Статті

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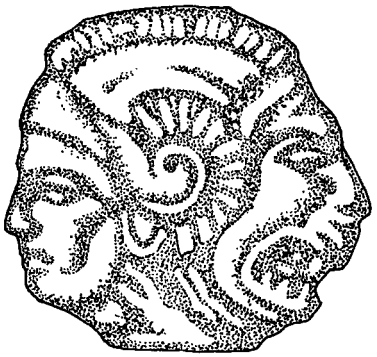

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ANALYSIS OF MICRO-RESIDUES ON STONE TOOLS FROM ZASKELNA IX, CRIMEA: FIRST RESULTS

The article presents the results of micro-residues study on the surface of stone tools from the lower, Acheulean layer of the cave site Zaskelna IX in the Crimea. Several recognised varieties of detected micro-residues of organic and mineral origin are characterised. Likely traces of specific wear inherent on the soft handle are identified. Pigment residues correlate with these traces. Micro-residues and use-wear indicate the possible wrapping of stone tools in the leather or plant substances with the help of adhesives containing ochre powder for safe and secure gripping in hand.

K e y w o r d s: residual analysis, micro-residues, use-wear, pigments, soft handle, Palaeolithic, Acheulean, Crimea, Eastern Europe.

Introduction

The study of various remains on stone artefacts has become an integral part of modern archaeological research of Stone Age sites. Due to the emergence of new technical means of microscopy and the development of methods of geochemical analysis, new ways of studying and interpreting stone artefacts are being formed in archaeology. At the present stage, along with the study of usage traces on stone tools, the method of residual analysis is becoming increasingly common (Anderson-Gerfaud 1986; Jensen 1988; Grace 1996; Andrefsky 2005; Marreiros, Gibaja Bao, Bicho 2015; Rots et al. 2013; Lemorini, Cesaro 2014; Stemp, Watson, Evans 2016; Pedergnana et al. 2016; Cnuts, Rots 2018).

In the context of Palaeolithic sites, finds of natural dyes, including iron oxides and oxyhydroxides, have always attracted particular attention. Historians and archaeologists traditionally consider such finds mainly as a reflection of symbolic behaviour. Numerous ethnographic and written sources serve as the basis for such interpretations (Wreschner et al. 1980; Doménech-Carbó, Osete-Cortina 2016; Watts 2018; Knight 2018). The general name «ochre» is a simplified term used in the archaeological literature for iron oxides and oxyhydroxides.

Red ochre (hematite) can be obtained from limonite by natural or anthropogenic dehydration. Natural formations of oxides and oxyhydroxides were formed in different geological periods. On the territory of Ukraine, powerful deposits of limonite were found (in the Kryvyi Rih basin and the east of the Kerch Peninsula (Антропов 1958).

It should be noted that sometimes stalactites are formed in karst cavities, often forming limonite, hematite, and malachite in the shape of buds. Occasionally, such forms of influxes have a shiny surface. In geology, such formations are called «glass heads» (Музафаров 1979).

In 2005, at 5 km north from Zaskelna IX, in the Paleogene sandy loam of the Ak-Kaia plateau, small accumulations of yellowish-brown (sometimes cherry-red) iron hydroxides and oxides with yellow-brown flint nodules were found (Степанчук та ін. 2006). The current paper adds new information to the al-

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Fig. 1. Location of Zaskelna IX and key sites of the Ak-Kaia variant of Micoquian in Chervona Balka (Red Gully) near Bila Skelia village, Bilohirsk district, the Crimea: *V* — Zaskelna V; *VI* — Zaskelna VI (Yu. H. Kolosov's); *IX* — Zaskelna IX

ready known analysis published in Ukrainian language (Рижов та ін. 2021).

The oldest evidence of the ochre usage comes from Africa. In particular, it is believed that ochre was deliberately collected and used in the Katu Pan site, which is dated about 500 ky (Watts, Chazan, Wilkins 2016). Pieces of ochre with traces of processing and usage and its remains on artefacts have been found in Pleistocene layers of many South Africa cave sites: Pinnacle Point (64 ky, layer B), Klasies River (100—85 ky) and Blombos (100 ky) (Watts 2010; Henshilwood et al. 2011; D'Errico et al. 2012; Beaumont, Bednarik 2013; Watts, Chazan, Wilkins 2016). In this context, it is worth mentioning the discovery on the ninth terrace of the Crimean southern coast (Чепалыга 2017) of several red-brown flattened pebbles, presumably siderite ($FeCO_3$) with signs of knapping, numerous dents and scratches. These pebbles were found together with flake and pebble tools of the Lower Palaeolithic appearance. For the Middle Palaeolithic period, ochre has been documented for many sites, including those known in the Middle East and the European continent (Hardy et al. 2001; Hovers et al. 2003; Hodgskiss 2010; Moncel et al. 2012; Сериков 2013; Lemorini, Cesaro 2014; Rots et al. 2013; Key, Lycett, Stephen 2017; Venditti et al. 2019; Velliky et al. 2019; Dayet et al. 2019). Fragments of ochre, often with various signs of intentional transformation and usage, are frequently found at Middle Palaeolithic sites of the Crimea (Колосов 1986, с. 37; Степанчук 2006, с. 248—249; Степанчук, Цвелых 2018; Степанчук, Нездолій, Вєтров 2018).

Modern research on various aspects of natural pigments usage is closely linked to experiments of ochre interaction with stone artefacts clarifying, the supply and origin of ochre (Hodgskiss 2010; 2020; Brooks et al. 2018; Lemorini et al. 2020). Ethnoarchaeological studies witnesses a widespread use of ochre as a component of aggregate paste for fastening lithic tools in a shaft, handle, leather and grass frame (Wadley, Williamson, Lombard 2004). In particular, African Palaeolithic sites provide valuable evidence for ochre as a component-filler for connection frame made of diverse organic materials with a sur-

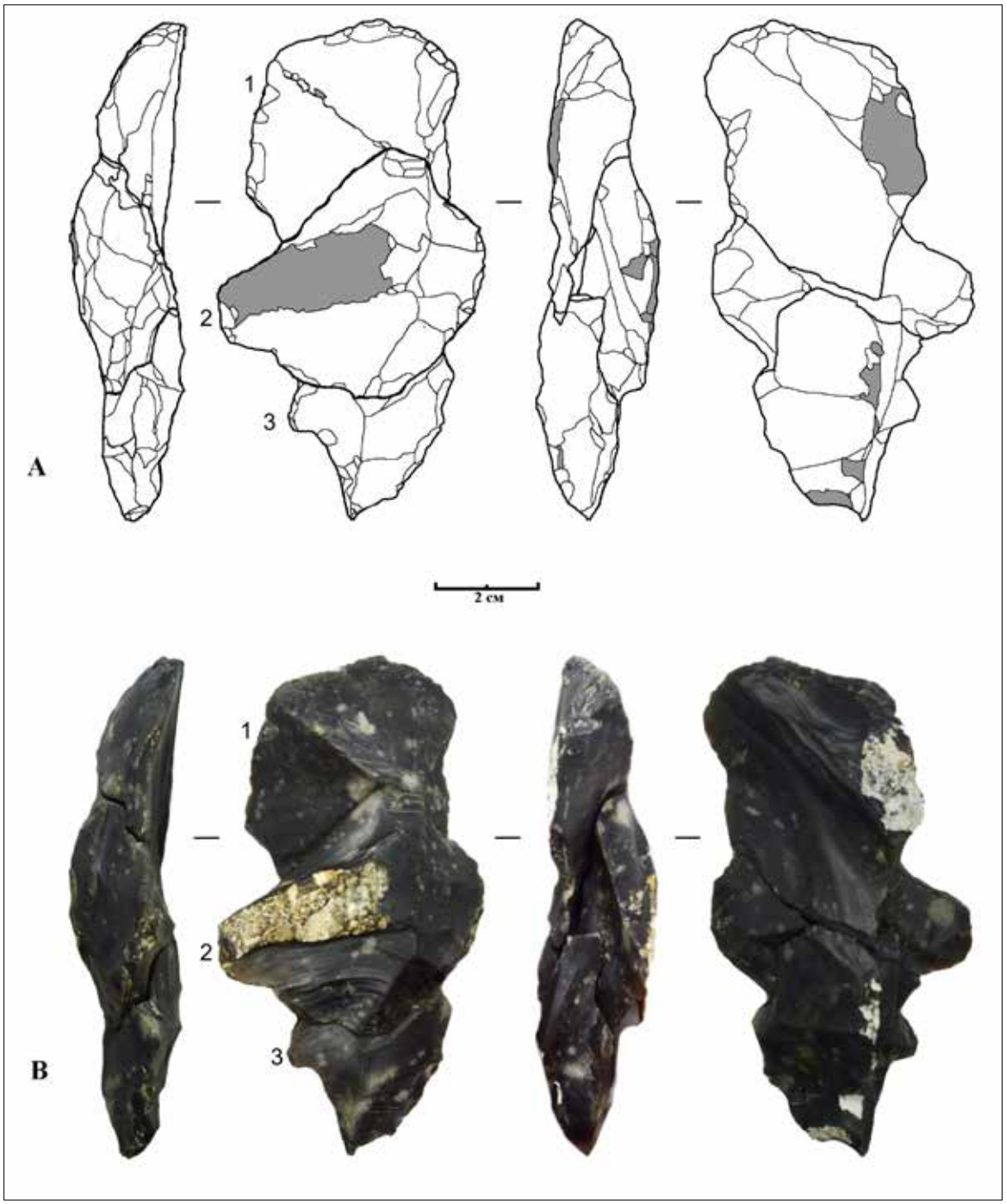

Fig. 2. Zaskelna IX, lower layer. Refitting of several flint flakes, demonstrating the usage of bipolar technique and rough shaping

face of lithic artefact (Wadley 2005; Wadley, Hodgskiss, Grant 2009; Rots, Van Peer, Vermeersch 2011).

