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REVIEW ARTICLE

The Lower Palaeolithic in Korolevo I (Transcarpathia, Ukraine, East-Central Europe): the earliest in Europe?

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Abstract. A recently published article in "Nature" (Garba et al., 2024) claims that lithic finds in the lowermost artefact-bearing sediments of lithological unit 26 at the Korolevo I site (Transcarpathia, Ukraine) are the oldest in Europe, dated to *ca*. 1.42 Ma with cosmogenic nuclides of gravel pebbles. These surprisingly old dates were then used to build hypotheses on the geochronology and routes of the initial Homo erectus colonization of Europe from the east. The present author reviews all published and unpublished Lower Palaeolithic (LP) data of the Korolevo I site, the field investigations of which he also participated in the 1980s, and came to the following negative results. The dated pebbles in Korolevo I unit 26 are of "intrusive" character, they do not date unit 26 and its lithic finds. Also, the proposed Early Pleistocene interglacial MIS 47, 45 and 43 periods for the LP colonization of Europe either via Asia Minor and the Danube River valley or the Caucasus and the southern part of Eastern Europe do not correspond to the known palaeogeographic and archaeological data from Western Eurasia. Besides, our review of LP contexts in Korolevo I suggests that the so-called lowermost LP lithic artefacts found in situ in archaeological horizon VII within lithological unit 26 in Korolevo I in 1984–1986 are distributed randomly horizontally and vertically. Moreover, they are mostly unworked hyalodacite and siliceous sandstone pieces together with several artefacts redeposited from the sediments above. Accordingly, the only certainly LP material in Korolevo I we know so far is situated in archaeological horizon VI, which is geochronologically associated with the Middle Pleistocene inter-Mindel period or MIS 14, dated to *ca*. 550 ka BP. However, the Korolevo I site still appears to represent the oldest LP human occupation in both Eastern Central Europe and Ukraine.

Keywords: Ukraine, Transcarpathia, Early Pleistocene, Lower Palaeolithic, Korolevo site complex

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The present paper is dedicated to the fiftieth anniversary (September 1974) of the discovery of the Korolevo Palaeolithic site complex by the outstanding researcher of the Palaeolithic of Ukraine, V.N. Gladilin (1935–2015)

"*Evidence of human presence and activity in Europe around or before 1 million years ago is still limited and controversial. At most of the sites, the uncertainties concern either stratigraphy and dating or the artefactual character of the objects. In fact, we never may be certain until we discover and document living surfaces with full contextual data about the past human behaviors*." (Svoboda *et al.*, 1998, p. 203)

1. Introduction

The Korolevo I site was discovered by Vladislav N. Gladilin (Demidenko, 2017) 50 years ago in September of 1974, in the Transcarpathian region of Ukraine which is the only Central European region of the geographically Eastern European

Fig. 1. Map of the Levant and Southern Europe with the location of Korolevo.

country (Fig. 1). Gladilin and his team from the Archaeological Museum of the Institute of Zoology, Ukrainian Academy of Sciences in Kyiv conducted large-scale archaeological investigations at the site every year between 1975 and 1991. Since then, Korolevo became widely known as a multi-period Palaeolithic site complex (e.g., Gladilin, 1989) with several *in situ* archaeological horizons in Quaternary sedimentary deposits up to a 12 m thickness, containing artefacts from the Lower Palaeolithic (LP) (e.g., Gladilin & Sitliviy, 1990) through the Middle Palaeolithic (MP) (e.g., Koulakovska, 1989) to the Early Upper Palaeolithic (UP) (e.g., Gladilin & Demidenko, 1989).

After the collapse of the Soviet Union, in the second half of the 1990s, L.V. Kulakovska and V.I. Usik[1] started regular Palaeolithic fieldwork in Transcarpathia. In contrast to Gladilin's approach who conducted intensive and systematic regional Palaeolithic studies in the context of the Central European Palaeolithic, these researchers mainly concentrated on Korolevo and a few other sites' stratigraphy and geochronology (e.g., Haesaerts & Koulakovska, 2006). They also investigated the integrity and characteristics of their lithic artefacts, mostly the Korolevo material excavated in the 1970s and 1980s (e.g., Koulakovskaya, 2004; Usik, 2003; 2008; Koulakovska & Usik, 2010). Reviewing the literature from the late 1990s to the 2010s, the Transcarpathian Palaeolithic can be seen as isolated and disconnected from contemporary sites and industries in neighbouring Central European regions. In the past 25 years, no papers were published in detail about any of the revised assemblages from Korolevo, or the newly excavated material from Beherove I, only strictly regional accounts (e.g., Koulakovska & Usik, 2011a; 2015; Usik *et al.*, 2004). One exception is the small assemblage of

1 For the sake of clarity, name varieties mentioned in the list of references as "Soldatenko, Koulakovska, Koulakovskaya" are all refer to L.V. Kulakovska, and "Usyk" to V.I. Usik.

33 lithics from Korolevo I horizon VII, the subject of the present paper. According to the published preliminary data from the 1980s and early 1990s, as well as more detailed papers from this century, the combined Palaeolithic industrial-geochronological sequence from Korolevo I and II spans from *ca*. 950 ka BP to *ca*. 40 ka BP. The sequence encompasses lithic industries from the LP to the Early UP, with the MP being the richest and best-represented among the archaeological horizons. Regarding the dating of the LP in Korolevo, the Korolevo I site was considered one of the oldest sites in both Central Europe and the entire European continent, dated to the "Günz" and "Günz-Mindel" periods, *ca*. 1.0–0.7 Ma (e.g., Gladilin & Sitliviy, 1990, pp. 128–129, 140–141).

The current Palaeolithic "island-like situation" in Transcarpathia was strengthened by the new dates of the lowermost LP artefact-bearing sediments in Korolevo I, *ca*. 1.42 Ma (Garba *et al.*, 2024). The newly received dates and their archaeological interpretation allowed our colleagues to conclude that "*Korolevo represents, to our knowledge, the earliest securely dated hominin presence in Europe*" (Garba *et al.*, 2024, p. 1). Accordingly, Korolevo is proposed to be the "first LP human island" in Europe, being an exceptional site. According to our present knowledge, Central European LP sites postdate the Early Pleistocene, so this is a strikingly early date. The known LP sites are almost two and a half times younger, not earlier than 0.6 Ma, and even that is still debated in the case of two presumably *in situ* Central European LP sites, based on their archaeological context, Přezletice and Stránská skála I in the Czech Republic (Valoch, 1995, pp. 69–70, 73–75; 2011, p. 12; Roebroeks & Kolfschoten, 1995, p. 304). Here we do not consider a few suggested LP loci with the presence of single lithic artefacts, e.g., the famous Quaternary sediment sequence at Červený kopec (Red Hill) in Brno (southern Moravia, Czech Republic) where allegedly "*a polyhedron was discovered in fossil soil PK X below the Matuyama/Brunhes palaeomagnetic boundary, i.e. approximately 0.8 m.y. old, and even older soil yielded a simple chopper (?)*" (Valoch, 2011, p. 22; see also Svoboda *et al.*, 1998). Such single finds without an industrial affinity cannot testify to an "LP site" status.

