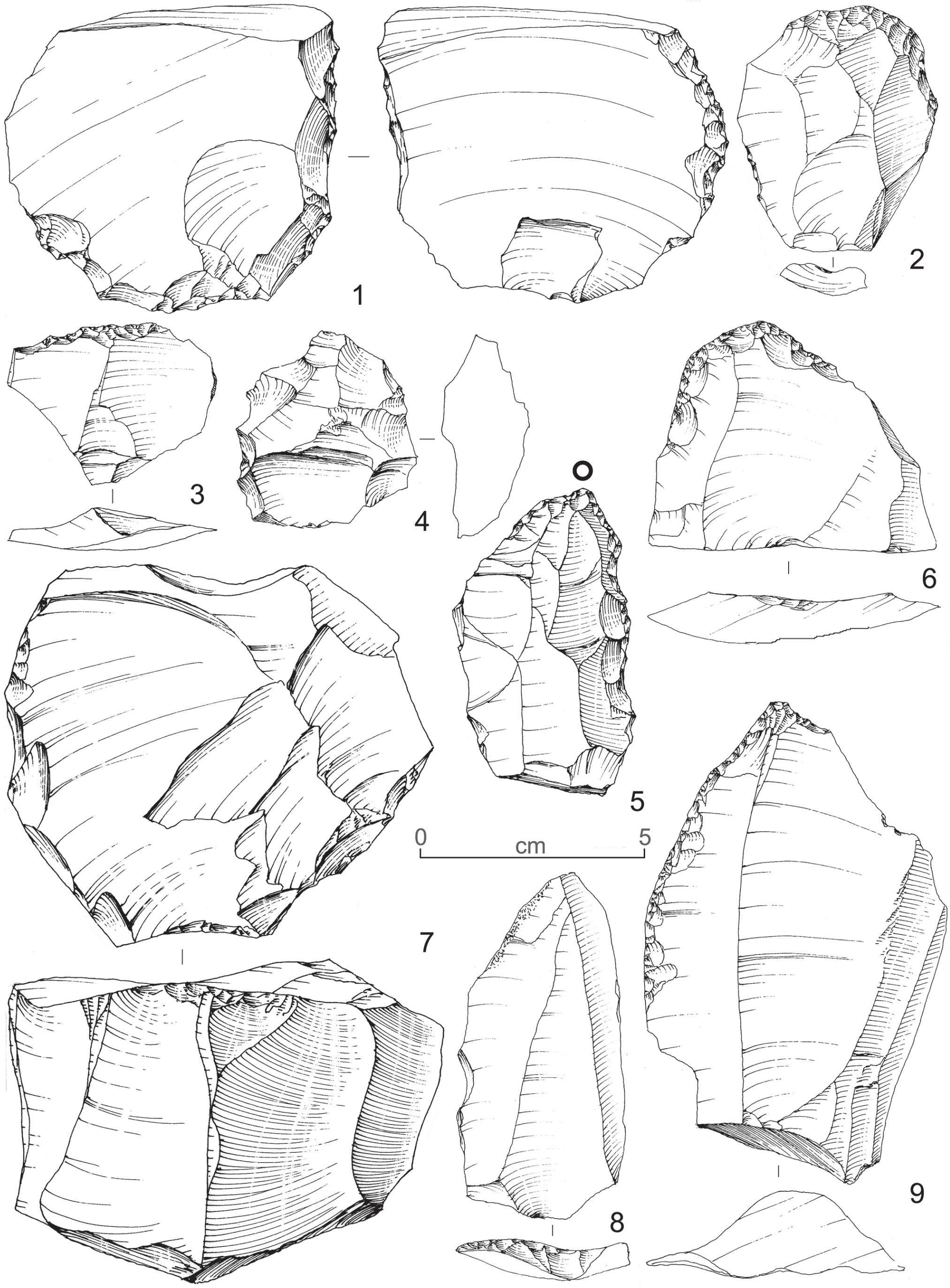
Pl. 12. SMR-2: Mousterian disc-cores characterised by centripetal, recurrent flaking around the entire core margin (nos. 1-7) (Drawings P. Biagi, inking G. Almerigogna)



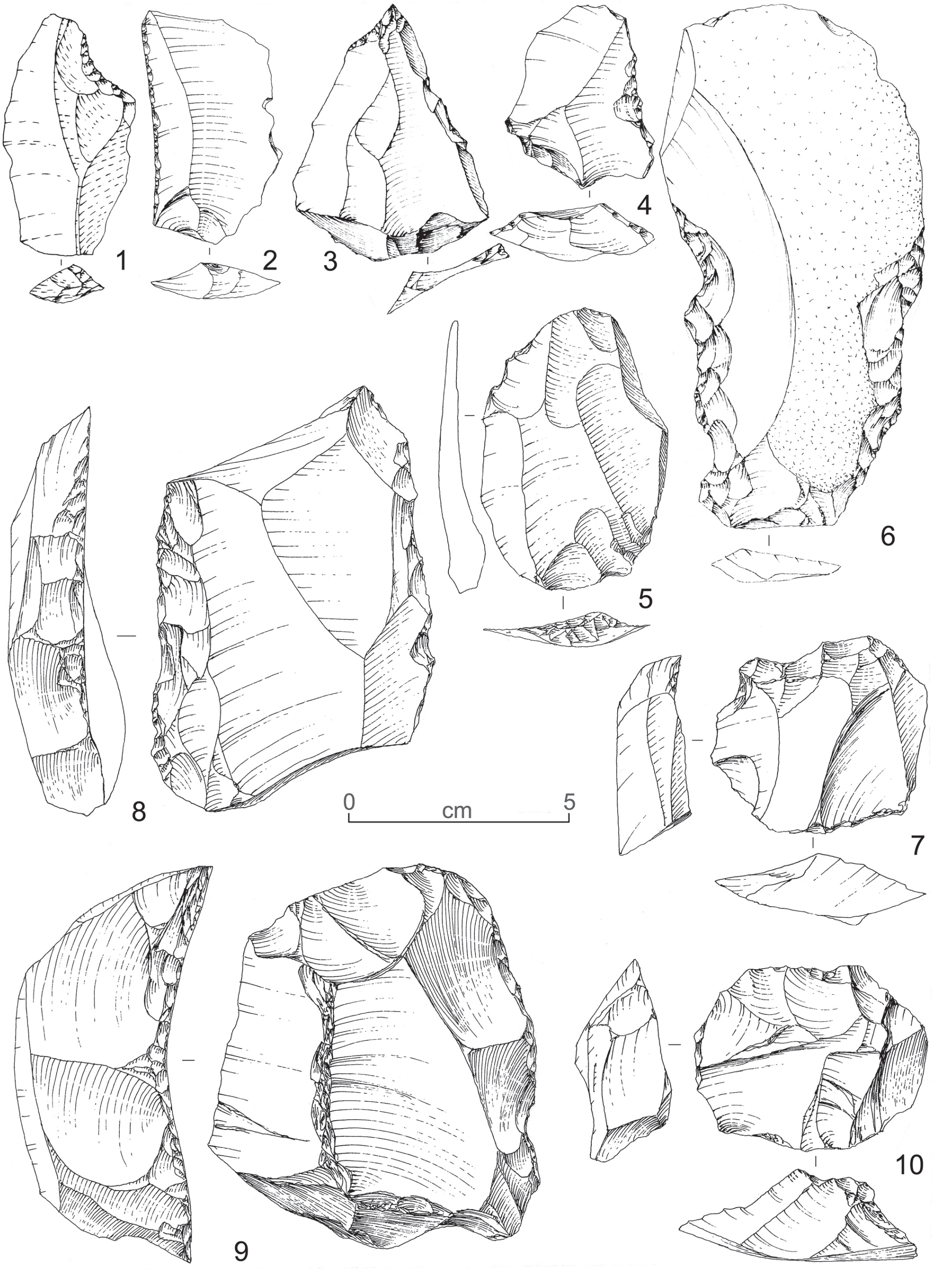
Pl. 13. SMR-2: unretouched and retouched Levallois points (nos. 1-8 and 15), different types of scrapers made from local chert (nos. 9-14) (Drawings P. Biagi, inking G. Almerigogna)



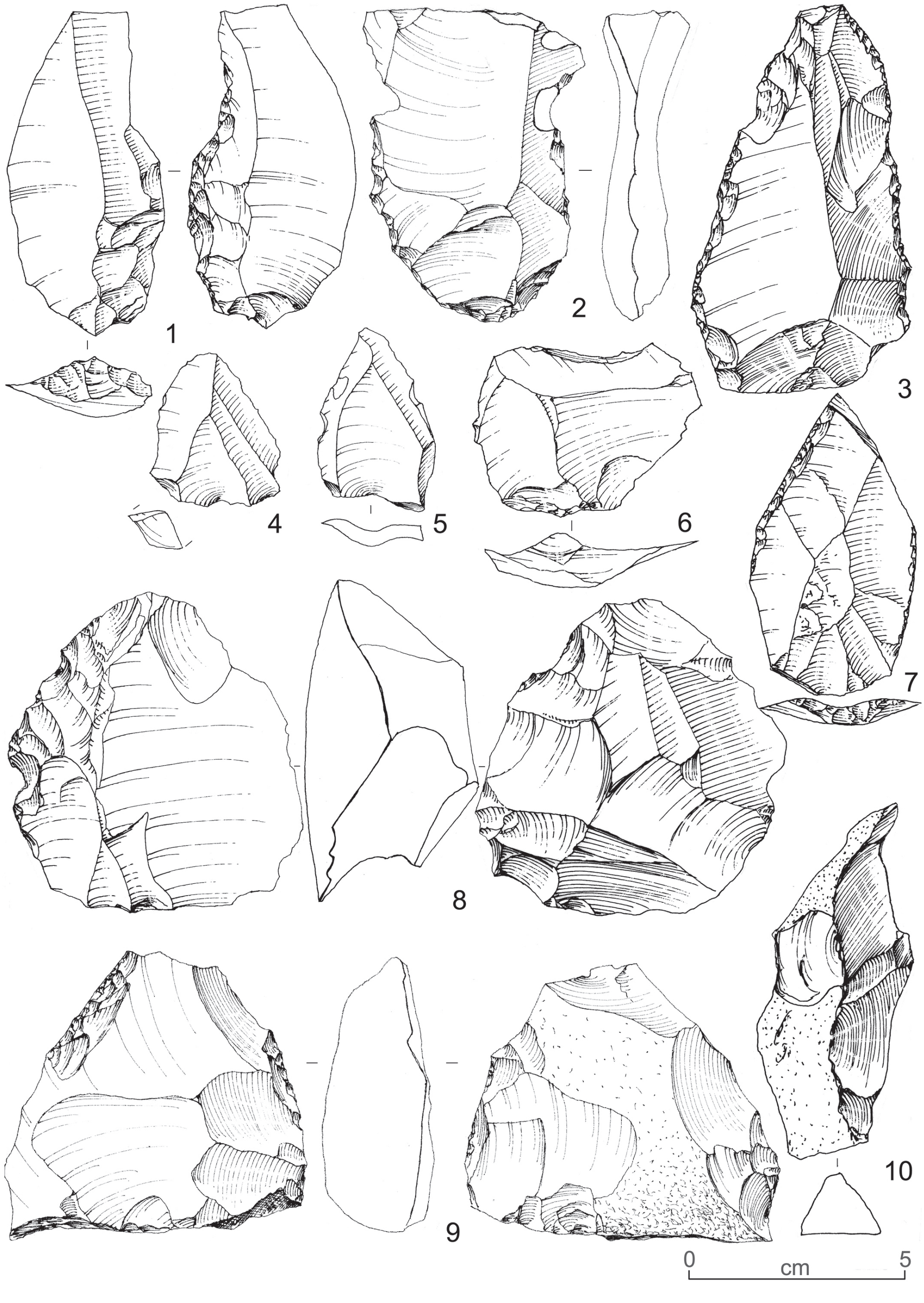
Pl. 14. Samarina surface sites: Levallois blade (Sam-55: n. 1), side scrapers (Sam-56: n. 2; Sam-39: n. 3), Levallois flake (Sam-58: n. 4), Levallois point (Sam-58: n. 5), Mousterian