Materials

General information about Zaskelna IX site. Zaskelna IX is located in the eastern part of the Crimean foothills, on the right bank of the Biiuk-Karasu River, near Bila Skelia village in Bilohirsk district, at the head of Chervona Balka (Red Gully) (fig. 1). The site is located beneath a three-meter cliff of nummulitic limestones, nearly 90 m above the river level. In front of the steep slope towards the gully, there is a slightly sloping area. Several fissures traced extend towards the monolith of the limestone plateau, one of which is interpreted as an entrance into a buried cave. The destruction of the entrance part and significant subsidence of the cave vault is explained by tectonic movements. Worthy to emphasise that this is the only Palaeoli-

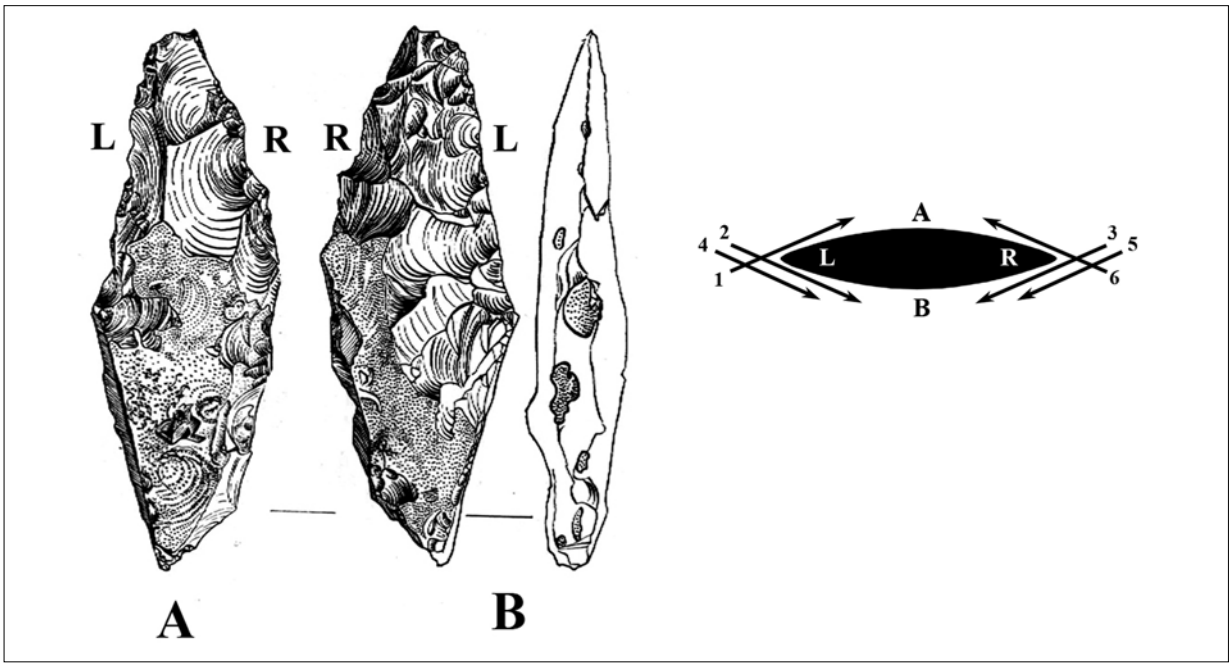

Fig. 3. The hand-axe from the lower layer of Zaskelna IX (artefact 10, Table 2), an example of technical information. The drawing after Yu. H. Kolosov (Колосов 1983, табл. LXXIV). Raw material: flint; type of treatment: shaping; order of processing of surfaces of the artefact: A (phase I) / B (phase II) / A (phase III). Processing stages: 1 (I) AL ▲ ↕ ?; 2 (II) BR ▲ ↕ ?; 3 (II) BL ▼ ↓ ?; 4 (II) BL ▼ ↓ ?; 5 (II) BR ▲ ↕ ?; 6 (III) AR ▼ ↕ ? I, II, III — phases of artefact shaping; 1—6 — stages of artefact shaping; A, B — artefact planes; L, R — artefact edges; ▲ ▼ — position of the point of convergence of the artefact edges; ↕ ↓? — the direction of the sequence of removals

thic cave site in Chervona Balka that faces North and is located at the very gully's head.

Yu. H. Kolosov discovered the site in 1969. In 1974—1975 and 1977, Zaskelna IX was explored by the Crimean Palaeolithic expedition (Колосов 1983). In total, the area of about 15 m^2 was investigated. Small scale excavation of the site was carried out in 2005. According to the stratigraphic features of the sediment column, the significant water content of the karst cavity of Zaskelna IX is reconstructed for ancient times. The results of the research in 2005 confirmed the presence of an underground watercourse in the cavity of the site (Степанчук та ін. 2006).

During the works of 1970's, the method of excavation by horizontal tunnel was used. Zaskelna IX was interpreted as a two-layered site. Yu. H. Kolosov recognized the finds referred to as the upper layer in a pack of sediments ranging between 20 cm from the day surface to a depth of about 1 m. This pack contained several artefacts and a few small and massive animal bones, separate teeth of predators and rodents. Flint artefacts are represented by blades and five bladelets with blunted edges presenting Graverttian points. It is not excluded that the finds of the upper layer may be the remains of a short-term Gravettian site washed away from the plateau's surface. Its possible age is indicated by radiocarbon dates by 26700 ± 200 (Ki-11682), and 25600 ± 200 (Ki-11678) BP obtained due to bone samples (Степанчук 2006). The faunal assemblage of the layer could be the result of human activity. It could also be the prey of small predators and birds of prey, which periodically used the niche of the rock fissure as a refuge.

Accordingly, to Yu. H. Kolosov's data, the lower cultural layer began at a depth of 1,5 m. Huge limestone blocks underlaid the clayey sediments with narrow gaps and small voids between them. These blocks represent a likely rock bottom of the karst cavity. Flint artefacts and bone remains of large, medium and small mammals are found in the layer, among which there were several small burnt fragments of tubular bones (Колосов 1983). The collection contains the quantitatively predominant saiga, primitive bison, reindeer, horse, mammoth (presented only by pieces of teeth) and other animals (Колосов 1983; Журавлев 2015). The absence of hearths recorded by excavations, lack of any signs of ancient surface, signatures of periodical watering, and a small number of stone artefacts of the second cultural horizon indicate this site's short-term nature.

Geochronological position. The lower layer of the site has no direct indication of the chronological position, although the remains were found in

