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# THE MIDDLE PALAEOLITHIC RECORD OF GEORGIA: A SYNTHESIS OF THE TECHNOLOGICAL, ECONOMIC AND PALEOANTHROPOLOGICAL ASPECTS

*ABSTRACT: This paper presents an overview of the work carried out over the last decade on the Middle Palaeolithic of Georgia by a Georgian-French team, co-directed by the national Museums of Georgia and France. Since 2000, the importance of several Middle Palaeolithic key sites in the Rioni-Kvririla Basin (western Georgia) has been highlighted by this collaboration. Southern Caucasus/Transcaucasia was occupied by human groups throughout the Pleistocene. This is to some extent due to its geographic position at the crossroads of Europe, Asia and Africa, as well as the fact that the region offered a rich variety of ecological niches to hominin populations. The southern flanks of the Great Caucasus mountain range is an area particularly rich in Palaeolithic sites, which have revealed evidence of the local evolution of some regionally-specific Palaeolithic traditions, as well as broader regional influences, particularly in relation to the Levant. The archaeological record of these sites demonstrates the need for further investigation into the relationship between environmental and cultural changes in order to enhance our understanding of the role of the Caucasus Mountains during the Palaeolithic.*

*KEY WORDS: Middle Palaeolithic – Technology – Palaeoanthropology – Economy – South Caucasus Georgia*

## INTRODUCTION

The Southern Caucasus (including Transcaucasia) is located between the Black and Caspian Seas, covering the Republics of Georgia, Armenia, and Azerbaijan. This region is at the crossroads of Asia, Africa and Europe. However, hominin mobility has been constrained by the 1200 km long Great Caucasus mountain range which

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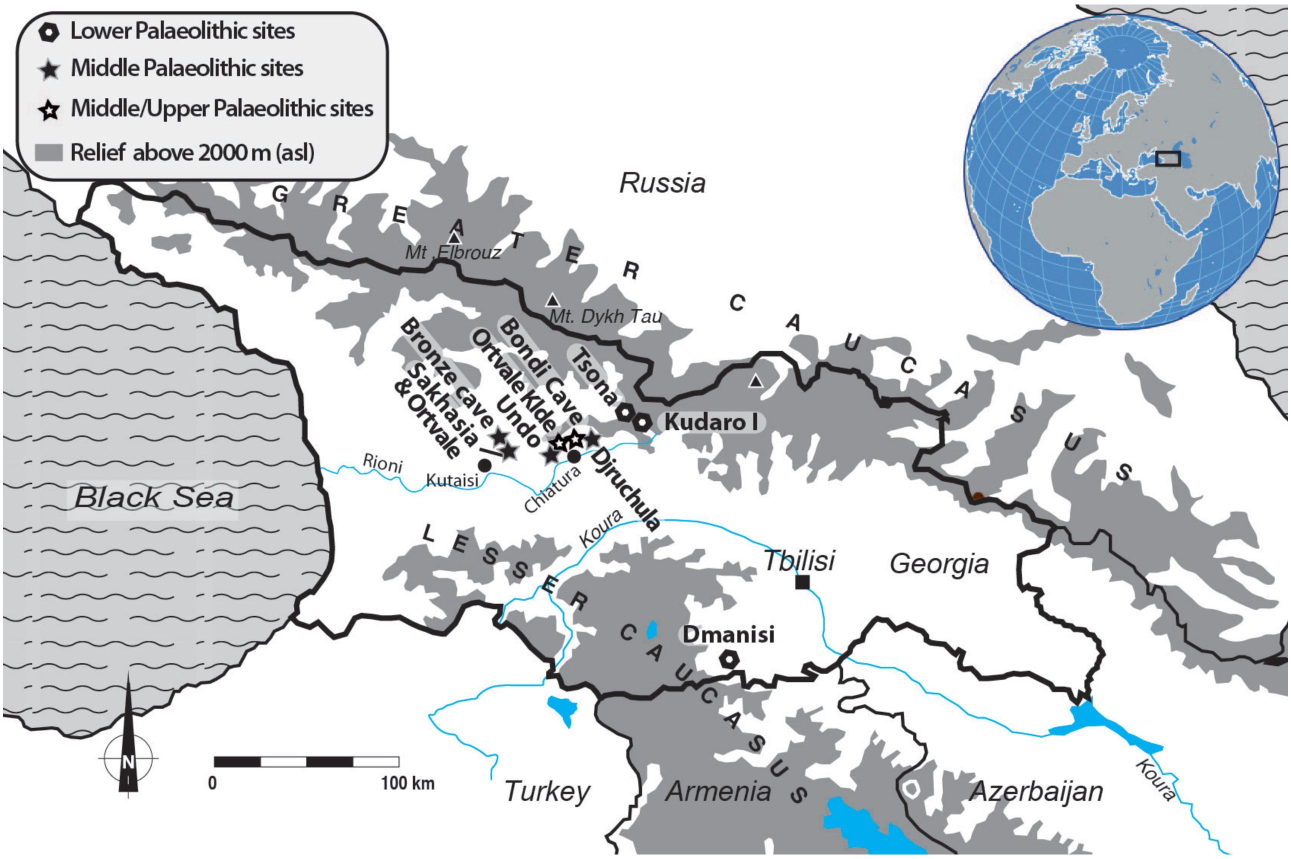


FIGURE 1. Location of the Lower and Middle Palaeolithic sites south of the Caucasus Mountains.

transects the Southern and Northern Caucasus with peaks reaching 5633 m asl.

It has been long postulated that during glacial periods, the Greater Caucasus formed a biogeographic barrier dividing the Southern and Northern Caucasus (Adler, Tushabramishvili 2004). This hypothesis is supported by lithic analyses that document specific Middle Palaeolithic (MP) features in the Southern Caucasus. Whilst in the case of the Northern Caucasus, Middle Palaeolithic techno-typological features share clear affinities with Eastern Europe and Crimea (Cohen, Stepanchuk 1999, Golovanova, Doronichev 2003), the Southern Caucasian Middle Palaeolithic industries are related to those from the Levant and the Zagros regions (Beliaeva, Liubin 1998, Tushabramishvili 2002, Tushabramishvili *et al.* 2007). However, the demographic isolation of the populations who made these industries has yet to be proved. In contrast, during Upper Palaeolithic (UP) times it is most likely that modern humans crossed this geographic barrier at least during milder climatic phases, as techno-typological similarities can be observed in Upper Palaeolithic lithic assemblages from the Southern and Northern Caucasus, suggesting more frequent inter-regional human contacts during this time period.

In such context, studies and fieldwork campaigns conducted over the past decade have focused on Lower and Middle Palaeolithic sites and assemblages in order to describe hominin behavior and evolution in the Southern Caucasus, as well as to characterize the timing and process of Neanderthal replacement by modern humans (*Figure 1*). New sites, including both Middle and Upper Palaeolithic sequences, were also discovered, thereby adding to our knowledge of the Upper Pleistocene occupations and their chronological framework (*Figure 2*). In the frame of this contribution, we will focus on some relevant Middle Palaeolithic series all located in Western Georgia (Rioni-Kvririla Basin, near the city of Chiatura).

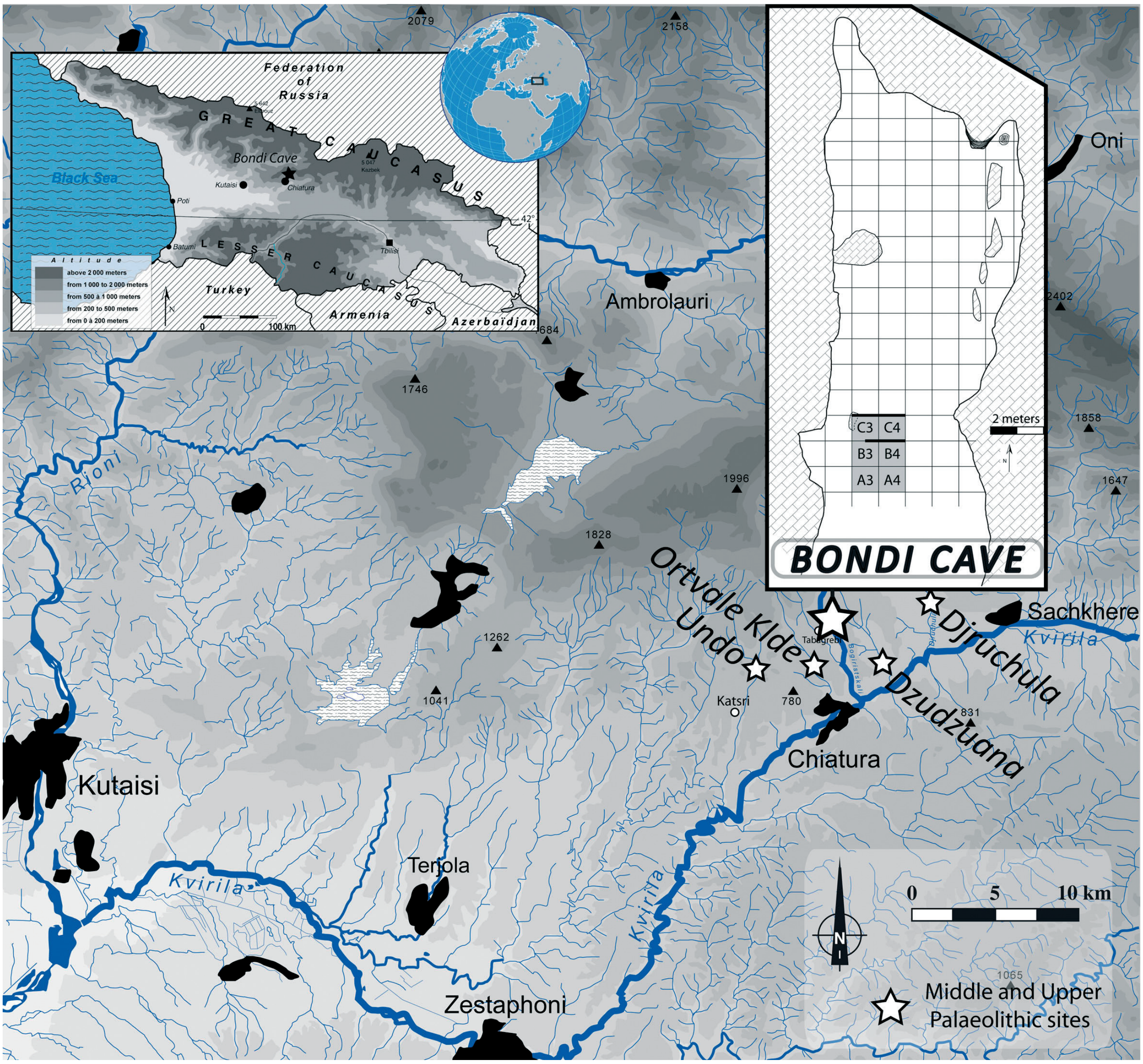


FIGURE 2. Location of the Middle Palaeolithic sites in the Imereti region.

## BEFORE THE MIDDLE PALAEOLITHIC

Dmanisi is the oldest site with records of hominin occupations outside Africa and provides evidence of hominin dispersal in Europe and Asia. The lithic assemblage from this site offers insights into hominin behavior 1.7–1.8 Ma ago in Eurasia and displays common features with the African Oldowan (Gabunia *et al.* 1977, Mgeladze 2008, Mgeladze *et al.* 2010, 2011). Similar sites with an Oldowan assemblage ("Tamanian variant of the Oldowan"), located along the Azov Sea and dated to 1.6–1.1 Ma ago, indicate that hominin populations probably moved along the Black Sea coast before 1 Ma ago (Shchelinsky *et al.* 2010).

Acheulean sites with *in situ* archaeological layers are rare in the Caucasus. Radiometric dates indicate a large temporal gap between Dmanisi and the oldest evidence of the Acheulean tradition in the area. These sites are only located in the southern part of the Caucasus Mountains: Tsona, Koudaro I and III. The Acheulean tradition is not known from the northern slopes of the mountain range (for instance at Treugol'naya) (Liubin 1959, 2002, Liubin, Barychnikov 1984, Liubin, Levkovskaya 1972, Levkovskaya 1980, Vereshchagin, Barychnikov 1980, Zamiatnine 1961). The base of Treugol'naya is dated to 583 ± 25 ka by ESR (levels 6, 7a, 7b) (Doronichev 2008, Doronichev, Golovanova 2010, Golovanova 2000, Golovanova, Doronichev 2005). It has been hypothesized that the Greater Caucasus mountain barrier was never crossed by these hominin populations, and that the occupants of the Southern Caucasus accessed this region from the Levant. The Acheulean (assemblages with bifacial tools) is clearly attested at 350 ka at Koudaro I even though evidence suggests an earlier arrival at around 600 ka.

Tsona cave, like Koudaro I and III, is located at the foot of the southern slope of the Great Caucasus, in Central Georgia (South Ossetia) (Kalandadze, Tushabramishvili 1978, Tushabramishvili 1978, 1984, Vekua *et al.* 1987). This is a high altitude site (2100 m above sea level [asl]), which yielded two Acheulean levels of unknown absolute age. Relative chronology is based on the archaeological attributes of the lithic artefacts (end of the Acheulean or Upper Acheulean) and by correlation with level 5v from Koudaro I cave, which is dated to circ. 350 ka (Mgeladze *et al.* 2008, Tushabramishvili 1984). Koudaro I is dated by TL between 360–90 and 245 ka. The whole sequence of Koudaro III seems to be younger, except for the base which is dated by TL to 580–112 ka (Golovanova, Doronichev 2003, Liubin 2002).

Koudaro I, located at 1600 asl, is near potential pathways, in South Ossetia close to Tsona. Silty levels 5a, 5b, and 5v yielded Acheulean material (Mgeladze 2008) and dating conducted by RTL (Moscow University) yielded an age of 360 ± 90 ka for level 5c, 350 ± 70 ka for level 5b, 245 ± 29 ka for level 5a, and 360 ± 90 ka and 250–300 ka for level 5v (e.g., Baryshnikov 1977, 2002, Liubin 1977, Liubin, Beliaeva 2004, Liubin, Levkovskaya 1972, Liubin *et al.* 1985, Vereshchagin 1967, Vereshchagin, Baryshnikov 1980).

Some specific tools, such as bifacial "Tzaldi" type tools are typical of the Caucasian Acheulean and are present in Tsona, Koudaro I and III, Azokh and in open-air sites in South Ossetia, Imereti, Abkhazia, and Armenia (Liubin 1960, 1981, 1989, Liubin, Beliaeva 2004, 2006, Liubin, Bosinski 1995, Touchabramichvili 2003). Other features, such as cleavers on flakes and various convergent bifacial tools, resemble the Acheulean of the Levant, suggesting influences from this area associated with original features, due to the Great Caucasus barrier (Bar-Yosef, Goren-Inbar 1993, Goren-Inbar *et al.* 2002, Ranov, Schäfer 2000).