Considering this significantly increased age proposed to the Korolevo I LP (Garba *et al.*, 2024), the present article aims to analyze all the data concerning the new chronometric results, their lithological and archaeological context, and to gain more insight into the LP record of Korolevo I.

2. The newly proposed absolute dates for the Lower Palaeolithic of Korolevo I and the associated data: Pro and Contra arguments

2.1. The absolute dating method

This is, in fact, a novel approach for Palaeolithic artefact-bearing sediments aiming "*dating with cosmogenic nuclides, beryllium-10 and aluminium-26*" of gravel pebbles "*using P-PINI (particle-pathway inversion of nuclide inventories) and isochron burial-dating methods*" because it considers how long the pebbles "*were exposed at the surface for sufficient time to accumulate a large inventory of ^{10}Be and ^{26}Al before their lengthy burial*" (Garba *et al.*, 2024, pp. 1–2). The authors also note the most known and successful previous application of a "*P-PINI model to 10Be–26Al data*" (Garba *et al.*, 2024, p. 3), was conducted on a quartz piece found in the Early Pleistocene sediments of level TE9 in the Sima del Elefante cave site (Sierra de Atapuerca, northern Spain), resulting in a 1.22 ± 0.16 Ma date (Carbonell *et al.*, 2008, pp. 466–467). Importantly, this latter example concerns unquestionably LP lithic artefacts, paleomagnetic dates and faunal evidence.

Cosmogenic nuclide dating is more and more popular in Palaeolithic archaeology, as it can reach beyond the limits of radiocarbon dating. However, the 2024 Korolevo case was the first cosmogenic dating attempt of the international team organized and headed by R. Garba. It would be fortunate for the Czech–Ukrainian scientific collaboration for Transcarpathian research, to test the method at younger sites in the region where the archaeological material is undoubtedly *in situ*, and the the raw materials of the on-site worked lithic artefacts were mainly siliceous sandstone pebbles, similar to the ones dated in Korolevo I (Garba *et al.*, 2024, Supplementary Information, Table S2). Such a site is Ruban, with an MP Quina-type Mousterian material dated to MIS 4, which is located in sandy clayey alluvium right at a fossil river, containing numerous sandstone pebbles with a potential to date both the unworked pebbles and the MP artefacts.

Fig. 2. Seven gravel pebbles from lithological unit 26, 1985 excavation block XIII, Gostryi Verkh, Korolevo I, dated with cosmogenic nuclides (after Garba et al., 2024, Supplementary Information – Fig. S4)

Another potential site is the Early UP Sokirnitsa 1-A, level 3 dated to MIS 3, *ca*. 20 km from the next sandstone occurrence (Demidenko & Racz, 2024, p. 241). However, the dating program aimed at the oldest recognized archaeological material in the region should be taken with caution. Such caution was warranted by G. Muttoni (Milano, Italy), a specialist in magnetostratigraphy and palaeomagnetism and one of the Garba *et al.*, 2024 article reviewers, noting that "*there is too much uncertainty around dates from the cosmological dating method to draw any conclusion about when the site was occupied*" (Johnson, 2024).

2.2. The sampling and dating procedures at Korolevo

For the Korolevo cosmogenic study, "*seven cobble-sized samples (Fig. S4) of different lithology (vein quartz, quartzite, fine-grained sandstone), weathering and mass from the lowermost cultural layer (level VII) were taken from the collection of the 1985 Transcarpathian Palaeolithic Expedition housed at the Archaeological Museum of the Institute of Archaeology in Kyiv*" (Fig. 2). These seven samples showed consistently "*high and relatively uniform 10Be concentrations (1.0–1.7 × 106 at g–1) and low $^{26}Al/^{10}Be$ ratios of 3.0 to 3.5.*" allowing the authors to suggest "*a single burial age*" for all the analyzed samples "*with little or no reworking*" (Garba *et al.*, 2024, Supplementary Information, pp. 10–11, 15). However, in connection with the isochron burial datning results of 1.42 ± 0.28 Ma (±1σ), the authors admitted "*an unexpectedly high (18%) uncertainty given the low degree of scatter among the samples*", namely, 280 000 years (Garba *et al.*, 2024, Supplementary Information, pp. 15–16). This is why the P-PINI burial dating calculations was additionally used for "*the same 10Be–26Al data*". The P-PINI dating results with additional calculations (see *contra* below), "*yields a burial age for level VII of 1.42 ± 0.10 Ma (±1σ), which includes 2% uncertainty on the decay constants and a surface $^{26}Al/^{10}Be$ production ratio that varies from 6.75 to 7.15*" (Garba *et al.*, 2024, Supplementary Information, p. 18). In other words, we can see the same basic date of 1.42 Ma with the uncertainty changed from 18% to *ca*. 7% using both isochron and P-PINI dating results. As a result, the paper concludes that the most reliable date is provided by the P-PINI model which also "*yields a well-constrained burial age that is relatively insensitive to both the average accumulation rate (Fig. S8) and the imposed initial depth*" (Garba *et al.*, 2024, Supplementary Information, p. 18).

However, the dated samples from level VII, and the dating results with "*a single burial age*" and "*little or no reworking of the samples*", still raise some serious doubts.

1) The results pertain to the seven pebbles used for dating, one third or 35% of the 20 pebbles "*embedded in the same cultural level VII (n = 20; depth 10.03–12.05 m)*" that "*were recorded, collected and stored with the artefacts as part of the museum collection*" (Garba *et al.*, 2024, Supplementary Information, p. 7). Moreover, Garba and Usik initially selected nine pebbles but then two "*fine sandstone*" clasts were excluded from the dating procedure due to the following two reasons (Garba *et al.*, 2024, Supplementary Information, p. 10, Table S2). One "*sample KOR-ISO-06 was excluded from further chemical processing due to its different origin (cf. Table S2)*". This clast, which was the heaviest piece with 2059 g, was found at the uppermost position of the 20 pebbles at a 10.03 m depth.[2] Another excluded pebble, sample KOR-ISO-02 weighing 462 g and found at a depth of 11.65 m, had "*low quartz content*". The remaining 11 pebbles were not described in the paper.

2) The uncertainty levels of 18% (280 000 years) for the isochron burial dating and *ca*. 7% (100 000

2 All depth measurements in excavation block XIII was taken from the present surface, at the highest corner of the block.

years) for the P-PINI burial dating are rather discouraging, although the authors propose to consider the more precise P-PINI model's results.