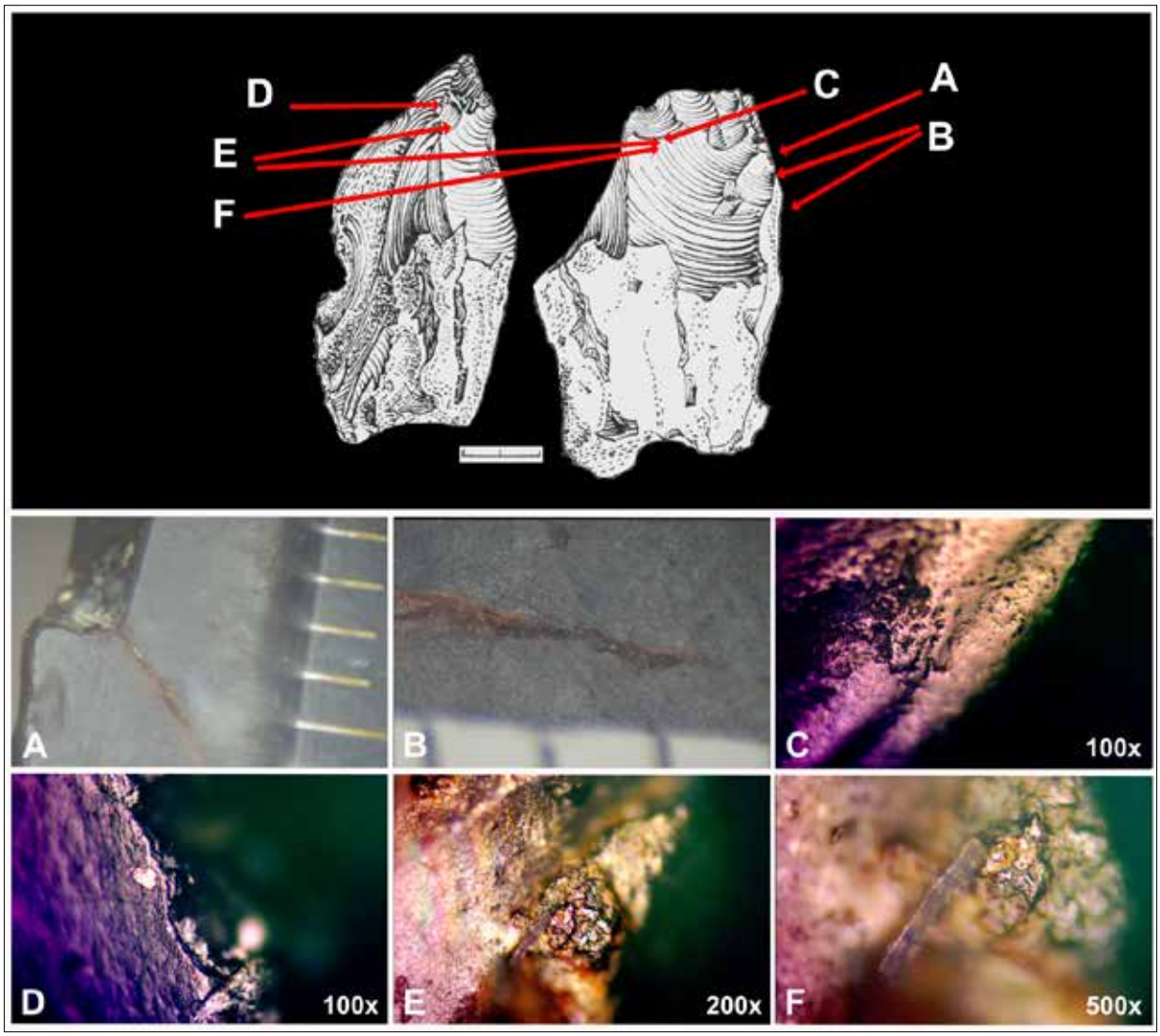

Fig. 4. Stone artefact 2. Zaskelna IX. The points of observation are marked with letters. *A, B* — crack filled with ocher; *C, D* — bright spot with groove (top and side view); *E, F* — the content of the filling groove — dark grey ochre pigments and organic residues

a stratigraphic context. Absolute dates are also not available. Traditionally, the age of the site is correlated with the last interglacial. Geomorphological data are of interest. The site is located at the head of Chervona Balka. To judge by the common regularities of gully formation, rock shelters suitable for settlement first appear at the mouth, then middle parts of gullies, and lastly, at their heads. In this case, Zaskelna IX, located at the very head of the gully, should be, at least, of the same age as other Middle Palaeolithic sites discovered in Chervona Balka. However, the lower layer of Zaskelna IX industry is more archaic than the materials found even in the lowest layers of Zaskelna V and VI in the upper tier of rock shelters or the lower buried level of rock shelters (Alioshyn grotto). The discrepancy is explained by the fact that the gully *«... had began to be settled not from the mouth or middle parts ... but from its upper reaches»* (Колосов 1983). This hypothesis is based on the O. Kliukin version of Chervona Balka formation in the Middle Quaternary period and its stabilisation as a result of the interception of the gully runoff during the Mousterian period (Клюкін, Колосов 1978).

An alternative version of the gully formation has recently been proposed: its appearance is explained by the development of hypogenetic karst (Климчук и др. 2013). According to this version, the cavities were formed directly in the limestone massif. Their opening occurred almost simultaneously along the entire length of the gully somewhere in the Late Pleistocene. This explanation is in good agreement with the young (post-Riss-Wurmian) age and the currently argued synchronicity of the settlement stages of all known Neanderthal sites in the Ak-Kaia area. The network of underground cavities

inside the limestone massive could start with ponor, which is a place where a surface stream flowed underground into karst in the area of Zaskelna IX. It can also be assumed that initially, the site was not a cave or rock shelter situated in the gully, but a location on a plateau in a suffusion depression near the mentioned ponor. In this case, the chronology of the lower layer of Zaskelna IX may well essentially precede the time of formation of the gully itself.

Stone industry of the lower layer of Zaskelna IX

Raw materials. Light-grey, grey, grey-brown, dark grey varieties of fine-grained, high-quality flint of the Turonian Cretaceous deposits were used as raw materials to manufacture the artefacts. Most of the artefacts have a chalk crust, sometimes eroded, sometimes fresh and brittle. In terms of colour, nature of the crust, features of inclusions, and the nature of zonation, the flint raw materials generally correspond to samples originating from local outcrops (Рыжов, Левчук 2018). There are exceptions: an item made of light grey flint with layered light-coloured zonation and an item made of light grey inhomogeneous flint. Such raw materials are more typical for the sites of the South-Western Crimea, in particular for the Bodrak River valley. The raw material of flakes generally corresponds to the raw material of heavy tools, and the exceptions are two Levallois flakes and a chopper-core. Thus, we can assume that assemblage includes several items from a mobile set of artefacts. In contrast, the predominant portion of artefacts are manufactured on pebbles and flint plates procured from the nearby deposits remoted at a distance of up to 5 km from the site.

As a potential source of pigments, the inhabitants of the lower layer of Zaskelna IX could use ochre concretions from Paleogene deposits, which are still observed at a small depth from the surface on the northeastern erosional slopes of the upper Ak-Kaia plateau, about 5 km from Chervona Balka. Another possible supplier of pigments is erosion processes, in the course of which the hydroxides and iron oxides are washed off the upper plateau and enter the karst cavities. Therefore, a source for pigments might be at one-step accessibility in the form of iron inflows or limonite pseudomorphoses (Бойко 2015).

Taphonomy. The physical preservation of the flint artefacts surfaces in the collection is quite good, which indicates their rapid burying. As a rule, the stone artefacts are not rolled or patinated, except for the only micro-flake. More intensive surface erosion is typical for two flakes from light grey flint and the chopper-core. The stone artefacts of the lower layer seem not to be relocated for a considerable distance, but, at the same time, the lithic as-

Table 1. **Typological structure of the lithic assemblage of the lower layer of Zaskelna IX, according to Yu. H. Kolosov (Колосов 1983) and the authors' definitions**

Typological definition	After: Колосов 1983	The study of 2019
Pre-cores	1	—
Flint fragments	—	14
Massive splinters	—	4
Flakes	67	28
Including *'knife-like blades' or bladey flakes*	6	—
Including *citron*	1	1
Levallois points	2	2
Single straight side-scrapers	1	2
Convergent side-scrapers	1	—
Chisel-like tools	1	1
Backed knives	2	—
Bifacial tools	10	10
Including *handaxe-like knives with a handle*	2	2
Including *handaxe-like knives with a back*	1	1
Including *handaxes*	2	2
Including *chopping and cutting tools*	1	1
Including *choppers*	2	2
Core-like choppers	—	1
Spearheads	1	1
Fragments of bifacial items	4	—
Total	90	60