## NEANDERTHAL REMAINS IN MIDDLE PALAEOLITHIC SITES

In the centre of Georgia, near Kutaisi and Chiatura, five Middle Palaeolithic sites have yielded human remains (Bronze Cave, Ortvale Klde, Ortvala Cave, Djruchula, Sakajia) (*Figure 3*). From a wider geographic perspective, these sites are located between the Neanderthal fossils from the North of the Black Sea, Kiik-Koba (Crimea) and Mezmaiskaya (Russia), and those from the south of Turkey, Shanidar (Iraq), and Dederiyeh (Syria).

A very well preserved upper second molar was found by David Tushabramishvili in 1974 in Bronze Cave, also known as Cuckhvati or Tsutskhvati. It was discovered in the 8th layer, dated by Pinhasi *et al.* (2012), and has a non-calibrated age of more than 44,000 years. It belongs to an eight-year-old child according to Gabunia *et al.* (1977), who had identified it as a permanent tooth. However, the bulging crown and the proportions between the crown and the root clearly indicate the temporary stage of this tooth. It is a deciduous tooth with an age estimate of 20–30 months (Logan, Kronfeld 1935, modified by Schour 1960 in Lautrou 1986), which is the age at which this tooth typically erupts. The root is more than three quarter complete. The complete root development (the closing of the root apex) occurs in modern-day populations at the age of 3.1 years in males and 2.8 in females (Smith 1991). Granat and Heim (2003) advocate an age of 30 to 32 months for the closing of the apex in Neanderthals. It is thus reasonable to advance an age of approximately 2.5–3.0 years old for the Bronze Cave molar. Morphologically, it is important to note the presence of Carabelli's tubercle and of a continuous *crista obliqua* joining the protocone and the metacone. The well-defined taurodontism described in Gabunia and Vekua (1990), according to Gabunia *et al.* (1961), is not confirmed by the observations of this study.

A second lower permanent molar was found in Ortvale Klde cave, located in the region of Tchiatoura, near the village of Abas-Zodi and Haut-Rgani, in the River Cerula gorge. It comes from the 5th layer of the second stratigraphic level containing Middle Palaeolithic material. Altogether, six levels at this site contain Middle Palaeolithic remains (Tushabramishvili 2002). The degree of wear and the type of tooth suggest that it comes

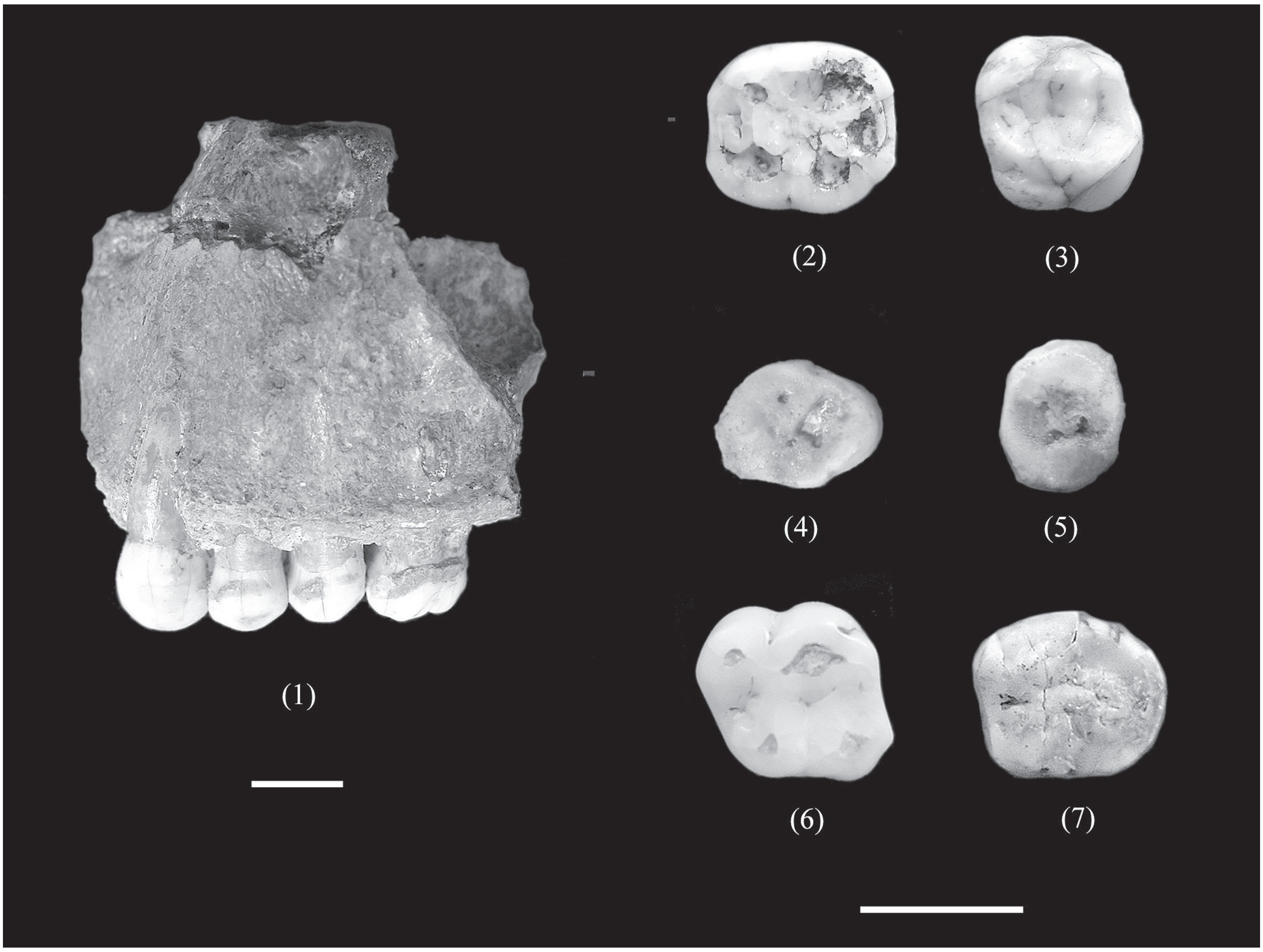


FIGURE 3. Middle Palaeolithic human remains from Georgia. 1, Sakajia left maxillary lateral; 2, Sakajia left M1 occlusal; 3, Cuckhvati left $dm^2$ occlusal; 4, Ortvala Cave left M3 occlusal; 5, Ortvala Cave I2 (?) occlusal; 6, Djruchula left M1 occlusal; 7, Ortvala Klde left M2 occlusal. Scale = 1 cm. Photos by F. Rivals and T. Chevalier.

from an adult or a development stage approaching adulthood. The presence of the anterior fovea on the occlusal surface is noteworthy. The roots are not fused.

Near Sakajia Cave, in Ortvala Cave, two adult teeth were unearthed in layer 3a, probably dating approximately to 38,500 years (non-calibrated, Pinhasi *et al.* 2012). One of these is a third upper left molar and the second tooth may possibly be a second upper incisor. The teeth are too worn to describe the occlusal surface.

In 1961, in Djruchula or Djroutchoula Cave, a first upper left adult molar was discovered in a Mousterian layer attributed to the second stratigraphic level. Gabunia *et al.* (1961) consider it to be a Neanderthal tooth, due to its dimensions, the fusion of the roots and the presence of taurodontism. It is important to add that the hypocone is well developed and that the general morphology is very similar to that of the upper first molar ($M^1$) from the Sakajia maxilla (see below). These two teeth are easy to compare given that they both display similar degree of wear (stage 5, Molnar 1971). These two upper first molars ($M^1$) present particularly large mesio-distal diameters, especially when compared to the Neanderthals from the Near East.

Sakajia Cave yielded the only Neanderthal remains, the most remarkable human elements, apart from the isolated teeth above, in the Southern Caucasus. The finds consist of a first lower left molar and a fragment of a left maxilla from layers 3b and 3d respectively, both of which are assigned to Würm I. Layer 3b is between 40,200 and 45,600 uncalibrated (uncal) years BP (Pinhasi *et al.* 2012).

No absolute date is available for layer 3d but the overlying layer 3c is dated to 45,700 uncal years BP (Pinhasi *et al.* 2012). The maxillary fragment is 50 mm in length and comprises the sub-nasal region and that overlying the jugal teeth. The presence of the alveolar incisor sockets and those of the dentition indicates that approximately half of the palate is preserved. The fracture appears to have occurred very close to the median palatine (intermaxillary) suture. Part of the maxillary sinus is present. It is delineated from the nasal cavity by a prominent ridge. The canine, premolars, and first molar are in anatomical position. A fragment of a second molar is visible but cannot be used for an anatomical description. The teeth are white, with a brownish deposit identified as calculus. This deposit is present on the vestibular crown surface of the $P^3$, the $P^4$, and the $M^1$. It is oblique and distally close to the cervical line. Tooth wear implies that this individual is an adult of at least 30 years. The Sakajia mandible was previously identified as a Neanderthal based on its massive size, the morphology of the sub-nasal feature and the size and shape of the maxillary sinus (Gabunia, Vekua 1990). For the latter authors, this maxilla is characterized by the narrowness of the piriform aperture and by its significant palatal depth. In addition to their observations, it is important to note the complex occlusal surfaces on all the teeth marked by marginal ridges, accessory cusplets or bifurcated central crests and a Carabelli tubercle on the $M^1$. Moreover, the dimensions of the canine and the molar are particularly large. The large mesio-distal diameter of the molar is partly due to the significant development of the hypocone. Due to the state of preservation of the maxilla, it is not possible to determine whether or not there is a canine fossa; its absence is a well-known attribute of Neanderthals (e.g., Heim 1974, 1978, Rak 1986, Trinkaus 1987).

The lower first molar (left $M_1$) from Sakajia is well-preserved with several manganese stains on the crown and roots. The apex of one of the roots is slightly damaged. The degree of wear implies that the specimen comes from a young adult or subadult. The anterior fovea is visible in spite of this wear. The roots are fused. The diameters of the crown, and particularly the mesio-distal diameter, are large in comparison to both Neanderthals and anatomically modern humans.

## MIDDLE PALAEOLITHIC TECHNOLOGICAL AND TYPOLOGICAL FACIES IN GEORGIA

The Georgian Middle Palaeolithic covers a long time span during the Middle and Upper Pleistocene, as shown by new dating from Djruchula, with the early Middle Palaeolithic layers dated to 260–140 ka (Meignen, Tushabramishvili 2006, Mercier *et al.* 2010) and Ortvale Klde, where Late Middle Palaeolithic occupation phases were dated to ca. 38 ka (Adler *et al.* 2008) (*Figure 2*). The lithic assemblages of a dozen key Middle Palaeolithic sites display a wide variety of technological features.

The main sites excavated throughout the 20th century were formerly grouped into four distinct facies (Liubin 1977, 1989, Nioradze 1992, Tushabramishvili 1984), considered to represent evidence of local variations. These are:

1) Charentian Mousterian: Tsopi type;
2) Denticulate Mousterian: Tsutskhvati type including Tskaltsitela Valley sites;
3) Tskinvali type with widespread production of Levallois points;
4) Djruchula-Koudaro type with Levantine laminar production, linking the Lower and Middle Palaeolithic.

This traditional classification is primarily based on typological trends. Recently, Pleurdeau *et al*. (2007) reassessed a number of collections, which led to the identification of technical features and the definition of several techno-types among some of the Middle Palaeolithic series, such as those from Djruchula, Bronze Cave, Sakajia and Ortvala Cave. In spite of common technical bases using Levallois and/or discoid core technologies and local raw material procurement (mainly flint and argillite), the assemblages display high variability. This variability is illustrated through the different ratios of these methods and laminar production.

The main features of these techno-types are summarized below (*Table 1*).

Whereas some local technical features (also visible on the northern flank of the Great Caucasus) have been explained by the ecological adaptation of populations to local environments or regional traditions, other trends have been highlighted as evidence of external influences. In this way, on a regional scale, Golovanova and Doronichev (2003) underlined different regional influences leading to a general overview of Middle Palaeolithic diversity in the Caucasus:

– Northwest MP Caucasian results from East European Micoquian influences;
– Central-South region of the Great Caucasus MP shows Levantine influences;
– Southern part of the Caucasus displays Zagrosian-type Mousterian features.

However, Middle Palaeolithic studies lack the chronological framework required to correlate hominid

TABLE 1. Main features of the lithic series from four key Middle Palaeolithic sites from Western Georgia.

| Sites | Bronze cave | Sakajia Ortvala Cave | Djruchula |
|---|---|---|---|
| Facies type | Tsutskhvati | Sakhasia/Ortvale | Djruchula-Koudaro |
| *Chaîne opératoire* | *In situ* Debitage | *In situ* Debitage<br>and imported pieces | Debitage<br>Mostly imported pieces |
| Product sizes | Small sizes<br>(L < 40 mm) | Middle range of sizes<br>(L = 50 mm) | Long products |
| Main features of core technology | Flaking on one dominant surface (unipolar)<br>Discoid (25%)<br>Few Levallois components (< 10%) | Flaking on a surface (unipolar)<br>Little volumetric evidence<br>Few Levallois components (15%)<br>Laminar products | Laminar (surface and volumetric flaking)<br>Levallois core technology<br>(uni- and bipolar) |
| Flake-tools | Few tools<br>Lots of crushed products | A lot of tools<br>Denticulates, scrapers, end-scrapers | Abundant<br>Retouched blades,<br>uni- and bifacial points |

occupation with environmental parameters, subsistence, technology, and a range of behavioral and social aspects. These studies assume that techno-typological variations merely reflect cultural units and hence do not indicate variations in occupation, subsistence behavior, or regional contacts between hominid groups. However, some recent studies suggest that Middle Palaeolithic techno-typological diversity can be viewed as an adaptation of hominid populations to fluctuating ecological conditions. For example, during glacial periods, the Transcaucasian Plain was favorable to human occupation, but hominid occupation in the high elevation regions of the Southern Caucasus only occurred during warmer interglacial and interstadial phases. Recently, investigations of the MP time span and the timing of Middle Palaeolithic occupation of these regions attest to variability throughout time, hitherto only attributed to the Early to Late Middle Palaeolithic (Meignen, Tushabramishvili 2006, Mercier *et al.* 2010, Pinhasi *et al.* 2012).

