Lower Palaeolithic Settlement of the Balkans: Evidence from Caves and Open-air Sites

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Lower Palaeolithic Settlement of the Balkans: Evidence from Caves and Open-air Sites

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Introduction

THE SIGNIFICANT ROLE that the Balkans played within the Lower Palaeolithic cultural and demographic trends – serving both as a migration corridor connecting Southwest Asia with Central/Western Europe, and as a glacial biotic refugium – has been already pointed out multiple times (Roksandic *et al.*, this volume). Until recently, the Lower Palaeolithic of the Balkans could only be discussed based on individual finds (choppers, bifaces, etc.) and those collected from uncertain contexts, as stratified sites were almost completely unknown. Lately, however, the situation has changed. Several relevant sites with faunal remains and artefacts attributed to the Lower and Middle Pleistocene have been explored in Romania, Bulgaria, Serbia and Greece, while numerous surface lithic scatters have been recorded, indicating the possibility that river and lake terraces and locations near raw material deposits were intensively visited not only in the Middle but also in the Lower Palaeolithic.

Several regional syntheses on the Lower Palaeolithic of the Balkans have been published recently, offering critical reviews of earlier interpretations (Doboş 2008; Tourloukis 2010). To avoid repetition, this chapter considers the results of previous research not only from the aspect of its reliability, but also from the aspect of archaeological potential. In this context, special attention is devoted to the comparison of the state of research of cave sites and open-air sites. These two types of sites differ significantly in the character of the remains uncovered, and more importantly by the fact that the systematic study on the latter has only recently begun. It is becoming evident that the focus of Lower Palaeolithic research in the Balkans should lie in building models for predicting site locations, which would include geoarchaeological and palaeoecological parameters, as well as behavioural factors

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that could affect the settlement of certain parts of the peninsula (Tourloukis 2016; Dinçer 2016; Bar-Yosef & Belfer-Cohen 2013; Dennell *et al.* 2011). This research should be aimed at resolving specific issues related to the study of the Lower Palaeolithic of South-east Europe and more generally of the Eastern Mediterranean region.

Cave sites

Overview of previous research

Despite the wide distribution of karst relief and the fact that research of Palaeolithic cave sites began relatively early (Basler 1979), the first cave sites with Lower Palaeolithic materials were recorded only in the early 1960s. During this period, the fossil cave of Šandalja I, near Pula (Malez 1979), and Petralona Cave, near Thessaloniki (Darlas 1995), were explored, while in the 1980s, exploration of Gajtan Cave in northern Albania (Fistani 1993) and Yarımburgaz Cave in the European part of Turkey yielded Lower Palaeolithic artefacts (Howell *et al.* 2010).

The beginning of the 21st century brought about more systematic research at several Lower Palaeolithic (LP) cave sites (Figure 2.1). Early Pleistocene strata were examined in Kozarnika Cave, in Bulgaria (Guadelli *et al.* 2005; Sirakov *et al.* 2010), and Balanica Cave Complex, in Serbia, which yielded hominin fossils, artefacts and faunal remains from the late Middle Pleistocene (Mihailović & Bogićević 2016), while bones presumed to have been used as tools were found at the palaeontological site of Trlica in Montenegro (Vislobokova *et al.* 2020). The collapsed rockshelter of Dealul Guran in Romania could also be attributed to this site type, but it will be presented together with the open-air sites, because it was located at the margins of the loess steppe that was present in the Lower Danube region during the Middle and Late Pleistocene (Iovita *et al.* 2012).

Chronology

The ages for most sites were determined based on the associated faunal remains, and there are very few for which absolute dates are available. Lower layers of the Šandalja I palaeocave near Pula contained Early Pleistocene (Late Villafranchian) fauna, as well as archaeological material: one chopper and one pebble with traces of use (Malez 1979; Spassov 2003; Vislobokova & Agadjanyan 2016).

The deepest layers of Kozarnika (13 and 12) were dated, based on large faunal remains, to 1.6–0.9 million years ago (Ma), layer 11b to 800–600 thousand years ago (ka), and layer 11a to 600–400 ka (Guadelli *et al.* 2005; Sirakov *et al.* 2010). However, some researchers have argued that the age of the deepest layers is more recent and probably corresponds to the onset of Epivillafranchian (Kahlke *et al.* 2011; Spassov 2016), as indicated by the analyses of small mammal fauna (Popov &

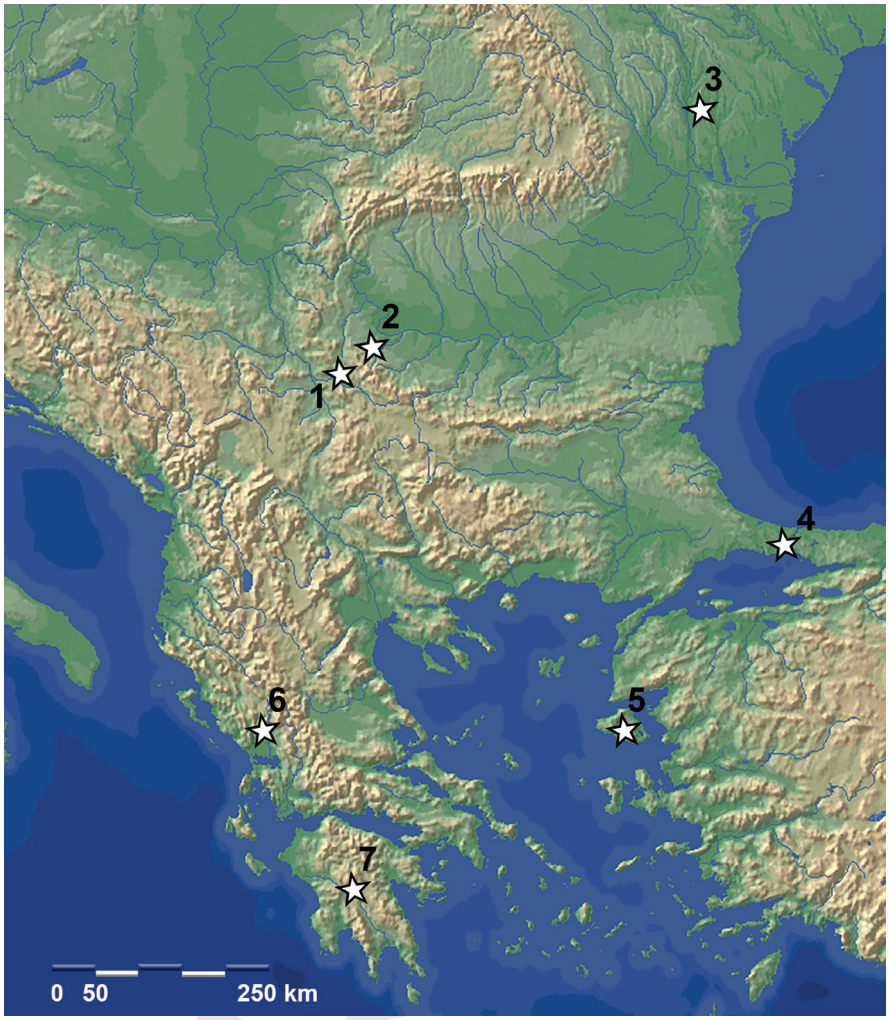

Figure 2.1 Map of stratified and dated Lower Paleolithic sites in the Balkans mentioned in the text: Cave complex Balanica (1), Kozarnika (2), Dealul Guran (3), Yarimburgaz (4), Rodafnidia (5), Kokkinopilos (6), Marathousa (7).

Marinska 2007; Popov 2009). Recent magnetostratigraphic studies have indicated that the age of the deepest layers in this cave does not exceed the early Brunhes (<0.78 Ma) (Muttoni *et al.* 2017).

The Trlica site in Montenegro was originally attributed to the late Early Pleistocene – later than 1 Ma (Van der Made & Dimitrijević 2015). Bogićević and Nenadić (2008) attributed it to an earlier phase (biozone MmQ2; 1–1.4 Ma), while recent re-evaluations of the site (Vislobokova & Agadjanyan 2016; Vislobokova

et al. 2020) identified the lower strata as Late Villafranchian/Early Pleistocene (MNQ 18), and the upper strata as early Middle Pleistocene (MNQ 19).