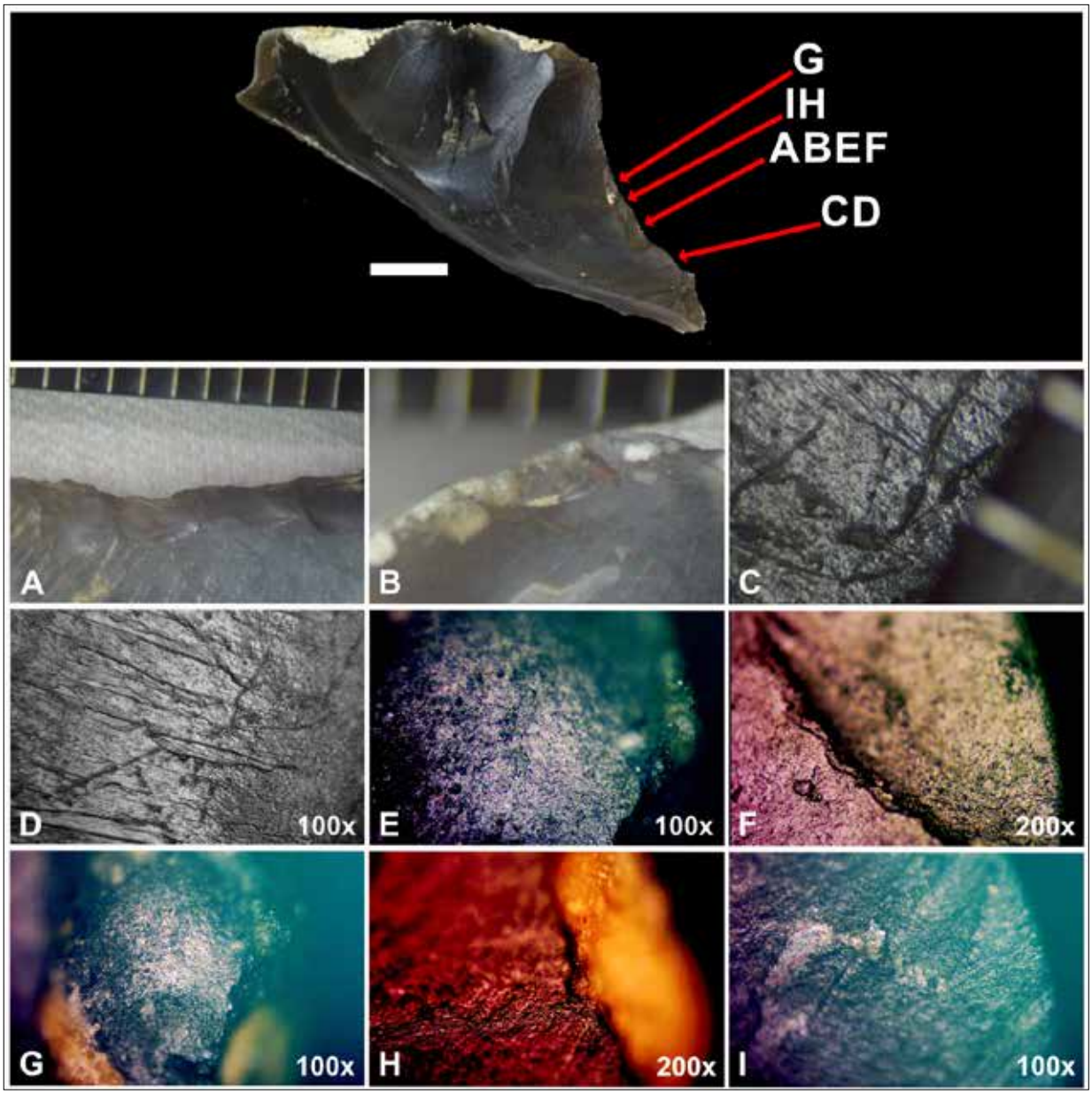

Fig. 5. Stone artefact 3. Zaskelna IX. *A, B* — microcracks filled with ochre and adhesive mass of light grey colour on the retouched edge; *C, D* — longitudinal and oblique striations from contact with hard material; *E, G, I* — isolated bright spots on the area of the edge damage; *G, H* — pasty residues of red pigments

semblage is incomplete. The infrequency of small-sized stone artefacts indicates either the washing out of the small fraction or, less likely, its loss during excavations. Some artefacts in the collection of the lower layer of the site have features that can be interpreted as natural fractures. They may relate to the conditions of cultural remains displacement as a result of the partial collapse of the suffusion depression in which the site was initially located.

Typological structure. According to Yu. H. Kolosov, the assemblage of the lower layer of Zaskelna IX includes 89 mainly light grey and black and isolated pink flint artefacts and a fragment of a slate plate (Table 1). Most of the tools are bifacial; among them, hand-axe like backed knives prevail. Our and Kolosov's typological definitions are principally well agreed, save for the one significant exception. It concerns the artefact that Yu. H. Kolosov defined as a core, while we define it as a chopper-core or core-like chopper. According to Yu. H. Kolosov (Колосов 1983), the amount of tools in the complex of the lower layer of Zaskelna IX is 28 %. Our examination reveals that the assemblage have no signs of on-the-spot core knapping; there are only waste-flakes from tool reshaping and sharpening and damage (fig. 2). Some tools were also reshaped directly at the site, as witnessed by a few refittings (fig. 2: 2—3). Two massive chips with straight axes on presumably dis-

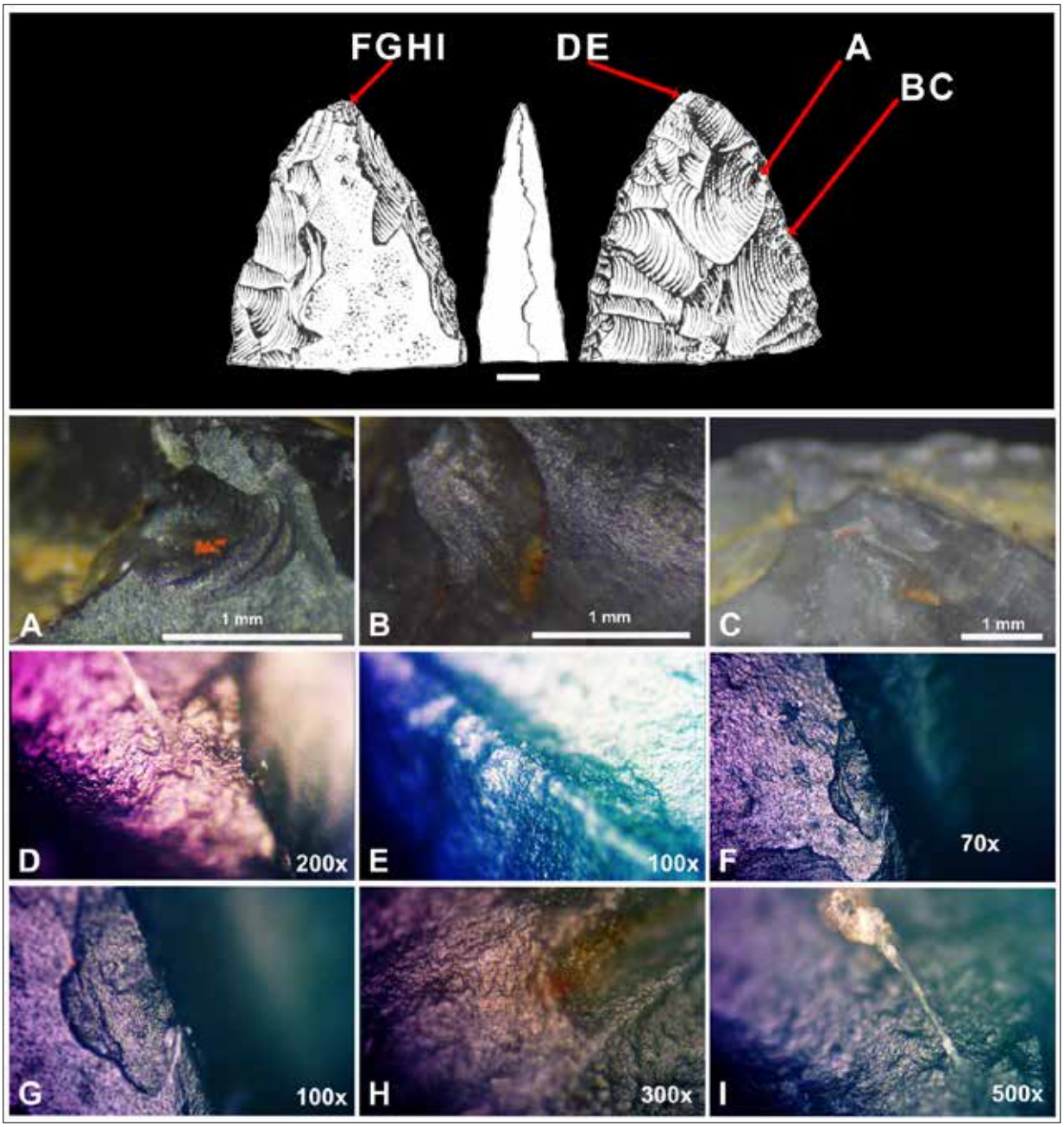

Fig. 6. Stone artefact 4. Zaskelna IX. *A—C* — pigment residues; *D* — organic residues in the micro-groove; *E* — perpendicular striations from contact with soft material; *F, G, H* — damage from the hafting; *I* — collagen residues (?)

tant raw materials document core usage with a bipolar scheme of work surface utilisation and roughly preparation of the striking platforms. Bifacial forms of the lower layer assemblage constitute 60 % of the total number of tools, according to Yu. H. Kolosov (Колосов 1983). The available flakes and chips demonstrate no correspondence to the available bifaces on their negatives' dimensionality and quantity. This evidence indicates the bifacial artefacts reached the site ready-made.