disc-core characterised by centripetal flaking (Sam-43: n. 6), convergent scraper (Sam-57: n. 7), straight single scraper with interior retouch (Sam-13: n. 8), cores characterised by centripetal flaking (Sam- 49: nn. 9 and 10), flake core (Sam-58: n. 11), Levallois core (Sam-60: n. 12) (Drawings P. Biagi, inking G. Almerigogna)



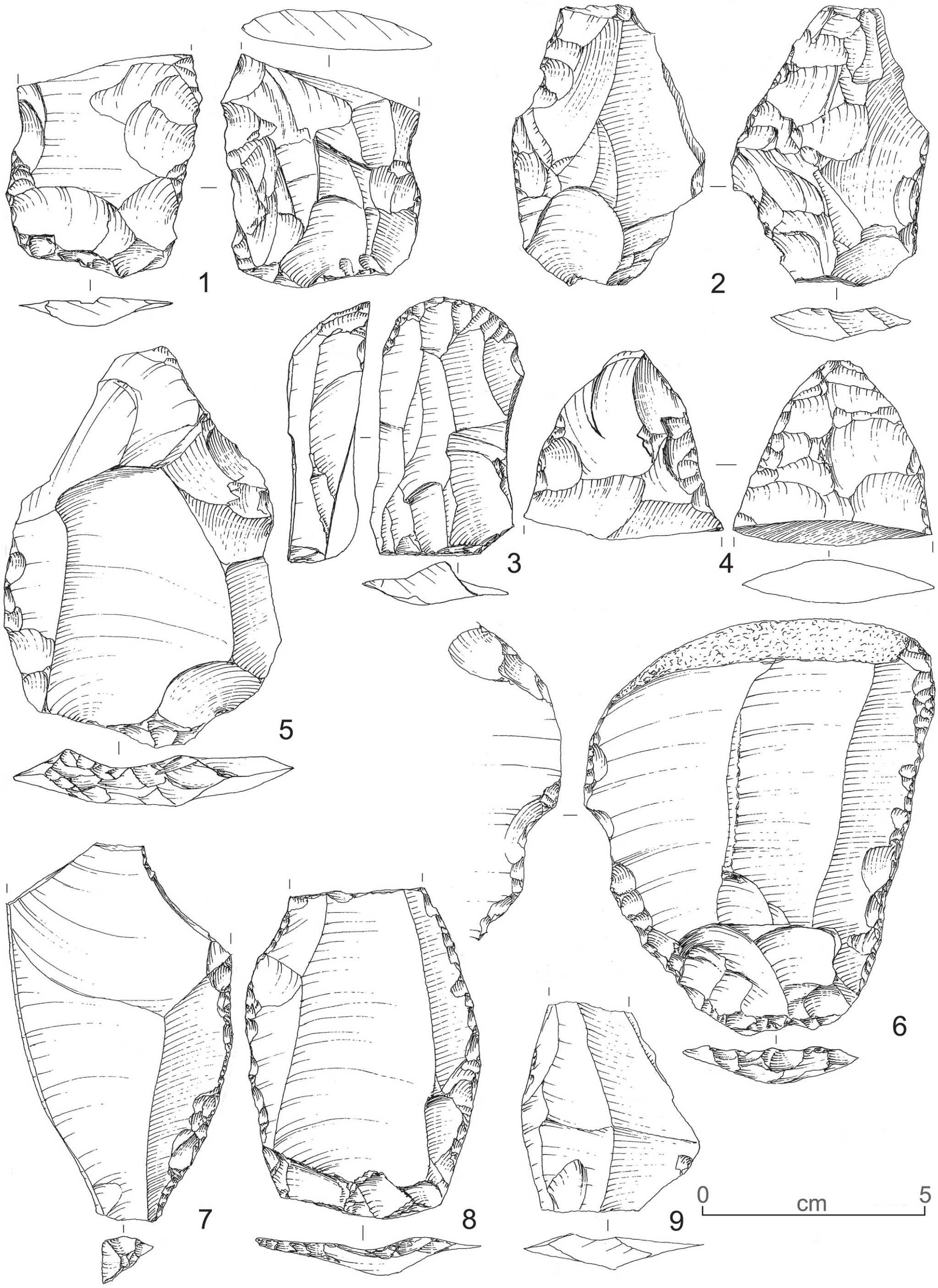
Pl. 15. Samarina surface sites: alternated scraper type 29 (Sam-7A: n. 1), convex, transverse scraper (Sam-36: n. 2), single, transverse scraper (Sam-40: n. 3), Mousterian disc-core characterised by centripetal flaking (Sam-18: n. 4), convergent scraper (Sam-40: n. 5), fragment of