Of the Middle Pleistocene cave sites, only Yarımburgaz, Velika and Mala Balanica, and Petralona were radiometrically dated. Based on electron spin resonance (ESR) dating, using the uranium array method and infrared luminescence, it was determined that the minimum age of layer 3b in Mala Balanica, which yielded a partial *Homo heidelbergensis* mandible, is 397–525 thousand years old (Rink *et al.* 2013). Both the sedimentological and palaeontological data indicate that the accumulation of the material occurred during an interglacial – MIS 13 or MIS 11. The upper layers of Mala Balanica (2a–2c) were dated via ESR to MIS 7, while the finds from layers 3a–3c in Velika Balanica were dated via thermoluminescence (TL) of burnt flint to MIS 9–7 (Mihailović *et al.* 2022).

The Lower Palaeolithic layers of Yarımburgaz Cave (Z and W) were dated, using the ESR method (Linear Uptake model), to the interval between 250 and 190 ka, which corresponds to MIS 7 and the end of MIS 8 (Blackwell *et al.* 2010). The age of the deposits in Petralona Cave was estimated to more than 350 ka, based on the dating of the upper stalagmite floor by the uranium disequilibrium method (Shen & Yokoyama 1986; Darlas 1995), or more than 150–250 ka based on the ESR dates that were obtained later (Grün 1996). In Gajtan Cave, layers were dated to the late phase of the Middle Pleistocene, that is, to the Holstein interglacial, based on faunal remains (Fistani 1993; Darlas 1995).

Taphonomy and human behaviour

The accumulation of faunal remains seems to have been mostly the result of carnivore activity. This is particularly evident in the karst cavity of Trlica, in which the remains of at least 34 mammalian species were found in the deepest layers (11 and 10). The faunal assemblage is dominated by the remains of herbivores (bovines, cervids and equids), but carnivore (ursids, canids, felids and hyaenas) remains were also found, including the genera *Pachycrocuta*, *Megantereon* and *Homotherium*. Four bone fragments, which originated from the lower layers, present traces that 'suggest their anthropogenic nature' and could thus represent tools: one 'percussor' and one 'retoucher/smoother' (Vislobokova *et al.* 2018), as well as two elongated bone fragments that are thought to have been used for other activities (Vislobokova *et al.* 2020). Without going into the details of this interpretation, which is indeed based on thorough analyses, it should be noted that the finds from Trlica only suggest, not prove, the human presence in the cave. The faunal remains were accumulated by carnivores; taphonomic factors (which could have caused damage to the bones) have not been fully elucidated, while a single lithic artefact found at the site did not originate from a stratigraphic context.

A similar context is observed in Šandalja I, with rich Early Pleistocene palaeontological material including remains of species such as *Canis etruscus*, *Ursus etruscus*, *U. mediterraneus* (=*U.* ex gr. *minimus*), *U.* cf. *deningeri*, *Stephanorhinus*

etruscus, *Cervus acoronatus* and *Leptobos stenometapon* (=*L. elatus*) (Malez 1979; Vislobokova & Agadjanyan 2016). However, unlike Trlica (Vislobokova & Agadjanyan 2016), anthropogenic factors of material accumulation have not been analysed in detail. It has been stated that the layer contains, among the fragmentary animal bones, 'traces of osteodontokeratic culture' and pieces of charcoal (Malez 1979: 284). These assertions somewhat call into question the stratigraphic context and chronology of the finds from the fossil cave's deepest layer, since no evidence of the use of fire in such an early period has been recorded elsewhere in Europe (Roebroeks & Villa 2011).

Traces of human presence are much more convincing at Kozarnika, where layers 13, 12 and 11a–11c contain numerous artefacts (Sirakov *et al.* 2010; Ivanova 2016). Among the lithic finds, artefacts from all production phases were found, which indicate the frequent and perhaps somewhat longer-term occupation of the cave by hominins. For now, there is not enough information about the exact nature of human activities conducted in the cave, but Sirakov *et al.* (2010) report a marmot phalanx from layer 12 with traces of tool use, which appear to indicate skin working. As for the finds from the deepest layers of Kozarnika, the question arises as to how many represent intentionally knapped artefacts and how many could be classed as geofacts – bearing in mind the fact that the layer also contains material that originates from the natural breakdown of chert nodules from the parent rock. According to the authors, artefacts with convex bulbs and visible impact points appear in higher percentage (70 per cent) only within layer 11 (Ivanova 2016).

Layer 3b in Mala Balanica, dated to older than 400 ka, contained numerous animal bones, including both herbivores (*Cervus elaphus*, *Dama dama*, *Capra ibex*) and carnivores (*Canis* sp., *Ursus* sp., *Crocuta spelaea*). The faunal material includes bones with carnivore teeth marks, which led to the assumption that the accumulation of remains in layer 3b was mainly due to the activities of carnivores (Roksandic *et al.* 2011). Now a limited number of artefacts found in the same layer requires us to re-examine this initial conclusion. Excavations of layer 3b, which have so far been carried out on an area of only 8 m^2, are still ongoing.

Many more remains were collected in both Petralona and in the cave of Gajtan (Darlas 1995). Numerous remains of horses, cervids and mountain goats were found in Petralona, with a large number of (mostly quartz) artefacts that indicates that the cave was intensively frequented by hominins at least for a period of time. The Gajtan Cave contained warm-loving mammalian fauna including *Dicerorhinus* cf. *mercki* (=*Stephanorhinus* cf. *kirchbergensis*), *Sus scrofa*, *Cervus elaphus*, *Capreolus capreolus*, *Dama dama*, *Bison priscus*, as well as the remains of carnivores. Traces of defleshing, intentional fragmentation and fire were observed on the collected bones.

Like many other caves, the dominant species and the primary occupants of the Yarımburgaz Cave are bears, which predominate among the faunal material (Stiner 2010). However, many lithic artefacts from all phases of production indicate that the cave was frequently, but for short periods, visited and utilised by hominin groups (Kuhn & Stiner 2010).

In the upper layers of Mala Balanica (2a–2c), the most numerous remains are those of *Capra ibex* and *Cervus elaphus*, but these layers also record *Castor fiber* and *Lepus* sp., various carnivores such as *Crocuta spelaea* and a speleoid bear identified as *Ursus spelaeus deningeroides* (Roksandic *et al.* 2011; Cvetković & Dimitrijević 2014). Only a small percentage of bones show traces of gnawing, which indicates that carnivores did not decisively influence the accumulation of bones in these layers of the cave (Mihailović *et al.* 2022). Traces of human presence, however, are clearly recognisable. In addition to the lithic artefacts, bones with cut marks, and more recently traces of fire, were discovered in the cave, all of which indicate that it served either as a temporary habitation or as one in which specialised activities related to the settlement of Velika Balanica were performed.

A much larger quantity of remains was found in the neighbouring Velika Balanica. Their structure indicates that the cave was not only frequently inhabited, but also that it represented a base camp at least at one point (Mihailović & Bogićević 2016). At the bottom of the sequence at the entrance part of the cave, which has so far been explored over an area of 6 m^2, we discovered a combustion feature that contained many burnt bones and chipped stone artefacts (Plavšić 2015). Artefacts from all phases of production and bones with traces that testify to butchering, skinning, dismembering and defleshing of the captured prey, as well as to bone marrow extraction (Marín-Arroyo 2014), were found in Velika Balanica. Taphonomic analyses have shown that the accumulation occurred due to human activities and not to the activities of carnivores. The hominins that inhabited Velika Balanica mostly hunted deer and ibex, but also large mammals (bovines, horse, rhinoceros), within a few kilometres from the cave.

Lithic assemblages

Lithic assemblages from cave sites have not been uniformly examined and published, and many sites have yielded only a small number of artefacts. For example, one typical chopper and one pebble with impact traces were found in Šandalja I (Malez 1979), while a single notched tool made on a thick quartz flake and two very small flakes were found in the lower levels of Mala Balanica.

