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ARTICLE *in* QUATERNARY INTERNATIONAL · JANUARY 2016

Impact Factor: 2.06 · DOI: 10.1016/j.quaint.2015.10.032

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ARTICLE IN PRESS

Quaternary International xxx (2015) 1–19

Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

The Early Pleistocene site of Kermek in western Ciscaucasia (southern Russia): Stratigraphy, biotic record and lithic industry (preliminary results)

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ARTICLE INFO

Article history:
Available online xxx

Keywords:
Kermek
Oldowan – Acheulean transition
Early Pleistocene
Upper Kujalnik
Western Ciscaucasia
Southern Russia

ABSTRACT

The discovery of the Early Pleistocene sites of Bogatyri/Sinyaya Balka and Rodniki 1 on the Taman Peninsula in western Ciscaucasia led to the recognition of a distinctive “Tamanian industry”, with a time-range of 1.6–1.2 Ma, and with characteristics that are transitional between Oldowan and Acheulean (“Archaic Acheulean”). The site of Kermek was discovered by V.E. Shchelinsky in 2008 during investigation of the older Lower Pleistocene sediments exposed in the coastal cliff of the Sea of Azov in the vicinity of previously studied sites.

In this paper, we present preliminary data from a multidisciplinary study of the Early Pleistocene site of Kermek, situated near to the sites of Bogatyri/Sinyaya Balka and Rodniki 1, but which is significantly older. This site is connected with a well-studied Early Pleistocene (late Kujalnikian) fluviatile-shallow marine sequence. These reverse magnetized deposits are characterized by freshwater and brackish water mollusks (with *Dreissena theodori*), and by a small mammal fauna (with *Allophaiomys deucalion*), and are dated to the latest Gelasian or early Calabrian ca. 2.1–1.8 Ma. The lithic industry from the site can be attributed to the Classic Oldowan but with distinctive local features that include indications of “advanced technologies” such as the manufacture of large flakes and picks. In this respect, this industry is assumed to have been a genetic precursor of the later Early Pleistocene Tamanian industry, which has a well pronounced Acheulean component.

1. Introduction

The southern regions of European Russia have long been considered among the areas of initial human occupation dating to the Early Pleistocene. This opinion was first expressed in the mid 20th century based on occurrences of what appeared as artificially split bones among the Early Pleistocene mammalian fauna of the Tsimbal locality in the Taman Peninsula (Vereshchagin, 1957), accompanied by occasional surface finds of stone tools of Early Paleolithic appearance (Formozov, 1962, 1965). Tsimbal was included in the list of the oldest Early Paleolithic sites of Eurasia, dated between 1.5 and 0.78 Ma (Bosinski, 1996, 2006; Jöris, 2014).

The finds from Tsimbal have long remained unsupported by evidence from other sites in the region. In the early 2000s several new Early Paleolithic sites were discovered in the southern part of Russia, which provide convincing evidence of early humans presence and settlement in this region. These new, important records include the early Middle Pleistocene (0.6–0.8 Ma) site of Karama, in the northwestern part of the Altai Mountains (Derevianko et al., 2005; Derevianko and Shunkov, 2008); the coeval site of Darvagchai 1 in east Ciscaucasia on the Caspian Lowland (Derevianko, 2006, 2009; Derevianko and Zenin, 2010); a series of Early Pleistocene sites (Ainikab 1, 2, Mukhkai 1, 2, Gegalashur 1, 3) in the northeastern Caucasus mountains of Daghestan (Amirkhanov, 2007, 2008); and a group of Early Pleistocene sites in the western Ciscaucasus on the Taman Peninsula (Bosinski et al., 2003;

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http://dx.doi.org/10.1016/j.quaint.2015.10.032
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Shchelinsky et al., 2003; Shchelinsky and Kulakov, 2007; Shchelinsky, 2010; Shchelinsky et al., 2010a). These important discoveries shed light on the earliest stages of human occupation of Western Asia and Eastern Europe, the appearance of ancient humans in Eurasia, their migrations routes and tool-making activities.

Of particular importance is the discovery of Early Pleistocene sites in the northwestern piedmonts of the Caucasus (Bosinski et al., 2003; Shchelinsky et al., 2003) on the Taman Peninsula in southern European Russia (Fig. 1). The area is situated in the north Caucasus steppe climatic zone, where until recently it was difficult to imagine any evidence of Early Paleolithic habitation.

It is therefore not surprising that, initially, a number of researchers expressed doubts and scepticism about the authenticity and artifactual character of the new finds. With this in mind, in 2008 an international scientific conference entitled “Early Paleolithic of Eurasia: New Discoveries” was organized on the Taman Peninsula. During this scientific event a visit to the newly discovered Taman sites was organized. The site location patterns as well as all archaeological artifacts were then observed and openly discussed by the conference participants. At the end, all scientists present agreed that the sites and finds were the result of human activity, and noted their occurrence in clear paleontological and geological contexts. Thus previous scepticism about the Taman Early Paleolithic sites was overcome. Some scholars still do not accept the anthropogenic character of the evidence, Doronichev in particular (see Doronichev, 2011), probably because this new date does not fit with his speculative view of Paleolithic development in the Caucasus.

Three Early Pleistocene sites are currently under study in western Ciscaucasia: Bogatyri/Sinyaya Balka, Rodniki 1 and Kermek. These sites are located close together on the northern (Azovian) shore of the Taman Peninsula, 25 km to the west of Temryuk city, near Za Rodinu village (Temryuk district, Krasnodar Region) (Fig. 2). The sites are situated at the geographic boundary between Western Asia and Southeastern Europe running along the Manych Depression from the Caspian to the Don River and to the Sea of Azov.

Investigation of the sites is far from complete. However, available data are sufficient to establish their chronology, and the techno-typological features of the stone artifacts. In particular, it can be assumed all three sites are of Early Pleistocene age, and thus relate to the initial stage of the Early Paleolithic. However, judging from the available paleomagnetic and biostratigraphic data, they belong to different stages of the Early Pleistocene (Shchelinsky et al., 2010a,b). The best studied sites in this group are Bogatyri/Sinyaya Balka and Rodniki 1, as they were excavated over several field seasons.

The multi-layer site of Bogatyri/Sinyaya Balka has good chronological control. The section, known as Sinyaya Balka, hosts an important paleontological feature (a significant quantity of fossils of large mammals) and was designated as a stratotype locality of the Tamanian faunal complex (biochronological unit) of Eastern Europe (Gromov, 1948; Vangengeim et al., 1991). The occurrence of the bones in a dislocated block of sediment has long obscured its geological position. Excavations in the 2000s revealed the reversed magnetisation of the sequence indicating its attribution to the Matuyama Chron (Dodonov et al., 2008a). The dating of the site is based on the fauna of large and small mammals, and paleomagnetic data. In all three artefact-bearing layers of the site the fauna has a similar taxonomic composition and belongs to the Tamanian complex. Typical taxa of this association are Tamanian southern elephant *Archidiskodon meridionalis tamanensis*, large horse *Equus* cf. *major*, giant steppe rhinoceros *Elasmotherium caucasicum*, bison *Bison* sp., deer Cervidae gen., antelope Tragelaphini gen., and arvicolids *Mimomys savini*, *Lagurodon arankae* (Titov et al., 2012). Bones of *Archidiskodon meridionalis tamanensis* and *Elasmotherium caucasicum* strongly dominate, whereas remains of horses, artiodactyls and other herbivores of medium size class are rare (Baigusheva and Titov, 2008; Titov and Tesakov, 2009), which is probably influenced by human hunting preferences.

The Tamanian faunal complex is based on materials from multiple localities in the Sea of Azov and Lower Don regions. It is traditionally dated between 1.1 and 0.8 Ma (Vangengeim et al., 1991). Recently, based on the study of small mammals, it was suggested that the age of the unit's lower boundary predates former estimates, back to ca. 1.55 Ma. Thus the age of the Sinyaya Balka fauna (and hence the Bogatyri site) is currently estimated as 1.2–1.5 Ma (Titov et al., 2012). The reverse magnetisation of the Sinyaya Balka sequence may indicate its accumulation during the Matuyama Chron (2.58–0.78 Ma). Given the traditional correlation of the Taman faunal complex localities with the late Early Pleistocene (1.1–0.9 Ma), the correlative interval can be formally restricted to the Chron S1r.1r (0.99–0.78 Ma). New biostratigraphic data for large mammals of this complex, however, may indicate an older age of the site sediments and their correlation with Chron S1r.2r

Fig. 1. Location of the studied Early Pleistocene sites in western Ciscaucasia (Taman Peninsula, Russia).

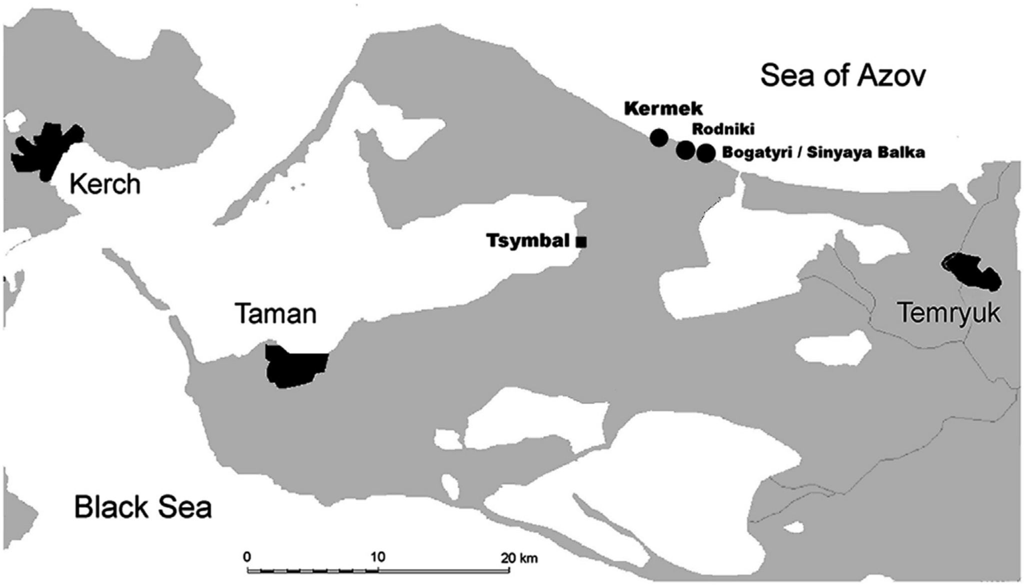

Fig. 2. Location of Early Pleistocene sites (black dots) at the northern shore of the Taman Peninsula.