Attribution of the stone industry. For a long time, the industry of the lower layer of the site was referred to the earliest period of the Ak-Kaia Mousterian culture (Колосов 1983; Колосов, Степанчук, Чабай 1993). This interpretation is due to searching for the local origins of manufacturing tradition of backed bifacial tools. Numerous archaic features (hand-axes, choppers) of Zaskelna IX lower layer assemblage were explained by the specificity of the economy profile of the site, left by the bearers of the Micoquian Ak-Kaia industrial tradition. However, the recent reexamination of the assemblage showed that technologically the lower layer of Zaskelna IX has little in common with the Eastern European Micoquian, known in the

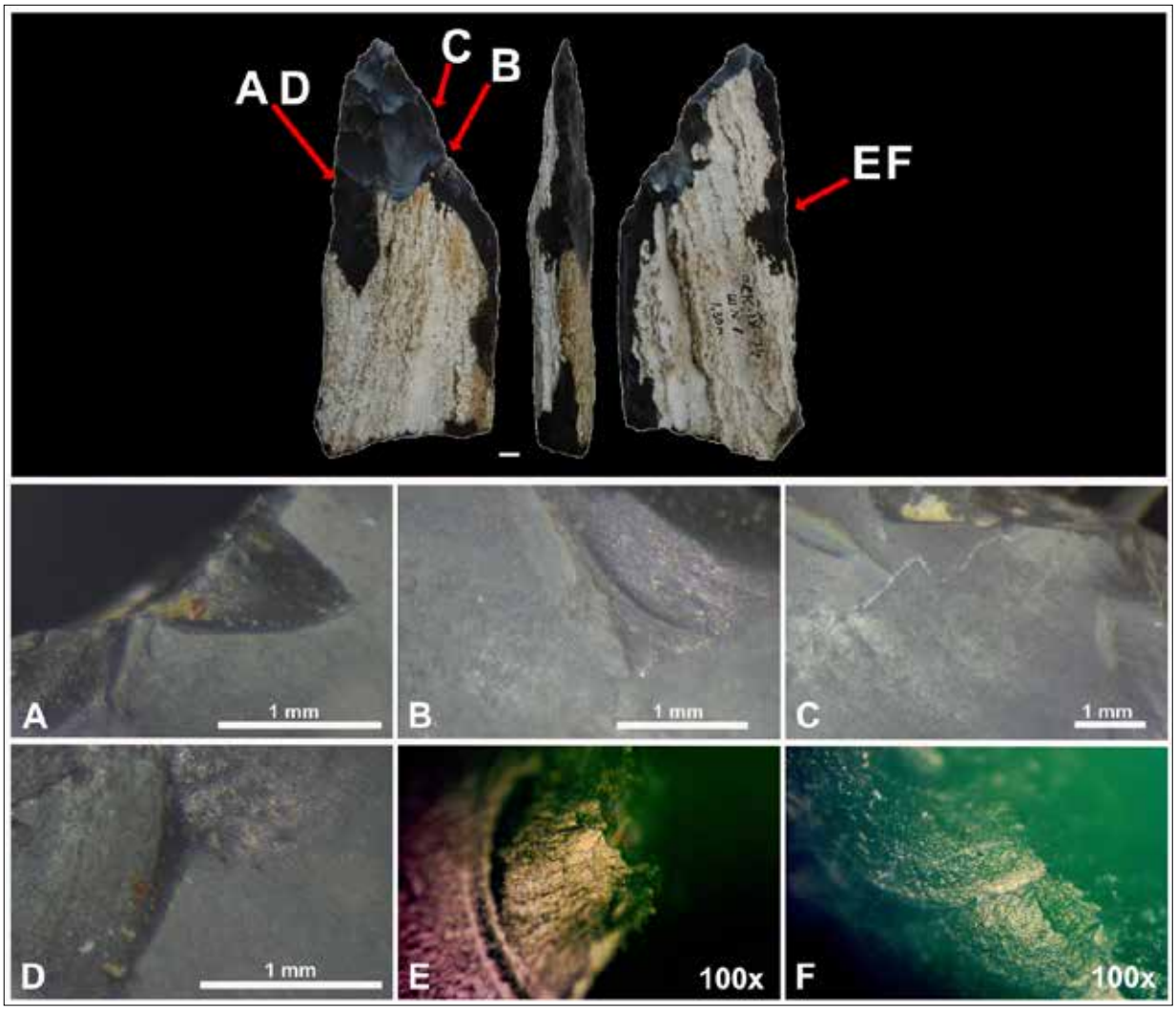

Fig. 7. Stone artefact 5. Zaskelna IX. *A—F* — pigment residues and traces of damage in the areas from the hafting

Crimea and elsewhere (Чабай 2018; Очередной 2011; Kot 2013). The sequential shaping of the surfaces of bifacial tools is most typical for the Micoquian tradition (Bosinski 1967; Joris 2006). Instead, a method of sequential processing of edges was used at Zaskelna IX, additionally accompanied by turning the tool surfaces and their rotation by 180° in a plane (fig. 3). In contrast to the stone assemblages of even the oldest Micoquain layers of Zaskelna group of sites, the bifacial artefacts of Zaskelna IX show surfaces roughly shaped by large removals produced exclusively by a hard hammerstone. There is no regular retouching along the working edges, and some artefacts show signs of using the bipolar technique for manufacturing and reshaping. The assemblage of the lower layer of Zaskelna IX contains archaic types, namely hand-axes and choppers. The archaic typological and technological features attribute the lower layer's assemblage to the Acheulean (Stepanchuk, Nezdolii 2018; Stepanchuk, Ryzhov, Nezdolii 2019). Dated analogies in remote areas (Doronichev, Golovanova 2003; Moncel, Schreve 2016) suggest that the age of the discussed materials may be at least 300—200 ky.

The series of stone artefacts involved in the study. For the residual analysis, we selected 15 stone artefacts from the lower layer excavations in 1974—1977. Pigment residues were found on eight stone artefacts (Table 2; fig. 4—11).

The artefacts showed traces of encryption using ink and glue and signs of easy cleaning after excavations on visual inspection. The surfaces preserve limestone-carbonate spots and remnants of detrital sand. At low magnification, areas with a light blue patina are visible under the microscope. The microrelief of the scar negatives of bifacial artefacts is plane and uniformly displayed under different lighting angles. The edge areas with signs of wear in the shape of scars and micro-scars have varying degrees of gloss and surface roughness due to the contact with different materials. Striation, edge-dam-

Table 2. **Stone artefacts of Zaskelna IX, for which micro-residue analysis was carried out**

Artefact, No.	Inventory No.	Presence of pigments	Depth, cm	Length, mm	Width, mm	Thickness, mm	Weight, g	Index of Invasiveness ***
1	Зск. IX-74, шурф 1		95—125	106	65	31	293	0,5
2	Зск. IX-74, шурф 1, П1	+		110,2	63,8	47,1	321	0,42
3	Зск. IX-74	+		11	54	20	12	
4	Зск. IX-75, сл. 2, № 39	+	125—130	64,7	56,6	20,9	69	0,85
5	Зск. IX-74, шурф 1	+	138	193	81	34	609	0,67
6	Зск. IX-74, шурф 1	+	95—125	179	80	30	448	0,63
7	Зск. IX-75, сл. 2	+	131	154	70	41	475	0,57
8	Зск. IX-75, № 56		160—225	57	84	677	402	
9	Зск. IX-74, шурф 1, прирізка		115—180	103	57	21	152	
10	Зск. IX-75	+	102 (?)	178	62	32	348	0,81
11	Зск. IX-74		125	22	44	60	27	
12	Зск. IX-75		198	140	57	38	297	0,93
13	Зск. IX-75, прирізка		115—180	99	65	18	133	
14	Зск. IX-74, шурф 1	+	135—180	95	47	13	49	
15	Зск. IX-75, сл. 2, № 36		125—180	67	35	12	28	