"*In the P-PINI model setup, the source zone is the contributing drainage area characterized by a set of model parameters that govern the pre-burial cosmogenic-nuclide inventory of the detrital particles (i.e., $^{10}Be/^{26}Al$ production rates, elevation range above sea level, bedrock density, periods of glacial cover, and erosion history). Each of these parameters is allowed to vary within a given range based on the field setting and together they define a range of plausible landscape histories experienced by the samples. The sink zone is defined as the site of permanent burial where samples are collected with the aim of determining their burial age*" (Garba *et al.*, 2024, Supplementary Information, p. 17).

Accordingly, it cannot be excluded that each of the parameters was set in such a way that they "artificially" lowered uncertainty from 280 000 to 100 000 years, although even the latter "narrow" interval provides a considerable interval to deal with. Certainly, previous testing of the cosmogenic nuclide methods in Transcarpathia would contribute to a more firm approach in setting the model parameters.

3) It is worth taking a closer look at the seven dated pebbles (Garba *et al.*, 2024, Supplementary Information, pp. 10–11, Table S2, Fig. S4). Even excluding the above-mentioned heaviest sample KOR-ISO-02 found at the highest position of 10.03 m, the seven dated pebble samples (Fig. 2) still do vary in depth (11.10–12.05 m), weight (196–1105 g), and size (the smallest fragmentary specimen is under 10 cm, the others are larger than 10 cm). Moreover, the samples are recovered from only three excavation squares (2×2 m each) in excavation block XIII. The excavation grid of this block has 32 squares in 128 m², which was excavated down to the lowermost stratigraphic unit 27 in 1983–1986. These factors cast doubt on the sedimentary homogeneous character without redeposition, thus the claimed simultaneous depositional age of these unworked (!) pebbles. Moreover, the published photos show (Garba *et al.*, 2024, Supplementary Information, Fig. S24) (Fig. 2), that four pebbles out of seven are heavily fragmented with worn surfaces, which strongly suggest transport or reworking. Concerning depth data, level VII containing the 33 lithic artefacts was measured between 9.40–12.00 m (2.60 m thickness). The interval is also considerable if we take the depth measurements of the artefacts into account, which are, according to Kulakovska and Usik, scatter between 8.98 and 12.05 m (3.07 m thickness, see Koulakovska, Usik & Haesaerts, 2010, p. 126; Kulakovska & Usik, 2015, p. 11). Accordingly, in level VII, there is no total overlap between the depth of the dated pebble samples (11.10–12.05 m) and the depth of the artefacts they are supposed to date (11.10–12.05 m and 8.98–12.05 m). It seems that the seven fragmented and worn pebbles date the lower-lying portion of the artefacts in level VII and not the entire unit in which the artefacts were distributed. It should be emphasized that 24 of the 33 artefacts in level VII were found at a depth between 8.98/9.40–11.00 m, that is, 72.7% of the artefacts were recovered above the dated pebbles (re-calculated from Kulakovska & Usik, 2015, pp. 14–17).

2.3. The dated pebbles and their stratigraphic position within the Korolevo I sediment sequence

The dated pebbles and artefacts of archaeological level VII stratigraphically belong to lithological unit 26: "*…light-grey sands of floodplain facies (unit 26), with multiple yellow and bright-red spots. The latter indicates enrichment in iron oxides that can be typical for sediments formed under a warm interglacial climate. According to the pollen data, this bed, with cultural layer VII, also was formed in an interglacial.*" Unit 26 was deposited above the lowermost Pleistocene unit 27 at the site: "*The lowermost (27) is represented by a basal bed consisting of pebbles cemented by red-coloured clays*" (Garba *et al.*, 2024, Supplementary Information, p. 5). In the main text where the short stratigraphy for Korolevo is illustrated (Garba *et al.*, 2024, Fig. 2, p. 3), unit 26 is characterized as "*Alluvial, silt/sand*" and unit 27 below as "*Alluvial gravel, clay matrix*" constituting two different alluvial sediment facies.

This stratigraphical description of unit 26 containing the lowermost artefact-bearing level VII mentions only sandy/silty sediment without a gravel component. Thus, the presence of 20 pebble- and cobble-sized clasts in unit 26, excavation block XIII of 1985, needs an explanation. Here it should be emphasized again that the pebbles in question are all "natural" and lack any evidence of treatment by Palaeolithic

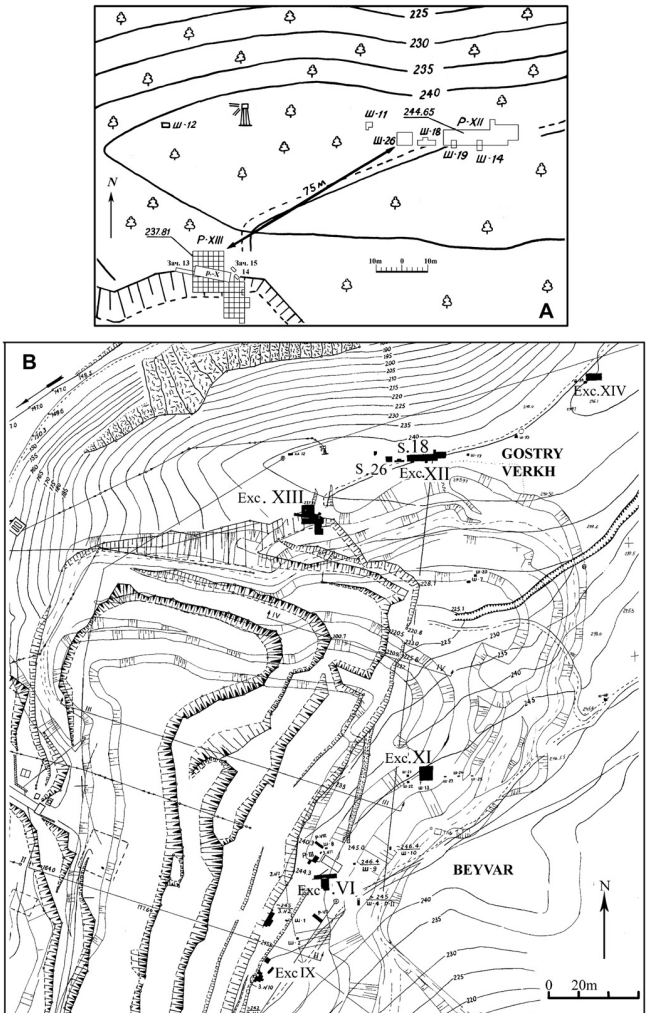

Fig. 3. A: excavation blocks in the Gostryi Verkh area in Korolevo, up to 1986 (after Adamenko et al., 1989, Fig. 3); B: relief map of the Gostryi Verkh area Beyvar areas in Korolevo I, with the excavation blocks up to 1988 (after Koulakovska *et al*., 2010, Fig. 2B)