A large number of artefacts were excavated from the deepest layers of Kozarnika (13, 12, 11c–11a). Local raw materials – chert, less often quartz – were used in the production of tools. The lithic industry contains almost no choppers (except for a few pieces which originated from Trench IV), and is dominated by flakes and tools made on flakes. In the earliest phase, the striking of the narrower side of cores was practised, while layers 11b and 11a also contain cores knapped along the longitudinal axis, preferential cores with a prepared flaking surface, and conical cores indicating the application of the discoidal method (Sirakov *et al.* 2010). In almost all layers, the tools are extremely small, and among them, the most numerous are retouched flakes, denticulated and notched tools, perforators and scrapers (Ivanova

2016). Scrapers and retouched flakes were mostly processed via discontinuous semi-abrupt retouching. Layer 11 contained trihedrals and 14 atypical bifaces.

The assemblage of Gajtan Cave consists of chopping-tools, atypical handaxes and 'other tools', mostly made of quartzite. A similar assemblage was recovered from Petralona (Darlas 1995). The lithic industry from Petralona, which has not yet been analysed in detail, is dominated by small tools made mostly on debris, and less often on flakes; pebble tools are underrepresented, and the most numerous tool types are sidescrapers – frequently retouched 'using a thick retouch' – and denticulated and notched pieces (Darlas 1995: 54).

A large number of artefacts were found in Yarımburgaz, of which about 1700 were analysed, including chips (Kuhn 2010). In the structure of the industry, cores represented about 14 per cent, and tools about 39 per cent. The high percentage of tools indicates that many were brought to the site. The raw materials used for the production of lithic artefacts were quartz, quartzite and flint, on which different technological procedures had been applied. Choppers were made using quartzite pebbles, and quartz cores were knapped using the bipolar method, while quartz cores were knapped using the discoidal method. Artefacts produced using the Levallois method were not found. The most numerous tools are flakes with irregular or denticulate edges, including tools reminiscent of the 'Tayac points'. In addition, notched Clactonian flakes were also recorded. About 5 per cent of the tools display edge modifications resembling Quina retouch.

Assemblages from layers 3a–3c in Velika Balanica and layers 2a–2c in Mala Balanica record almost identical lithic industries, although Velika Balanica has a much larger number of artefacts: 1178, compared to only 111 pieces from Mala Balanica (Mihailović *et al.* 2022). Quartz artefacts predominate at both sites, while flint is less common. In terms of the technological procedures, Quina and discoidal methods were most common, and Clactonian and Kombewa methods were also present, while Levallois artefacts were not recorded. Sidescrapers are the most frequent tool type (>40 per cent). Among these, a significant number were retouched using Quina and demi-Quina retouch. Denticulated and notched tools are also relatively frequent (>16 per cent), while other tool categories are much less common. In addition to these, a single Mousterian point and one typical limace were also found in Velika Balanica.

Open-air sites

Overview of previous research

The majority of Lower Palaeolithic open-air sites were discovered only after the Second World War. In the western Balkans, bifacial artefacts associated with the Acheulean were found at the site of Punikve, near Ivanec in north-western Croatia, and a single 'handaxe' was found at Donje Pazarište in Lika (Malez 1979;

Karavanić & Janković 2006). Several open-air sites in Bosnia and Herzegovina (Gatačko polje, Kamen, Crkvina) yielded choppers and other artefacts with 'archaic' features, which were associated with Clactonian and Tayacian (Kujundžić-Vejzagić 2001, 2005).

A similar situation has been observed in the eastern and southern Balkans. In Romania and Greece, several sites with tools made on pebbles and flakes were attributed to the Lower Palaeolithic, but this attribution was later questioned (Doboş 2008; Tourloukis 2010). Open-air sites were also recorded in Albania, near Gajtan (Fistani 1993; Darlas 1995). However, only a few of these sites were later verified. The site of Rodia in Thessaly records quartz artefacts which are thought to be of Early Pleistocene age, while a single Acheulean handaxe was found in 1991 at Kokkinopilos in southern Epirus (Runnels & van Andel 1993; Tourloukis 2010).

During the 1990s, surface sites with high concentrations of artefacts were recorded in the central and eastern Balkans, some of which were attributed to the Lower Palaeolithic. Within the lithic material collected at the Kremenac site near Niš, southern Serbia, Šarić (2011, 2013) identified choppers, 'proto-bifaces' and various tools on irregular flakes, which he chronologically assigned to the middle and late phase of the Early Pleistocene. At the sites of Shiroka Polyana and Kremenete in the western Rhodopes, and Benkovski in the Eastern Rhodopes, Ivanova (2016) singled out artefacts (bifaces and tools with bifacial retouch) that were tentatively assigned to the Acheulean.

The beginning of the 21st century in Romania, Serbia and Greece saw a systematic search for open-air Lower Palaeolithic sites. In Romania, a detailed field survey of Palaeolithic sites in the south-eastern province of Dobrogea was undertaken, which led to the discovery of the Dealul Guran site (Iovita *et al.* 2012; Doboş & Iovita 2016). In Serbia, our team conducted a systematic survey of the Pleistocene river terraces of the Zapadna and Južna Morava river valleys (Mihailović *et al.* 2014, 2015; Mihailović & Bogićević 2016), while Greece saw: (1) the launching of a field survey project of Lower Palaeolithic sites in fluvial and lacustrine contexts in the Megalopolis Basin in the Peloponnese (Thompson *et al.* 2018), and (2) several projects related to the study of human presence on islands (Carter *et al.* 2014; Runnels *et al.* 2014; Galanidou *et al.* 2016).

Chronology

Chronologies of artefact-bearing layers have been radiometrically determined only for Dealul Guran and several sites in Greece. The age of the archaeological horizons at Dealul Guran was determined by luminescence dating using the post-infrared infrared-stimulated luminescence ($pIRIRSL_{225}$) method (Iovita *et al.* 2012; Doboş & Iovita 2016). Three dates were obtained for the artefact-bearing layers D and E – two of which correspond to MIS 11 (420–360 ka) and one (sample EVA1087) corresponding to MIS 9. However, it is considered that the age of the

layers more likely corresponds to MIS 11 since the date for the last-mentioned sample lies within 2σ of the other two samples (Iovita *et al.* 2012).

In Greece, the earliest date was obtained for the Marathousa 1 site in the Megalopolis Basin (Peloponnese) using the ESR (Blackwell *et al.* 2018) and pIRIRSL methods. The average age of ESR samples was found to be 503.0 ± 11.8 ka – which corresponds to early MIS 13, while the age based on optical dating (480–420 ka) corresponds to MIS 12 (Jacobs *et al.* 2018).

The pIRIRSL method was also applied at the site Rodafnidia at Lisvori on Lesbos Island, where unit 1 (streambed deposit), which yielded the artefacts, was dated to 164 ± 33 ka (MIS 6) and 258 ± 48 (MIS 8). Galanidou *et al.* (2016) indicate that the artefacts were redeposited from older sediments so that these dates are considered as *terminus ante quem* or minimal ages. At Kokkinopilos, the first TL dates obtained for unit B (from which the Acheulean biface originated) showed that this layer is at least 91 ka (which is the age obtained for the uppermost palaeosol) and is likely 250–150 ka (Zhou *et al.* 2000; Runnels & van Andel 1993). These results were confirmed by dates obtained later for unit C (which also contained bifaces) for which a minimum age of 220–207 ka was determined via pIRIRSL (Tourloukis *et al.* 2015).

At the Stelida site at Naxos, an infrared-stimulated luminescence (IRSL) age of 219.9–189.3 ka was obtained for the lithostratigraphic unit 7 (Carter *et al.* 2019). However, it is still not clear whether the lithic material from this layer belongs to the Lower or Middle Palaeolithic, due to the lack of diagnostic artefacts.