Moreover, it still appears difficult to technically discriminate some local specificities, rooted in the local Acheulean for instance, from external influences related to human mobility from the Levantine area. New dates (Mercier *et al.* 2010) indicate that the Djruchula-Koudaro group appeared at an early stage and may contribute to discerning the extent of Levantine influence and local Acheulean affiliation (Tushabramishvili *et al.* 2007). The Djruchula-Koudaro group series indicate intensive flaking of large elongated products from different core technologies, including "Upper Palaeolithic type" technology. Bifacial retouch on these elongated products is also typical. The sites are located in a limited geographical area which corresponds to the Rioni-Kvirila basin in South Ossetia (Tsona and Koudaro Acheulean and Mousterian caves) to Imereti (Djruchula cave, open-air sites of Shvalieti and Khvirati).

The early Middle Palaeolithic levels of Djruchula appear to be contemporaneous with the youngest Acheulean levels at Koudaro (Meignen, Tushabramishvili 2006, Mercier *et al.* 2010, Pleurdeau *et al.* 2007). The Acheulean series of Koudaro I and Tsona yielded elongated products associated with bifacial tools bearing both Levantine and local features (for instance, cleavers on flakes for the former and Tzaldi tools or rectangular bifacial tools for the latter). Since this "laminar" trend persists in the Mousterian levels, it could be embedded in the uni- and bipolar reduction sequence observed in the Acheulean series (for instance on the Koudaro cores). This core technology would have been maintained in the Early Middle Palaeolithic recorded at Djruchula (mainly blades and elongated points). The Middle Palaeolithic laminar phenomenon generally appears as a sporadic regional trend over time in relation to demographic pressures. The ratio of unifacial and bifacial points would be due either to Levantine influences, as observed in Hayonim or other Levantine sites (Meignen 1998), or to Acheulean affiliation. The hypothesis of a Micoquian influence from the northwest Caucasus is sometimes advanced although it is uncertain as to whether Neanderthals crossed the mountains.

In conclusion, in the present state of knowledge, different factors suggest that the Djruchula-Koudaro complex of sites located in the Southern Caucasus may result from a combination of influences from the Northern Caucasus and from a local Acheulean. Golovanova and

Doronichev (2003) suggest that the Great Caucasus barrier could have been temporarily crossed during the Middle Pleistocene, from the Southern Levant (as indicated by laminar production with volumetric reduction).

## EXAMPLES OF MIDDLE PALAEOLITHIC OCCUPATIONS: THE SITES OF DJRUCHULA CAVE, ORTVALE KLDE, BONDI CAVE AND UNDO CAVE

### Djruchula cave

The site of Djruchula is located in the western part of Georgia. This cave opens in a Jurassic limestone formation at an elevation of 600 m asl and faces northeast. It is situated 35–40 m above the river and has a surface area of 127 $m^2$. It was discovered in 1957 and excavated from 1958 to 1967 by D. Tushabramishvili.

Eighteen geological layers were identified in the 4 m infilling and two archaeological levels were documented. Upper level I (layers 2–7) and lower level II (layers 9–14) are separated by 1 m of sterile deposits. Severe erosional activity was observed at the cave entrance.

The faunal remains are dominated by *Ursus*. In the lower level, *Dicerorhimus merki* remains are present, a species which is absent from the Upper Pleistocene in the Caucasus (Adler, Tushabramishvili 2004). The lower level contained a human tooth, attributed to a Neanderthal by L. Gabunia and T. Chevalier.

The two archaeological levels are ascribed to the Djruchula-Koudaro complex (Liubin 1977, 1989, Tushabramishvili 1984) or to the late Middle Palaeolithic (Liubin 1977). Based on common features with Levantine sites (Meignen 2000, Meignen, Tushabramishvili 2006, 2006), the type of site use, the types of deposits, and new dates (Mercier *et al.* 2010), the occupations are considered to be Early Middle Palaeolithic (Meignen, Tushabramishvili 2006, Tushabramishvili 2002).

The upper level contains less material (*n* = 1281) than the lower level (*n* = 2412), mainly consists of small flakes, chunks and a high proportion of unretouched flakes (*n* = 726 in lower level II and *n* = 118 in upper level I) (*Table 2*).

Flint and argillite are the two main raw materials. Flint outcrops are located on the plateaux above the site (Adler, Tushabramishvili 2004), and argillite was collected as pebbles in the river near the site. Two main flint types were used, a red and a grey flint. The argilite is grey and was exploited in similar proportions in both levels (23% in upper level I, 28% in lower level II). However, this ratio differs for the retouched products. 9% of the tools in level II are in argillite, compared to 27% in level I.

The typo-technological composition of the series brings to light the main technical traits of each layer. The first observation concerns the quasi-absence of the *chaîne opératoire*. Apart from several pebbles presenting elementary shaping, the rest of the debitage comes from a debitage *chaîne opératoire*, with the presence of cores (between 2 and 3%) and debitage products (flakes, blades, and points) (*Figure 4*). Several traits differentiate the two layers:

– the presence of products issued from the first stages of debitage in layer II (*n* = 31).
– an almost total absence of knapping waste (small flakes, chunks, pebble fragments) in the upper layer I.

Flakes only account for a small percentage of debitage products in layer I (11% compared to 33% in layer II) whereas blades are abundant (48% compared to 31%), as are unretouched points (20% as opposed to 3%).

The low density of the archaeological material and the fact that not all of the elements of the *chaîne opératoire* are represented pointed to occasional use of the cave, linked to a variety of activities in the different levels.

Despite the different distributions, technological and typological behavior appears to be similar in both levels. These series represent an industry with a predominance of blades and blade tools.

The identification of four main operative schemas emerged from the study of the cores and the debitage products:

1) The first is related to the Levallois methods, with the debitage of a plane or slightly convex surface parallel to the intersection of the two secant core surfaces. Using different modalities (preferential flake or recurrence, generally uni or bipolar), this method leads to the production of a wide range of products (flakes, blades or points).
2) The second attests to the exploitation of one or two convex surfaces by crossed-centripetal management, with a debitage axis secant to the intersection of the two core surfaces. This operative method is affiliated to discoidal debitage, in so far as the process and the shapes of the products are concerned. The products are mainly made up of flakes and points and are not exclusively related to this techno-type.
3) The third is a variant of the laminar/lamellar Upper Palaeolithic type operative method with rotating core exploitation and volumetric management of the laminar surface. This production type is only represented by a few cores but is nonetheless present throughout the infilling.

TABLE 2. Composition of the lithic series of the two archaeological levels at Djruchula.

| | | Upper level I | | Lower level II | | Total | |
|---|---|---|---|---|---|---|---|
| Types of products | | *Nb* | % | *Nb* | % | *Nb* | % |
| Pebbles and nodules | | 20 | 1 | 77 | 3 | 97 | 3 |
| First cortical flakes | | 0 | 0 | 31 | 1 | 31 | 1 |
| Debitage products without retouched (> 20 mm) | | 631 | 49 | 1554 | 62 | 2185 | 57 |
| Including: | Flakes | 118 | | 726 | | 844 | |
| | Blades | 387 | | 566 | | 953 | |
| | Points | 91 | | 28 | | 119 | |
| | Chunks | 0 | | 120 | | 120 | |
| | Burin bladelets | 1 | | 0 | | 1 | |
| | Unknown | 14 | | 6 | | 20 | |
| Cores | | 37 | 2 | 57 | 2 | 94 | 2 |
| Small flakes (< 20 mm) | | 0 | 0 | 371 | 15 | 371 | 10 |
| Flake-tools | | 613 | 48 | 430 | 18 | 1043 | 27 |
| Including: | Sidescrapers | 116 | | 126 | | 242 | |
| | Notches | | | 5 | | 5 | |
| | Becs | | | 2 | | 2 | |
| | Denticulates | 1 | | 12 | | 13 | |
| | Convergent points | 406 | | 187 | | 593 | |
| | Truncated tools | 1 | | 1 | | 2 | |
| | Thin and invasive retouches | 1 | | 9 | | 10 | |
| | Burins | | | 4 | | 4 | |
| | Endscrapers | 1 | | 6 | | 7 | |
| | Limace | | | 1 | | 1 | |
| | Double scrapers | 87 | | 74 | | 161 | |
| | Double denticulates | | | 3 | | 3 | |
| Total | | 1281 | 100 | 2412 | 100 | 3693 | 100 |

4) Lastly, the fourth type involves the successive debitage of several orthogonal surfaces. Core management is mainly unipolar and consists in the debitage of a series of three or four flakes (often elongated) on each surface.

These four operative methods appear to be the dominant mode of production of the different types of products intended to be retouched. Among the retouched tools, uni- or bilateral retouched points are abundant (often straight with uni- or bifacial retouch, at times inverse with a predominance of inverse distal retouch). Some of these pieces present inverse proximal retouch intended to thin the product. Given the high proportion of laminar products in the assemblage, and the study of the scars and the non-retouched edges of these tools, we conclude that most of these points are retouched blades rather than points issued directly from debitage (fine, thin, often scalar or invasive retouch forming the point on the distal edge). Besides these types of retouched points ($n$ = 592, which represents 57% of the tools), blades with direct bilateral retouch and a rectilinear non-retouched distal edge ($n$ = 161 or 15%) are the most characteristic tool type. The points are formed by diverse types of retouch, which sometimes form abrupt edges. Inverse and partial bifacial retouch are also features often found.

Blades are the most abundant products in the assemblage, comprising both retouched and unretouched pieces ($n$ = 1354). The study of their technical and morphological characteristics shows that they generally come from two distinct operative methods, one issued from a Levallois-type debitage of a plane surface, and the other from a more volumetric, Upper Palaeolithic-

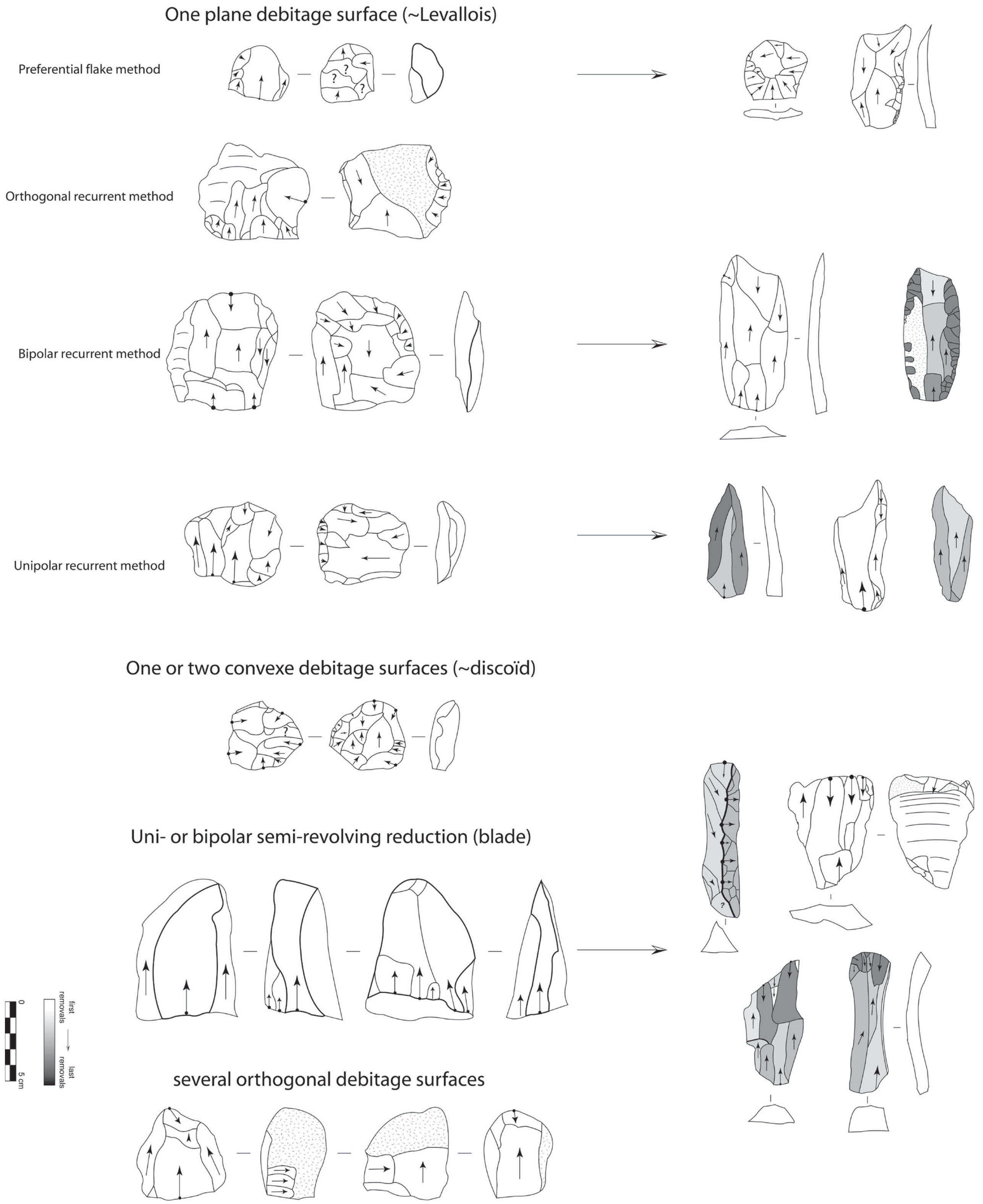


FIGURE 4. The Drujula flint processing system.

type management. The coexistence of these two methods is visible in the morphological and technical characteristics of the debitage products (both retouched and unretouched) and the cores.

The average length of the whole laminar products (74% of the blades) is 74 mm, with an average elongation index of more than 2.7. A certain number of these products are over 100 mm long (*n* = 115 or 11%), thereby increasing the average standard deviation $E/C_L = 20.6$. Nonetheless, a substantial proportion of the laminar objects display a more standard length of 50 to 60 mm (*n* = 304 or nearly 30%).

Furthermore, the thickness of the laminar products varies according to the section. When the section is triangular, blades are thicker, whereas blades with a parallelogram section are thinner. These differences appear to be linked to the operative method used:

– Approximately half of the blades with parallel or subparallel ridges and lateral edges (sometimes with a degree of distal convergence) point towards a unipolar recurrent debitage linked to a non-Levallois Upper Palaeolithic-type exploitation (confirmed by certain prismatic cores). Average width is quite low, which means that the artefacts are elongated (index L/w > 3). Several crested blades (*n* = 9) are also present, as well as some blades or flakes presenting a substantial part of the laminar debitage surface (with an almost hexagonal section), indicating the recurrent and rotating sequence of this type of laminar exploitation.
– The rest of the products with subparallel ridges and edges, as well as products presenting less rectilinear ridges (in the shape of an X or an S), at times with cortical residues, seem to come from the exploitation of the surface *sensu stricto*. These blades are much wider (and therefore present a lower elongation index than the last group, 2 < IL/w < 2.5) and are laminar flakes rather than blades. Several laterally plunging blades (*débordant*) also attest to this type of debitage (n ~ 10).