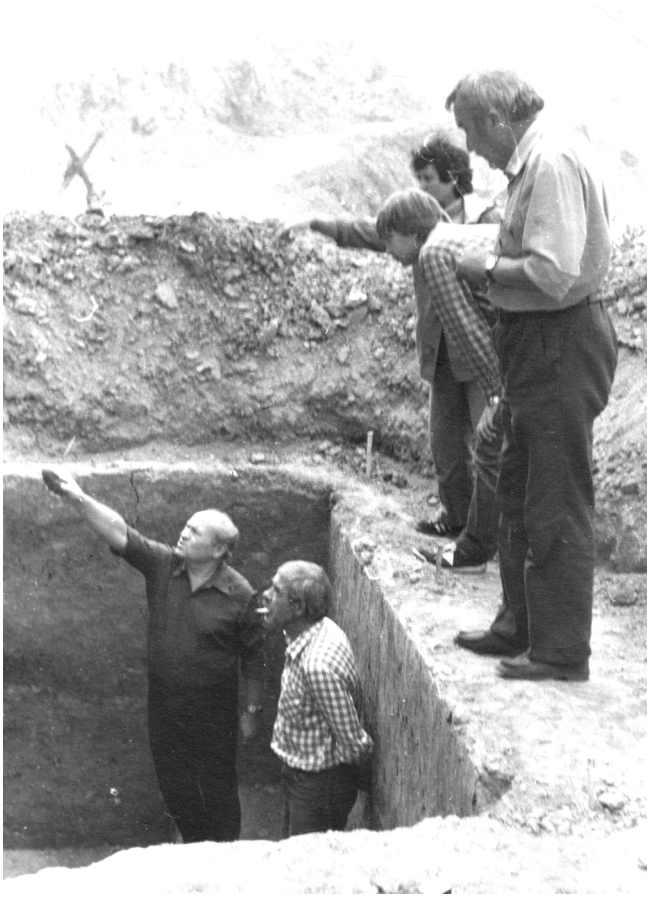

Fig. 4. Profile studies in 1985, along squares и-к-л – 10 in excavation block XIII, Gostryi Verkh area. From left to right: O.M. Adamenko, V.I. Tkachenko, G.A. Pospelova, Yu.E. Demidenko, V.N. Gladilin (photo by Yu.V. Kukharchuk)

humans, suggesting that they were not brought to their place of recovery by humans. Consequently, we have to find other ways to confirm or abandon the co-occurrence of these pebbles and LP lithic artefacts in level VII.

The stratigraphic description of Korolevo I in the 2024 paper is based on secondary sources, not new fieldwork. The authors used previous lithological studies conducted in the 1980s (O.M. Adamenko and V.N. Gladilin), 1998 (P. Haesaerts) and 2006 (J. Nawrocki and M. Lanczont with Polish and Ukrainian colleagues), mainly the description of Haesaerts from 1998 about unit 26. "*Unites 25 et 26 (11,20 a 11,50 m). Sable limoneux a taches grises et ocre, passant vers le bas a un sable gris-jaune legerement stratifie, lequel repose au sommet du cailloutis de l'unite 27*" ["Units 25 and 26 (11.20 to 11.50 m). Silty sand with gray and ochre spots, passing downward to a slightly stratified gray-yellow sand, which rests on top of the pebble of Unit 27" (translated by the present author)] (Haesaerts & Koulakovska 2006, p. 25). The other descriptions and illustrations of the lower straighraphic units in Korolevo I present sondages 18 and 26 from the 1980s, profile cleanings in 1998 and 2006, located *ca*. 75 m to the east from block XIII of the 1983–1986 excavations (Fig. 3), as well as excavation block XIII itself (e.g., Adamenko & Gladilin, 1989, Fig. 2, Tab. 1; Adamenko *et al.*, 1989, pp. 6–16, Figs. 4 & 5; Gladilin, 1989, pp. 99–101, Fig. 4; Haesaerts & Koulakovska, 2006, pp. 25–27, Fig. 2; Koulakovska, Usik & Haesaerts, 2010, pp. 126–127, Fig. 3; Kulakovska & Usik, 2015, p. 7, Fig. 4; Nawrocki, *et al.* 2016, p. 77, Tab. 1, Fig. 10; Garba *et al.*, 2024, Fig. 2; Garba *et al.*, 2024, Supplementary Information, p. 5). None of them showed the presence of large- and medium-sized gravel pebbles above the basal unit 27, the

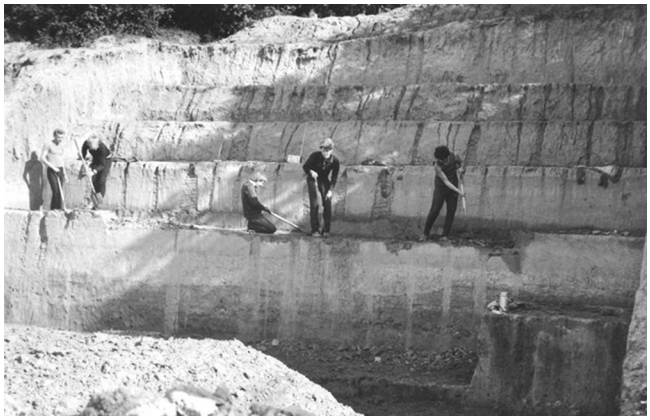

Fig. 5. Excavation in excavation block XIII, Gostryi Verkh area in 1984 (photo by Yu.V. Kukharchuk)

only proper gravel alluvium with pebbles in the site's sedimentary sequence. Here it is also worth mentioning that geologist O.M. Adamenko, who studied the sedimentary units in the field in the 1970s–1980s, used the basic stratigraphic and lithological data observed in sondage 18 both before and after (!) the excavations of block XIII (e.g., Adamenko *et al.*, 1989, pp. 6–16) (Fig. 4).

Stratigraphical unit 26 in Korolevo I is sometimes shortly described as "*small pebble alluvium*" (e.g., Koulakovska, Usik & Haesaerts, 2010, p. 126). With this name, Haesaerts followed the stratigraphy of Korolevo as described by Adamenko and Gladilin in the 1980s. They noted the presence of "*small pebbles (up to 5 cm)*" in unit 26, while unit 27 below was characterized "*with big pebbles*" (e.g., Gladilin, 1989, p. 97).[3] However, such small pebbles usually occur within alluvial sands (!) and they can not weight more than 50 g, while the dated cobbles are much heavier (196–1105 g) and larger (>10 cm). Thus, units 26 and 27 contain considerably different clasts and they cannot be confused. Therefore, the dated large- and medium-sized pebbles look absolutely "lithologically exogenous" in unit 26.