(1.77–1.07 Ma) (Dodonov et al., 2008a). The southern elephant of Sinyaya Balka assigned to *Archidiskodon meridionalis tamanensis* is typical for the Taman faunal complex. Judging from its likely basal position among occurrences of the Tamanian elephants (Baigusheva and Titov, 2008), the age of the Bogatyri/Sinyaya Balka site may be estimated as ca. 1.5–1.6 Ma (Sablin, 2008).

Faunal and palynological evidence from Bogatyri/Sinyay Balka revealed the existence of forest-steppe and steppe landscapes, and mixed forests with the presence of elm, oak, hornbeam, beech and walnut along river valleys under conditions of warm temperate climate (Dodonov et al., 2008b; Simakova, 2009; Shchelinsky et al., 2010a).

The Rodniki 1 site, unlike Bogatyri/Sinyaya Balka, occurs in undisturbed Lower Pleistocene strata including coastal-marine sands and subaerial loams. Lithic artifacts were found in the basal pebble bed containing sub-rounded gravel and boulders of various sedimentary rocks and sandy interlayers. This layer is overlain by a thick sandy member correlated with the Apsheronian transgression of the Ponto-Caspian Region (Shchelinsky et al., 2010b). The small mammal fauna of the basal bed at Rodniki 1 includes *Allophaiomys* cf. *pliocaenicus*, *Lagurodon arankae*, Lagurini gen., *Mimomys* cf. *savini*, *Mimomys* cf. *pusillus*, *Mimomys* sp., *Borsodia* sp., *Ellobius* sp., *Spermophilus* sp., *Allactaga* sp., *Spalax* sp. and *Allocricetus* cf. *ehiki*. The megamammal remains are few but include fragments of elephant teeth. The association is typical for mid Early Pleistocene (Calabrian) in the time-range ca. 1.4–1.6 million years ago (Shchelinsky et al., 2010a, b). This fauna is broadly synchronous with the mammalian fauna of the adjacent Bogatyri/Sinyaya Balka site. The landscape and climatic conditions during the formation of Rodniki 1 are similar to those of the Bogatyri/Sinyaya Balka site (Simakova, 2009).

The lithic industries of both sites are also similar (Shchelinsky, 2010, 2013a). This similarity is clearly manifested in the raw material, the primary flaking technology, the method of tool making and the tool categories. In fact, they form an industry with well-defined technological and typological features, representing a distinct entity that can be termed the “Tamanian industry”. This industry existed in western Ciscaucasia between ca. 1.2–1.6 Ma (Shchelinsky, 2014, 2015).

However, the cultural-stadial status of the Tamanian industry is still unclear. Initially it seemed to meet the techno-typological criteria of Oldowan/Mode 1 technology and to represent a local variant/facies (Shchelinsky et al., 2010a). However, a more detailed study of the assemblage revealed some quite developed forms of artifacts, as well as manufacturing techniques, that can be hardly be attributed to the petrographic and morphological characteristics of the local raw materials.

2. Tamanian lithic industry in the context of Early Pleistocene technocomplexes

Lithic industries attributable to Oldowan/Mode 1, now identified not only in Africa, where they were first described (Leakey, 1971), but also in various regions of Eurasia have differing ages. In Africa they are dated from 2.6 to 1.6 Ma, in southern and eastern Asia from 2.0 to 0.8 Ma, and in Europe from 1.6 to 0.6 Ma (Barsky, 2009). These industries precede more developed Acheulean industries, characterized by large flake technology and tool types such as handaxes, picks and cleavers, although in some regions Oldowan and Acheulean industries coexist.

The main technological and typological characteristics of the Oldowan are well known. It is a commonly agreed that Oldowan industries, wherever identified, are characterized by the use of local raw materials collected by hominins exclusively in the immediate vicinity of the sites; by very simple knapping technology aimed at making small non-standardized flakes, and by a very limited number of retouched tools from flakes and debris (combination of natural fragments and knapping debris). There are, however, nuances in the interpretation of Oldowan technology and evolution. For some researchers, the technological simplicity of Oldowan industries is almost absolute. These researchers assume that Oldowan lithic technology was focused on making small flakes with sharp cutting edges, whereas the archetypal choppers, discoides, polyhedrons, heavy-duty scrapers and proto-bifaces (“heavy-duty tools” of M. Leakey) are interpreted not as deliberately made tools, but as a byproduct of making flakes (Schick and Toth, 2006).

Technological and typological changes in the Oldowan tool manufacture and repertoire were also differently assessed by researchers. One opinion is that during this period technological

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stagnation took place, although Oldowan industries differed from one another by variations in raw material selection and reduction strategy. These variations were explained in terms of economic and environmental factors (Stout et al., 2010). Other researchers believe the Oldowan could be divided into two evolutionary stages – Pre-Oldowan or Archaic Oldowan and Oldowan *sensu stricto* or Classical Oldowan. The oldest industries dated between 2.55 and 1.9 Ma are attributed to Pre-Oldowan; they are characterized particularly by the use of raw materials collected from the vicinity of the sites. Knapping was performed by unifacial, unidirectional and rarely centripetal removals. Multipolar and bifacial knapping was used rarely. Cores have a small number of removals. Among the chipped stones retouched tools made from flakes and debris are virtually absent; core-tools or pebble tools and particularly choppers and chopping-tools are occasionally present. Classical Oldowan industries, younger than 1.9 Ma (the eponymous complexes of Olduvai Gorge in Tanzania) are not fundamentally different from the Pre-Oldowan. However, they appear more evolved. There are more bifacial and multifacial cores, and an increasing number of pebble tools and spheroids. A very important innovation in the industries of this Classical Oldowan stage is a noticeable increase in small retouched tools (end- and side scrapers and denticulates), made from flakes and debris (Lumley et al., 2009a,b).

Oldowan/Mode 1 technology is also attested in European sites, concentrated in karstic areas of the Sierra de Atapuerca in Spain. Here, in the stratigraphic sequence from the oldest to the youngest strata, the researchers recorded clear signs of improvement in stone working technology, in terms of diversity of the raw materials used, increasing complexity of the knapping techniques and tool fashioning (Mosquera et al., 2013; Ollé et al., 2013).

Thus, the Oldowan is increasingly perceived not as a cultural unit, but rather as a set of similar though not identical industries. Morphologically, the stone inventory of these industries varies depending on the quality of the available raw materials, site function, and other factors. Of interest in this regard is the recently proposed four-phase evolutionary model describing progressive changes and increasing technological complexity in Oldowan industries, and suggesting that in terms of technology there are not always clear borders/distinction between the Oldowan and Acheulean industries (Barsky, 2009; Carbonell et al., 1999a, 2009, (2015)).

As noted above, the Early Pleistocene Tamanian industry of western Ciscaucasia does not fit the technological and typological parameters of Oldowan/Mode 1 either in its African or in its European variants, although there are similarities between the Oldowan and the Tamanian industry (Shchelinsky, 2014, 2015). It is worth listing the most significant features of the Tamanian industry. First, there is documented use of one type of raw material – local and strongly silicified dolomite of Miocene age. However, there was no deliberate or preferential choice of this material; quite simply there were no other rocks within many kilometres of the Tamanian sites. The primary dolomite is also absent in outcrops surrounding the sites. The hominins collected dolomite on eroded surfaces of mud volcanic sediments containing these redeposited concretions in large quantity, and partly on the beaches near the sites. The raw material was only in the form of platy separateness and their various debris in different dimensions. Raw material in the form of pebbles was absent (except for some isolated pebbles of quartz, which served as hammerstones). Evidently, the sites' inhabitants preferred to use the high quality fine-grained dolomite instead of quartz. Selection of dolomite pieces was performed by two methods: the usual sorting of naturally occurring fragments and a specialized method of intentional splitting of large platy pieces of dolomite into smaller fragments with subsequent selection of the most suitable pieces in terms of size and quality. The necessity of such operations appears to be due to the fact that the surfaces of the dolomite fragments were often affected by chemical weathering. As a result, the unweathered part of the dolomite was the most suitable material for toolmaking. Splitting allowed extraction and selection for use of the most durable and fine-grained dolomite pieces. Intentional fabrication of debris by splitting of larger dolomite fragments is indicated by the typical relief of the splitting surface and the patina on these surfaces, which is no different from that on other dolomite artifacts in the same assemblages. Dolomite debris both intentionally split and natural was used as cores and as blanks for tools. In general, in the Tamanian industry their manufacture and use was as important as the production and use of flakes. However, flakes and fragments are not the dominant element in this industry. Flakes, including those with retouch and other secondary treatment, make up slightly more than half of the industry.

There are many cores and large and small retouched tools of various types, fashioned by flaking and retouching. Cores usually show a small number of removals. They have unprepared striking platforms and are characterized by the predominance of unifacial unidirectional knapping. There are also bifacial and multifacial (prismatic) cores. However, centripetal cores are virtually absent.

The flakes mostly correspond to the cores. Many are primary (the dorsal surface is completely corticated), and semi-primary (partially covered with cortex). Other flakes have parallel, convergent, parallel-counter and multidirectional dorsal negatives. This variety suggests a complex reduction sequence. Flakes are mainly formless but there are also sub-rectangular, sub-triangular and oval flakes. Flake butts are usually corticated. Flake dimensions are variable. However, if we consider only intact and nearly intact specimens, including retouched flakes, small flakes (1–5 cm long) and large flakes (>5 cm) occur in roughly equal proportions. There are numerous that are 1–3 cm long. It is noteworthy that among large flakes, a representative group of very large flakes, ranging in length from 10.4 cm to 16.5 cm, can be distinguished. Some of these very large flakes were fashioned into macro-tools.

Macro-tools are characterized by a combination of choppers, chopper-like scrapers, core scrapers/heavy-duty scrapers, picks and cleavers (the definitions of core scrapers/heavy-duty scraper, picks and cleavers follows: Tixier, 1957; Kleindienst, 1962; Leakey, 1971; Leakey and Roe, 1994; Clark and Kleindienst, 1974, 2001; Bar-Yosef and Goren-Inbar, 1993; Sharon, 2009; Beyene et al., 2013). Various forms of chopper are attested in the Tamanian industry, with some made on large flakes. Among the choppers unifacial tools predominate. Chopping tools are rare. Abundant among the choppers are shortened forms with a broad working edge, as well as elongated forms with a narrow working edge. There are a significant number of pointed choppers. Chopper-like scrapers are similar to the choppers, but they are made on carefully removed small flakes. Core scrapers/heavy-duty scrapers are massive with oval or round shapes. Picks are also well represented, though they are made mostly on fragments, and rarely on large flakes. Among the picks the most representative are unifacially shaped specimens, while bifacial picks are rare. The cross-sections of picks are often sub-quadrangular, trapezoidal, or sub-triangular. Typical trihedral picks are virtually absent. Cleavers are robust and found as single specimens. A very important technological and typological feature of the Tamanian industry is the presence of many and varied small retouched tools made on flakes and debris. Many are well made, standardized and typologically distinct. We can also list different types of side-scrapers, end-scrapers, borers, “reamers” (a type of borer), “thorned” tools, beaked, denticulates, notches, and some other categories of small retouched tools. However, associated with them, are also a significant number of amorphous, slightly modified tools in the form of partially retouched flakes and small fragments.