Facetted butts are predominant (> 50%), indicating organized debitage (careful preparation of one or several striking platforms), and the curvature of the underside and the camber are not very pronounced.

Cores displaying visible characteristics of the operative method are more abundant in the lower level than in the upper level. Nonetheless, both levels show a similar distribution of the four main operative methods. The two techno-types leading to the recurrent production of laminar series predominate:

– Most of the cores (approximately 30%) display a plane (or slightly convex) debitage surface exploited in a unipolar recurrent way (*n* = 10 in layer I and *n* = 12 in IIa layer II). In the lower layer, several of these cores were exploited by a lineal mode (*n* = 5, often with an elongated removal scar), sometimes on the internal flake surface.
– Eight cores (or approximately 9%) do not bear a debitage surface *stricto-sensu* but rather a sort of laminar volume, at times still in the process of being formed.

In all cases, the low dimensions contrast with the much larger laminar debitage products, which generally come from sequences anterior to the last visible phases on the cores.

The Middle Palaeolithic Djruchula-Koudaro complex was defined on the basis of laminar debitage and characteristic bifacial retouch used to form points on laminar products (blades and points). Some of the levels attributed to this complex (Djruchula sites, top of the Kudaro I and Tsona sequences, surface sites of Shvalieti and Khvirati) present laminar assemblages with volumetric debitage and a high proportion of blades and points. They are located in a confined geographic zone, between the high Caucasian Mountains (South Ossetia) and the Rioni-Kvirila (Imereti) Basin.

The re-evaluation of the lithic assemblages from key sites in the region, associated with information from new prospecting and surveys at certain Acheulean surface sites, has led to a more detailed description of this complex. The observation of certain technical attributes implies that it may be affiliated to the Acheulean.

The base levels of Koudaro I appear to be older, whereas those of Tsona are characteristic of the end of the Acheulean, as shown by the bifacial retouch. However, one of the debitage methods used in both Acheulean sequences is unipolar and bipolar. This method may have produced the elongated products present in the Acheulean at Tsona and Koudaro, as in layer V at Azych, and in the later Acheulean open-air sites in the Northern Caucasus (Golovanova 2000). The high frequency of elongated products cannot be merely accidental.

This unipolar and bipolar debitage method is based on a surface management of the cores, and is comparable to one of the methods observed at Djruchula and in the upper levels of the Tsona and Koudaro I sequences.

The surface sites near Chiatura (for example Orbali I, II, III, IV, Sarbebi, Jokoeti) are not well dated but provide evidence of both laminar debitage (in terms of volume) and Levallois debitage (unipolar, unipolar convergent and centripetal), similar to the technical traits identified at Djruchula. Most of the products have not been retouched, suggesting that these sites are knapping workshops. They are associated with several bifaces with very invasive retouch (Tushabramishvili 2002). The reworking of the ridges of these tools tends to suggest a late Acheulean or an early Middle Palaeolithic. Similarly, the base levels of Tsona also yielded a bifacial backed, plano-convex piece in flint, which could be Micoquian maybe of similar age range. The Acheulean in the Imereti zone is described as a late Acheulean with few bifaces, like in north Caucasus, whereas south Transcaucasia (for example, Armenia) has yielded Acheulean sites with more bifaces (Golovanova, Doronichev 2003). This observation corroborates the rare stratified sites where radiometric constraints are available.

The typological characteristics of the assemblages of Koudaro I, Tsona, and Azych have been defined in the past as Proto-Charentian, and even though this definition does not appear to be satisfactory in the light of new approaches, it indicates that specific tool types persisted in later assemblages (Liubin 1981).

Over the past forty years, conflicting hypotheses have been suggested for the filiation of the various Middle Pleistocene assemblages found in the southern Caucasus at the transition between the Acheulean and the Middle Palaeolithic. Besides the varied state of knowledge the debate is strongly biased by the location and specific topographic characteristics of the Caucasian barrier, which could have acted both as an auspicious "refuge zone" with diverse biotopes and as a corridor for prehistoric groups to pass through. However, it is not excluded that groups could have crossed this mountainous barrier, as attested by the cave of Treugol'naya located on the northern flank. Furthermore, the potential link between North and South Caucasus is substantiated by the presence of about fifteen accessible mountain passes at an altitude of around 2000 m west of Mount Kasbegi probably devoided of ice during several periods between 400 and 200 ka. The whole of the Caucasus could thus have been occupied at an early stage, whereas further north, the steppes of the Russian plains were not conducive to human occupation, as shown by the absence of Acheulean sites.

The data obtained from the detailed study of the operative debitage methods tend to suggest that technical similarities could well have existed between the Acheulean and the first assemblages of the Middle Palaeolithic, even if the presence of allochthonous behavior appears to be undeniable in some sectors and seems to denote a time rupture in the occupations.

Examination of the material from the sites of Koudaro I, Tsona, and Djruchula enables us to gauge the difficulty to build a satisfactory hypothesis for the origins of the Djruchula-Koudaro complex in the Caucasus that could varied depending on which traits are highlighted. Even if no techno-typological affinities could be established between the Acheulean and the successive industries in the North Caucasus according to Golovanova and Doronichev (2003) and Golovanova *et al.* (1998), some technical and typological traits are specific to the Caucasus and others are found both in the North and the South. They suggest that some contacts may have existed between human groups, or at least, support the idea of a strong regional community, which would not have disappeared altogether. This continuity is undeniable, even after the arrival of new allochthonous behaviour at the end of the Middle Pleistocene, as shown by:

– The presence during the Middle Pleistocene of several Tzaldi-type pieces and quadrangular bifacial tools characteristic of a "Caucasian Acheulean";
– The geographically localized presence of characteristic bifacial, Micoquian-type retouch in the south (appearing towards MIS 8-6 in Central Europe and developing during MIS 5 (Foltyn *et al*. 2000), whereas these assemblages are frequent in the northwest Caucasus during the more recent Middle Palaeolithic;
– The presence of late Acheulean open-air sites in the northwest Caucasus bearing both Levantine traits and original characteristics (pointed bifaces, high frequency of Levallois debitage).
– The use of raw materials, such as obsidian, which is absent from the Imereti zone. Future research will probably reveal whether these rocks come from the south and southwest of Georgia, from the Black Sea in Russia or Armenia (Blackman *et al*. 1998).

**Ortvale Klde**

The site of Ortvale Klde is located near Chiatura, at an altitude of 530 m asl, 35 m above the present-day river (*Figure 5*). It was first discovered and excavated in 1973 by D. Tushabramishvili (Tushabramishvili 1984, 1994). The rock shelter is composed of two separate chambers. The southern chamber is a corridor (5 m wide), while the other chamber opens out to a maximal width of over 15 m. The southern part of the site yielded a long sedimentary sequence with several human occupation layers, recording in particular the transition from the Middle to the Upper Palaeolithic. Recent analyses have described the chronology and the modalities of this transition process through an extensive dating programme. The results highlighted significant changes between the Late Middle Palaeolithic and Early Upper Palaeolithic, indicating occupational discontinuity between the two periods (Adler *et al.* 2008), and suggest a relatively late arrival of UP populations in the Southern Caucasus between 38 and 34 ka BP (Adler *et al.* 2008, Bar-Yosef *et al.* 2006). While there is a clear difference between the Neanderthal and modern human lithic assemblages, the two groups display quite similar subsistence behavior, employing the same strategies adapted to the diversity of the ecological niches (Adler *et al.* 2006, Bar-Oz, Adler 2005, Bar-Oz *et al.* 2002, 2004).

Surveys conducted in the 1970s in the northern chamber by D. Tushabramishvili brought to light Early Middle Palaeolithic levels at the bottom of the sequence (Tushabramishvili 1984). New fieldwork was carried out in the northern chamber in 2006 (Moncel *et al.* 2013) and three Middle Palaeolithic (MP) layers were observed at the bottom of the sequence (*Figure 6*). Only the upper layer (70–100 cm deep) has provided $^{14}$C dates carried out on an ungulate bone (OxA-X-2464-51: 19,600 ± 130, d13c 18.5).

The predominant species is the Caucasian tur (*Capra caucasica*), followed by the steppe bison (*Bison priscus*). The vast majority of the specimens were adult animals. The percentage of tur remains decreases from 80% in the Middle Palaeolithic to 52% in the Upper Palaeolithic levels. Several occurrences of cut marks and percussion marks demonstrate the dominant role of humans in amassing and modifying the faunal assemblage. The faunal assemblages are similar to sequences from western Georgia and Armenia (Adler *et al.* 2006, Bar-Oz *et al.* 2008, 2012).

The MP lithic material is for the most part made from high quality flint from the Cenomanian-Turonian formations near the site, on the plateau. Several black obsidian pieces are also present in these MP levels and results concerning obsidian provenance are similar to those from the UP layers (and also for the UP layers of the nearby Bondi Cave) (Le Bourdonnec *et al.* 2012). These pieces consist of pre-knapped flakes transported

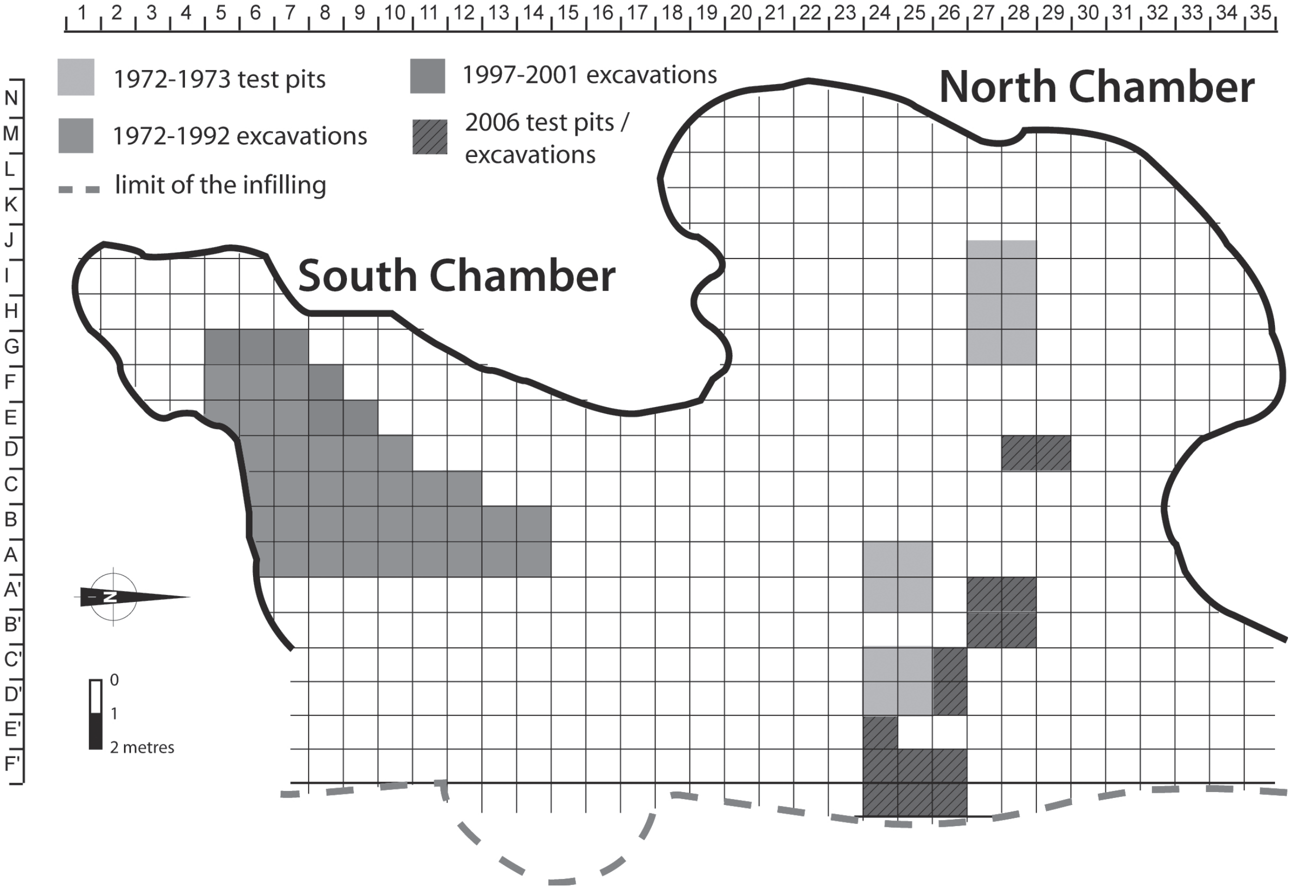


FIGURE 5. Map of the excavated areas in Ortvale Klde. Our excavations concern the North Chamber (Moncel *et al.* 2013).

from sources related by physico-chemical analyses to outcrops in the south of Georgia (near Lake Chikiani, 100 km from the site) and probably in Armenia and Turkey (up to 300 km from the site), indicating extensive long-range human mobility associated with this rock type during this occupation phase.

All the flaking phases are represented in the flint assemblages indicating *in situ* debitage (*Figure 7*). The debitage products are dominated by flakes and blades with unidirectional removal scars. There are several blades and crested flakes, which indicate evidence of volumetric preparation or the occasional use of laminar volumetric management. The cores display the coexistence of four main strategies that can be described as Levallois or discoid type: 1) recurrent convergent unipolar and unipolar debitage from a plane surface (elongated blanks) (Levallois core technology), 2) successive or alternative flaking of two secant surfaces (discoid-type?), 3) peripheral debitage of one or two convex surfaces (biconical section), 4) unipolar debitage of a slightly convex surface using lateral *débordement*.

The tool kit consists mainly of unilateral and bilateral unifacial points, generally made on pointed blanks, and of scrapers, retouched on laminar blanks and flakes.

The study of technological behavior suggests that a parallel exists between the techno-typological characteristics of MP units from the northern chamber and layers 10 to 5 at the base of the sequence in the southern chamber. Differences between the two chambers could be due to specific activities in different parts of the site (Moncel *et al.* 2013). The MP assemblages from the northern chamber (Layers 10–6) were initially described as "typical Middle Palaeolithic", characterized by non-Levallois production with abundant scrapers.