Taphonomy and human behaviour

The most complete data on the Lower Palaeolithic inhabitation in the Balkans come from the Marathousa 1 site (Peloponnese), where skeletal remains of a straight-tusked elephant (*Palaeoloxodon antiquus*) were found in association with chipped stone artefacts, in an *in situ* lacustrine-paludine context. Traces of tool use were recorded on the elephant's bones, which indicate that the large animal was butchered on the spot (Konidaris *et al.* 2018). Short-term habitation was also proposed for the Dealul Guran site (Romania). No animal bones were found at the site; however, the structure of the lithic industry (with only five tools found) indicates that workshop activities were performed on the site. Unlike these two sites, Rodafnidia on Lesbos was obviously intensively occupied, as evidenced by the size of the site and the number of collected finds (Galanidou *et al.* 2016). The hominins at the site are thought to have exploited resources from the fluvio-lacustrine environment near geothermal springs that contained mineral deposits produced in hydrothermal conditions.

Field surveys of open-air Palaeolithic sites in the Central Balkans have shown that the Pleistocene terraces of the Zapadna Morava River (t3 and t4) were intensively inhabited in the Middle and possibly the Lower Palaeolithic. Dozens of lithic scatters (with large or small concentrations of artefacts) were recorded in

the lower course of the Zapadna Morava river, on the approximately 70 km stretch from Čačak to Vrnjačka Banja (Mihailović *et al.* 2014; Mihailović & Bogićević 2016). The majority of the collected lithic materials are Middle Palaeolithic, but artefacts that can be attributed to the Lower Palaeolithic were also recorded at a couple of sites (Kosovska Kosa, Gvozdenac). Most sites are located in the immediate vicinity of primary and secondary mineral deposits. In addition to knapping products, numerous tools were also found at these sites (e.g., ~20 per cent at Kosovska Kosa), showing that the settlements did not have a specialised character but rather represented living sites, where various activities were performed.

Once a correlation between the intensity of inhabitation and mineral deposits was established, a systematic survey of Palaeolithic sites in the Vardar geotectonic zone began; this zone is characterised by rich deposits of raw materials of hydrothermal origin (Miladinović *et al.* 2016). Several Palaeolithic sites were recorded during the course of the survey, both at the mineral deposits themselves (Goč, Lojanik, Radan) and on the river terraces and in the streambeds in their vicinity (Mihailović *et al.* 2014, 2015; Bogosavljević Petrović *et al.* 2018). Traces of presence of Palaeolithic groups have been recorded at these locations, but (as in the case of Kremenac and the Bulgarian sites) it was difficult to separate possible Lower Palaeolithic material from geofacts (Radinović & Jovanović 2019) and finds from later periods. Preliminary results of the analyses indicate that, in addition to the flaking products related to the workshop activity, there are also a number of tools that could have been used in everyday activities.

Lithic assemblages

Only three Lower Palaeolithic sites in the Balkans show relatively high concentrations of finds from stratigraphically secure and dated contexts. The locality of Marathousa 1 yielded about 1200 artefacts, of which as many as 741 were chips up to 1.5 cm in length (Tourloukis *et al.* 2018). In terms of raw materials, most artefacts were made using radiolarites, which came from a deposit located about 4–5 km from the site, but had probably been procured from secondary deposits, closer to the site. The high prevalence of chips and microchips suggests *in loco* reduction, with the goal of producing blanks for tool making. Not counting tiny flakes and fragments, tools make up about 19 per cent of the lithic assemblage. Maximally exploited cores with alternating surfaces, as well as cores that were secondarily used as tools, were detected. Tools resulting from rejuvenation were also found. The lithic industry has a microlithic character as a whole; the length of the small artefacts varies between 15 mm and 25 mm. Backed, denticulated and notched pieces predominate among tools. The Marathousa 1 industry is categorised as a 'small tool assemblage'. Two denticulated bone artefacts, produced in the same fashion as the stone tools, as well as one diaphysis fragment thought to have served as a bone percussor, were also recorded at the site.

Slightly fewer artefacts were found at Dealul Guran: 139 pieces larger than 2.5 cm and 422 pieces smaller than 2.5 cm (Iovita *et al.* 2012). The artefacts were made using Cretaceous–Tertiary flint procured near the site. Cores and flakes dominate the structure of the industry, while no formal tools have been found. The most numerous are single-platform cores, but multiple-platform and Kombewa cores were also recorded. The small size of the artefacts is explained by the fact that frost-cracked and local flint was utilised in production.

A large assemblage of about 700 artefacts was collected during the excavations at Rodafnidia (Galanidou *et al.* 2016). The artefacts were mostly made using chert and opals of hydrothermal origin. The general structure is dominated by cores and flakes, which, combined, make up more than 85 per cent of the collection. Among tools, 16 bifaces and three artefacts classified as cleavers were found. However, as Levallois cores were also recorded at the site, the question arises whether this is Acheulean with Prepared Core Technology (PCT), or Middle Palaeolithic material that originates from a later stage of the settlement (Galanidou *et al.* 2016).

Among the stratified sites with somewhat fewer finds, Kokkinopilos, Plakias and Rodia in Greece stand out. Apart from bifaces, products of flaking and tools (mostly denticulated and notched) were found at Kokkinopilos, while no Levallois products were recorded (Tourloukis *et al.* 2015). Bifaces and various tools made of quartz and other raw materials – large cutting tools (LCTs) and scrapers, denticulates and notches – were found at the Plakias in south Crete (Runnels *et al.* 2014; Tourloukis & Harvati 2018), while the site of Rodia records a quartz industry with choppers, globular and amorphous cores, and retouched tools dominated by denticulated and notched pieces (Runnels & van Andel 1993; Tourloukis & Harvati 2018).

In regards to the central and eastern Balkans surface assemblages, from which the material was collected selectively, it should be noted that the identification of Lower Palaeolithic tools (choppers, protobifaces, etc.) at Kremenac (southern Serbia) is somewhat questionable due to the large number of geofacts occurring at the site, while only a relatively small number of artefacts that can be attributed to the Lower Palaeolithic were identified in the material from Bulgarian sites (especially at Shiroka Polyana). Finds from Shiroka Polyana (13 bifacial cores and bifaces) were attributed to the Acheulean (Ivanova 2016), although no typical pieces were found, while 11 chopping tools were identified within the Kremenete lithic assemblage. The character of finds from the surface site of Benkovski will be possible to assess only when they are published in detail.

In Serbia, there are several open-air localities where more or less homogeneous assemblages were collected. Within the assemblage from the site of Kosovska Kosa (with a total of 224 artefacts), near Čačak, 13.6 per cent are cores, choppers and chopping tools, 46.3 per cent flakes larger than 1.5 cm, 10.5 per cent large chunks, and 19.1 per cent are tools (Figure 2.2 A), among which sidescrapers, irregular endscrapers, denticulated and notched pieces predominate (Mihailović & Bogićević 2016). A single Levallois flake was also recorded, which (judging by the smoothness and shine) was probably redeposited from another location. In the

material collected from the Gvozdenac site, near Vrnjačka Banja (Mihailović *et al.* 2015), no typical Middle Palaeolithic artefacts were identified, but there are preferential cores, naturally backed and chipped backed knives, and scrapers on massive and irregular flakes (Figure 2.2 B).

The site of Petrovac 1, on the Radan Mt. in southern Serbia, is set within the raw material deposit on the edge of one of the calderas of the Lece volcanic complex (Miladinović 2012). Thousands of artefacts have been collected from the surface