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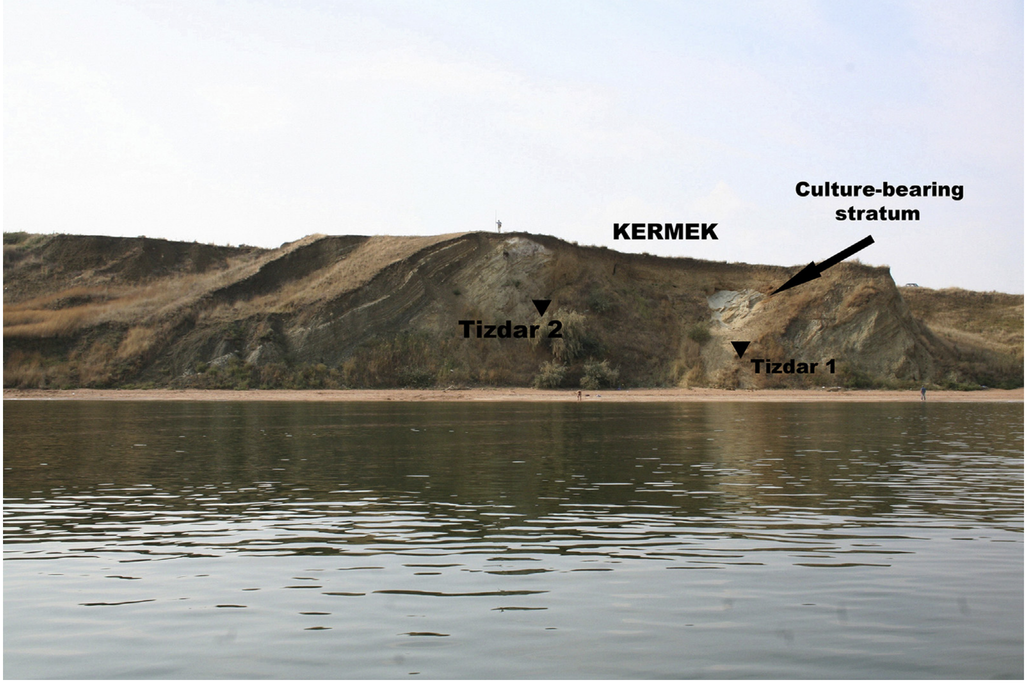

Fig. 3. Exposure of the Upper Kujalnikian in the coastal cliff of the Sea of Azov, and positions of Kermek and Tizdar sites viewed from the north.

Given the above-mentioned technological and typological characteristics of the Tamanian industry, it is obvious that its cultural-chronological attribution is very difficult. It is possible to assign it to the so-called late European Mode 1 (Mosquera et al., 2013), making its age significantly older. However, the existence in this industry of large flakes and such complex standardized and typologically distinct tools as picks and cleavers contradicts such a simplistic interpretation. It is well known that such tool types are not attested even in the later industries of Mode 1. On the other hand they are important for defining Acheulean (Early Acheulean) industries usually in combination with handaxes, which first appeared in Africa around 1.76 Ma (Lepre et al., 2011; Beyene et al., 2013; Semaw et al., 2013). In the Tamanian industry handaxes (the main technological marker of the Acheulean), are absent and this fact does not allow us to attribute it to the Early Acheulean industry. In order to better characterize this industry, we have proposed a

Fig. 4. The culture-containing layer of Kermek in the Early Pleistocene sequence overlain by covering loams.

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new term “archaic Acheulean”. It should be emphasized that it is not synonymous with the term “Early Acheulean”. The term “archaic Acheulean” is promoted to define the peculiar character of the Tamanian industry which combines technological and typological features of both Oldowan/Mode 1 and early Acheulean technocomplexes. Most likely it is a transitional industry between Oldowan/Mode 1 and Acheulean.

3. Geological setting, fauna and age site of Kermek

The site of Kermek is located 1 km west of the village of Peresyp, 0.5 km north of the village of Za Rodinu, 250 m east of the mouth of the Sinyaya balka (gully), and 200 m west of the site of Rodniki 1 (N 45 21.45, E 37 06.19) (Fig. 2). It was discovered during a study of the older Lower Pleistocene sediments exposed in the coastal cliff of the Sea of Azov near to previously studied sites (Shchelinsky et al., 2010b).

The site of Kermek occurs on the left limb of the Tizdar brachyanticline. The strata are monoclinally tilted with 80–90° strike and 30–35° dip (Pevzner et al., 1998; Dodonov et al., 2008b; Shchelinsky et al., 2010b). The sequence of Early Pleistocene sediments is exposed along the 15–20 m high coastal cliff of the Azov Sea for ca. 100 m (Fig. 3). It consists of interbedded bluish clays, fine-grained light grey and yellow sands, poorly sorted and unsorted gravels, and dark mud volcanic clays. The total thickness is more than 50 m. The tilted sequence is unconformably overlain by 3 m thick horizontally bedded brownish loams enriched at the base in ferruginous rubble.

This section has been known since the early 20th century. Gubkin and Varencov (1933) reported the Kujalnikian age of the deposits. The section was studied in detail by field teams from the Geological Institute of the Russian Academy of Sciences (Pevzner et al., 1998; Vangengeim et al., 1991; Tesakov et al., 1999; Tesakov, 2004). The Tizdar sequence (bottom to top) is as follows (thickness in brackets):

1. Clays and silts bluish-grey, sandy, layered, in the upper part with thin-walled shells of *Dreissena polymorpha* (>7 m).
2. Gravel of ferruginous sandstone and carbonate concretions with abundant shells of brackish and freshwater mollusks (see below, Tizdar 1). This bed yielded small mammal association Tizdar 1 (1 m).
3. White sands, fine-grained, micaceous, with mollusk shells of *Dreissena polymorpha*, *Theodoxus* sp. (0.5–1 m).
4. Black sandy unstratified clays with large calcareous concretions of complex shape. (4 m).
5. White fine- and medium-grained micaceous and cross-bedded sands with gravelly interbeds. The bed is locally enriched in shells of brackish- and freshwater mollusks, plant detritus and remains of small mammals. The Kermek site occurs at the base of the bed, and the site of Tizdar 2 at the top (20 m).
6. White fine-grained micaceous silty sands with indistinct bedding (10 m).
7. Black sandy clays with horizons of carbonate concretions (>7 m).

The covering loams of the upper part of the section (Fig. 4) yielded scarce and fragmentary remains of *Mammuthus* cf. *chosaricus* (tooth fragment), bones of *Bison* sp., and an almost complete mandible of horse *Equus* cf. *chosaricus*. This association is typical for the Khazar faunal complex and dates to the late Middle Pleistocene.

The bed containing lithic artifacts is located between the well-studied paleontological localities of Tizdar 1 and Tizdar 2, above the clay of bed 4 in the basal level of the sandy member of bed 5. In this bed occurs an interlayering of cross-bedded sands and gravel

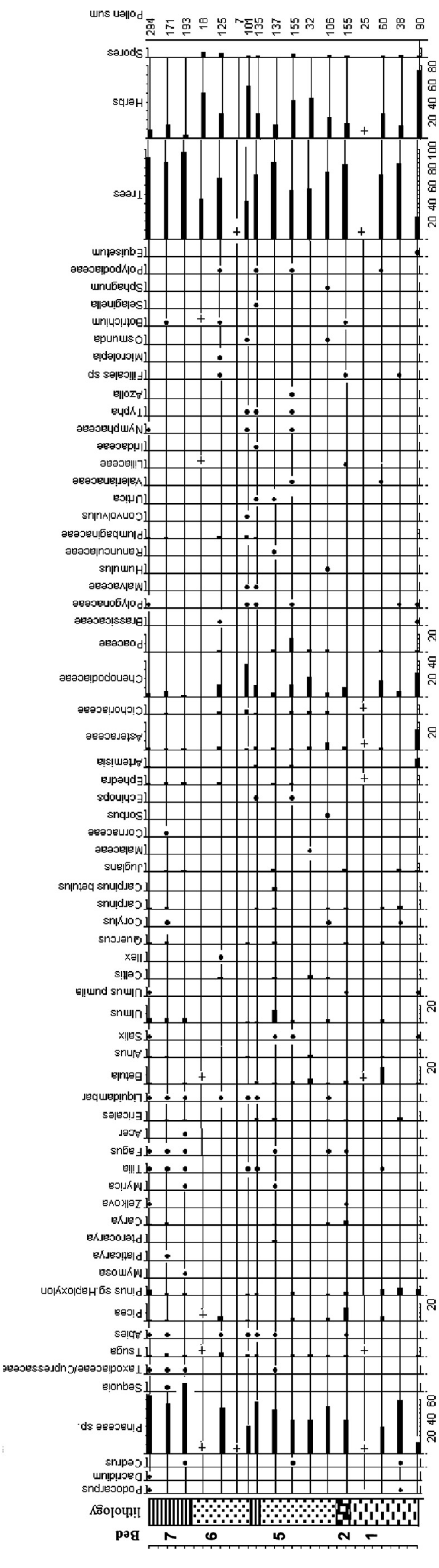

Fig. 5. Palynological diagram of the Tizdar sequence.