2.4. Concluding remarks

The presented arguments showed that the middle- and large-sized pebbles used for the dating of the LP in Korolevo I have worn surfaces indicating reworking, they occurred together only with a small portion of the lithic artefacts in level VII, in the lower part of lithological unit 26. These arguments suggest that the dated pebbles are "intrusive" in unit 26 and cannot be associated with the LP archaeological material. Taking into consideration that such large- and medium-sized gravels are known only from unit 27 in the lower sediment sequence of Korolevo I, the most plausible scenario is that these pebbles in unit 26 originate from the underlying unit 27. Thus, these pebbles proposed to be dated to *ca.* 1.42 Ma might represent the age of unit 27, the archaeologically sterile gravel alluvium at Korolevo I.

3. Unit 26 in the Korolevo I site stratigraphy: some possible explanations of the presence of large- and medium-sized pebbles

Considering the "intrusive, not genuine" origin of these pebbles within unit 26, we propose several factors to explain their occurrence in silty/sandy deposits, that all contributed to the complicated lithology of unit 26.

1) The most straightforward explanation for their presence that comes to mind to the present author, who personally participated in the excavation of block XIII in 1983 and 1985–1986, is fieldwork methodology. Having no fauna and other organic remains in the artefact-bearing sediments, Gladilin used a 2×2-metre grid instead of 1×1, as usual for Palaeolithic sites, without internal subdivision of the 4 m^2. As Gladilin presumed, find density did not increase, so block XIII was excavated with spades and without sieving, in 20 cm thick spits with arbitrary horizontal levels (Fig. 5), despite the previously known significant southeastern inclination of the sediment sequence (see below). Taken together, it was a rather unsophisticated excavation technique targeting to acquire *in situ* LP artefacts in block XIII.

Here, the present author draws special attention to the use of the term archaeological "*level/layer*" in Garba *et al.* 2024. These terms were applied only for artefacts found *in situ* by Kulakovska and Usik (e.g., Kulakovskaya, 2009, p. 92). However, in their Korolevo revision, several assemblages were composed of *in situ* finds, artefacts from excavated but redeposited sediments, and also

3 The stratigraphic studies of V.N. Gladilin and O.M. Adamenko in Korolevo are often cited from the English publication by Gladilin in 1989, to avoid mistakes in geological terminology. For the present paper, the author used and translated their other articles published in Russian in the 1980s.

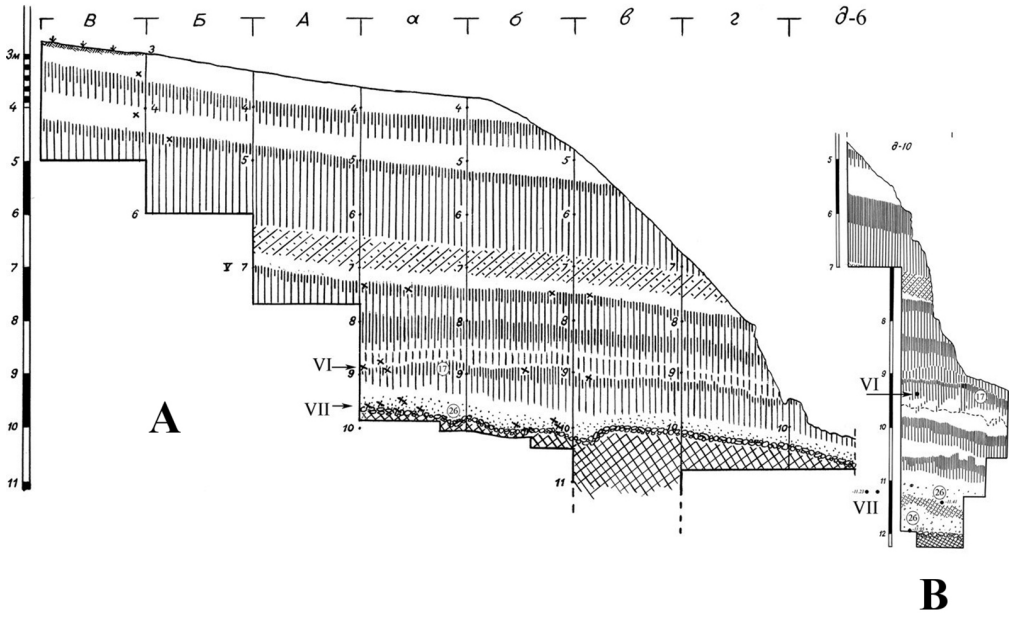

Fig. 6. Excavation block XIII, Gostryi Verkh area, Korolevo I (1983–1986). A: part of the eastern stratigraphic profile; B: the eastern stratigraphic profile for square д-10 (modified after Koulakovska *et al*., 2010, Fig. 10)

finds collected from the surface. Such mixed assemblages were named "*cultural-chronological complexes*" by Gladilin (e.g., Gladilin, 1989, p. 93). He also (!) used the term "*cultural horizons/horizons*" (e.g., Gladilin, 1989, p. 102) for *in situ* excavated artefacts at the site where a real find horizon was visible during fieldwork. The opinion of the present author is that Gladilin used his "*horizon*" term correctly for these occurrences, again, due to the mentioned absence of organic remains and the rarity of archaeological features. Apart from weakly-preserved fireplace remains in a few instances, the only archaeological phenomena in the excavated *in situ* beds were lithic artefacts. This is why the term "*horizon*" perfectly fits here, and not the term "*layer/level*". Accordingly, the term "*horizon*" will be used in this meaning in the remainder of this article.

In excavation block XIII, both lithological units and archaeological horizons inclined to the southeast more than three meters along the 22 m trench, including horizon VII with the artefacts measured between 8.98–12.05 m in depth (e.g., Koulakovska, Usik & Haesaerts, 2010, Fig. 9–10; Kulakovska & Usik, 2015, Fig. 5–6) (Fig. 6A). This inclination hindered the stratigraphic control of find positions during the excavations. It was especially true for squares а-б – 1-4, в-г – 4, far from the main longitudinal profile in the east (Fig. 7). Here, occasional mixing of finds from different lithological units have probably taken place. Therefore, the presence of pebbles from unit 27 in the lower part of unit 26 is not surprising with such excavation circumstances.

2) The lower part of the stratigraphic sequence of Korolevo I has some "deposition problems".