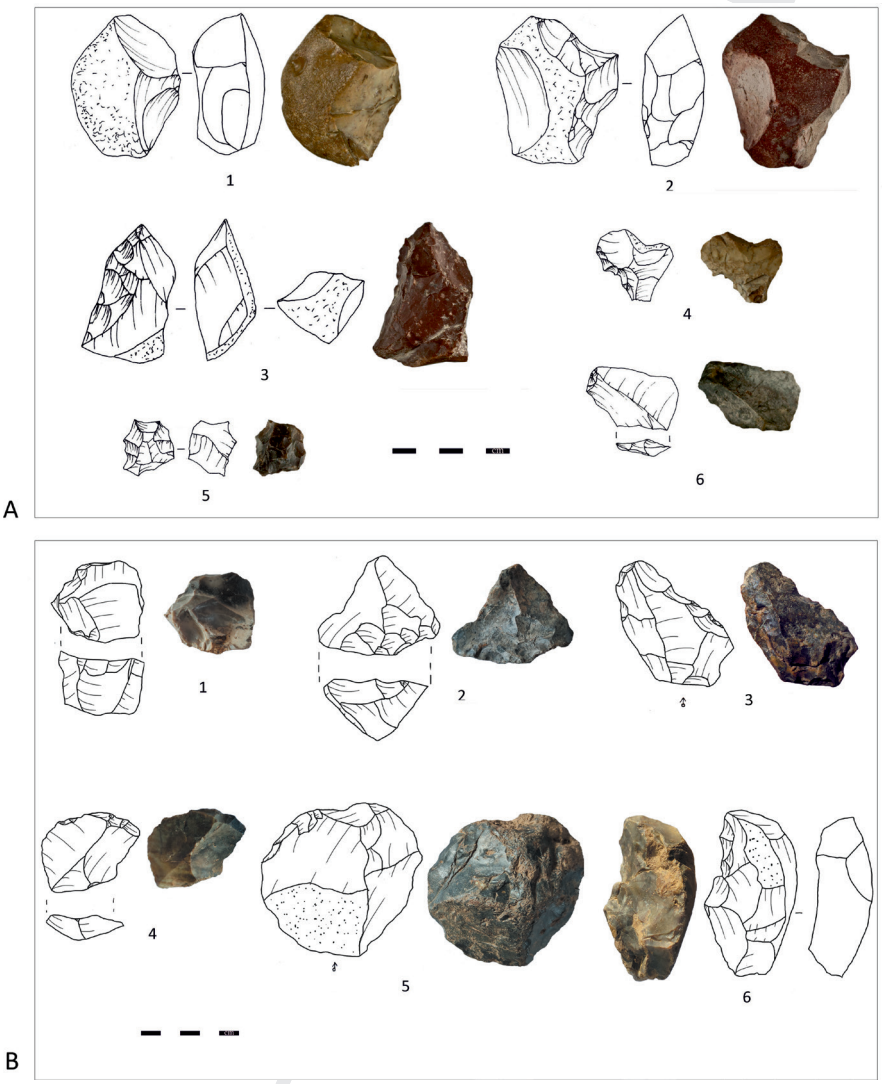

Figure 2.2 2A: Kosovska Kosa: side-choppers (1–2), pointed scraper (3), denticulated tools (4–5) and an endscraper (6). 2B: Gvozdenac: cores (1–2) and scrapers (3–6).

of sector G of this site; while almost no Levallois products were recorded. There are numerous discoidal, single- and multi-platform cores, as well as unstandardised tools on flakes (scrapers, notches and denticulates). The excavations undertaken in 2020 and 2021 revealed that the site contains three distinct geological layers. Layer 2 yielded lithic material similar to that collected from the surface, while layer 3 contained numerous irregular (mostly unretouched) small flakes, together with massive choppers made of pyroclastic rocks (Mihailović *et al.* 2021). Based on the lithic material collected so far, it can be assumed that the finds from Petrovac 1 (especially those which originated from layer 3) belong to the Lower Palaeolithic. In order to confirm this, however, it will be necessary to establish the chronology and check the stratigraphic integrity of the artefact-bearing layers. The TL, OSL and palaeomagnetic dating of the artefact-bearing layers is currently underway.

Discussion

As shown in this brief overview, the past two decades have seen a major shift in knowledge about the Lower Palaeolithic in the Balkans. However, our interpretations of this period on this territory still rest mainly on the materials from only a few sites with finds in primary and dated contexts (Marathousa, Balanica, Dealul Guran), including Kozarnika (the age of which has not yet been precisely determined), as well as the materials from sites with finds from secondary contexts, and for which only minimum ages could have been determined (Rodafnidia, Kokkinopilos).

Finds from the end of the Early and the beginning of the Middle Pleistocene have been recorded mainly in caves (Kozarnika, Šandalja I, Trlica). Although not yet proven, due to the numerous chronological and taphonomic issues, large faunal assemblages found in these caves suggest that the Balkan Peninsula might have been inhabited in the Early Pleistocene. This is a distinct possibility, given that finds dating to more than a million years were reported for the neighbouring regions of the Black Sea (Shchelinsky *et al.* 2016; Spassov 2016) and Anatolia (Slimak *et al.* 2004; Kuhn 2011).

Given the fact that the oldest remains come from carnivore sites, not much can be said about the mobility and subsistence practice of hominins in this period. The artefacts collected from Kozarnika, however, convincingly demonstrate that in the 'core-and-flake' industries, a knapping method reminiscent of the discoidal and Levallois technologies appears very early (Sirakov *et al.* 2010). Bifacial artefacts do appear in Kozarnika's layer 11, but they are not typical and cannot be linked to the Acheulean industries in Central and Western Europe (Ivanova 2016). The Rodia quartz industry could come from the early part of the Pleistocene epoch, but it has not yet been reliably dated (Tourloukis 2010).

Remains from Marathousa, Dealul Guran and the deepest strata (3b) of Mala Balanica are currently the only reliable evidence of settlement in the Balkans in the middle part of the Middle Pleistocene (MIS 13–11). Research at Marathousa 1 has

shown that hominin groups inhabited fluvio-lacustrine basins during this period and exploited megafauna, which has been confirmed in neighbouring regions of Central Europe, the Apennine Peninsula (Anzidel *et al.* 2012; Boschian & Saccà 2015) and the Levant (Ben-Dor *et al.* 2011; Agam & Barkai 2018). The remains found at these sites were created by short-term occupations, meaning that the artefacts collected could be considered only in the context of more or less generic 'small tool assemblages'.

Preliminary results of field surveys of river terraces and localities near the deposits of raw materials indicate that the sites were intensively inhabited in the Middle, and probably in the Lower, Palaeolithic. Lithic scatters with large numbers of artefacts – including choppers, as well as artefacts that can be conditionally attributed to both the Clactonian, or *système par surface de debitage alterné* (SSDA) method (Forestier 1993), and PCT – have been documented at many sites. As no typical Acheulean artefacts have been found at any of these sites (including Bulgarian ones), it must be stated that the border between the Acheulean and non-Acheulean industries in South-east Europe remains more or less unchanged. However, the clear presence of Acheulean in the extreme south of the Balkans (Kokkinopilos, Rodafnidia, Plakias) certainly represents an important novelty.

The final proof for the breaching of the Movius Line was obtained during the research of Velika and Mala Balanica (Mihailović *et al.* 2022): the earliest evidence for the appearance of Quina/Yabrudian technology in Europe was found at this site, which dates back to almost 300 ka. Artefacts from layers 3a–3c in Velika Balanica and 2a–2c in Mala Balanica show many similarities with those from the Yabrudian sites in the Levant, but also with the 'proto-Charentian' artefacts from Karain Cave on the southern coast of Turkey, that have been dated to the approximately the same period (Otte *et al.* 1998; Kozłowski 2002). All this indicates that in MIS 9 or 7, and perhaps in MIS 8, when the sea-level was lower (Tourloukis 2010), there was a population shift and/or a cultural transmission on the route between the southern Levant and South-eastern Europe. The findings from Balanica, however, testify not only to technological transformation, but also to changes in mobility pattern, the way resources were exploited and the organisation of life in habitations (with regular use of fire) towards the final shaping of Middle Palaeolithic behaviour (Kuhn 2013). It remains to be seen who the bearers of these changes were. Hopefully, this issue will be resolved soon, since hominin fossil remains were also discovered in layer 3 of Velika Balanica (Roksandic *et al.* 2019, 2022; Radović *et al.* 2020).

Conclusion

Unlike previous research, which was mainly focused on the identification of cultural remains and reconstruction of routes of hominin dispersal, recent research has shed light on the chronology of sites, but it also enabled the reconstruction of mobility and behaviour of hominin groups at habitations, including the organisation

of lithic technology. However, there are still numerous gaps in the knowledge on the Lower Palaeolithic in the Balkans, as well as issues related to the context of the finds and the spatial and temporal variability of the industries.

Recent Lower Palaeolithic research in the Balkans has also shown a strong correlation between site density and distribution of mineral resources, as well as between resource availability and variability of the industries. It turned out that the largest number of sites is located near the primary and secondary deposits of raw materials, which, judging by the presence of formal tools, indicates that the availability of mineral resources was one of the decisive factors in choosing locations for settlement.