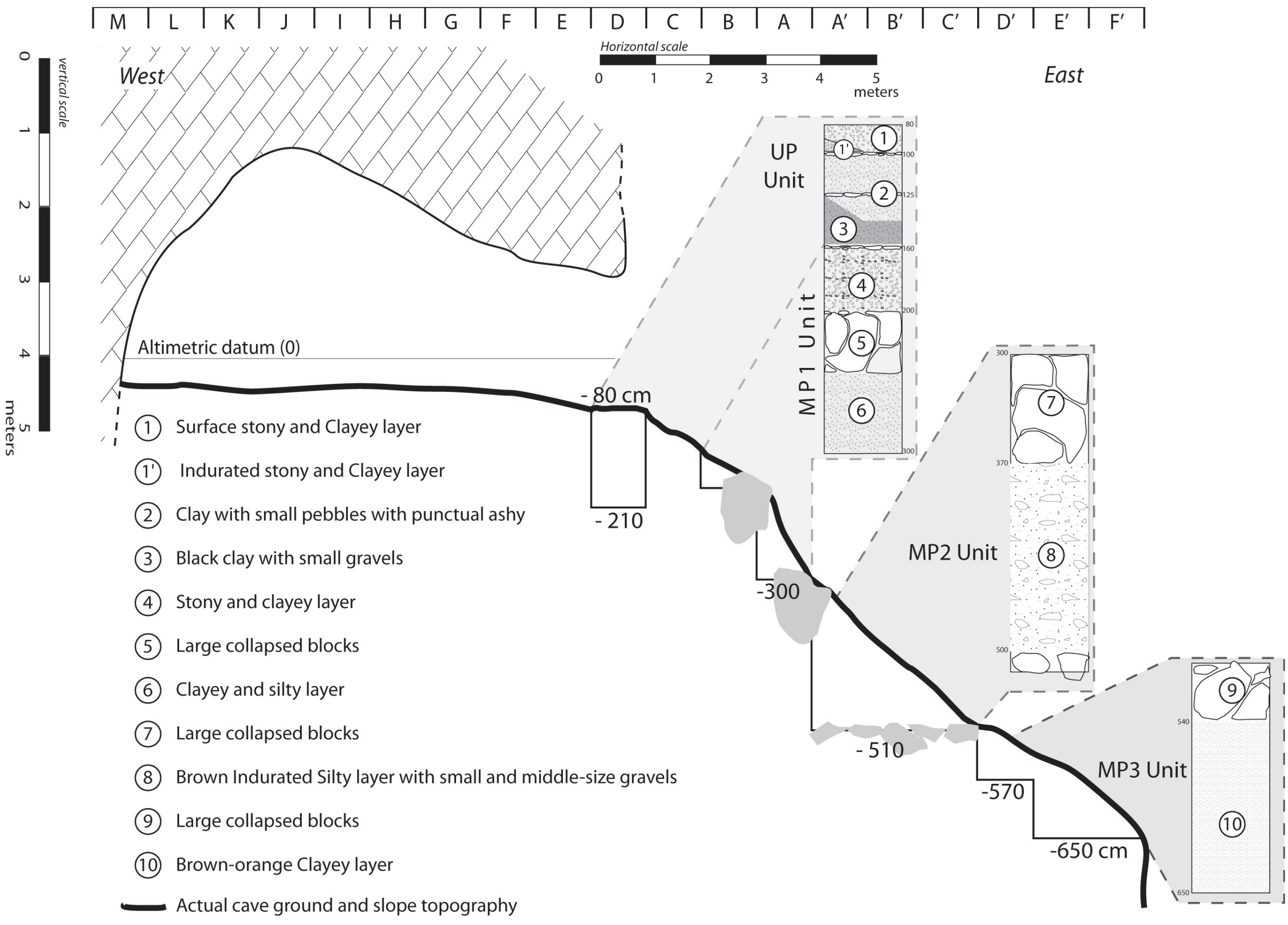


FIGURE 6. Sequence of the North Chamber at Ortvale Klde. The Middle Palaeolithic layers are MP2 and MP3 in front of the cave (Moncel *et al.* 2013).

Nevertheless, a new analysis of the series by D. Adler (2002) highlighted a Levallois component with clear unipolar recurrent reduction throughout the MP sequence. The MP technical mode in the northern chamber does not exactly correspond to that described for the MP in the southern chamber, even though some

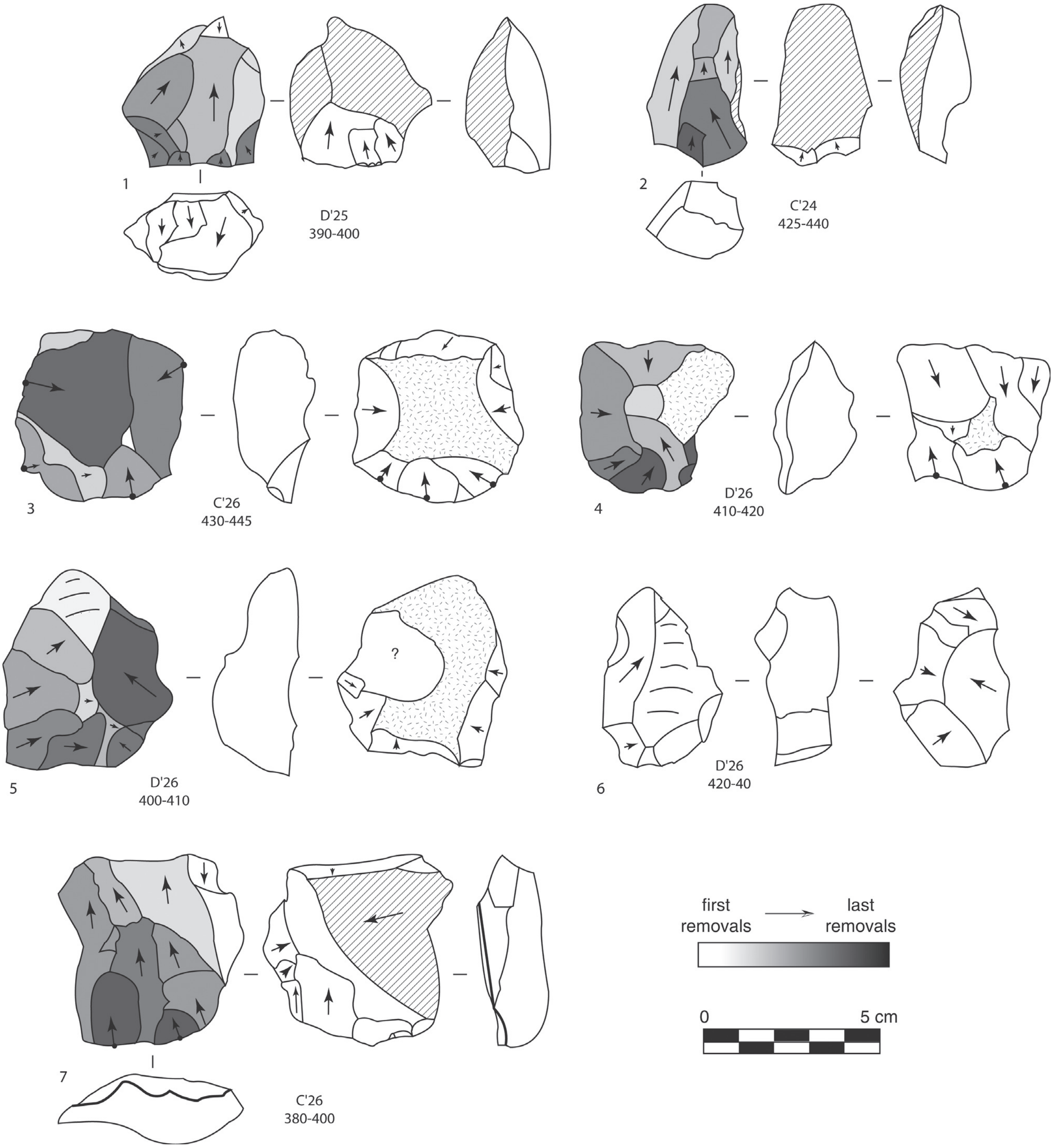


FIGURE 7. Diversity of core technology at Ortvale Klde. Middle Palaeolithic flint flakes and elongated products.

features appear to be similar. In particular, the presence of the production of elongated and pointed blanks, as well as retouched unifacial points (both unilateral and bilateral) on elongated blanks, characterizes both assemblages, although proximal thinning of the tools is less widespread in the northern chamber. In both cases, blanks with specific morphological attributes are often selected for tool manufacture. Similarly, the dominant debitage is based on the management of plane, Levallois-type surfaces in both chambers. It is, however, described as predominantly unidirectional in the southern sequence, except for "*débordant* flakes" with centripetal or unipolar removals in order to control the Levallois flaking surface. It is both unidirectional, convergent unidirectional and centripetal in the northern part. Several crested blades provide evidence of the debitage of laminar products in the northern chamber. Convergent side scrapers are more frequent in the southern chamber with evidence of intense reworking and recycling of the tools whereas there is little evidence of resharpening in the northern chamber. This may indicate different occupation types or durations. Raw material use in both chambers is similar with predominant local flint procurement and some use of obsidian (Adler 2002, Le Bourdonnec *et al.* 2012).

The MP facies at the site of Ortvale Klde does not appear to be associated with any of the known Georgian's facies (Tushabramishvili *et al.* 1999). It is described either as a typical non-Levallois Mousterian rich in "Charentian" features (Tushabramishvili 1994, 2002, Tushabramishvili *et al.* 1999) or as a Middle Palaeolithic sequence with recurrent unipolar Levallois features (Adler 2002, Adler, Tushabramishivili, 2004). The assemblages contain abundant double and convergent scrapers, and display thinning of the ventral face, which are both similar features to contemporaneous assemblages from the Zagros (Lindly 2005, Otte, Kozlowski 2007).

However, the new MP Ortvale Klde assemblages from the northern chamber share some technical features with other sites in the Southern Caucasus area whereas the Northern Caucasus yields Eastern European "Micoquian" type assemblages (Adler 2002, Golovanova, Doronichev 2003, Golovanova *et al.* 1999, 2010b). Our Middle Palaeolithic material from the base layers bear features with:

1) Early Middle Palaeolithic levels from Djruchula (Meignen, Tushabramishvili 2006, Mercier *et al.* 2010, Tushabramishvili *et al.* 2007), where a recent analysis of the reduction sequence has brought to light two exploitation concepts: the debitage of a Levallois-type surface with rotating and semi-rotating flaking of the volume (Djrujula-Koudaro group). The dimensions of the products are large and retouched pieces are either unilateral and bilateral tapered points, or simple or bilateral side-scrapers.
2) Middle Palaeolithic levels in Bronze Cave (Pleurdeau *et al.* 2007). The MP assemblages bear evidence of recurrent unipolar reduction, partly from Levallois debitage and with a percentage of blades ranging from 4 to 14%. A high proportion of the tools (which make up 14 to 17% of the assemblage) are convergent with fine or scalar retouch and partial bifacial retouch. At the site of Sakajia, 25% of the products are blades, obtained with Levallois methods, undoubtedly on semi-rotating cores. The characteristic tools at this site are convergent denticulates.

**Bondi cave**

Bondi Cave is a new site (*Figure 8*) located near the sites of Ortvale Klde and Dzudzuana, which has yielded Early Upper Palaeolithic (EUP) and Upper Palaeolithic (UP) sequences (Tushabramishvili *et al.* 2012) (*Figure 9*). It is a south-facing site on a small valley slope approximately 30 m above the Tabagrebi River. During excavations conducted from 2007 onwards, a sedimentary sequence of more than 3 m thick was revealed. Eight distinct lithological layers were identified. The dates indicate episodes of human occupations from 38,750 ± 480 $^{14}$C BP (43,123 ± 632 cal BP$_{Hulu}$) (layer VII) to 14,050 ± 90 $^{14}$C BP (17,295 ± 225 cal BP$_{Hulu}$) (layer III) (*Figure 10*). A hominin tooth recovered in the UP complex (layer Vb, ~25 to 29 cal BP) is attributed to *Homo sapiens* sp.

Two layers (VII and VIII) in the lower part of the site yielded Middle Palaeolithic-type artefacts. These artefacts differ markedly from those in the upper layers attributed to the Upper Palaeolithic on the basis of their typo-technological composition and larger size. Layer VII (with MP affinities) was dated to between ~38.7 to 35 ka $^{14}$C BP (43 to 40 ka cal BP$_{Hulu}$) and layers V to III (UP levels) from ~24.6 to 14 ka $^{14}$C BP (29 to 17 ka cal BP$_{Hulu}$). These two complexes are separated by a layer of large collapsed blocks (layer VI) dated to about 31.2 ka $^{14}$C BP (35.4 ka cal BP$_{Hulu}$).

Levels containing some material from the Middle Palaeolithic (MP), and more abundant material from the Upper Palaeolithic (UP), were excavated, yielding faunal assemblages dominated by the Caucasian Tur (*Capra caucasica*) and the European bison (*Bison* cf. *bonasus*). High proportions of the bones bear cuts and percussion marks indicating that human activity (hunting, transport

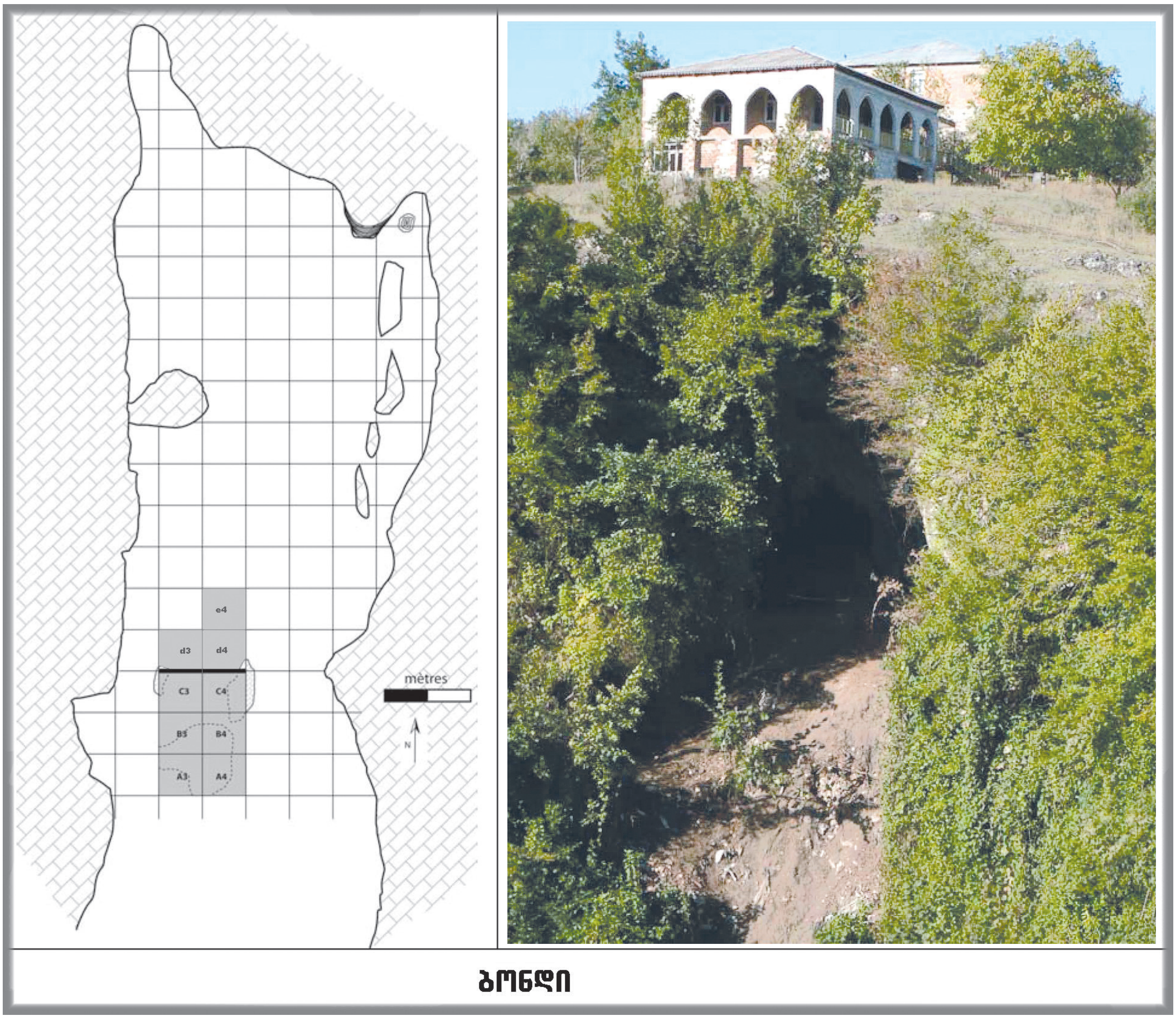


FIGURE 8. Photo and map of the excavated area of Bondi Cave.