There are "*three erosional hiatuses between the Matuyama–Brunhes boundary and level VII (Fig. 2)*" (Garba *et al.*, 2024, p. 2), that is, a *ca*. 1.5 m thick sediment package constitutes units 23–25 between lithological units 22 (*ca*. 0.77 Ma) and 26 (see Gladilin, 1989, pp. 98–100). Although Adamenko and Gladilin distinguished lithological units 25 and 26 (e.g., Gladilin, 1989, p. 97), and Haesaerts combined them (Koulakovska, Usik & Haesaerts, 2010, p. 126), it is still worth noting that "*in Korolevo excavation XIII, an erosional break* [underlined by the present author] *is observed between the alluvial units 26 and 25*" (Garba *et al.*, 2024, Supplementary Information, p. 5). Moreover, the silty/sandy deposits of Haesaerts' unit 26 were not lithologically homogeneous in its entire 0.8 m thickness. The mentioned "*erosional break*" refers to this phenomenon observed by Haesaerts: "*In square д-10, lithological layer 26 is divided by a horizon of diluvium* [underlined by the present author], *suggesting a localized episode of disturbance within the stratigraphic sequence (Fig. 10). Above horizon 3, level VII artefacts were found (Fig. 10). Beneath this horizon, one flake and two chunks were found. There was no diluvium observed either above or below*" (Koulakovska, Usik & Haesaerts, 2010, pp. 126–127) (Fig. 6B). Probably, lithological unit 24 in the stratigraphy of Adamenko and Gladilin

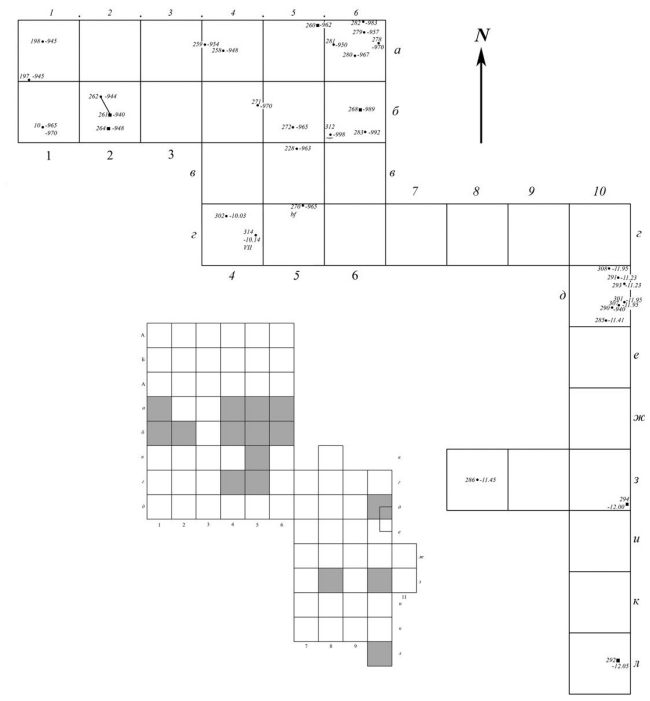

Fig. 7. Plans of excavation block XIII, Gostryi Verkh area, Korolevo I (1983–1986). Spatial distribution of horizon VII lithic artefacts recognized by Kulakovska and Usik (modified after Koulakovska *et al.*, 2010, Fig. 9)

for sondage 18 and 26 (e.g., Gladilin, 1989, p. 96) is also a similar diluvium up to 0.10 m thick.

Thus, it is highly likely, that a series of identified and probably not identified (!) diluvium episodes and erosional breaks influenced the site's stratigraphy at its most complicated lower part, and this is the reason why some large- and medium-sized pebbles appeared in unit 26.

3) The topography of excavation block XIII, where the artefacts of horizon VII were found *in situ* in 1984–1986, is worth a special discussion (Fig. 3B). Usik, one of the key archaeological contributors to Garba *et al.*, 2024, analyzed the stratigraphic position of horizon V, the uppermost LP "*Acheulian*" horizon of Gladilin (e.g., Gladilin & Sitliviy, 1990, pp. 55–65; Tab. XXIV–XXIX), which is now considered Early MP (Usik, 2009). He mentions:

"*Excavation block XIII. The excavation block is located approximately 75 m southwest of sondage 26 [Adamenko et al., 1989, p. 7, fig. 4]. The current state of the quarry shows that the excavation block was cut into the western edge of a huge ravine* [underlined by the present author], *the bottom of which is located approximately in line of sondages 18 and 26. The cultural layer, which corresponds to layer V and can be analyzed, comes from the part excavated in 1983–84. In an area of more than 100 m², less than 100 artefacts have been found (Fig. 2). According to the description of the eastern wall (sq. A, a-6), loess-like loam corresponding to horizon 9 lay at a depth of 7.00 m to 7.30 m (Fig. 2, I). Along the border of squares A-a 1-6, a drop of loam in the western direction to a depth of 7.40 m to 7.70 m was noted (Fig. 2, I (A/a)). The northern projection of the artefact scatter from squares A-6/a-6 shows a significant vertical dispersion (Fig. 2, I). These observations are confirmed by a few refitted artefacts. A similar situation is seen when projecting the position of artefacts along line 6 onto the eastern wall of the excavation. In general, we can conclude that in the studied part of excavation XIII, artefacts of layer V were deposited in the lower part of horizon 8, in the loam of horizon 9 and the upper part of horizon 10, corresponding to the horizons of the main stratigraphic sections of Korolevo (Fig. 3). Apparently, the cultural layer was influenced by the activity of the ravine and the ancient relief* [underlined by the present author and translated by the present author]." (Usik, 2009, p. 104).

Having such a complicated stratigraphy for archaeological horizon V with its lithic artefacts dispersing in three (!) lithological units, due to ravine processes, it would be logical to assume a similar situation for the finds of horizon VII. Indeed, looking at the northern, transversal profile a/A – 1 – 6 of excavation block XIII (Koulakovska, Usik & Haesaerts, 2010, Fig. 9a-b) (Fig. 8A), a partly compressed stratigraphy is seen, in which lithological unit 26 is missing for more than half of the 12 m wide profile in its western part; besides, an inclination to the east suggests an active ravine context. It also means that a part of lithics assigned by Kulakovska and Usik to horizon VII, which comes from at least eight squares (a-б – 1-4, 32 m² in total, Fig. 8B), was most probably deposited in the gravel of lithological unit 27 that is well-represented there. It is also possible that units above this gravel, now unknown to us, contained these artefacts. Thus, the lithic assemblage of archaeological horizon VII was composed by Kulakovska and Usik from artefacts originating from at least three lithological units: units 26 and 27, and probably some now-unknown unit(s) above.