In regard to technological variability, it should be noted that the inventories of artefacts found in caves are quite different from those found in open-air sites. While artefacts found in caves can be associated with small tool industries (in the early phase) and with Quina methods (in the late phase – i.e., at Balanica), open-air sites record Acheulean industries, simple PCT, and (later) typical Levallois technology as well. In that context, the question began to arise as to how much the variability of industries can be related to behavioural and ecological factors, and how much to the cultural tradition or cultural transmission related to population movements.

It was once thought that the Balkan Peninsula could have been quite isolated during the Pleistocene, due to geographical and environmental barriers (Kozłowski 1992). Recent research, however, has shown that this is probably not the case, and that cultural and biological interaction between the Levant and the Balkans and the Pontic zone likely existed (Spassov 2016; Muttoni *et al.* 2018; Roksandic *et al.*, this volume). For a more detailed assessment of these interactions, it will be necessary to continue research to provide a better insight into the 'segmented history' of the Lower Palaeolithic of South-east Europe (Malinsky-Buller 2016). Only then will it be possible to develop more complex models that would enable understanding of the demographic trends and cultural and social connections between the populations in the entire Eastern Mediterranean area.

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References

Agam, A. & Barkai, R. (2018), 'Elephant and Mammoth Hunting during the Paleolithic: A Review of the Relevant Archaeological, Ethnographic and Ethno-Historical Records', *Quaternary*, 1(3): 1–28.

Anzidel, A.-P., Bulgarelli, G.-M., Catalano, P., *et al.* (2012), 'Ongoing Research at the Late Middle Pleistocene Site of La Polledrara di Cecanibbio (Central Italy), with Emphasis on Human–Elephant Relationships', *Quaternary International*, 255: 171–87.

Bar-Yosef, O. & Belfer-Cohen, A. (2013), 'Following Pleistocene Road Signs of Human Dispersals Across Eurasia', *Quaternary International*, 285: 30–43.

Basler, Đ. (ed.) (1979), *Praistorija Jugoslavenskih Zemalja I* (Sarajevo, Svjetlost).

Ben-Dor, M., Gopher, A., Hershkovitz, I. & Barkai, R. (2011), 'Man the Fat Hunter: The Demise of *Homo Erectus* and the Emergence of a New Hominin Lineage in the Middle Pleistocene (ca. 400 kyr) Levant', *PLoS ONE*, 6(12): e28689.

Blackwell, B.A.B., Schwarcz, H.P., Farrand, W.R., *et al.* (2010), 'Electron Spin Resonance (ESR) and $^{230}Th/^{234}U$ Dating in the Lower Chamber at Yarımburgaz, Turkey', in F.C. Howell, G. Arsebük, S.L. Kuhn, M. Özbaşaran & M.C. Stiner (eds), *Culture and Biology at the Crossroads: The Middle Pleistocene Record of Yarımburgaz Cave (Thrace, Turkey)* (Istanbul, Ege Yayınları), 51–72.

Blackwell, B.A.B., Sakhrani, N., Singh, I.K., *et al.* (2018), 'ESR Dating Ungulate Teeth and Molluscs from the Paleolithic Site Marathousa 1, Megalopolis Basin, Greece', *Quaternary*, 1(3): 22.

Bogićević, K. & Nenadić, D. (2008), 'Early Pleistocene Rodents (Rodentia, Mammalia) from Trlica near Plijevljja (Montenegro)', *Neues Jahrbuch für Geologie und Paläontologie Abhandlungen*, 247(3): 325–33.

Bogosavljević Petrović, V., Petrović, A., Galfi, J., Jovanović, D. & Radonjić, Đ. (2018), 'Grey Zones of Production: Discussing the Technology of Tools at the Lojanik Quarry in West-central Serbia', *Journal of Lithic Studies*, 5(2).

Boschian, G. & Saccà, D. (2015), 'In the Elephant, Everything is Good: Carcass Use and Re-use at Castel di Guido (Italy)', *Quaternary International*, 36: 288–96

Carter, T., Contreras, D., Doyle, S., Mihailović, D.D., Moutsiou, T. & Skarpelis, N. (2014), 'The Stelida Naxos Archaeological Project: New Data on the Middle Palaeolithic and Mesolithic Cyclades', *Antiquity Project Gallery*, 341(88).

Carter, T., Contreras, D. A., Holcomb, J., *et al.* (2019), 'Earliest Occupation of the Central Aegean (Naxos), Greece: Implications for Hominin and *Homo sapiens*' Behavior and Dispersals', *Science Advances*, 5(10), eaax0997.

Cvetković, N.J. & Dimitrijević, V.M. (2014), 'Cave Bears (Carnivora, Ursidae) from the Middle and Late Pleistocene of Serbia: A Revision', *Quaternary International*, 339–40: 197–208.

Darlas, A. (1995), 'The Earliest Occupation of Europe: The Balkans', in W. Roebroeks and T. Von Kolschoten (eds), *The Earliest Occupation of Europe* (Leiden, University of Leiden), 51–9.

Dennell, R.W., Martinon-Torres, M. & Bermúdez de Castro, J.M. (2011), 'Hominin Variability, Climatic Instability and Population Demography in Middle Pleistocene Europe', *Quaternary Science Reviews*, 30(11–12): 1511–24.

Dinçer, B. (2016), 'The Lower Paleolithic in Turkey: Anatolia and Hominin Dispersals Out of Africa', in K. Harvati & M. Roksandic (eds), *Paleoanthropology of the Balkans and Anatolia: Human Evolution and its Context* (Dordrecht, Springer), 213–28.

Doboș, A. (2008), 'The Lower Paleolithic of Romania: A Critical Review', *PaleoAnthropology*, 2008: 218–33.

Doboș, A. & Iovita, R. (2016), 'The Lower Paleolithic of Romania Revisited: New Evidence from the Site of Dealul Guran', in K. Harvati & M. Roksandic (eds), *Paleoanthropology*

of the Balkans and Anatolia: Human evolution and its context (Dordrecht, Springer), 171–86.

Fistani, A. (1993), 'Human Evolution in Albania for the Quaternary Period', in B. Sigmon (ed.), *Before the Wall Fell: The Science of Man in Socialist Europe* (Toronto, Canadian Scholars Press), 141–78.

Forestier, H. (1993), 'Le Clactonie: mise en application d'une nouvelle méthode de débitage s'inscrivant dans la variabilité des systèmes de production lithique du Paléolithique ancien', *Paléo*, 5: 53–82.

Galanidou, N., Athanassas, C., Cole, J., *et al.* (2016), 'The Acheulean Site at Rodafnidia, Lisvori on Lesbos, Greece: Part I', in K. Harvati & M. Roksandic (eds), *Paleoanthropology of the Balkans and Anatolia: Human Evolution and its Context* (Dordrecht, Springer), 119–38.

Grün, R. (1996), 'A Re-analysis of Electron Spin Resonance Dating Results Associated with the Petralona Hominid', *Journal of Human Evolution*, 30: 227–41.

Guadelli, J.-L., Sirakov, N., Ivanova, S., *et al.* (2005), 'Une séquence du Paléolithique Inférieur au Paléolithique Récent dans les Balkans: la grotte Kozarnika à Orechets (nord-ouest de la Bulgarie)', in N. Molines, M.-H. Moncel & J.-L. Monnier (eds), *Les Premiers Peuplements en Europe* (BAR International Series, 164; Oxford, Archaeopress), 87–103.

Howell, F.C., Arsebük, G., Kuhn, S.L., Özbaşaran, M. & Stiner, M.C. (eds) (2010), *Culture and Biology at a Crossroads: The Middle Pleistocene Record of Yarımburgaz Cave (Thrace, Turkey)* (Istanbul, Zero Books/Ege Publications).

Iovita, R., Fitzsimmons, K., Doboş, A., Hambach, U., Hilgers, A. & Zander, A. (2012), 'Dealul Guran: Evidence for Lower Palaeolithic (MIS 11) Occupation of the Lower Danube Loess Steppe', *Antiquity*, 86(334): 973–89.