*** After: Clarkson 2002

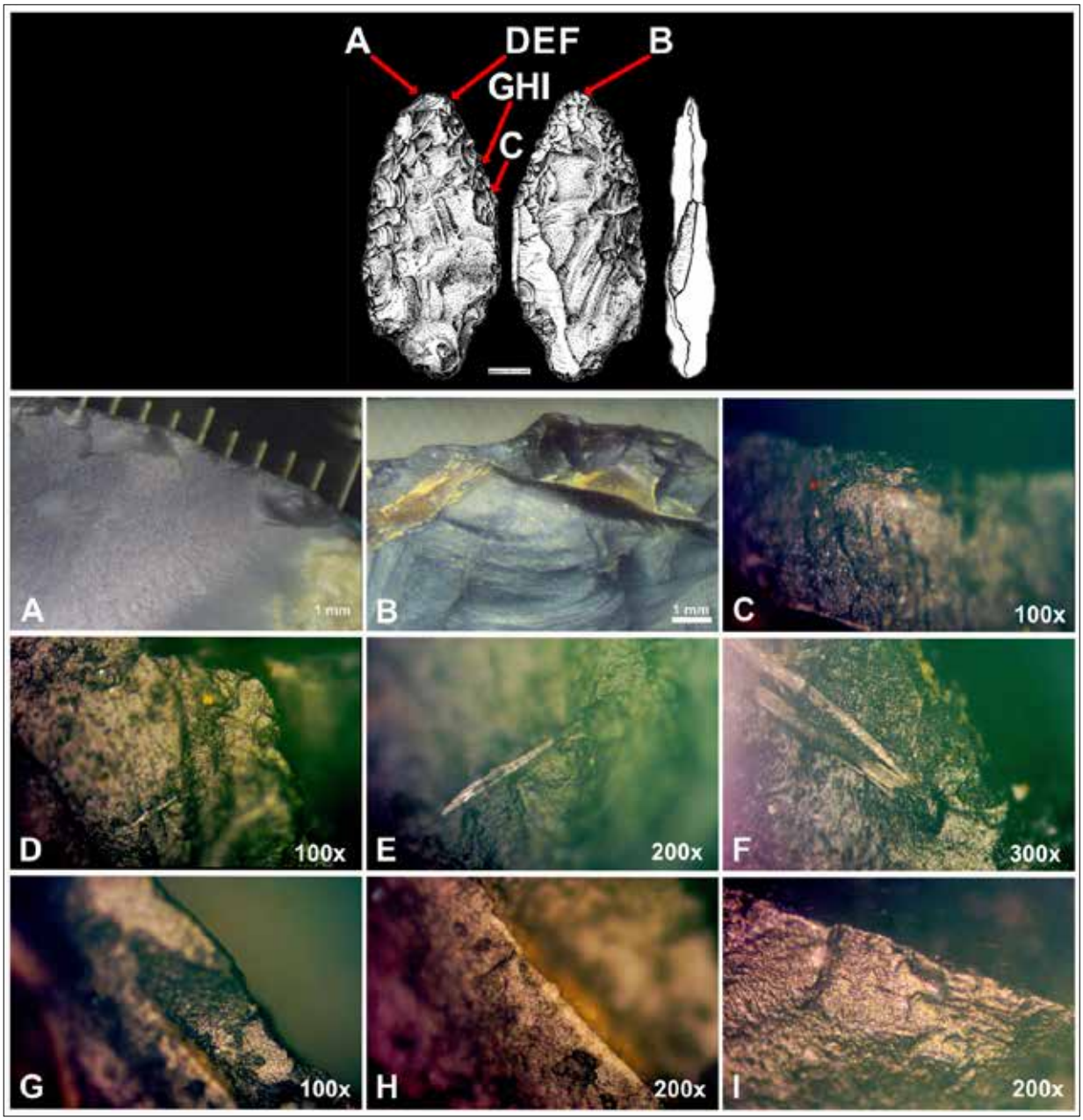

Fig. 8. Stone artefact 6. Zaskelna IX. *A—C* — edge damages are associated with contact from hard to soft materials; *B* — dark grey pigments; *D—F* — residues of organic material; *G—I* — damages are associated with contact of medium soft material

age, edge-rounding and bright spots were observed in some areas of flint tools. Nodules, drops, flaws formed of various non-siliceous materials are determined on the surfaces of edges with signs of wear.

Lithic artefacts and fauna remains are stored at the Institute of Archaeology of the National Academy of Sciences of Ukraine.

Methods

To examine the surface of artefacts, we used a Wraymer LW-820T binocular stereoscopic microscope. The total magnification ranges between 6.7 to 45 x; the eyepiece field of view is 22 mm. A Nikon D 3200 camera with a SA 20 microscope adapter with 2 x magnification was used for photography. For more than 100-fold magnification, an XJL-101a-Ulab metallographic microscope with replaceable revolving heads was used. The maximum magnification constitutes up to 1000 x.

Results

In the process of studying macro- and micro-traces of usage on stone artefacts from the lower layer of Zaskelna IX, traces of damage and destruction, as

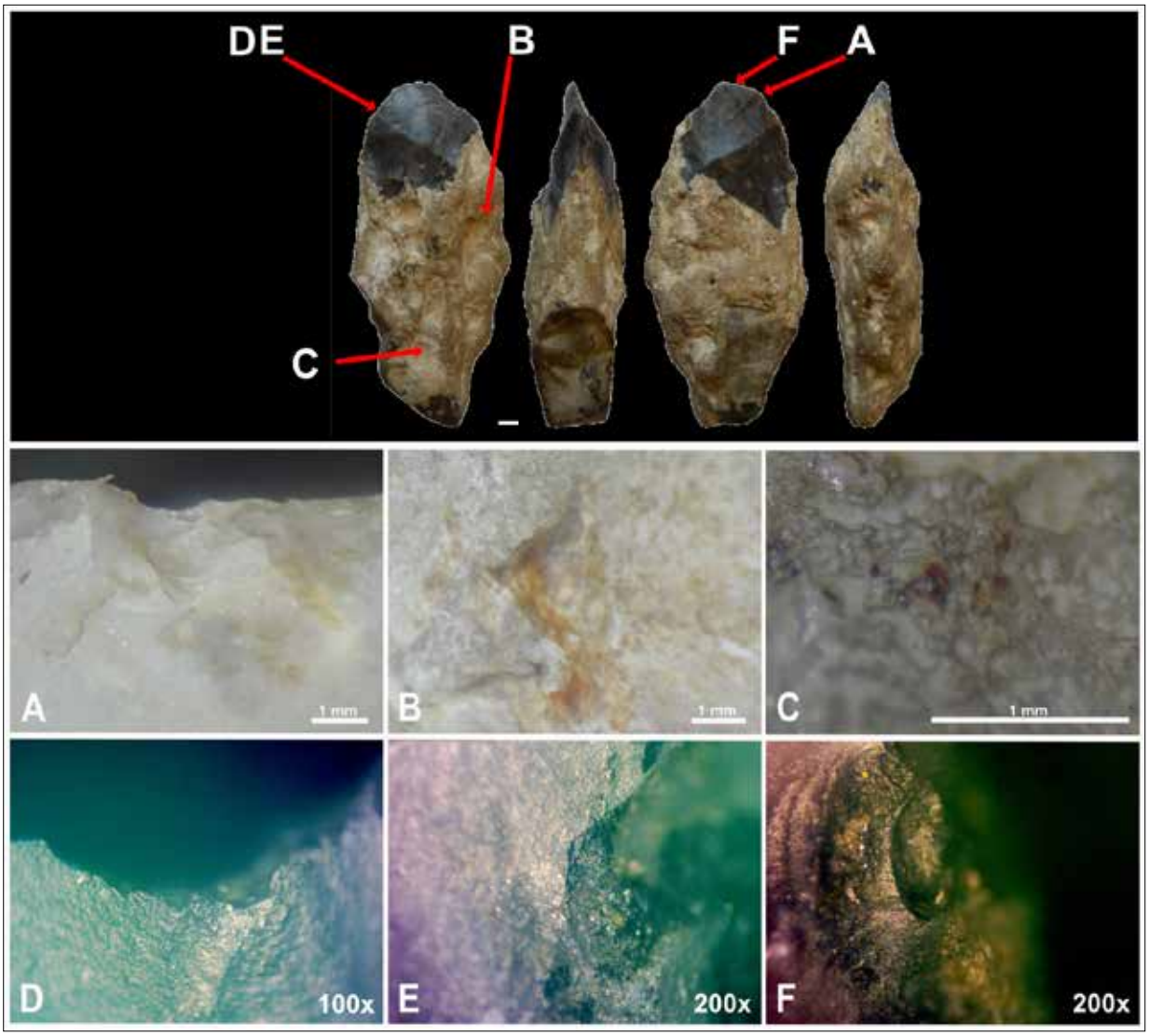

Fig. 9. Stone artefact 7. Zaskelna IX. *A, B* — residues of light grey pigments; *D* — diagonal polishing on the edge damage; *E, F* — residues of dark grey pigments approaching black

well as remnants of organic and mineral pigments of different colours, as well as probable remains of plant origin, were detected.

Evidence of edge damage and breakage. There are two varieties of this kind of macro- and microwear traces. The first variety is associated with the edge damages that appeared during intense contact with hard, sometimes medium-hard, and rarely soft material. Irregularly stepped, half-moon scars and scars with feather termination with low or medium degrees of edge damages rounding are found. They are mainly located at the point of convergence of the left and right edges both on convex and straight areas. Perpendicular and diagonal striations and rough polishing are observed, which can be associated with cutting and chopping operations in the disassembly of animal carcasses. Another variety of wear traced on the main surfaces and peripheral ends of artefacts indicate a different cause of damages. There are longitudinal striations and shiny light polishing (bright spots) in the distal and medial parts of the artefacts, on ridges between negatives and along the artefacts' edges. The latter are blunted due to abrasion and damage.

Residues of pigments. As a rule, outside the zones that were showing the wear damage, which occurred during the work, the remnants of organic and mineral composition pigments were recorded under magnification in different parts of the artefacts. By colour, the detected pigments are divided into three groups: red with light and dark shades, light grey with yellow and green hues, and dark grey to black. The variously coloured and mainly presented in spot-like form, the residues also differ in density and structure. The first group consisted of conditionally «red» pigments with a fragile base containing quartz impurities in the mi-