and butchery for meat and marrow) was the main depositional agent for the UP. Carcass transport was selective according to animal size. The characteristics of the assemblage suggest short occupations of the cave by mobile UP foragers. The end of the UP sequence is characterized by a higher proportion of bison procurement in comparison to the tur. Major paleoenvironmental fluctuations were not observed during the sequence, and the general composition of the fauna probably reflects a more open setting for the late MP and UP human occupations in this region, compared to the Holocene (Yeshurun *et al.* submitted).

All the artefacts from layers VII and VIII ($n$ = 342) are non-retouched and made of local flint (*Figure 11*). They are mainly small and large flakes, with unipolar or centripetal negative removals. Some thick or thin blades (50–60 mm long) and pointed elongated flakes are also present. The cores are Levallois (preferential, unipolar and centripetal recurrent), and discoidal. Flaking is focused on the production of short or elongated unifacial or bifacial flakes. These levels present affinities with the late MP in the region and in the Caucasian area (Adler, Tushabramishvili 2004, Adler 2008, Golovanova, Doronichev 2003, 2005, Liubin 1977, 1989, Liubin,

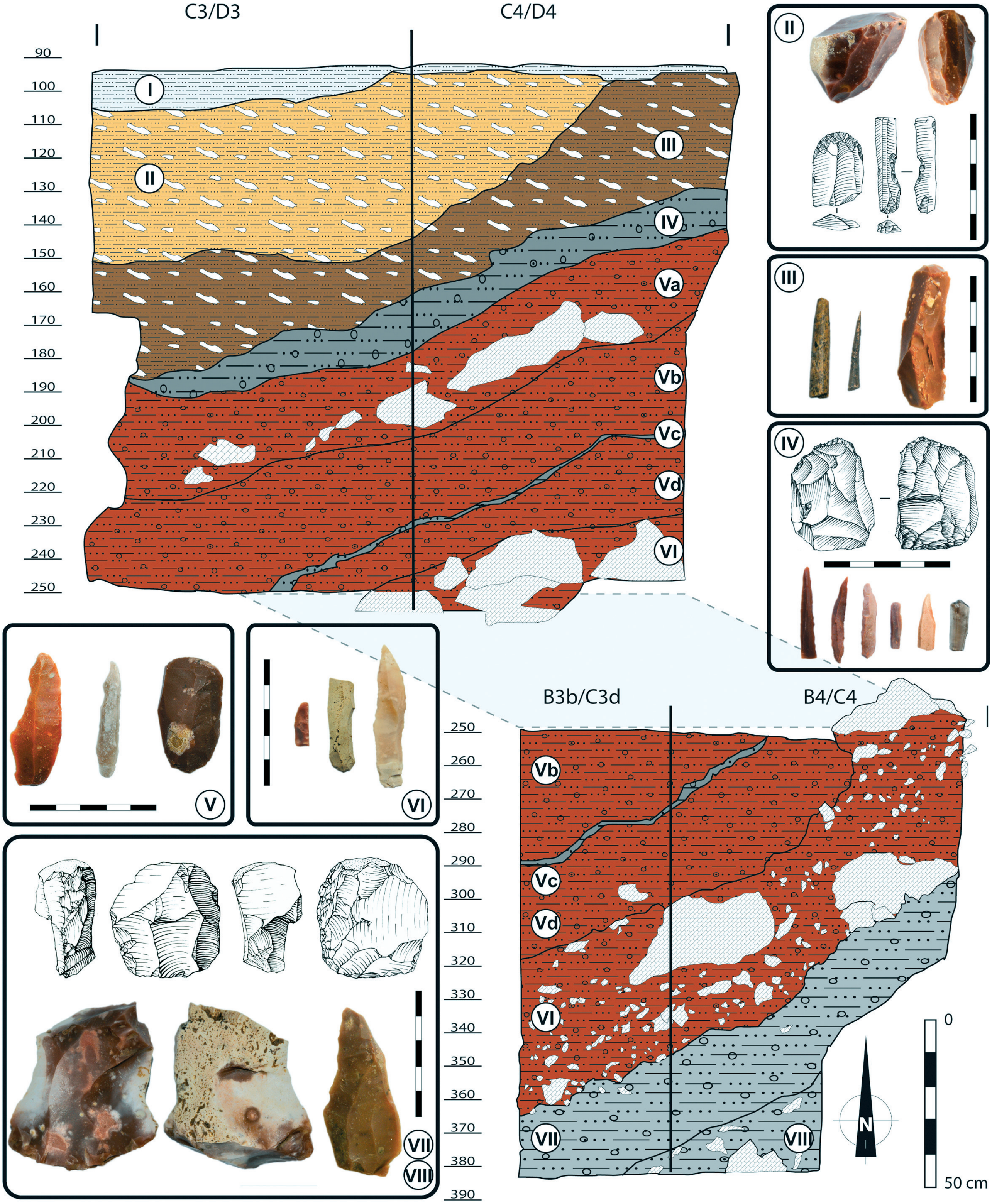


FIGURE 9. Sequence at Bondi Cave and some artifacts illustrating the Upper and Middle Palaeolithic layers (Tushabramishvili *et al.* 2012).

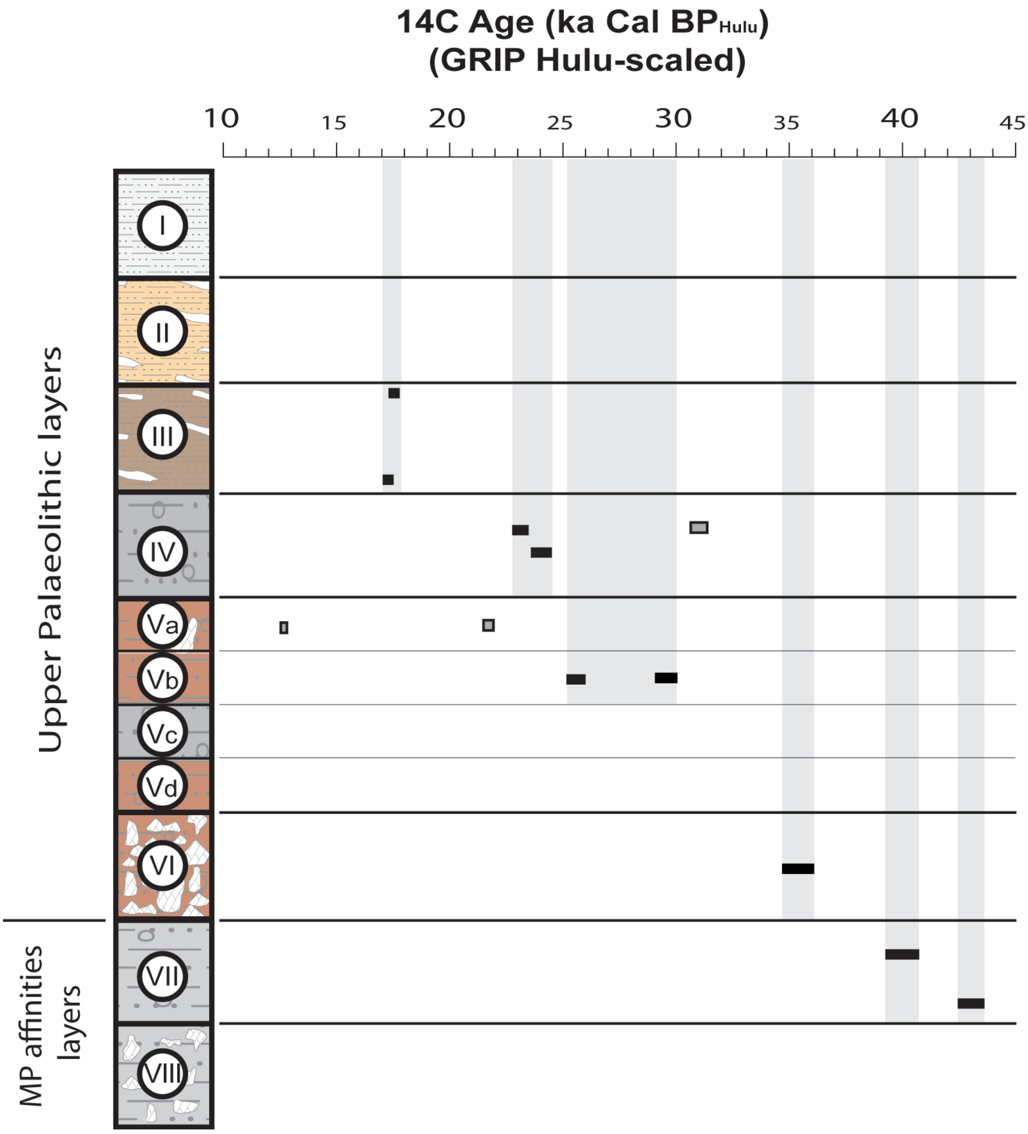


FIGURE 10. [14]C dating for the sequence at Bondi Cave (Tushabramishvili *et al.* 2012).

Bosinski 1995, Meignen 1994, 2000, Meignen, Tushabramishvili 2006, Nioradze 1992, Pleurdeau *et al.* 2007, Tushabramishvili 1984, 1994, 2002, Tushabramishvili *et al.* 1999, 2007).

**Undo Cave**

Undo cave is located near Chiatura, like Bondi Cave and Ortvale Klde (*Figure 11*). It is a 40 m long corridor terminating in a 45 m deep gallery. The present day terrace is 2 m high and 5 m large. The cave is located 100 m above the present-day river and faces southwest. Fieldwork conducted from 2007 onwards yielded both Upper Palaeolithic (UP) (inside the cave near the entrance behind a large block, composed of small flint blades and flakes) and Middle Palaeolithic artefacts (MP) (outside the cave, among large blocks due to the collapse of the cave vault over time).

Outside the cave, two or three distinct MP layers bearing abundant *Ursus spelaeus* remains have been identified. The MP sequence covers sterile red deposits typical of an enclosed cavity infilling. Flint artifacts were discovered among bear bones and the remains of other species. The position of the bones indicates disturbed sediments, migrating from the cavity throughout time.

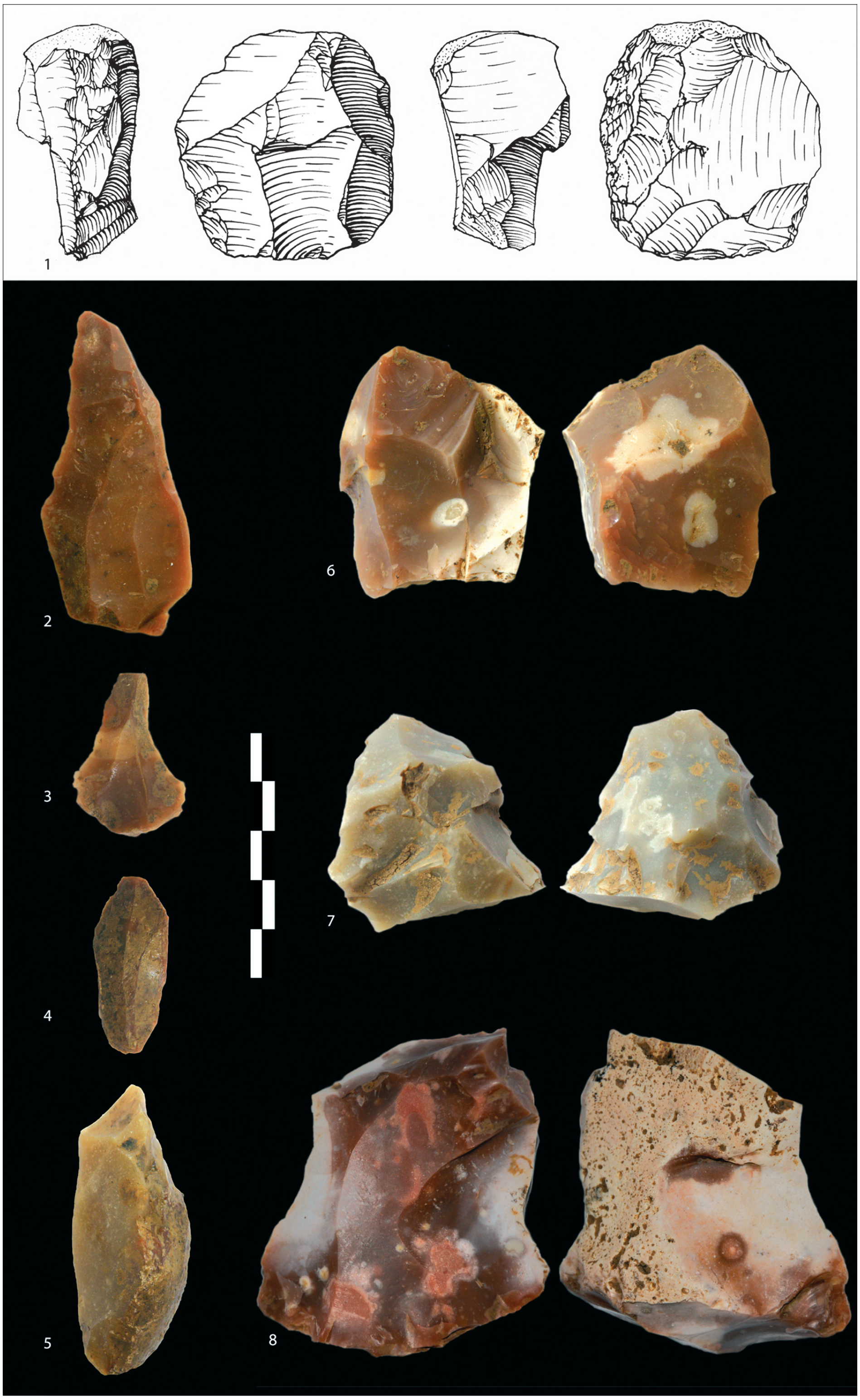


FIGURE 11. Flint flakes and cores in the Middle Palaeolithic layers at Bondi Cave (layers VII and VIII).