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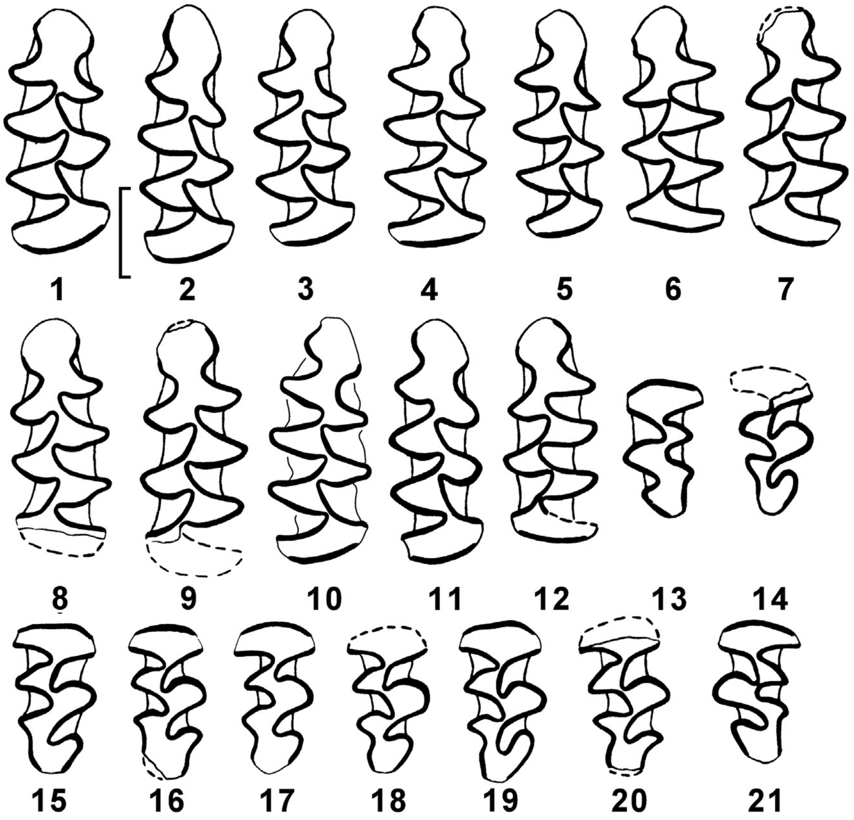

Fig. 6. *Allophaiomys deucalion* Kretzoi from Kermek and Tizdar. 1-12, first lower molars, m1; 13-21, third upper molars, M3. Scale bar, 1mm.

ca. 1 m thick (Figs. 3 and 4). This part of the section likely originated in a shallow off-shore setting of the brackish marine basin.

According to Taktakishvili and Semenenko, the molluskan association of the Tizdar sequence with dominant Dreissenidae, including *Dreissena theodori* Andrusov, is characteristic for the upper part of the Kujalnikian (Tesakov et al., 1999).

The paleomagnetic samples were taken at intervals of 1 m from clay layers at the base and at the upper top part of the section (beds 1 and 7). All of them showed reverse magnetization that does not contradict the Late Kujalnikian age of sediments based on the malacofaunal analysis (Vangengeim et al., 1991).

The Kujalnikian is the eastern Paratethys marine regional stage of the Black Sea basin. Kujalnikian deposits correspond to the interval of the magnetic polarity timescale ranging from the Gauss Chron (early Kujalnikian) to the early part of the Matuyama Chron (late Kujalnikian) (Pevzner, 1989). Based on the study of the most complete natural sections in western Georgia and boreholes from the Kertch Peninsula it has been shown that the upper boundary of the Kujalnikian is situated between the Olduvai and Gilsa Chrons (Pevzner, 1989). In modern terms (Roberts et al., 2010; Ogg, 2012) it can be interpreted as placed between the main part of the Olduvai Chron (C2n) and its upper normal subchron ("Vrika subchron"). Thus the upper limit of the Kujalnikian is drawn inside the Olduvai. Because the deposits of the lower and upper parts of this section show reversed polarity, the main part of the Tizdar sequence, bearing in mind their Kujalnikian age, likely correlate with either the pre-Olduvai interval (C2r.1r) or, less likely, an interval within this Chron (C2n) (Pevzner, 1989; Tesakov et al., 1999).

The dating of the site of Kermek and the whole Tizdar sequence is thus based on clear and reliable biostratigraphic and paleomagnetic evidence (Pevzner et al., 1998). The occurrence of the site in a shallow marine sequence makes it possible to constrain its chronological position using the known upper boundary ages of the Kujalniakian regional stage of the eastern Paratethys. Therefore, the age of the site is not younger than 1.778 Ma (top of the Olduvai Chron) based on straightforward stratigraphic correlation. We, therefore, dismiss the criticism of Muttoni et al. (2013) that this correlation is unreliable.

3.1. Palynology

The Tizdar sequence was sampled in increments of 1–2 m. Sixteen samples characterize the lower clays and silts (bed 1), gravels of bed 2, sands (beds 5, 6), and dark clays (bed 7) (Fig. 5). Pollen concentration is higher in the clays and lower in the sandy-gravelly interbeds. All samples yielded dinoflagellata. The lower silt member (bed 1) shows pollen of herbs (*Artemisia*, *Asteraceae*, *Chenopodiaceae*). The arboreal group reaches 25% and is represented by pollen of *Pinus*, *Salix*, *Ulmus*, *Juglans* and *Liquidambar*. This assemblage indicates a predominance of meadow and step landscapes. The upper part of the bed shows an increase in arboreal pollen of *Pinus* and *Betula*. Pollen of *Tilia*, *Corylus*, *Quercus*, *Carpinus* also appears. This assemblage reflects increased mesic conditions and expansion of conifer and broad-leaved forests.

Beds 2, 5 and 6, including the Tizdar 1, Kermek and Tizdar 2 levels, contains a diverse herbal group (up to 50–60% of the spectra) with Chenopodiacea, Poaceae, Asteraceae, *Artemisia*, Polygonaceae, Valerianaceae, Polygonaceae, Plumbaginaceae, *Typha* and *Azolla*. The arboreal group is dominated by pine, with single pollen grains of *Tsuga*, *Abies*, *Carya*, *Tilia*, *Acer*, *Fagus*, *Liquidambar*, *Quercus*, *Carpinus* and *Sorbus*. The reconstructed landscapes combine meadows steppe

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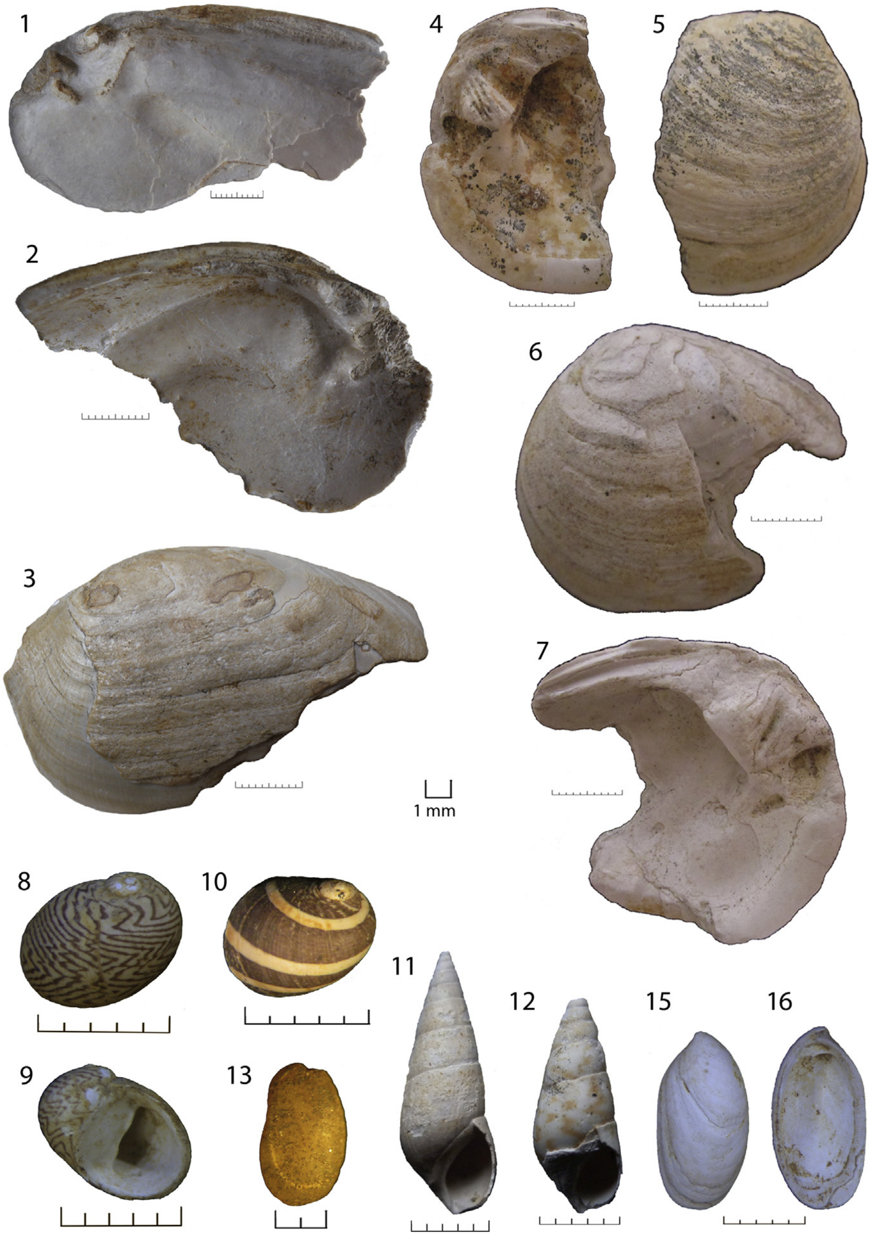

Fig. 7. Brackish- and freshwater mollusks from Kermek. 1–3. *Margaritifera arca* Tshepalyga, 1964: 1 – T-12/MgA-2 left valve, inner side; 2. T-12/MgA-1 right valve, inner side; 3. T-12/MgA-1, right valve external side; Kermek. 4–7. *Bogatschevia* sp.: 4. T-12/Bsp-1, left valve, inner side; 5 – T-12/Bsp-1 left valve, external side; 6. T-12/Bsp-2, right valve, inner side; 7. T-12/Bsp-2, right valve, external side; Kermek. 8–9. *Theodoxus danubialis* (Pfeiffer): 8. T-08/TD-1, coloration pattern, antiapertural view; 9. T-08/TD-1, viewed from the mouth; Kermek. 10. *Theodoxus* cf. *transversalis* (Pfeiffer), T-10/TT-1, coloration pattern, antiapertural view; Kermek. 11. *Fagotia acicularis* (Férussac, 1823), T-08/FA-1, apertural view. Kermek. 12. *Fagotia esperi* (Férussac, 1823), T-08/FE-1, apertural view. Kermek. 13. *Limax* sp.: T-08/Lsp-1, spatula. Kermek. Scale bar, 1 mm. 14–15. *Dreissena theodori kubanica* Krestovnikov, 1928: 15. T-08/DTk-1, right valve, external view; 16. T-08/DTk-1, right valve, internal view; Tizdar 1.

and conifer–broad-leaved forests. Pollen of riparian vegetation indicates the presence of water bodies with slow currents.

All samples from the silty and sandy part of the section showed the presence of dinoflagellates: *Systematophora* spp, *Spiniferites* spp., *Gonyaulax digitale*, *Operculodinium* spp., *Linguladinium* spp., *Achomosphaera andalusiense*, *Polysphaeridium* spp., *Polysphaeridinium zoharyi* and *Filisphaera filifera*.