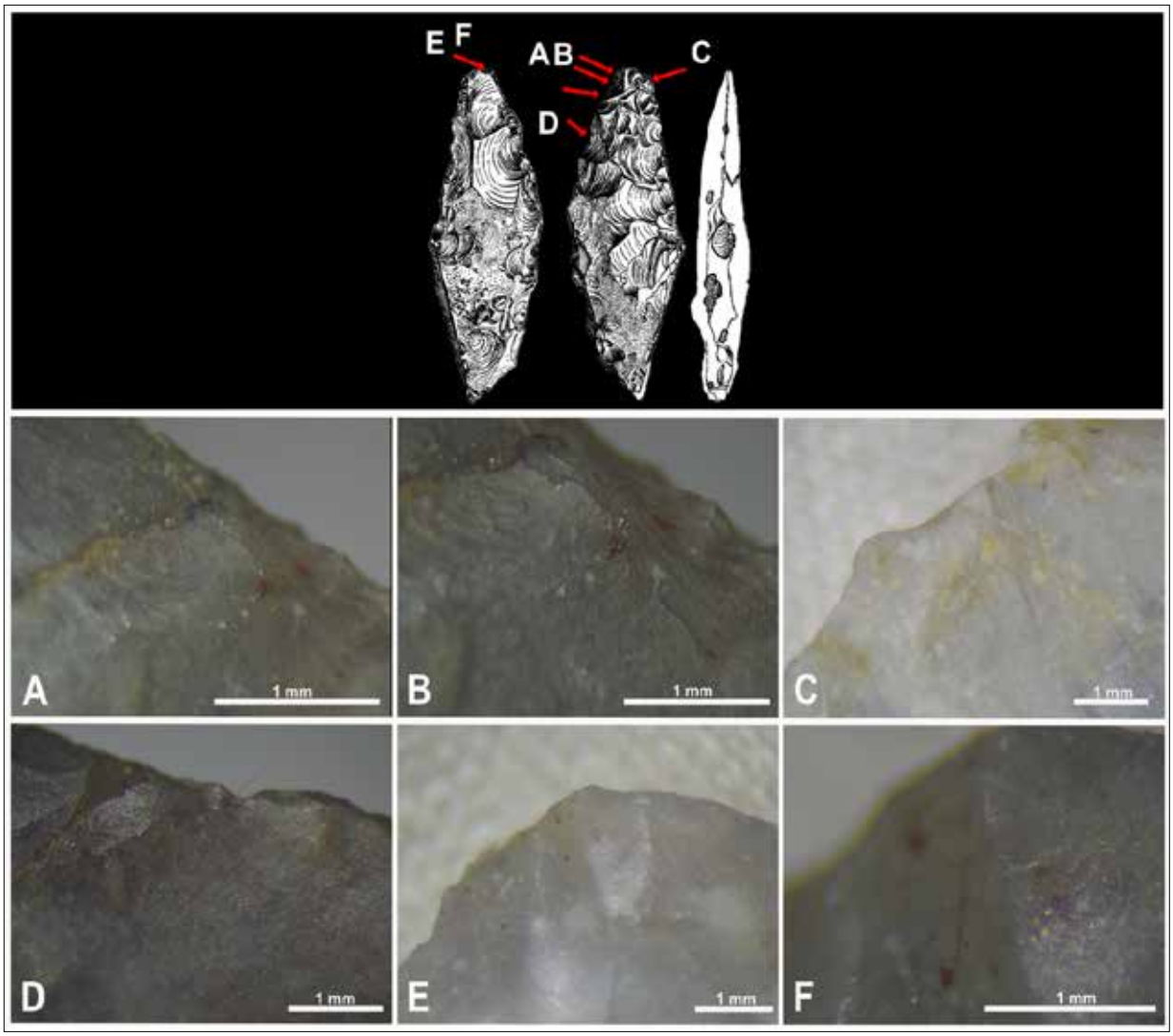

Fig. 10. Stone artefact 10. Zaskelna IX. *A—C* — residues of pasty light grey and red pigments

crostructure, traced at a magnification of 10 to 90 x. The quartz grain diameter is less than 0.1 to 0.5 mm. There are transparent with glare and opaque yellowish oval grains of quartz, and when trying to tear them off the surface, they break up into tiny elongated lamellar parts. Under a magnification of up to 200 x, the reflecting light dark grey to almost black rounded droplets are observed (fig. 4: c—f; 5: f; 8: g; 9: e; 11: a, b, d).

Residues of the second group, namely light grey pigments with yellow and green hues, are characterised by a pasty base of organic origin. The structure is pasty and translucent with glare. In pigments, from time to time, elongated and oval with a reddish colour are traced from separate spots of light and dark shades. Often red dots of the first type are attached to them. As a rule, they are located on the top of these spots (fig. 6: b, c; 7: a; 8: b; 9: b; 10: a—c; 11: e). Along the periphery, the spots smoothly transit to the surface of the flint artefact. Depending on the location and structure of the flint material, the transition zones are also traced in microcracks and cavities (fig. 5: a, b; 6: b, c; 9: a—c; 10: a; 11: c, e, f).

The third group includes dark grey, amorphous, often spotted pigments. At the periphery, these resinous spots have sharp contacts into the primary siliceous material of the artefact. When trying to tear them off the surface, they break up into small fragments with smooth edges (fig. 4: c—f; 8: c, g; 9: e, f).

Remains of probable plant origin. During the research, the remains of organic materials were recorded, which requires more detailed further research. In particular, on artefact 6 (fig. 8), fragments of plant origin (tree ?) were revealed, according to preliminary estimates. Fragments were found in the locations with scaring fractures of the biface. Use-wear, morphology and topography of the section indicate contact with hard organic

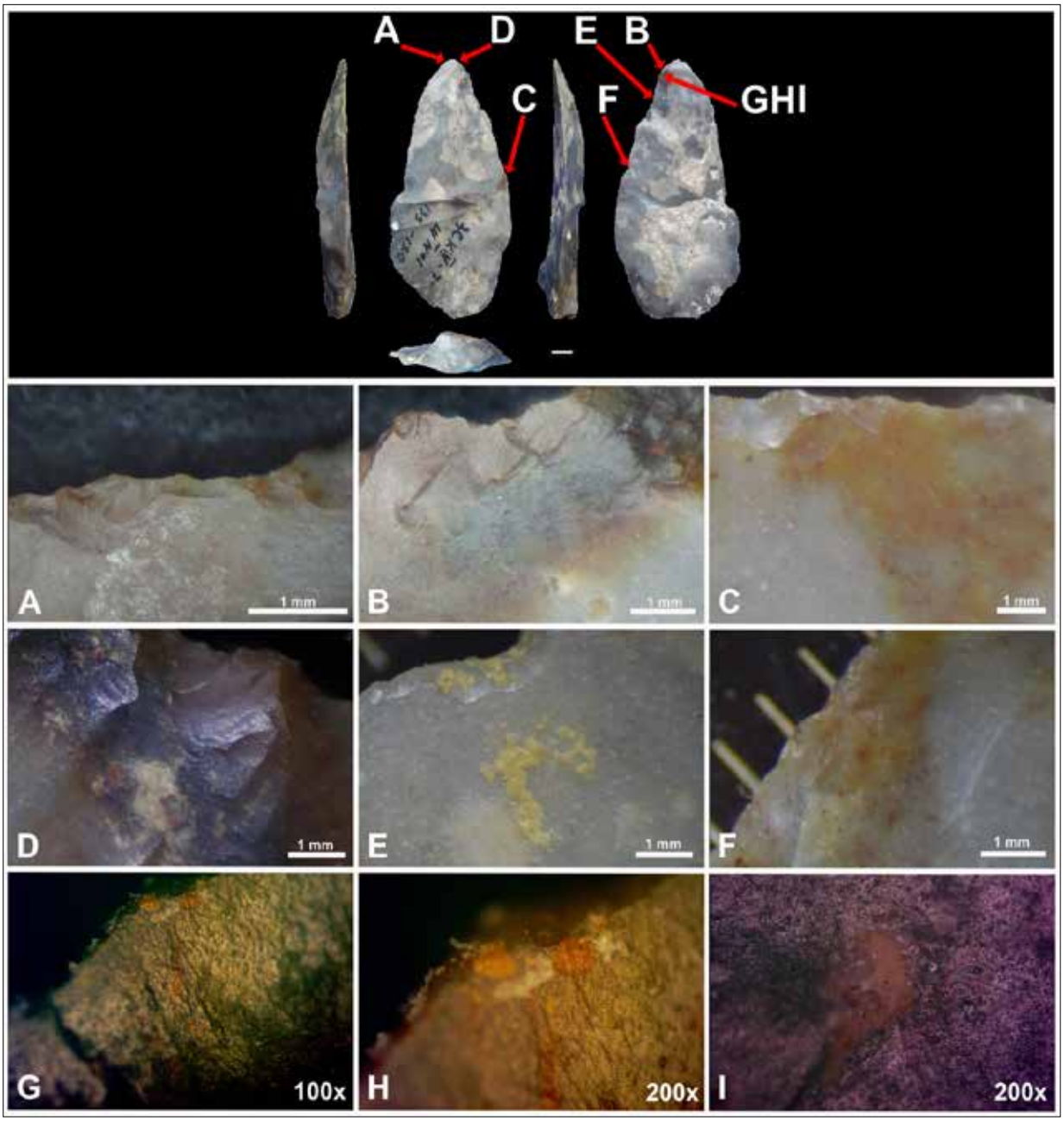

Fig. 11. Stone artefact 14. Zaskelna IX. Residues of pigments of the main types. *A—C, F, G—I* — red with light and yellow shades; *D* — dark grey to black formation on a background of light grey with yellow hues; *E* — light grey with yellow and green hues

material. Small-diameter bright spots, separation grooves and ridges (fig. 8: c, d, g, i). In the distal part of the artefact 3, a comparatively large collagen spot of unknown origin was found (fig. 6: d, i). The presented biface fragment contains evidence of pigments of the first and second groups (fig. 6: a, c). The use-wear and edge damage indicate contact with soft to medium-soft material, like tissues of plant and animal origin. The third group includes dark grey, amorphous, often spotted pigments. At the periphery, these resinous spots have sharp contacts with the primary siliceous material of the artefact. When trying to tear them off the surface, they break up into small fragments with smooth edges (fig. 4: e, f; 8: d, g; 9: e, f).