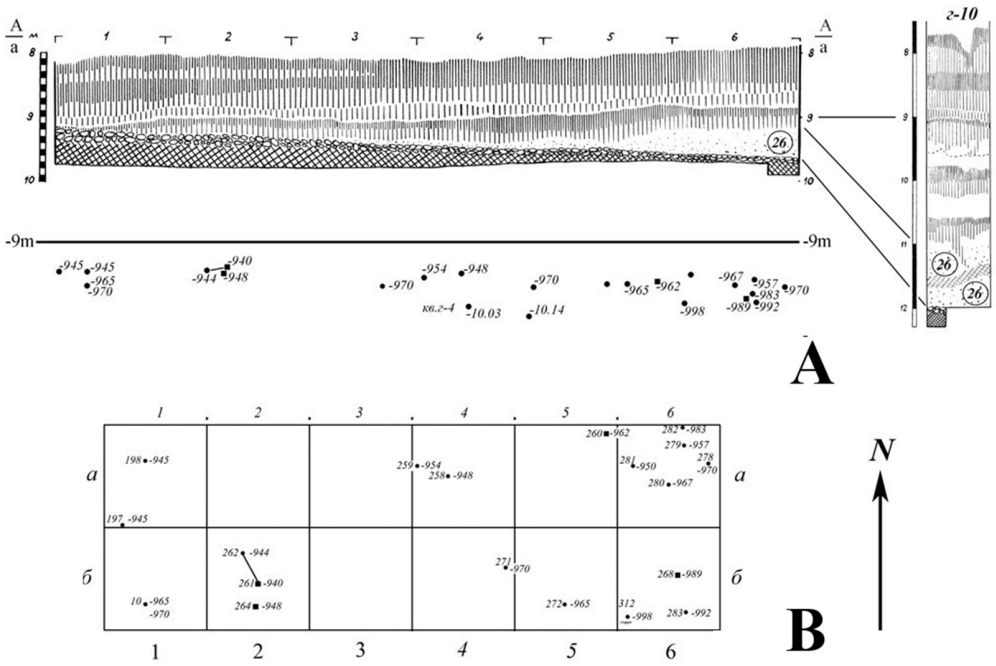

Fig. 8. Excavation block XIII, Gostryi Verkh area, Korolevo I (1984–1986). A: northern stratigraphic profiles and the vertical positions of horizon VII lithic artefacts, as recognized by Kulakovska and Usik; B: horizontal distribution plan of horizon VII lithic artefacts, as recognized by Kulakovska and Usik (modified after Koulakovska *et al*., 2010, Fig. 9)

Usik's description of the lithics from horizon V in excavation block XIII is also worth citing here: "*The artefact assemblage composition: the virtual absence of lithic concentrations and formal tools, and the presence of clearly random items that are primarily the result of separate, unrelated flaking processes, indicate a peripheral nature of the excavated area*" [translated by the present author] (Usik, 2009, p. 106). Combining Usik's description of the stratigraphy and lithics of horizon V, one can get the impression that this lithic assemblage consists of randomly redeposited pieces due to sedimentation processes affected by the ravine. The same could also happen with the lithic artefacts and pebbles of horizon VII in excavation block XIII (see the lithic artefact analysis of horizons VII and VIII below).

Thus, sediments below the Matuyama-Brunhes boundary at Korolevo ("*passing between the VIIIth and IXth fossil soils*" – Gladilin, 1989, p. 100, that is, between lithological units 21 and 22), particularly in the huge ravine area of excavation block XIII had no easy stratigraphy and depositional history. Accordingly, stratigraphic and artefact disturbance must be expected, especially in the lower sediments, where depth measurements of horizon VII lithic artefacts scatter between 8.98/9.40 and 12.00/12.05 metres, along the 307 cm long slope of the ravine.

4) The lowermost Korolevo lithological unit 27 also deserves a more thorough look. Adamenko and Gladilin, and then Haesaerts emphasize its gravelly characteristics. "*The same loam* [Yu.D. – like the ones of units 25 and 26] *with marked ochre-red hue and with big pebbles; alluvium; thickness up to 0.30 m*", and this unit 27 is underlined by unit 28: "*the weathering crust of the dacite*" (Gladilin, 1989, p. 97).

"*Cailloutis hétérogène comprenant une majorité de galets, cimenté par un sable argileux bigarré. Ces cailloutis et les alluvions limono-sableuses susjacentes … appartiennent à la terrasse de la Tisza*" ["Heterogeneous gravel comprising mainly pebbles, cemented by a variegated clayey sand. These pebbles and the overlying silty-sandy alluvium belong to the Tisza terrace" (translated by the present author)] (Haesaerts & Koulakovska, 2006, p. 25).

The 2006 study of the lowermost sediments at Korolevo, corresponding to lithological unit 27, provided more details: "*Bw horizon (?) red-orange, weakly developed, faint. Scattered river gravels occurring in its lower part were redeposited from the hypsometrically higher alluvial horizon (Fig. 1C). It is possible that this red-orange horizon is a soil developed directly on weathering crust of volcanic rocks (it may be evidenced by a high content of clay fraction, enrichment with resistant minerals). This soil is characterised by high content of iron*

compounds up to 6.5%. It is partially redeposited and contains kaolinized blocks/debris of volcanites so it looks like breccia. Sharp erosion-denudation boundary separates this soil from the weathering crust developed on andesitic basement" (Nawrocki *et al.*, 2016, p. 77). Regarding the pebbles in unit 26, it is the most important information here is the redeposition of pebbles from a higher alluvial level. In the case of redeposition, the presence of pebbles in the silty-sandy alluvium of unit 26 is not surprising, especially when we consider the "ravine factor" effect on the sediments in excavation block XIII.

Summarizing the four mentioned factors: the unsophisticated excavation methods, various diluvium episodes and erosional breaks, the location of excavation block XIII within a huge ravine affecting sedimentation, including redeposition of gravels from topographically higher alluvial sediments; the "intrusive" presence of large- and medium-sized pebbles in unit 26 is highly probable. Thus, the cosmogenic nuclide dating of unit 26 pebbles to 1.42 Ma, and the inferred result that Korolevo I provides "*the earliest securely dated hominin presence in Europe*" (Garba *et al.*, 2024, p. 1) does not correspond to the lithological situation of unit 26 in excavation block XIII and should be rejected.

4. The 1.42 Ma date for Korolevo I and the newly proposed hypotheses on the geochronology and the earliest Early Pleistocene, LP human dispersal routes into Europe

Besides the absolute dating program of the lowermost artefact-bearing sediments in Korolevo, Garba and his associates also propose the geochronology of LP human occupation at Korolevo and the initial occupation of high-latitude Europe (Garba *et al.*, 2024, Fig. 1). Their hypotheses are cited below.

"*Our findings at Korolevo provide the first primary evidence advancing the hypothesis that Europe was colonized from the east. A plausible dispersal scenario is that the Korolevo hominins stem from the Levant via Asia Minor, the Danube corridor and the Pannonian Basin (Fig. 1). Alternatively, a route from the Caucasus and to the north of the Black Sea remains a possibility*" (Garba *et al.*, 2024, p. 4).