Ivanova, S. (2016), 'A Route Through the Balkans and Implications for the Earliest Settlement of Europe', in K. Harvati & M. Roksandic (eds), *Paleoanthropology of the Balkans and Anatolia: Human Evolution and its Context* (Dordrecht, Springer), 187–211.

Jacobs, Z., Li, B., Karkanas, P., *et al.* (2018), 'Dating of the Middle Pleistocene Marathousa 1 (Greece) Lacustrine Sediment Using Multiple Aliquot Pre-dose Multi-elevated Temperature Post-infrared Stimulated Luminescence (MET-pIRIR)', *Quaternary International*, 497: 170–7.

Kahlke, R.-D., García, N., Kostopoulos, D.S., *et al.* (2011), 'Western Palaearctic Palaeoenvironmental Conditions during the Early and Early Middle Pleistocene Inferred from Large Mammal Communities, and Implications for Hominin Dispersal in Europe', *Quaternary Science Reviews*, 30(11–12): 1368–95.

Karavanić, I. & Janković, I. (2006), 'The Middle and Early Upper Palaeolithic in Croatia', *Opuscula Archaeologica*, 30: 21–54.

Konidaris, G.E., Athanassiou, A., Tourloukis, V., *et al.* (2018), 'The Skeleton of a Straight-tusked Elephant (*Palaeoloxodon Antiquus*) and Other Large Mammals from the Middle Pleistocene Butchering Locality Marathousa 1 (Megalopolis Basin, Greece): Preliminary Results', *Quaternary International*, 497: 65–84.

Kozłowski, J.K. (1992), 'The Balkans in the Middle and Upper Palaeolithic: The Gate to Europe or a Cul-de-sac?', *Proceedings of the Prehistoric Society*, 58(1): 1–20.

Kozłowski, J.K. (2002), 'The Middle and the Early Upper Paleolithic Around the Black Sea', in T. Akazawa, K. Aoki & O. Bar-Yosef (eds), *Neanderthals and Modern Humans in Western Asia* (New York, Kluwer Academic Publishers), 461–82.

Kuhn, S.L. (2010), 'The Yarımburgaz Lithic Assemblage', in F.C. Howell, G. Arsebük, S.L. Kuhn, M. Özbaşaran & M.C. Stiner (eds), *Culture and Biology at the Crossroads: The Middle Pleistocene Record of Yarımburgaz Cave (Thrace, Turkey)* (Istanbul, Ege Yayınları), 93–129.

Kuhn, S.L. (2011), 'Was Anatolia a Bridge or a Barrier to Early Hominin Dispersals?', *Quaternary International*, 223–4: 434–5.

Kuhn, S.L. (2013), 'Roots of the Middle Paleolithic in Eurasia', *Current Anthropology*, 54: 255–68.

Kuhn, S.L. & Stiner, M.C. (2010), 'The Yarımburgaz Lithic Assemblage', in F.C. Howell, G. Arsebük, S.L. Kuhn, M. Özbaşaran, & M.C. Stiner (eds), *Culture and Biology at the Crossroads: The Middle Pleistocene Record of Yarımburgaz Cave (Thrace, Turkey)* (Istanbul, Ege Yayınları), 301–19.

Kujundžić-Vejzagić, Z. (2001), 'Pećina pod lipom – paleolitsko stanište na Glasinačkoj visoravni', *Glasnik Zemaljskog Muzeja u Sarajevu*, 48–9: 33–89.

Kujundžić-Vejzagić, Z. (2005), 'Ružina Pećina – paleolitiska stanica kod Gacka', *Glasnik Zemaljskoj muzeja Bosne i Hercegovine, Arheologija N.S.*, 46: 7–52.

Malez, M. (1979), 'Nalazišta paleolitskog i mezolitskog doba u Hrvatskoj', in Đ. Basler (ed), *Praistorija Jugoslavenskih Zemalja I* (Sarajevo, Svjetlost), 195–295.

Malinsky-Buller, A. (2016), 'Lost and Found: Technological Trajectories within Lower/Middle Paleolithic Transition in Western Europe, North of the Pyrenees', *Quaternary International*, 409: 104–48.

Marín-Arroyo, A.B. (2014), 'Middle Pleistocene Subsistence in Velika Balanica, Serbia: Preliminary Results', in D. Mihailović (ed.), *Palaeolithic and Mesolithic Research in the Central Balkans* (Belgrade, Serbian Archaeological Society – Commission for the Palaeolithic and Mesolithic), 121–9.

Mihailović, D. & Bogićević, K. (2016), 'Technological Changes and Population Movements in the Late Lower and Early Middle Paleolithic of the Central Balkans', in K. Harvati & M. Roksandic (eds), *Paleoanthropology of the Balkans and Anatolia: Human Evolution and its Context* (Dordrecht, Springer), 139–51.

Mihailović, D., Milošević, S. & Radović, P. (2014), 'New Data about the Lower and Middle Paleolithic in the Western Morava Valley', in D. Mihailović (ed.), *Paleolithic and Mesolithic research in the Central Balkans* (Belgrade, Serbian Archaeological Society – Commission for the Palaeolithic and Mesolithic), 57–67.

Mihailović, D., Borović Dimić, J., Dimić, V., Kajtez, I., Gavrilović, N. & Heffter, E. (2015) 'Rekognosciranja nalazišta iz donjeg i srednjeg paleolita na severoistočnim obroncima Goča', *Glasnik Srpskog arheološkog društva*, 31: 165–85.

Mihailović, D., Mladenović, S., Plavšić, S. & Roksandic, M. (2021) 'Istraživanje paleolitskog nalazišta Petrovac 1 na planini Radan (južna Srbija)', in A. Crnobrnja & V. Filipović (eds), Srpsko arheološko društvo – XLIV skupština i godišnji skup Srpsko arheološko društvo – Zavičajni muzej Paraćin, Beograd, 42–3.

Mihailović, D., Kuhn, S.L., Bogićević, K., *et al.* (2022), 'Connections Between the Levant and the Balkans in the Late Middle Pleistocene: Archaeological Findings from Velika and Mala Balanica Caves (Serbia)', *Journal of Human Evolution*, 163: 103138.

Miladinović, Z. (2012), *Mineralogenetske karakteristike i potencijalnost juvelirskih mineralnih resursa leckog vulkanskog kompleksa*. PhD dissertation, University of Belgrade.

Miladinović, Z., Simić, V., Jelenković, R. & Ilić, M. (2016), 'Gemstone Deposits of Serbia', *Geologica Carpathica*, 67(3): 211–22.

Muttoni, G., Sirakov, N., Guadelli, J.-L., *et al.* (2017), 'An Early Brunhes (<0.78 Ma) Age for the Lower Paleolithic Tool-bearing Kozarnika Cave Sediments, Bulgaria', *Quaternary Science Reviews*, 178: 1–13.

Muttoni, G., Scardia, G. & Kent, D.V. (2018), 'Early Hominins in Europe: The Galerian Migration Hypothesis', *Quaternary Science Reviews*, 180: 1–29.

Otte, M., Yalcinkaya, I., Kozłowski, J., Bar-Yosef, O., Bayon, I-L. & Taskiran, H. (1998), 'Longterm technical evolution and human remains in the Anatolian Palaeolithic', *Journal of Human Evolution*, 34: 413–31.

Plavšić, S. (2015), 'Analiza prostorne distribucije gorelih artefakata i zona gorenja u sloju 3 Velike Balanice', *Glasnik Srpskog arheološkog društva*, 31: 7–37.

Popov, V. (2009), 'The Small Mammals from Sectors 7, 8, and 12 of Kozarnika Cave: Results from the Excavations during the Field Season of 2008 and Some Comments of the Biostratigraphy of the Deposits', *Projet de recherche conjoint: 'Les plus anciennes manifestations de la présence humaine dans les Balkans' Mission Préhistorique Française en Bulgarie du Nord* (MAE), 211–7.

Popov, V. & Marinska, M. (2007), 'An Almost One Million Year Long (Early to Late Pleistocene) Small Mammal Succession from the Archaeological Layers of Kozarnika Cave in Northern Bulgaria', *Courier Forschungsinstitut Senckenberg*, 259: 79–92.