Discussion

Ochre spots of the first and second groups gravitating to the periphery of the marginal areas of the siliceous surface of stone tools are often mixed and include impurities of dark grey spots referred to the third group. On other surfaces, particularly carbonate areas, the artefacts demonstrate bright spots and striation, sometimes possessing lustre. In the areas of well-detected microwear traces (striation,

smooth stretches, grooves) and the depressions of the relief of the artefacts (fig. 6: d, h; 9: b—f; 11: g, h), these pigments often have a marked light yellow and reddish hue. Dark grey and yellow spots of likely resin are preferably confined to areas of polishing and areas with signs of high pressure appeared between the tool and the contact materials (fig. 4: c—f; 5: c, d; 11: a—c, f—i).

The study of the macro- and micro-patterns of marginal damage revealed a correlation between pigments of different types and specific types of damage. Some areas of the marginal zones of the tools have multiple overlapping scars, characterised by step and hinge terminations of a rounded proximal edge. We believe the microrelief of scar negatives, and their morphology indicate contact with a handle. The correlation between the damages and pigments can be explained by the possible usage of organic substances and glue when fixing a soft handle made of leather or plant to a stone tool (fig. 4: a—f; 5: c—i; 6: d—h; 7: a—f; 9: b—f; 11: a—i).

The above suggestions are supported by the fact that some areas of the studied stone artefacts indicate intense continuous pressure. These areas are characterised by extended microcracks localised along the pressure line and contain the ochre material (fig. 4: a, b).

The microfractures in some areas have extensions in the shape of triangular and wedge-shaped bound (sliced) scars with small bright spots and signs of contact with soft and medium-soft material (fig. 4: c—f; 5: e—i; 6: d, e, h, i; 8: c—i; 9: d), as well as with hard material (fig. 5: c, d).

Conclusions

A sample of fifteen flint tools from the lower layer of Zaskelna IX site was subjected to micro-residue and use-wear analysis for the first time. According to the techno-typological features, the lower layer of Zaskelna IX can not be referred to the Micoquian of Ak-Kaia type and instead belongs to the Acheulean. The exact chronological position of the layer is currently unknown; the probable age of the assemblage is estimated on the ground of techno-typological features as at least 300—200 ky. The features of the raw materials suggest the presence of several items from a mobile set of tools and a series of similar artefacts on pebbles and flint tiles from nearby deposits, away from the site's location at a distance of up to 5 km. The stone tools were brought to the site in finished shape, however, some of them had been repaired at the site. The pigments could be derived from outcrops accessible up to 2 km away.

According to the preliminary study results, most of the analysed bifacial artefacts from the lower layer of Zaskelna IX demonstrate signs of being used as cutting tools for soft and hard organic materials, presumably for the butchering of animal carcasses.

Residual of organic and mineral origin were recorded in different areas of the surface of stone artefacts, usually outside the area of butchering wear. Red, light yellow and dark grey pigments were recorded on eight items. Organic substances were found on two artefacts, further study of which requires additional types of analysis. Pigment location pattern and the relationship between them and different kinds of use-wear suggest that the ochre was used at Zaskelna IX site as a paste component for holding tools in a handle or hafting leather or plant wrappers on stone tools. A protective wrap or pad is the simplest and probably the earliest invented handle (Barham 2013). Archaeological, experimental and ethnographic analogies of such protecting accommodations are widely reported (Wadley, Williamson, Lombard 2004; Wadley 2005; Wadley, Hodgskiss, Grant 2009; Rots, Van Peer, Vermeersch 2011).

These are the so-called soft handles. The stone tools equipped with this kind of accommodation during work, for instance, butchering, were not held in bare hands, and its non-cutting part was wrapped in a piece of leather and bandaged. For a tighter fixation, such a soft handle could be additionally attached to the tool's surface using adhesives such as resin. Adhesive mixtures could contain natural pigments.

The suggested evidence of using soft handles during the late Acheulean is of particular interest. The possible usage of sophisticated technology in the lower layer of Zaskelna IX involving the manufacture of special fastening adhesives containing ochre powder, expands our understanding of ancient technologies and life support strategies. The conducted pilot residual analysis demonstrates the great potential of micro-studies of materials from the Crimean Palaeolithic sites.

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МІКРОЗАЛИШКОВИЙ АНАЛІЗ КАМ'ЯНИХ ЗНАРЯДЬ СТОЯНКИ ЗАСКЕЛЬНА IX У КРИМУ: ПЕРШІ РЕЗУЛЬТАТИ

Стаття присвячена результатам дослідження поверхонь кам'яних артефактів нижнього шару стоянки Заскельна IX у Криму.

Тривалий час комплекс нижнього шару стоянки відносили до раннього етапу аккайської мустьєрської культури, не старіше останнього міжльодовиків'я плейстоцену. Однак нова ревізія техніко-типологічних ознак колекції знахідок дозволяє віднести матеріали нижнього шару стоянки до ашельського часу. На відміну від матеріалів навіть найдавніших шарів аккайської мустьєрської культури, кам'яні артефакти стоянки Заскельна IX не мають яскраво вираженого традиційного мікокського характеру двобічної обробки знарядь. Оформлення кам'яних знарядь здійснювалося методом прямого удару з використанням твердих відбійників. Набір знарядь включає ручні рубила, чопери і долотоподібні вироби.

Для дослідження мікрозалишків було відібрано 15 кам'яних артефактів: двосторонні знаряддя, відщепи, нуклеподібний чопер. Під час дослідження були виявлені макро- і мікросліди використання, ознаки пошкодження та руйнування країв артефактів. На восьми кам'яних виробах виявлені мікрозалишки різнокольорових пігментів органічного й мінерального складу.

Мікрозалишки органічного й мінерального походження були зафіксовані на різних ділянках поверхонь артефактів, як правило, поза зоною пошкоджень, що виникли в процесі використання. Кореляція розташування залишків пігментів із пошкодженнями зносу дозволяє припустити, що вохра, імовірно, використовувалася на стоянці Заскельна IX (нижній шар) як компонент клею для фіксації в руків'ях або для фіксації за допомогою м'якої накладки органічного походження.

Перші вказівки на ймовірне використання в нижньому шарі Заскельної IX складної технології, що включає виготовлення спеціальних клеїв для затиску кам'яних знарядь, до складу яких входив порошок вохри, розширюють наші уявлення про стародавні поведінкові технології і стратегії виживання.

К л ю ч о в і с л о в а: залишковий аналіз, мікрорештки, пігменти, м'яке руків'я, палеоліт, ашель, Крим, Східна Європа.

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МИКРООСТАТОЧНЫЙ АНАЛИЗ КАМЕННЫХ ОРУДИЙ СТОЯНКИ ЗАСКАЛЬНАЯ IX В КРЫМУ: ПЕРВЫЕ РЕЗУЛЬТАТЫ

Статья посвящена результатам исследования поверхностей каменных артефактов нижнего слоя стоянки Заскальная IX в Крыму.

Долгое время комплекс нижнего слоя стоянки относили к раннему этапу аккайской мустьерской культуры не старше последнего межледниковья плейстоцена. Однако новая ревизия технико-типологических признаков позволяет удревнить возраст материалов и отнести нижний слой стоянки к ашельскому времени. В отличие от материалов даже самых древних слоев аккайской мустьерской культуры, каменные артефакты стоянки Заскальная IX не имеют ярко выраженного традиционного микокского характера двусторонней обработки орудий. Оформление орудий осуществлялось методом прямого удара с использованием твердых отбойников. Орудийный набор включает ручные рубила, чопперы и долотовидные изделия.

Для исследования микроостатков было отобрано 15 каменных артефактов: двусторонние орудия, отщепы, нуклевидный чоппер. В ходе исследования были выявлены макро- и микроследы использования, признаки повреждения и

разрушения кромок артефактов. На восьми каменных изделиях обнаружены микроостатки разноцветных пигментов органического и минерального состава, а также возможные остатки растительного происхождения.

Микроостатки органического и минерального происхождения были зафиксированы на разных участках поверхности артефактов, как правило, вне зоны повреждений, возникших в процессе использования. Корреляция расположения остатков пигментов с повреждениями износа позволяет предположить, что охра, вероятно, использовалась на стоянке Заскальная IX (нижний слой) как компонент клея для фиксации в рукояти или для фиксации при помощи мягкой накладки органического происхождения.

Первые указания на вероятное использование в нижнем слое Заскальная IX сложной технологии, включающей изготовление специальных крепежных клеев, в состав которых входил порошок охры, расширяют наши представления о древних поведенческих технологиях и стратегиях выживания.

К л ю ч е в ы е с л о в а: остаточный анализ, микроостатки, пигменты, мягкая рукоять, палеолит, ашель, Крым, Восточная Европа.

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