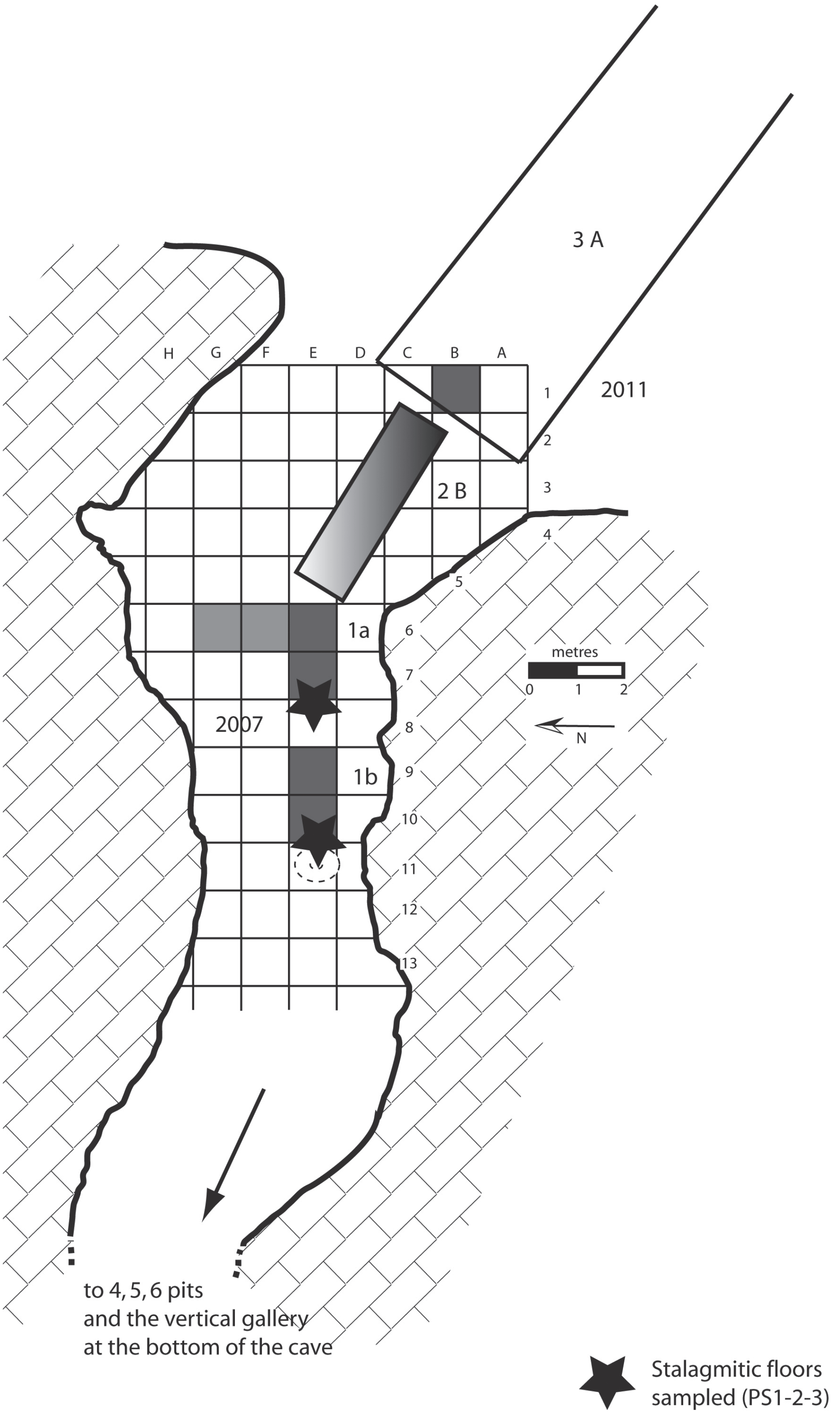


FIGURE 12. Map of the excavated areas at Undo cave.

The small lithic series are made on local flint (red, grey, and brown) collected from the plateaux (*Table 3*). Several artefacts made from obsidian, sandstone and quartz indicate other procurement strategies. The series is composed of short and elongated flakes, very small flakes, chunks, points, small blades and some long and thick blades (*Figures 13, 14, 15*). Products were mainly produced by Levallois core technology. The two cores are Levallois and discoid types. Blades were produced either by Levallois core technology or by laminar cores (management of the core volume). Technical behavior is similar to the "Djrujula-Koudaro facies". The composition is typical of material brought by humans for short-term occupations. Preliminary data from faunal remains point to intensive human activity in UP layers whereas the MP layers indicate above all bear occupations with occasional human occupations. This concurs well with the characteristics of the lithic series.

## Flint and obsidian procurement strategies

### *Flint*

Most of the flint described in the Middle Palaeolithic assemblages displays common features and is red, grey, or brown, and of good quality.

Fieldwork on the plateau located above the caves in the vicinity of the city of Chiatura yielded evidence of flint outcrops and raw material provisioning. Moreover, several open-air archaeological sites, located on the flint outcrops, have been described in the past as Lower and Middle Palaeolithic sites.

Fieldwork resulted in the re-discovery of some of these sites and new series of test pits yielded both geological samples of flint and archaeological artefacts. The artefact assemblages consist of crude cores, cortical flakes, flakes, and flake-tools. Most of the flint is red and similar to that observed in the archaeological cave series. It is available as good-quality cubic nodules.

These outcrops are thus likely potential outcrops and may well have been used by hominins during the Upper Pleistocene. They were easily accessible from the caves.

TABLE 3. Types of artifacts in the Middle Palaeolithic layers at Undo cave.

| Type | Flint | Obsidian | Quartz | Sandstone | Total |
|---|---|---|---|---|---|
| Backed flakes | 2 | | | | 2 |
| Blades | 39 | | | 1 | 40 |
| Bladelets | 22 | | | | 22 |
| Bladelet cores | 5 | | | | 5 |
| Cores | 1 | | | | 1 |
| Discoid cores | 2 | | | | 2 |
| Elongated flakes | 7 | | | | 7 |
| Flakes | 75 | 2 | | | 77 |
| Fragments | 66 | | 1 | | 67 |
| Levallois blades | 4 | | | | 4 |
| Levallois cores | 1 | | | | 1 |
| Levallois elongated flakes | 3 | | | | 3 |
| Levallois flakes | 13 | | | | 13 |
| Levallois points | 6 | | | | 6 |
| Points | 2 | | | | 2 |
| Micro pebble-tools | 1 | | | | 1 |
| Microflakes | 60 | | | | 60 |
| Nodules | 16 | | | | 16 |
| Total | 327 | 2 | 1 | 1 | 332 |

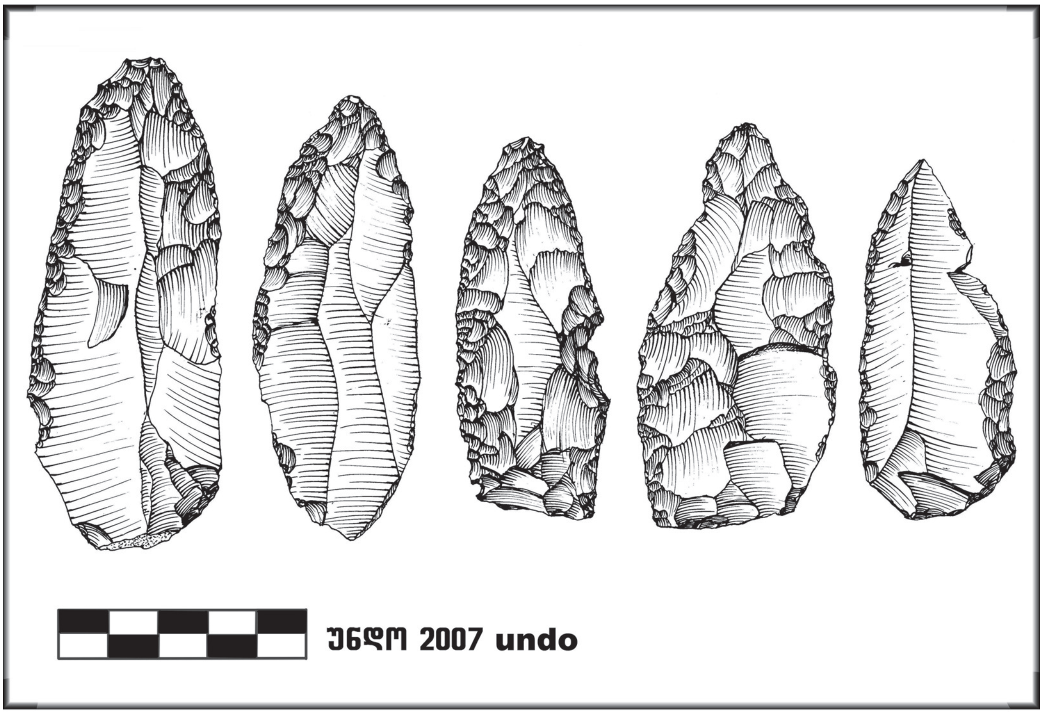


FIGURE 13. Middle Palaeolithic flint points from Undo Cave. Drawings by L. Orjonikikidze.

FIGURE 14. Middle Palaeolithic flint points and flakes from Undo cave.

FIGURE 15. Levallois blade in flint *in situ* at Undo cave.

***Obsidian***

Non-destructive elemental compositions were obtained on 15 obsidian artefacts from Bondi Cave and Ortvale Klde. Eleven samples were analyzed using particle-induced X-ray emission (PIXE) at the Paris (France) AGLAE and the Gradignan (France) AIFIRA ion beam facilities (Le Bourdonnec *et al.* 2012) and four others by X-ray fluorescence in energy dispersion (EDXRF) at the Bordeaux *Centre de Recherche de Physique Appliquée à l'Archéologie* (this paper). The same fifteen major and trace elements were obtained by EDXRF and PIXE. Four types of composition were differentiated on the basis of the Ca, Ti, Mn, Fe, Zn, Sr, and Zr contents. One of those was found to correspond to obsidian from the Chikiani/Paravani volcanic field, based on our own PIXE, ICP-AES/MS (Le Bourdonnec *et al.* 2012) and EDXRF (this work) analyses (*Table 4*). The origin of the other obsidian samples is less clear. As previously stated, the composition of type 1 artefacts corresponds well to that of the Ikisdere obsidians in northwest Anatolia. However, it also shows, to a lesser degree, some chemical affinities with the other eastern Anatolia obsidians from Meydan Dağ, Mus, and Pasinler (Le Bourdonnec *et al.* 2012: Fig. 10). The type 2 obsidians seem to come from the Sarikamis North source, east of Pasinler. The only type 3 artefact, which essentially differs from type 2 by its Ca contents, might come from another, as yet undetermined, Sarikamis source.

The nearest source to Bondi Cave and Ortvale Klde is that of Paravani/Chikiani, on the northern slope of the Lesser Caucasus. The lowest energy expenditure route to this source follows the valleys that cut into the Greater Caucasus southern slope, down to the Likh mountain range, which runs to the Lesser Caucasus. This means a walking distance of about 170 km. The northeastern Anatolian sources of Ikisdere and Sarikamis are further away and can be reached following two different routes; either by crossing through the Lesser Caucasus belt from the high Kura River valley, or bypassing the belt on its western end, along the Black Sea coastline. This involves a walking distance of about 350–400 km. The more

TABLE 4**.** Obsidian types of elemental composition at Bondi Cave and Ortvale Klde.

| Palaeolithic period | Site | Type of elemental composition | | | | Method | Reference |
|---|---|---|---|---|---|---|---|
| | | Chikiani | 1 | 2 | 3 | | |
| Upper | Bondi Cave | 2 | 2 | | | PIXE | Le Bourdonnec *et al.* (2012) |
| | | 2 | | | | EDXRF | This study |
| | Ortvale Klde | | 1 | 2 | 1 | PIXE | Le Bourdonnec *et al.* (2012) |
| | | | | 2 | | EDXRF | This study |
| Middle | Ortvale Klde | 2 | 1 | | | PIXE | Le Bourdonnec *et al.* (2012) |

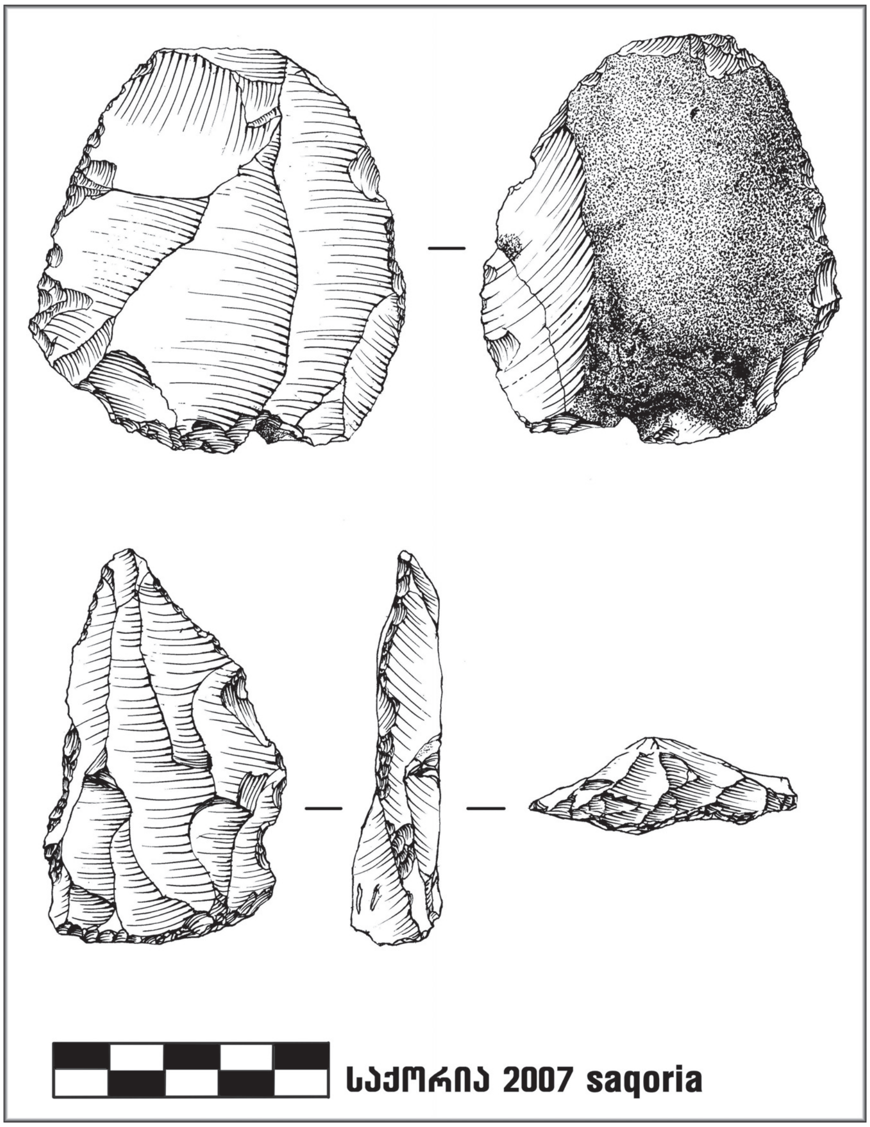


FIGURE 16. Levallois flint core and flake found at the open-air site of Saqoria. Examples of artifacts from the flint outcrops located on the plateau above the cave sites.Drawings by L. Orjonikikidze.

distant sources of Meydan Dağ, Mus, and Pasinler are unlikely to have supplied the obsidian used in Bondi Cave and Ortvale Klde.