Radinović, M. & Jovanović, M. (2019), 'Paleolitski artefakti ili geofakti: analiza površinskih kolekcija prikupljenih u blizini ležišta mineralnih sirovina na području Vrnjačke banje', *Glasnik Srpskog arheološkog društva*, 35: 7–25.

Radović, P., Lindal, J., Mihailović, D. & Roksandic, M. (2020), 'Hominin Fossil Material from the Middle Pleistocene of Velika Balanica Cave (Serbia) and its Implications for Human Evolution in Europe' (abstract), *Serbian Archaeological Society 43rd Annual Meeting*, 14–16 October 2020, Subotica (Serbia), 78–9.

Rink, W.J., Mercier, N., Mihailović, D., Morley, M.W., Thompson, J.W. & Roksandic, M. (2013), 'New Radiometric Ages for the BH-1 Hominin from Balanica (Serbia): Implications for Understanding the Role of the Balkans in Middle Pleistocene Human Evolution', *PLoS ONE*, 8(2): e54608.

Roebroeks, W. & Villa, P. (2011), 'On the Earliest Evidence for Habitual Use of Fire in Europe', *Proceedings of the National Academy of Sciences*, 108(13): 5209–14.

Roksandic, M., Mihailović, D., Mercier, N., *et al.* (2011), 'A Human Mandible (BH-1) from the Pleistocene Deposits of Mala Balanica Cave (Sićevo Gorge, Niš, Serbia)', *Journal of Human Evolution*, 61: 186–96.

Roksandic, M., Lindal, J., Radović, P. & Mihailović, D. (2019), 'New Middle Pleistocene Material from Serbia and its Implications for Human Evolution in Europe' (abstract), *Canadian Association for Physical Anthropology 47th Annual Meeting*, 23–26 October 2019, Banff (Canada), 63–4.

Roksandic, M., Radović, P., Lindal, J., & Mihailović, D. (2022), Early Neanderthals in Contact: The Chibanian (Middle Pleistocene) Hominin Dentition from Velika Balanica Cave, Southern Serbia. *Journal of Human Evolution*, 166: 103175.

Runnels, C. & van Andel, T.H. (1993). 'A Handaxe from Kokkinopilos, Epirus, and its Implications for the Palaeolithic of Greece', *Journal of Field Archaeology*, 20: 191–203.

Runnels, C., Digregorio, C., Wegmann, K. W., Gallen, S. F., Strasser, T. F. & Panagopoulou, E. (2014), 'Lower Palaeolithic Artifacts from Plakias, Crete: Implications for Hominin Dispersals', *Eurasian Prehistory*, 11(1–2): 129–52.

Shchelinsky, V.E., Gurova, M., Tesakov, A.S., Titov, V.V., Frolov, P.D. & Simakova, A.N. (2016), 'The Early Pleistocene Site of Kermek in Western Ciscaucasia (Southern

Russia): Stratigraphy, Biotic Record and Lithic Industry (Preliminary Results)', *Quaternary International*, 393: 51–69.

Shen, G. & Yokoyama, Y. (1986), 'T-230/U-234 Dating of the Petralona Speleothems', *Anthropos*, 11: 23–32.

Sirakov, N., Guadelli, J.-L., Ivanova, S., *et al.* (2010), 'An Ancient Continuous Human Presence in the Balkans and the Beginnings of Human Settlement in Western Eurasia: A Lower Pleistocene Example of the Lower Palaeolithic Levels in Kozarnika Cave (North-western Bulgaria)', *Quaternary International*, 223–4: 94–106.

Slimak, L., Roche, H., Mouralis, D., *et al.* (2004), 'Kaletepe Deresi 3 (Turquie), aspects archéologiques, chronologiques et paléontologiques d'une séquence pléistocène en Anatolie centrale', *Comptes Rendus Palevol*, 3: 411–20.

Spassov, N. (2003), 'The Plio-Pleistocene Vertebrate Fauna in South-Eastern Europe and the Megafaunal Migratory Waves from the East to Europe', *Revue de Paléobiologie*, 22(1): 197–229.

Spassov, N. (2016), 'Southeastern Europe as a Route for the Earliest Dispersal of *Homo* Toward Europe: Ecological Conditions and the Timing of the First Human Occupation of Europe', in K. Harvati & M. Roksandic (eds), *Paleoanthropology of the Balkans and Anatolia: Human Evolution and its Context* (Dordrecht, Springer), 281–90.

Stiner, M.C. (2010), 'A Taphonomic Study of Bone Assemblage Formation and Artifact–Bear Associations', in F.C. Howell, G. Arsebük, S.L. Kuhn, M. Özbaşaran & M.C. Stiner (eds), *Culture and Biology at the Crossroads: The Middle Pleistocene record of Yarımburgaz Cave (Thrace, Turkey)* (Istanbul, Ege Yayınları), 131–66.

Šarić, J. (2011), 'Lower Paleolithic Site Kremenac Near the Village Rujnik (Serbia)', *Starinar*, 61: 7–31.

Šarić, J. (2013), *Kremenac, donjopaleolitsko nalazište* (Belgrade, Arheološki institut).

Thompson, N., Tourloukis, V., Panagopoulou, E. & Harvati, K. (2018), 'In Search of Pleistocene Remains at the Gates of Europe: Directed Surface Survey of the Megalopolis Basin (Greece)', *Quaternary International*, 497: 22–32.

Tourloukis, V. (2010), *The Early and Middle Pleistocene Archaeological Record of Greece: Current Status and Future Prospects* (Leiden, Archaeological Studies Leiden University Vol. 23, Leiden University Press).

Tourloukis, V. (2016), 'On the Spatio-temporal Distribution of Mediterranean Lower Paleolithic Sites: A Geoarchaeological Perspective', in K. Harvati & M. Roksandic (eds), *Paleoanthropology of the Balkans and Anatolia: Human Evolution and its Context* (Dordrecht, Springer), 303–23.

Tourloukis, V. & Harvati, K. (2018), 'The Palaeolithic Record of Greece: A Synthesis of the Evidence and a Research Agenda for the Future', *Quaternary International*, 466: 48–65.

Tourloukis, V., Karkanas, P., & Wallinga, J. (2015), 'Revisiting Kokkinopilos: Middle Pleistocene Radiometric Dates for Stratified Archaeological Remains in Greece', *Journal of Archaeological Science*, 57: 355–69.

Tourloukis, V., Thompson, N., Panagopoulou, E., *et al.* (2018), 'Lithic Artifacts and Bone Tools from the Lower Palaeolithic site Marathousa 1, Megalopolis, Greece: Preliminary Results', *Quaternary International*, 497: 47–64.

Van der Made, J. & Dimitrijević, V. (2015), '*Eucladoceros montenegrensis* n. sp. and Other Cervidae from the Lower Pleistocene of Trlica (Montenegro)'. *Quaternary International*, 389: 90–118.

Vislobokova, I.A. & Agadjanyan, A.K. (2016), 'New Data on Age of the Pleistocene Fauna from the Trlica Locality (Montenegro, Central Balkans) and its Correlation with Other Faunas of Europe', *Stratigraphy and Geological Correlation*, 24(2): 188–202.

Vislobokova I.A., Agadzhanyan A.K. & Lopatin A.V. (2018), 'First Evidence for Possible Bone Tools of Hominins in the Mid-Early Pleistocene on the Balkans', *Moscow University Anthropology Bulletin* (*Vestnik Moskovskogo Universiteta. Seria XXIII. Antropologia*), 2018(2): 130–42.

Vislobokova, I.A., Agadzhanyan, A.K. & Lopatin, A.V. (2020), 'The Case of Trlica TRL11–10 (Montenegro): Implications for Possible Early Hominin Dispersals into the Balkans in the Middle of the Early Pleistocene', *Quaternary International*, 554: 15–35.

Zhou, L.P., van Andel, T.H. & Lang, A., (2000), 'A Luminescence Dating Study of Open-air Palaeolithic Sites in Western Epirus, Greece', *Journal of Archaeological Science*, 27: 609–20.