The composition of the pollen spectra and phytoplankton indicate the Late Pliocene-Early Pleistocene age of the silty and sandy members of the Tizdar sequence (Powell, 1992; Bolikhovskaya, 1995).

The spectra of dark clays at the top of the studied section (bed 7) and in the clayey interlayer in the middle part of the section contain pollen of *Acacia*, *Sequoia*, *Cedrus*, *Engelhartia*, *Platicarya*, *Pterocarya*, *Tilia caucasica*, *Fagus*, and other taxa. This association is characteristic of the Miocene and Early Pliocene (Ananova, 1974; Shchekina, 1979; Filippova, 2005). These deposits also showed the presence of a mixed Paleogene-Neogene dinoflagellate association with *Deflandrea phosphoritica*, *Impagidinium polidium*, *Operculodinium* spp., *Operculodinium* cf. *centrocarpum*, *Gonyaulax digitale*, *Galeoacysta etrusca*, *Spiniferites* spp., *Achomosphaera andalusiense*, *Systematosphora* spp., *Systematophora placacantha*, *Hystrichosphaeropsis*

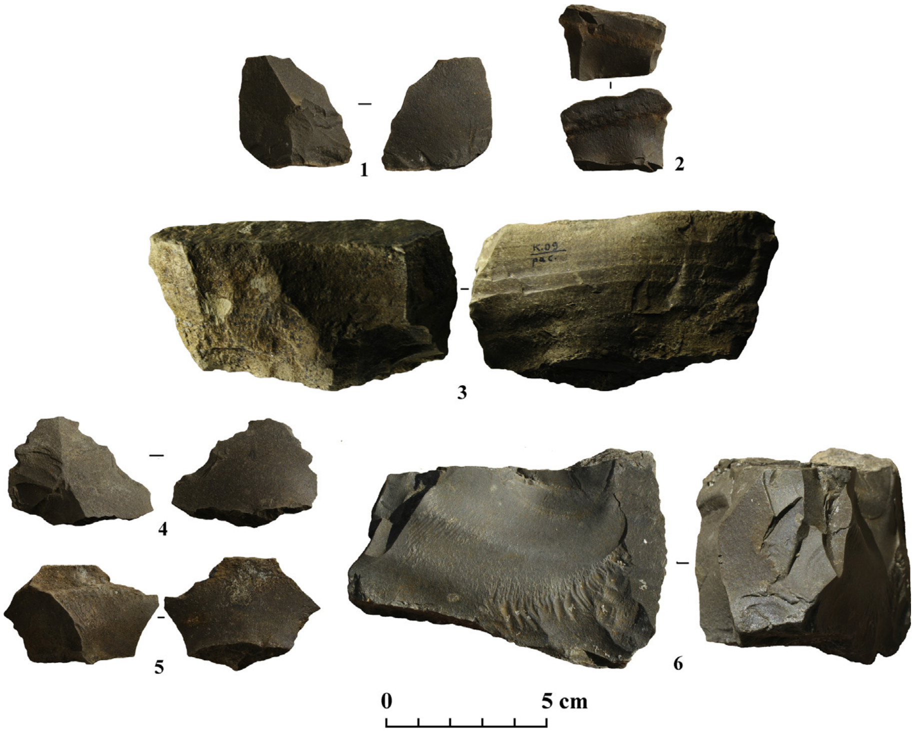

Fig. 8. Flakes (1–5) and core (6) from Kermek.

obscura, *Impagidinium* spp., *Homotrybium* spp. and *Wetzeliella* spp. It is most likely that the clay interbeds contain considerable amounts of redeposited Tertiary pollen owing to mud volcanic activity.

3.2. Mammals

The Tizdar sequence yielded two assemblages of small mammals (Fig. 3). The lower one (Tizdar 1) comes from the gravel layer (bed 2) at the base of the section. The upper one (Tizdar 2) is located upsection in the gravelly interbed at the top of the middle sandy member of the section (bed 5). Both assemblages have similar faunal compositions and include remains of primitive *Allophaiomys* (Tesakov, 2004).

Tizdar 1 includes Soricidae gen., Leporidae gen., *Spermophilus* sp., *Spalax* sp., *Allactaga* cf. *ucrainica*, *Plioscirtopoda stepanovi*, *Allocricetus* cf. *ehiki*, *Allophaiomys deucalion*, *Pitymimomys pitymyoides*, *Mimomys reidi*, *Mimomys* cf. *pliocaenicus*, *Borsodia newtoni*, Lagurini gen., *Ellobius kujalnikensis* and *Clethrionomys* cf. *kretzoii*.

Tizdar 2 includes *Crocidura* sp., *Desmana* sp., *Spermophilus* sp., *Spalax* sp., *Allactaga* cf. *ucrainica*, *Plioscirtopoda stepanovi*, *Apodemus* sp., *Allocricetus* cf. *ehiki*, *Allophaiomys deucalion*, *Prolagurus (Lagurodon) arankae*, *Prolagurus ternopolitanus* vel *Borsodia newtoni*, *Pitymimomys pitymyoides*, *Mimomys reidi*, *Mimomys* cf. *pliocaenicus* and *Ellobius kujalnikensis*.

A limited assemblage of vertebrates was collected from Kermek. Fishes (identified by S. Kurshakov, Institute of arid zones SSC RAS) include freshwater taxa such as roach *Rutilus* cf. *rutilus*, catfish *Silurus* cf. *glanis* and pike *Esox lucius*. Small mammals from Kermek are similar to previously known associations of Tizdar with *Allophaiomys deucalion* (6), Lagurini gen. (2), and *Spermophilus* sp. (1). The vole *Allophaiomys deucalion* from the Tizdar sequence (Fig. 6) characterizes one of the most morphologically primitive phases in the development of rootless Microtini in Central and Eastern Europe (Tesakov, 2004).

In evolutionary and chronological terms, the three studied assemblages Tizdar 1, Kermek, and Tizadar 2 are correlated with the East European regional zones MQR11 and MQR10 (Pevzner et al., 2001; Tesakov, 2004). Tizdar 1 (MQR11) is characterized by the co-occurrence of *Allophaiomys deucalion* and the latest *Borsodia*; Kermek and Tizdar 2 (MQR10) show association of *Allophaiomys deucalion* and the earliest rootless Lagurini, *Prolagurus ternopolitanus* and *Lagurodon arankae*. These assemblages are referred to the early part of the Psekups faunal complex (Tesakov, 2004) and dated between ca. 2.1–1.8 Ma.

Remains of large mammals from Kermek are scarce and fragmentary and include beaver *Trogontherium* sp., dolphin Delphinidae gen. indet., canid *Canis* sp., southern elephant *Archidiskodon meridionalis* cf. *meridionalis*, rhinoceros *Stephanorhinus* aff. *etruscus*, giant steppe rhinoceros *Elasmotherium* sp., horse *Equus* sp., and deer Cervidae gen. indet. This association is characteristic of the early Early Pleistocene of southern Eastern Europe (late Middle to Late Villafranchian) and to the Psekups faunal complex. This animal association indicates savanna-like forest-steppe landscape bordering a brackish water marine basin evidenced by molluskan association and the presence of dolphins.

3.3. Mollusks

Three main associations of mollusks are known from the section: Tizdar 1 (bed 2), Tizdar 2 (top of bed 5) (Pevzner et al., 1998; Tesakov, 2004), and Kermek (base of bed 5) (Frolov, 2013). The main taxa from Kermek are shown in Fig. 7.

The molluskan association of Tizdar 1 includes (identifications by V.N. Semenenko):

Dreissena polymorpha (prevailing), *D. theodori*, *D.* cf. *choriensis*, **Limnocardium (Tauricardium) squamulosum*, **Pontolmyra panticapea gurianthica*, **Prosodacna* sp., **Pterodacna* sp., **Arcicardium* cf. *arcado*, Cardiidae indet., massive Unionidae, *Vallensiennius* cf. *kujalnicus*, *Viviparus* sp., *Micromelania* sp., *Melanopsis* sp., *Neritina*

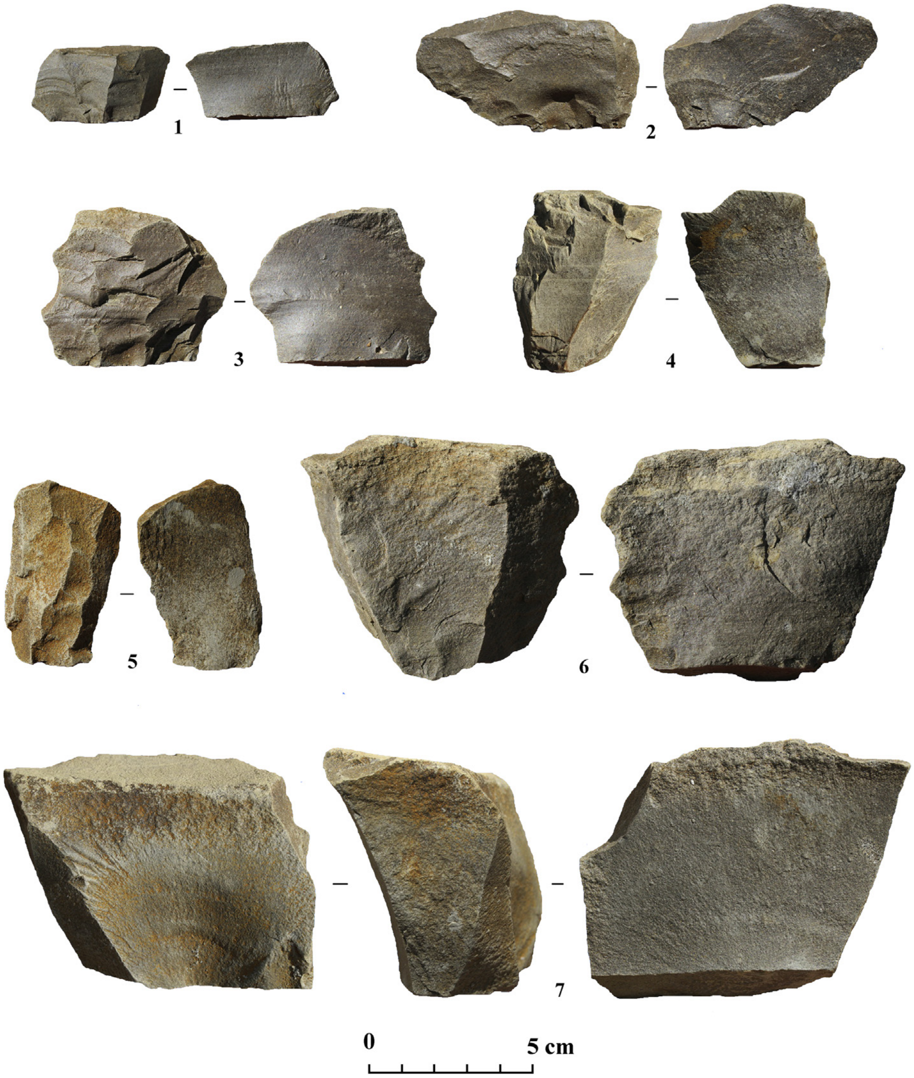

Fig. 9. Flakes (1–7) from Kermek.