The most documented period so far for these two sites is the Upper Palaeolithic where it appears that obsidian from at least four different sources was used (*Figure 17* top). Middle Palaeolithic obsidian was only found at Ortvale Klde, and is represented by three specimens. In spite of this small number of pieces, the use of two sources has been documented (*Figure 17* bottom). Overall, the data obtained in this study suggest that some kind of connection existed at least ~30 ka ago between eastern Anatolia and the Greater Caucasus communities.

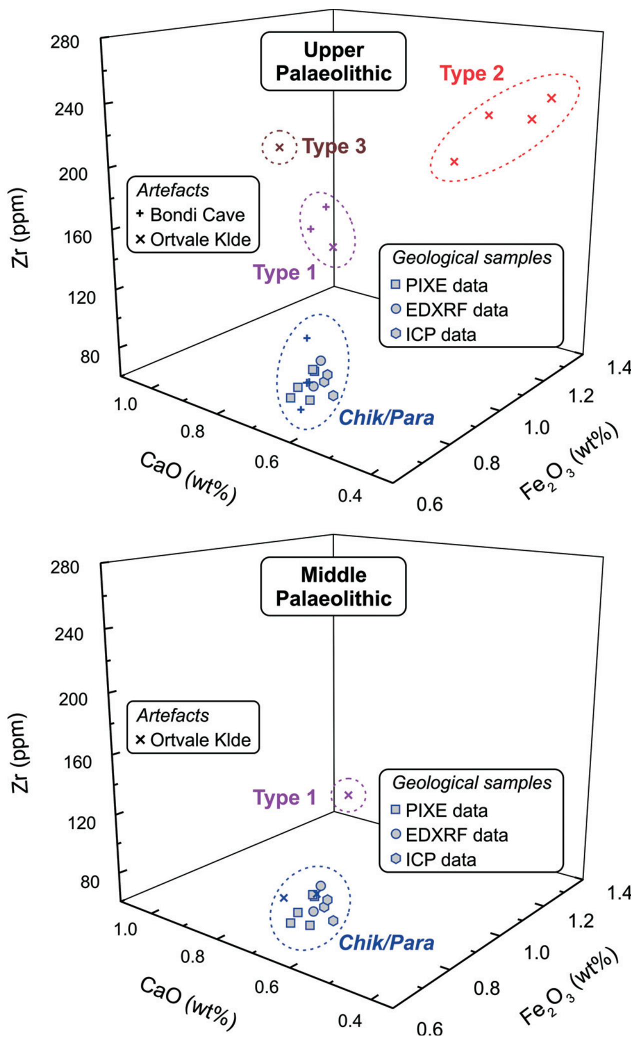


FIGURE 17. Distribution of the four obsidian chemical types at Bondi Cave and Ortvale Klde in Middle and Upper Palaeolithic stratigraphic levels.

This relationship has been established for the southern flank of the mountains, but no obsidian from the nearby source of Baksan, in the northern Greater Caucasus has yet been found at Bondi Cave and Ortvale Klde. This hypothesis is based on the limited data currently available concerning the trace element contents of obsidian from eastern Anatolian and Armenian sources and may therefore be subject to future revision.

**Late Middle Palaeolithic and Middle/Upper Palaeolithic transition**

Palaeolithic research has also addressed the question of the timing and nature of the Middle/Upper (MP/UP) Palaeolithic transition in the South Caucasus (e.g., Adler *et al.* 2008, Pinhasi *et al.* 2012, Tushabramishvili *et al.* 2012). The chronology of the Late Middle Palaeolithic and Early Upper Palaeolithic of the southern Caucasus is based on several chronometric ages and various methods (Radiocarbon, Thermoluminescence (TL), and Electron Spin Resonance (ESR)) from two sites both located in western Georgia: Ortvale Klde (Adler *et al.* 2008) and Dzudzuana (Bar-Yosef *et al.* 2006). At Ortvale Klde the demise of the last Neanderthals and the establishment of modern human populations took place towards 38–34 ka $^{14}$C BP (42–39 ka cal BP), but the onset of the UP is currently based on a single radiocarbon date from unit 4 (Adler *et al.* 2008). In both the Northern and Southern Caucasus there is a clear association between late Middle Palaeolithic assemblages and Neanderthal fossils in sites bearing human remains. Current archaeological knowledge concerning the timing of the late Middle Palaeolithic and early Upper Palaeolithic in the Northern Caucasus is based on numerous radiometric dates from a single site: Mezmaiskaya (Golovanova *et al.* 2006, 2010a, b). The timing of the MP/UP transition in Mezmaiskaya was recently revisited with the direct radiocarbon dating of human remains (Pinhasi *et al.* 2011). These ages indicate with a high level of probability that Neanderthals did not survived at Mezmaiskaya Cave after 39 ka cal BP.

Recently, new radiocarbon dates were also conducted on MP layers at the sites of Bronze Cave, Sakajia and Ortvala from western Georgia (in the Imereti Region). This dating focused on layers yielding Neanderthal fossils (Pinhasi *et al.* 2012).

The stratigraphic sequence of Sakajia Cave contains six MP layers which yielded lithics made mainly on local flint/chert (Nioradze 1937, 1953, Pleurdeau *et al.* 2007). Neanderthal remains were recovered from layers 3a, 3b, and 3d (Gabunia, Vekua 1990). At Sakajia, as at Ortvala Cave (Nioradze 1953, 1992, Pleurdeau *et al.* 2007), Levallois core technology is rare and tools are abundant. These are mostly made on blades and include retouched points, simple, convergent, and *déjeté* side-scrapers, denticulated and notched tools (Golovanova, Doronichev 2003). The analyses of radiocarbon dates for LMP occupational phases at Sakajia and Ortvala support a model of a co-terminus Neanderthal disappearance at both sites. The modelled calibrated chronology for Sakajia indicates that the end of the Late Middle Palaeolithic (Layer 3a) occurred between 41 to 36.6 ka cal BP. In the case of Ortvala, the latest Middle Palaeolithic occupation level is older than 41.7 ka cal BP. The Bayesian model for Sakajia indicates that the onset of the Upper Palaeolithic (Layer 2) began between 39.3 and 34.7 ka cal BP (95.4% confidence interval). However, this is currently based on a single radiocarbon date (Pinhasi *et al.* 2012).

Bronze Cave is part of the Tsutskhvati cave complex and does not contribute to the debate on the MP/UP transition. The MP industry is characterized by a unipolar recurrent reduction sequence (non-laminar), partly by Levallois core technology and discoid-type flaking (Pleurdeau *et al.* 2007), and by a predominance of side-scrapers and denticulated/notched tools. Retouched points are poorly represented and the industry has been defined as part of the "Tsutskhvati Group" with influences from the Zagros area (Golovanova, Doronichev 2003, Tushabramishvili 1978). The Middle Palaeolithic of Bronze cave pre-dates ~46,000 cal BP and therefore older than the other sites, confirming the absence of a late MP phase at this site.

These new results confirm that Neanderthals survived in the Caucasus until around 37 ka cal BP. Neanderthal extinction in the region took place before the first arrival of anatomically modern humans (AMH) and there is no evidence for the temporal co-existence of the two species in either the Northern or Southern Caucasian regions.

Recent results from the nearby site of Bondi Cave also provided new data on the MP/UP transition in the region. Up until now, excavations have yielded two cultural complexes, with layer VII (uppermost layer with MP affinities including blades, elongated flakes, and evidence of Levallois core technology) dated to between 38.7 to 35 ka $^{14}$C BP (43–40 ka cal $BP_{Hulu}$) and layers V to III (UP levels indicating an increase in the bladelet ratio throughout time, with one *Homo* sp. remain from layer V) from 24.6 to 14 ka $^{14}$C BP (29–17 ka cal $BP_{Hulu}$) (Tushabramishvili *et al*. 2012). The timing of the completion of the MP/UP replacement at this cave seems to be within the confidence range of that reported for Ortvale Klde. The UP layers would thus be partly contemporaneous with the Dzudzuana UP (Units D at 32–26 ka, C at 23–19 ka, and B at 13–11 ka) and the Ortvale Klde UP (38 ka BP for layer 4d and 34 ka BP for layer 4c) (Adler, Tushabramishvili 2004, Adler *et al.* 2008, Bar-Yosef *et al.* 2006, Kvavadze *et al.* 2009, Meshveliani *et al.* 1999, 2004). The base of the sequence (~38.7–35 ka $^{14}$C) has yielded occupation levels showing affinities with the MP of the region. Due to the dating hiatus between layer VII and layer VI/V, we suggest that in this cave, there was no MP/UP continuity and that the transition entailed some sort of hiatus after local Neanderthal extinction, probably followed by the recolonization of the region by AMH (Adler *et al.* 2008, Bar-Oz *et al*. 2008, Bar-Yosef *et al.* 2006, Cohen, Stepanchuk 1999, Golovanova *et al.* 1999, 2006, 2010a, b, Ovchinnikov *et al.* 2000, Pinhasi *et al.* 2011).

The lower layers VII and VIII yielded far fewer artefacts but nonetheless contain thick elongated lithic products which contrast markedly with the thin and elongated blades found in UP layers. The presence of Levallois core types in these layers is also remarkable.

Several aspects of the archaeology, the palaeontology, and the palaeoenvironmental data from the upper part of the Bondi Cave sequence resemble those observed in the UP of Dzudzuana and Ortvale Klde. Specifically, these aspects relate to raw material exploitation (where local flint predominates and exogenous obsidian was used in the UP levels), laminar and bladelet production and lastly, to the presence of microlithic tools. The absence of Aurignacian components is also common to these sites (only a few carinated cores were recovered from the upper layers of Bondi, as in Dzudzuana unit C) (Meshveliani *et al.* 2004, Bar-Yosef *et al.* 2006), whereas these elements appear to be a local development stemming from the UP in certain neighbouring areas, for instance in Zagros and Taurus in Iran, which date to between 35–23 ka BP (e.g., Otte, Kozlowski 2007). Moreover, bone tools are rare in Bondi Cave but have been recovered at Dzudzuana (Bar-Yosef *et al.* 2006), in the final UP of Sakajia and Gvardjilas Klde (Nioradze, Otte 2000) and in the later EUP at Mezsmaiskaya (Golovanova *et al.* 2010a). The observed differences between sites could relate to different management of the environment and the territory, or to possible differences in occupation seasons and the wide diversity of ecological niches (Adler *et al*. 2006, Bar-Oz *et al.* 2002, 2004).

## CONCLUSION

Our research on key Middle Palaeolithic Georgian sites enables us to discuss human occupation throughout time in the region bordering the Caucasus Mountains and to discriminate between features related to external influences vs. regional and local history. The research has also contributed to our knowledge of the MP/UP transition.

The site of Dmanisi (1.8 Ma) confirms the early arrival of hominids in this area with lithic elements related to African behavior. According to dating, Acheulean groups appear to have settled in this area at least as early as 350 ka, although some dates indicate Acheulean occupations at 500 ka after a long chronological gap in relation to the oldest evidence.

Acheulean artefacts found *in situ* in Georgia, Southern Caucasus, indicate both specific features and common trends with Levantine assemblages. Koudaro I bifaces could reflect Early Acheulean bearing resemblances to the Levantine corpus due to tool attributes (for instance shaping modes and mainly sinusoidal edges). On the other hand, the younger Tsona lithic assemblage recorded some typological specificity, which is not observed in the Levantine series, such as rectangular bifacial tools, bifaces with a transversal edge or Tzaldi-type tools. Then again, other elements, such as cleavers on flakes, represent common traits with the Levant. We can thus detect strong influences from populations from the Levant, which did not transcend the mountain barrier, thereby developing original traditions in relation to activities in isolated mountainous areas.

Koudaro I and Tsona caves record evidence of two types of assemblages linked to different land use patterns and different types of high elevation sites (short-term and longer-term occupations). The large bifacial tools are more varied at Tsona for short-term occupations whereas at Koudaro I, cordiform and triangular bifaces are associated with *in situ* flaking. The cave location demonstrates the extension of territories to high elevation localities in the mountains during the Acheulean period when climatic conditions were probably more clement. Raw materials confirm hominin mobility between low and high altitudes.

After the Acheulean, the Early and Late Middle Palaeolithic series (Drujula cave) indicate some connections with external areas and various techno-complexes are described in relation to traditions, activities, ecological conditions, or chronology. Recent dating places the Middle Palaeolithic time span from 250 to 38 ka. New discoveries and new detailed analyses of the lithic series indicate that Neanderthal occupations in the Southern Caucasus probably maintained relationships with the Levant and the Zagros as well as some local *in situ* development (core technology focusing on elongated products and blades, retouched points).

Finally, excavations at sites such as Bondi cave seem to support the timing and process of the MP/UP transition already documented in Ortvale Klde. However, further work focusing on the base of the archaeological sequence is required in order to confirm this apparently rapid replacement of MP Neanderthals by UP modern humans in the cave.

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