scraper (Sam-27: n. 6), laminar flake core (Sam-62: n. 7), Levallois point (Sam-40: n. 8), single side scraper (Sam-43: n. 9) (Drawings P. Biagi, inking G. Almerigogna)



Pl. 16. Materials from different sites: notched quartzite flake (Vasilitsa-7δ: n. 1), dark green quartzite side scraper (Sam-29: n. 2), pseudo-Levallois point (Sam-23: n. 3), side scraper (Fourkas-2: n. 4), Levallois flake (SMR-4: n. 5), double side scraper (Koleo-1: n. 6), transversal scraper (Aghios Elias-1: n. 7), carinated scrapers (Anitsa 1706 m, n. 8; and Anitsa top, n. 9), core (Anitsa, n. 10) (Drawings P. Biagi, inking G. Almerigogna)



Pl. 17. Mt. Gurguliu surface finds: inverse scraper type 25 (GRG-1: n. 1), single-side scraper (GRG-26: n. 2), convergent scraper (GRG-23: n. 3), pseudo-Levallois point (GRG-72: n. 4), Levallois point (GRG-74: n. 5), Levallois flake (GRG-2: n. 6), retouched Levallois point (GRG-25: n. 7), Levallois cores (GRG-49: n. 8; GRG-56: n. 9), corticated crested flake (GRG-80: n. 10) (Drawings P. Biagi, inking G. Almerigogna)



Pl. 18. Kirkuri B (KRK-B): fragments of bifacial tools (nos. 1 and 4), side scrapers (nos. 2 and 6), end scraper (n. 3), Levallois flake (n. 5); Buried Site near the Holy Cross Church: side scrapers (nos. 7 and 8), Levallois flake (n. 9) (Drawings P. Biagi, inking G. Almerigogna)