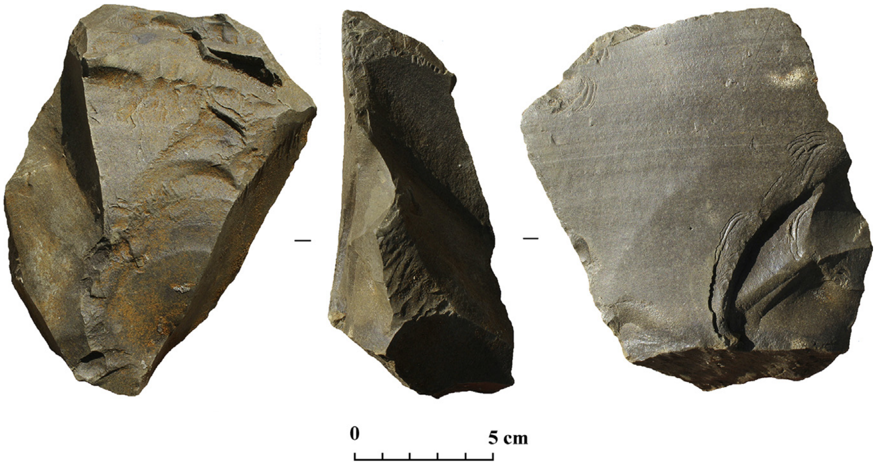

Fig. 10. Large flake from Kermek.

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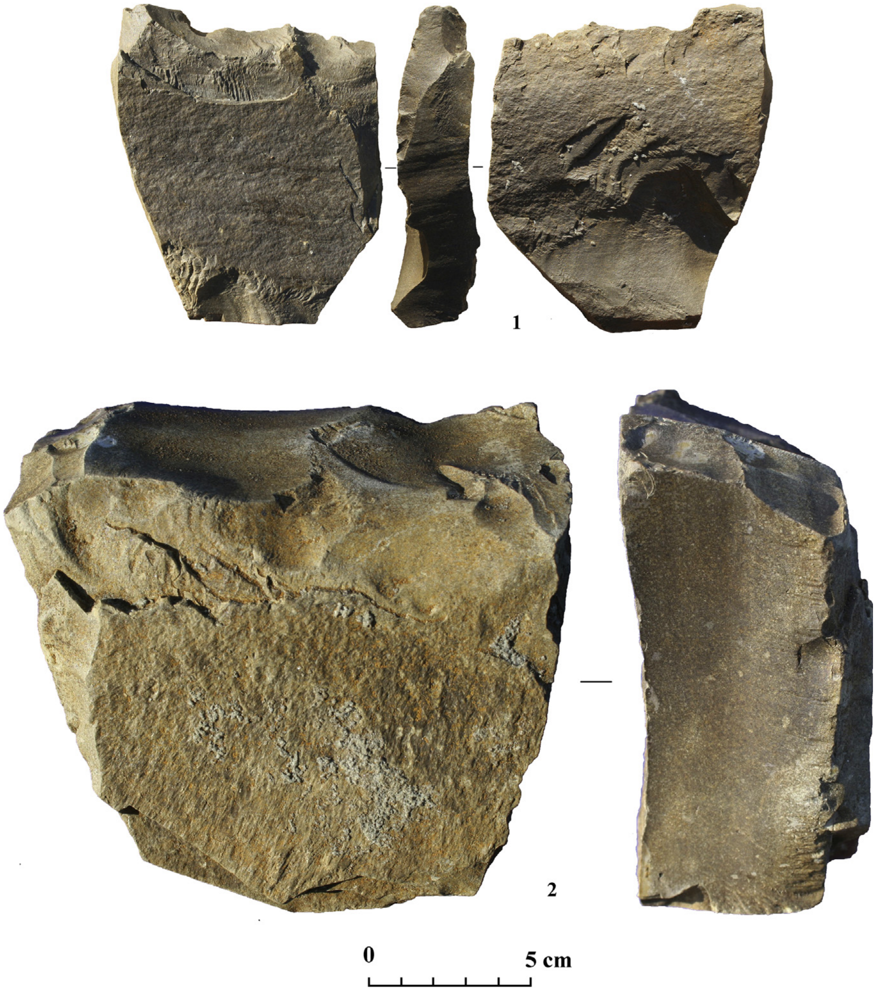

Fig. 11. Choppers (1–2) from Kermek.

sp., *Zagrabica* sp. (determination of I.G. Taktakishvili), ?*Monodacna* cf. *subriegeli*, *Dreissena theodori kubanica*, *Theodoxus punctatolineatus*, *Unio* ex gr. *tamanensis* (identified by V.N. Semenenko). Frolov (2013) adds *Bithynia* sp., *Parafossarulus* sp., *Fagotia esperi*, *Fagotia acicularis*, *Fagotia* sp., *Theodoxus danublalis* and *Pisidium* spp. Asterisks indicate taxa redeposited from Kimmerian sediments (Semenenko, pers. comm.).

The molluskan association of Tizdar 2 includes (identifications by V.N. Semenenko):

Dreissena polymorpha, *D. theodori*, *Viviparus* ex gr. *sinzovi*, *Melanopsis esperi*, *Valvata piscinalis*, *Lithoglyphus naticoides*, *Theodoxus* sp., *Unio* ex gr. *tamanensis*, Cardiidae indet. and *Pisidium amnicum* (identified by Semenenko). Frolov (2013) adds *Bithynia* sp., *Parafossarulus* sp., *Pisidium sulcatum*.

The molluskan assemblage from Kermek is very similar to the associations of Tizdar 1 and 2 (Frolov, 2013). It contains *Fagotia esperi*, *F. acicularis*, *F.* sp., *Theodoxus* aff. *transversalis*, *T. danubialis*, *T.* cf. *danubialis*, *Parafossarulus* sp., *Bithynia* sp., *Lithoglyphus* sp., *Micromelania* sp., *Viviparus* sp., *Limax* sp., *Dreissena polymorpha*, *Margaritifera (Margaritifera) arca* and *Bogatschevia* sp. (Frolov, 2013).

The molluskan associations of the Tizdar sequence indicate freshwater alluvial and brackish-water estuarine conditions with a mosaic of rheophilic and stagnophilic conditions.

The co-occurrence of the fossil pearl mussel, *Margaritifera arca* and the unionid Bogatschevia sp. was described for the Boshernitsa molluskan complex correlated to Early–early Middle Apsheronian (early Calabrian) (Tshepalyga, 1967). But the presence of D. theodori and absence of the unionid Pseudosturia, a typical later Early Pleistocene unionid, indicates an age close to the Gelasian/Calabrian transition.

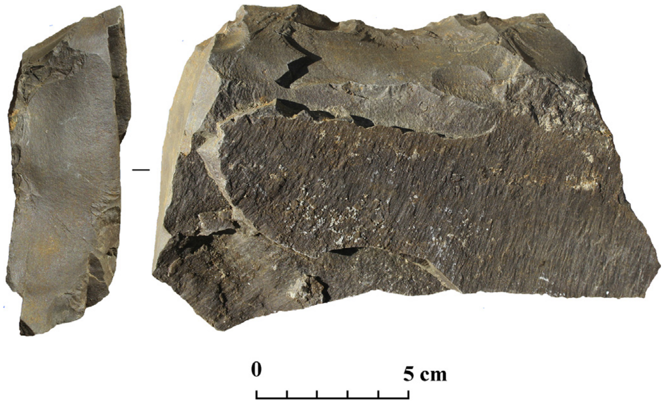

Fig. 12. Chopper-shaped side scraper from Kermek.

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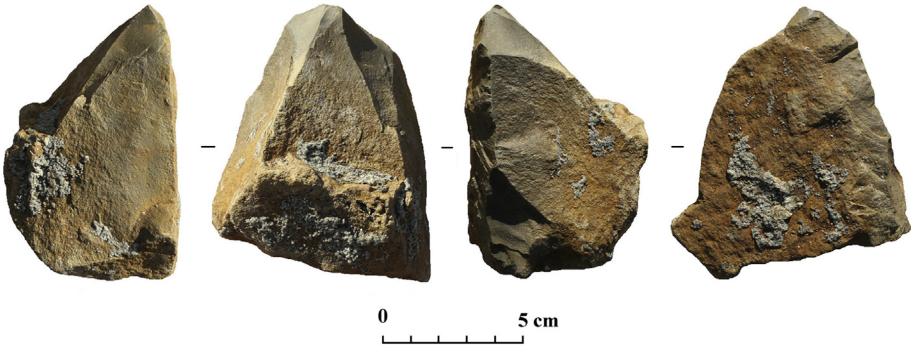

Fig. 13. Partial bifacially pick from Kermek.

4. Artifact-bearing bed of the Kermek site

The artifact-bearing bed of the site consists of intercalated gravelly-pebbly layers and sandy layers with abundant shells of freshwater and brackish-water mollusks, having a maximum thikness of 1 m (Fig. 4). Analysis of these sediments indicates that they were formed in the beach area of a brackish-water basin with relatively low wave action. The coarse-grained material of the layer comes mainly from the underlying mud volcanic clays, where it is rather numerous.

Archaeological finds from the bed are numerous and represent a well-defined industrial complex. Morphological features, state of completeness, as well as the archaeological and geological contexts of these finds clearly indicate their anthropogenic origin. There are

Fig. 14. Unifacially picks from Kermek.

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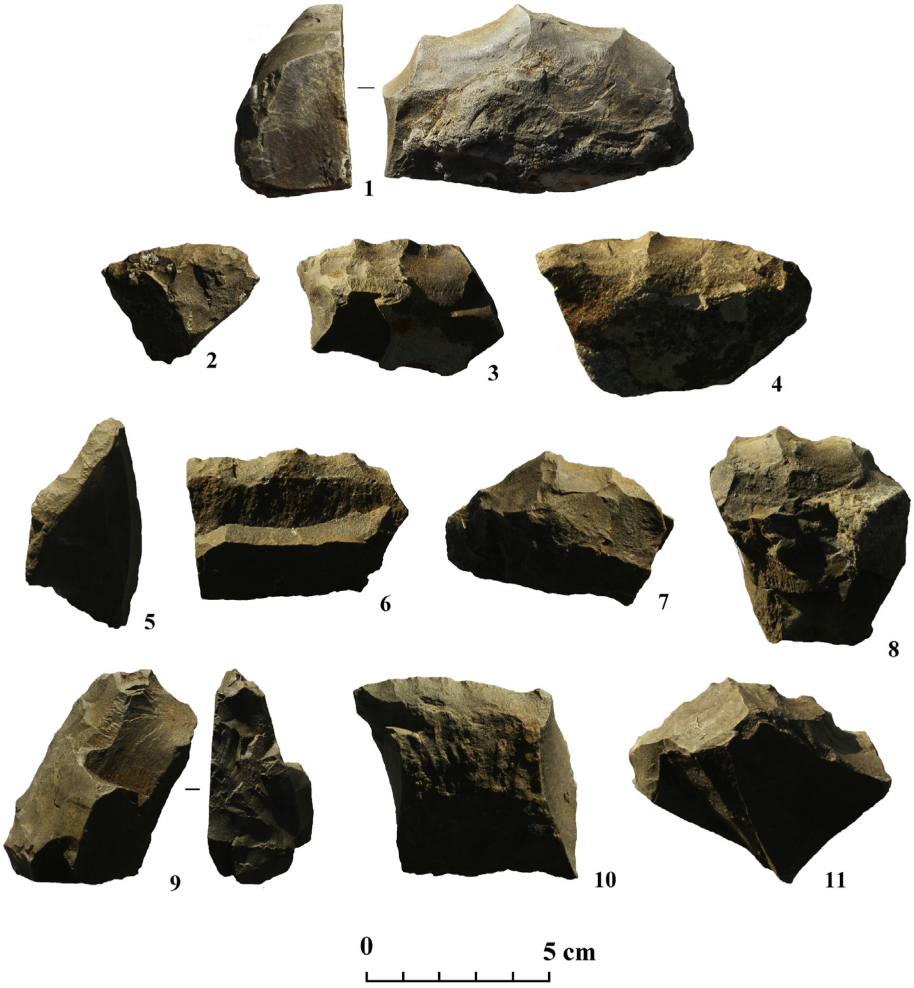

Fig. 15. Chopper (1) and small retouched tools (2–11) from Kermek.

not only lithic artifacts, but also numerous fragmented bones of fossil mammals. The preservation and patina of the artifacts are clearly different from the natural clastic material in the layer. Cultural remains are dispersed throughout the bed, but occur mainly in the strata of loose sand and clay pellets, rarely in the strata of gravel. Therefore, they were not subjected to significant mechanical alterations. The number of artifacts increases toward the bottom of the culture-bearing bed. Often the artifacts lay directly at the bed's contact with the underlying clay and were partially embedded within it. The cultural remains were in general sparsely distributed. The sporadic clusters have fuzzy boundaries. For the most part, the lithic artifacts and animal fossils showed no signs of water rolling. This suggests only minimal transport by wave action. The main reason for the sparseness of the cultural remains in the bed was likely the short duration of human activities at the site. The site was located in a beach on the bank of a desalinated sea bay or estuary, and probably was visited by people repeatedly.

5. Lithic industry

During an initial 30 m^2 excavation ca. 400 lithic artifacts were recovered. Analysis of this material is still in progress, but the following general observations can be offered.

5.1. *Raw material*

The basic raw material was local silicified dolomite of Miocene age. The same raw material was used by the makers of the Tamanian industry at later sites in the vicinity. Along with dolomite, the hominins sporadically used a black and gray-yellow flint. The raw material was obtained mainly in the form of variably sized tabular fragments. There was deliberate selection of fragments by quality and size. The use of flint is documented by the presence of only three small flakes, knapped from pebbles. For the most part, the raw material was brought on the site, but not from very far away. Today the same dolomite occurs in the immediate vicinity of the site in outcrops and screes of ancient mud volcanic deposits.

5.2. *Preservation of the artifacts*

Although the artifacts occur in beach sediments, very few of them have surfaces smoothed by water action. The artifacts are mostly well preserved. This suggests the artifacts were exposed on the activity surface for only a short time before being buried by sedimentation. However, many artifacts were subjected to chemical weathering. The artifacts are predominantly grayish-brown, brownish-gray, brown and yellowish brown color with different shades of patina depending on the structure and density of the raw material.

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Table 1
Modification of choppers from the Kermek site.

Groups of choppers	Subgroups of choppers			Total
	With straight working edge	With convex working edge	With pointed working edge	
Proportionate choppers	1	3	2	6
Shortened choppers	1	1	7	9
Elongated choppers	4	2	2	8
Total	6	6	11	23

5.3. *Characteristics*

The composition of the artifacts suggests there was a full cycle (chaîne) of stone knapping and shaping of tools at the site. The lithic assemblage includes: cores, flakes and debris and tools (Figs. 8–15). The flakes and debris represent more than half of all artifacts. Lithic implements are mainly large (5 cm or more). Among the small artifacts (<5 cm) flakes predominate.

5.4. *Cores and flakes*

The cores are quite simple. They represent dolomite debris, flaking of which was carried out without preparation (Fig. 8, n 6). A natural horizontal or sloping surface of a fragment covered with cortex, or rarely a smooth fracture surface was used as the striking platform. Similar patterns are characteristic for the removal surfaces of cores. In other words, the cores were not subjected to preparatory treatment, neither at the beginning nor during the flaking process. Cores differ in the manner of their reduction. Cores with one, two, three or more flaking surfaces are represented in different proportions. The most numerous are unifacial cores with one or two striking platforms, roughly prismatic and with one negative removal. It is important to note the presence of very large cores, intended for removals of especially large flakes (>10 cm).

Flakes are diverse (Fig. 8, n 1–5; 9 and 10). Many of them are broken. Whole and nearly whole specimens are mostly small, i.e. less than 5 cm long. There are primary or cortical, half-cortical and non-cortical flakes. Among the last mentioned there are more flakes with parallel and convergent orientation of negatives of removals on the dorsal side. Essentially, this corresponds to the available cores. Flake butts (straight or angled) are unprepared on almost all flakes. They are often corticated, rarely smooth, and only in a few cases roughly prepared. Among the flakes larger than 3 cm, shapeless ones predominate. However, it is important to note that there are some flakes of more or less regular form, which are blade-like, sub-triangular, oval and sub-rectangular, including several with shortened proportions (Fig. 9). There are single naturally

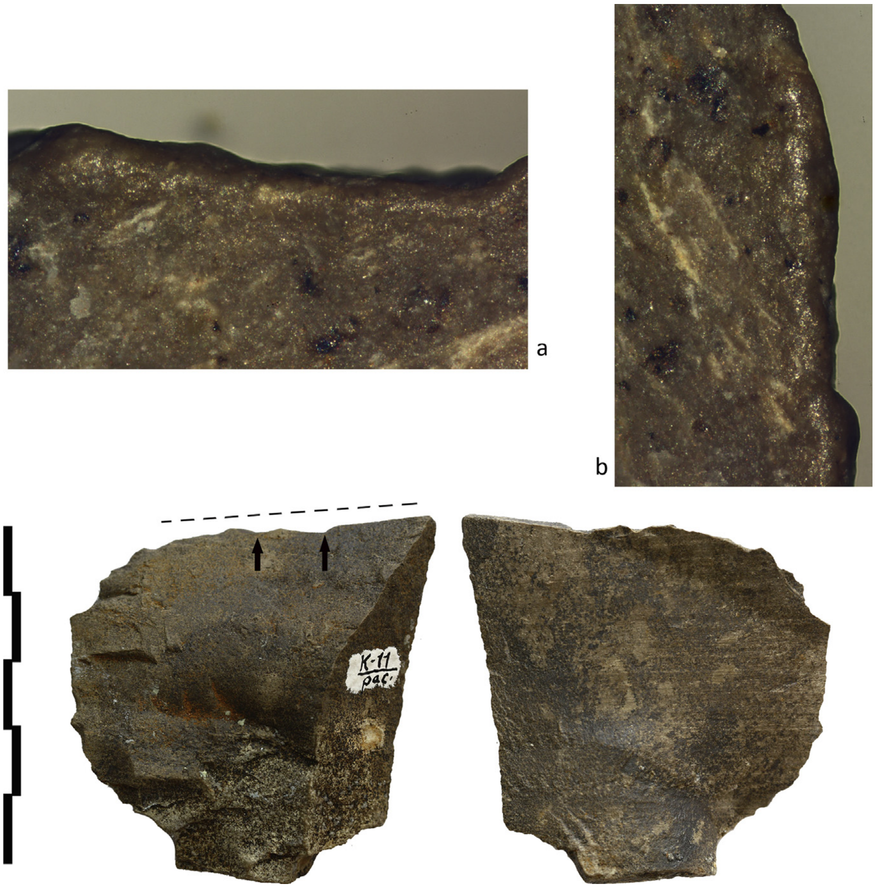

Fig. 16. Flake with transversal retouch (K_6) used for soft material (fresh hide) scraping. The microphotos (×100) show the use-war traces, taken at the points marked by arrows. Photos and figure by M. Gurova.

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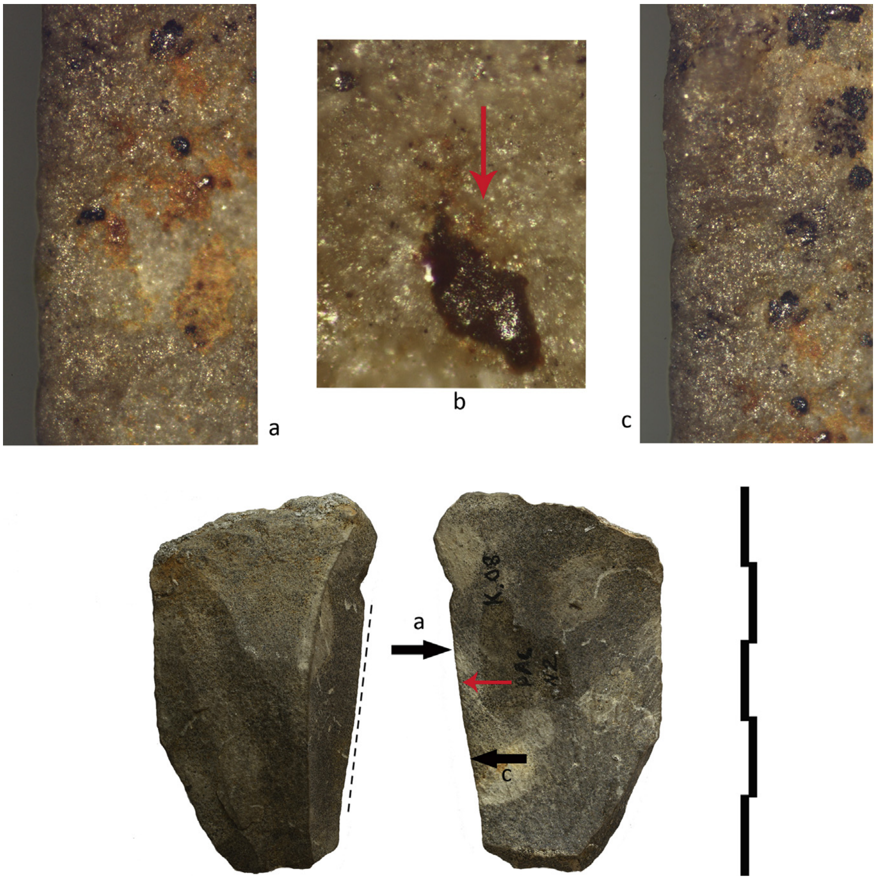

Fig. 17. Flake (K_8) used for butchering (meet/fresh hide processing). The microphotos show the use-war traces (a, c – ×100) and undetermined residues (b – ×150). The arrows indicate the points of microphotos.
Photos and figure by M. Gurova.

backed flakes and flakes of Kombewa type. It is important to note the presence of a series of large flakes (>10 cm) that were used as tools (Fig. 10). The edges of some of the flakes have micro scars indicating possible utilization and single removal negatives of resharpening.

Along with the knapping of cores and the production of flakes, the intentional splitting of the natural cleavage planes of dolomite played a very important role in the industry for purposes of obtaining suitable fragments for toolmaking.

5.5. *Tools*

The tools are well defined and form two groups: macro-tools and small retouched tools.

Macro-tools are represented by choppers, chopper-shaped side scrapers, core scrapers/heavy-duty scrapers and picks. True bifaces are absent. There is only one atypical partial biface. All of these tools are made on natural fragments and knapping debris.

Choppers (23 specimens) are clearly different from the cores (Figs. 11 and 15, n 1). Some have partial treatment of the lateral edges and butt to facilitate gripping in the hand. All choppers, except one, are unifacial. Shortened and elongated choppers with straight and pointed working edges are the most representative (Table 1).

Chopper-shaped side scrapers (10 specimens) are shaped more carefully in comparison with the choppers (Fig. 12). Small removals and retouch were used for fashioning the working edge.

Picks (12) have distinctive characteristics common to such tools, although all of them were made from "debris" (both natural fragments and knapping debris) (Figs. 13 and 14). There are two groups of picks: those with a pronounced butt (5) (Fig. 13) and those with a non-pronounced butt (7) (Fig. 14). In the first group two picks have partial bifacial treatment (Fig. 13). Three others are unifacial. The form of the working tip is different – pointed (2), narrow scraper-shaped (1) and narrow wedge-shaped (2). The butts of some tools are partially treated. All picks of the second group (7) are unifacial (Fig. 14). The shape of their working ends is also variable – pointed (2), narrow scraper-shaped (1), narrow chisel-shaped (1) and narrow wedge-shaped (3). Similar modifications of picks are evident in the Tamanian industry as a whole (at the sites of Bogatyri/Sinyaya Balka and Rodniki 1) (Shchelinsky, 2013b, 2014).

Small retouched tools are numerous and fall into different typological categories (Fig. 15, n 2–11). They are fashioned with different degrees of skill. There are side-scrapers, end-scrapers, beaked tools, thorned tools, and denticulated and notched tools. These tools were made from flakes and debris (as in the case of picks). Moreover, tools made from debris are conspicuously common. The side-scrapers are particularly interesting. They predominate in this group. Those made on flakes can be divided into single, transverse, and diagonal side-scrapers. They differ from the same tool type in the Middle Paleolithic only by the poor quality of the flake-blanks and the rough preparation of the working edge.

The above summarizes the preliminary characteristics of the lithic industry of the Kermek site. Unquestionably, it is less developed in comparison with the Tamanian industry from the nearby sites of Bogatyri/Sinyaya Balka and Rodniki 1, and the industry can

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Fig. 18. Blade-like flake with partial scars (K_5) with traces of PDSM (post-depositional surface modifications). The microphotos (×100) show polishes due to taphonomic factors. Photos and figure by M. Gurova.

be attributed to Oldowan/Mode 1 on the basis of its fundamental technological and typological characteristics. It can be referred to the Classical Oldowan, as envisaged by Lumley et al. (2009a,b), which industries demonstrate a relatively high level of technological development.

6. Functional study

The functional identification of the toolkit of the earliest hominins is no longer an enigma. Since the pioneering work on tools from Koobi Fora (Keeley and Toth, 1981) there have been many stimulating studies revealing different facets of the functional approach to the earliest lithic assemblages. These includes: methodological and procedural aspects (Márquez et al., 2001; Borel et al., 2014); experimental works including recognition of post-depositional surface modification or PSDM (Asryan et al., 2014; Lemorini et al., 2014); and residue analysis (Dominguez-Rodrigo et al., 2001). Through the application of use-wear analysis there is now a much better understanding of the nature and range of early human activities. Among the traces revealed by use-wear analysis, most common are those relating to butchery, but there is also occasional evidence of hide and woodworking (Carbonell et al., 1999b, 676–677; Dominguez-Rodrigo et al., 2001, 297; Márquez et al., 2001, 295; Ollé et al., 2013, 146, 150).

A functional study of the Kermek material represented a real challenge because of the very early age of the site. Hitherto use-wear studies of very early sites outside Africa have been few, represented primarily by the site of El-Kherba (Ain Hanech, Algeria) dating to ca. 1.8 Ma (Sahnouni et al., 2013). Traces of use on the Kermek artifacts were first observed by V. E. Shchelinsky during a general study of the assemblage. But focused and detailed use-wear analysis had not been carried out.

The pilot functional study was done by MG during two short visits to the St-Petersburg lab using a Canon 450 EOS for macrophotographs and an Olympus BH2-UMA microscope – for micrographs. A series of 12 tools of various types were selected for use-wear observation. The study showed the excellent preservation of the dolomite specimens and allowed some micro wear traces to be documented and interpreted in spite of the limitations of the available analytical equipment. There was no opportunity for a targeted experimental study, and the referential database of existing results was used (see the literature cited above). The

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artifacts were subjected to simple water cleaning before observation. The picks represented the greatest challenge because of the massive and well exposed tips and edges. In fact, the only wear traces were localized on the tips themselves indicating treatment of soft material (probably hide). Use-wear traces were detected mainly on the flake edges, which exhibited smoothing and light polishes that could be attributed to meat and fresh hide processing (mainly longitudinal cutting operations) (Figs. 16 and 17). Some of the artifacts possess detectable additive particles on the edges which were interpreted as residues, but there was no opportunity for follow-up analyses using SEM (Fig. 17b). The clearest example of post-depositional surface modifications PDSM was on a blade-like flake with visible shiny polish and smoothing of the surface, dorsal ridges and edges (Fig. 18). The results of this pilot study clearly demonstrate the potential for a further use-wear analysis using better technical equipment. This could be feasible in the context of a fruitful collaboration within multidisciplinary research team.

7. Discussion and conclusions

1. The site of Kermek occurs in situ in a well-documented geological context associated with deposits of the late Kujalnikian regional stage of the stratigraphic framework for the Black Sea region. Through a combination of geological, biostratigraphic and paleomagnetic data it is dated to the Early Pleistocene, late Gelasian to early Calabrian transition, between ca. 2.1–1.8 Ma. Thus, it is the oldest known Western Eurasian Early Paleolithic site outside the Caucasus.
2. Apparently, the site was located on the shore of an estuary or inlet of a desalinated sea basin. Thus, we can speak about a "coastal" adaptation of the first humans (Shchelinsky, 2013a), which seems to be a characteristic of the initial period of the Early Paleolithic of the Caucasus and Ciscaucasia.
3. The lithic industry is characterized by a relatively complex technology, including a sequence of operations. There are clearly recognizable and distinct stages of raw material selection, primary knapping and tool manufacturing.
   - the reduction sequence involved primarily unifacial unidirectional and convergent removals and, less frequently, bifacial and multifacial core reduction. There are indications of a degree of control over shape and dimensions of flakes;
   - there is a wide spectrum of tools, including well made and standardized forms. Apart from the common macro-tools (choppers and core-like scrapers) there are distinct types of tools such as chopper-like scrapers and picks.
   - the technological and typological features of the Kermek industry indicate that it belongs to Oldowan/Mode 1 or, more specifically, to the Classic Oldowan;
   - there are however certain features that are typical of more "advanced technologies" – the manufacture of large flakes and picks – which are characteristic of Acheulean industries;
   - thus the Oldowan industry of Kermek can be considered as a basal stage of the Tamanian industry, which we define as transitional between Oldowan and Acheulean;
   - a further detailed use-wear analysis of the artifacts would be helpful in further characterizing this industry.
4. The discovery of the Kermek site has shown that the oldest Early Paleolithic of the Caucasus and adjacent Asia Minor is not limited to the site of Dmanisi in the southern Caucasus (Lordkipanidze et al., 2007) and Ubeidiya in the Levant (Bar-Yosef and Goren-Inbar, 1993). This discovery, as well as the recent finds of the oldest Early Paleolithic sites in the Lesser Caucasus in Armenia (Presnyakov et al., 2012) and in the northeastern Caucasus in the Dagestan mountains (Amirkhanov, 2007) show that in the Early Pleistocene, during the Gelasian–Calabrian transition, ca. 2.1–1.8 Ma, the first humans appeared in Western Eurasia not only at Dmanisi, but almost simultaneously colonized the entire territory of the Caucasus and Ciscaucasia. At the same time, the Kermek site is the northernmost known extent of settlement by the first hominins, located on the border of Western Asia and Eastern Europe.

Acknowledgments

This work was supported by the Russian Humanitarian Science Foundation, project no. 15-01-00049-a; the program of scientific cooperation between Russian Academy of Sciences and the Bulgarian Academy of Sciences, project "Ancient ways of settlement of the European continent: migration processes through the Sea of Azov Region and the Balkans. Characteristics of industries and the development of cultural exchange between human groups" (2012–2014); and the projects of the Russian Foundation for Basic Research nos. 14-05-31037; 15-05-03958-a; 15-04-02079-a. The authors are grateful to Clive Bonsall for the reading a draft of the paper and suggesting improvements to the English.

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