"*H. erectus occupied Korolevo at a time* [...which] *(1.42 ± 0.10 Ma) coincides with three interglacial warm periods* [...] *MIS 47, 45 and 43* [...] *These interglacials apparently offered some of the most favourable conditions for* H. erectus *during the half million years before the Middle Pleistocene Transition.* [...] *This supports the idea that early hominins exploited warm interglacial periods to disperse into higher latitudes*" (Garba *et al.*, 2024, pp. 4–5).

The present author proposes that these ideas do not correspond to the widely known paleogeographic and archaeological evidence of the Palaeolithic in Western Eurasia.

First, considering interglacials as periods for the first human dispersals to Europe from the East Mediterranean Levant during the Early Pleistocene. Global average sea levels during interglacials were significantly higher than today, in the Mediterranean Basin as well. Early Pleistocene *Homo erectus* groups without seafaring vessels and knowledge would not be able to cross open waters between Asia Minor and the Balkans. The route via the Caucasus, considered due to the Dmanisi Early Pleistocene site in the region, would be even more complicated for any LP human groups because there were two natural barriers between the South Caucasus and the southern part of Eastern Europe. The first barrier was the Main Caucasian Range which did not allow any LP and MP human groups, neither *Homo erectus* nor Neanderthals to travel through. This is why, for example, MP Micoquian sites are well-known in the North Caucasus and entire Eastern Europe but they are completely unknown in Transcaucasia. On the other hand, MP Zagros Mousterian sites frequently occur in the South Caucasus and are absent in the North Caucasus and Eastern Europe. Similar examples can be found in the LP, the South Caucasus is rich in Acheulean sites but there is not even one Acheulean site in entire Eastern Europe. Only Early UP *Homo sapiens* groups with various lithic traditions penetrated the North Caucasus and the southern parts of Eastern Europe from Transcaucasia because they followed the eastern shore of the Black Sea, exploiting aquatic resources for their subsistence. LP and MP humans did not exploit marine and river food resources systematically, consequently, they were unable to follow sea shorelines (see Demidenko, 2014; 2020). The high mountains certainly posited a similar obstacle to their dispersion.

The second natural barrier was the Manych Strait (Fig. 9) that connected the Caspian Sea and

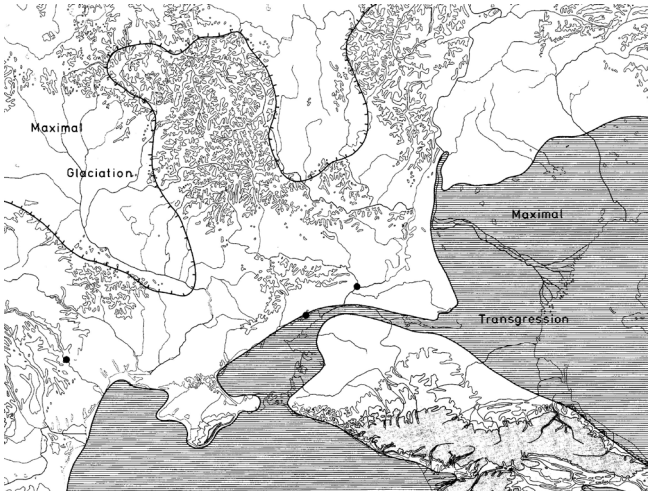

Fig. 9. Map of the southern part of Eastern Europe showing maximum glaciation and the maximum transgression of the Manych strait (modified after Praslov, 1995, Fig. 2)

the Sea of Azov during interglacials and even interstadials of the Pleistocene (see, e.g., Kaplin & Selivanov, 1999, pp. 169–239; Yanina, 2009). This sea-like water barrier would be again impossible to cross for LP *Homo erectus* groups without seafaring vessels and knowledge. The Pleistocene Manych Strait obstacle was also considered by Gladilin (1976, pp. 141–142), who believed that the peopling of Eastern Europe during various periods of the LP and the MP happened from the west, from Europe and not from the south, via the Caucasus. That was one of the reasons he moved to Transcarpathia in his search of LP sites (Gladilin, 1976, pp. 137, 148; Demidenko 2017, pp. 165–166). Finally, there is one more data set that contradicts an Early Pleistocene LP "Caucasian migration route". LP "*early hominin sites*" in the Taman peninsula of the Black Sea and the northern Caucasus are briefly mentioned (Garba *et al.*, 2024, p. 4), as indicators of LP human migrations from the South to the North Caucasus and further to the south of Eastern Europe. Some Russian colleagues working in the northern Caucasus for the last 40 years have reasonably considered these sites to be "*related to shallow water marine and marine shore sediments, which correspond to typical conditions for the formation of eolithic or geofact assemblages. The shallow water marine and marine shore environments are also unique to these sites and have no analogs among verified Early Pleistocene archeological assemblages in either Europe and West Asia or Africa. Two lines of evidence combining archaeological and geoarchaeological indicators strongly suggest that the "Oldowan" assemblages from Dagestan and Taman most likely represent collections of naturally broken stones that were selected by researchers among fragments of the same rock that is present naturally in the area*" (Doronichev & Golovanova, 2022, p. 18). Based on their views, there are no LP archaeological "bridge sites" between Dmanisi in the South Caucasus and the south of Eastern Europe as it was suggested by Garba and his associates.

In conclusion, the present author argues that the newly proposed dating of the lowermost artefact-bearing sediments in Korolevo, the suggested geochronology and Early Pleistocene, LP human migration routes to Europe are incorrect in the Garba *et al.* 2024 article.

5. Lower Palaeolithic stratigraphy and artefacts in Korolevo: previous and newly proposed hypotheses

5.1. Stratigraphy

After the discovery of Korolevo I in September 1974, Gladilin conducted large-scale annual fieldwork at the site, excavating *in situ* archaeological horizons. Gladilin also understood that the rock most frequently used for on-site artefact production in Korolevo, andesite (hyalodacite, see for the most recent update in Demidenko & Rácz, 2024), is characterized by varying degrees of surface weathering, less for the younger and more for the older pieces. It has led him to group finds from *in situ* excavated contexts, redeposited sediments, and also from surface collections together, according to their degree of weathering (e.g., Gladilin, 1989, p. 95). As a result, he and then we, as his team, started to use the term "cultural-chronological complex" for these assemblages, instead of horizon. Nevertheless, some artefact assemblages originate only from *in situ* horizons in Korolevo I, such as the Early UP Ia horizon, and the MP IIb and II horizons, that do not contain lithics from redeposited sediments or the surface. Then, in the 2000s, Kulakovskaya and Usik started to concentrate on analyses of only *in situ* finds for each horizon excluding finds from other contexts. Their revision led to the distinction of a "pure" industrial component in "mixed" assemblages, which also changed the characteristics of the industries in some cases (e.g., Koulakovska & Usik, 2017).

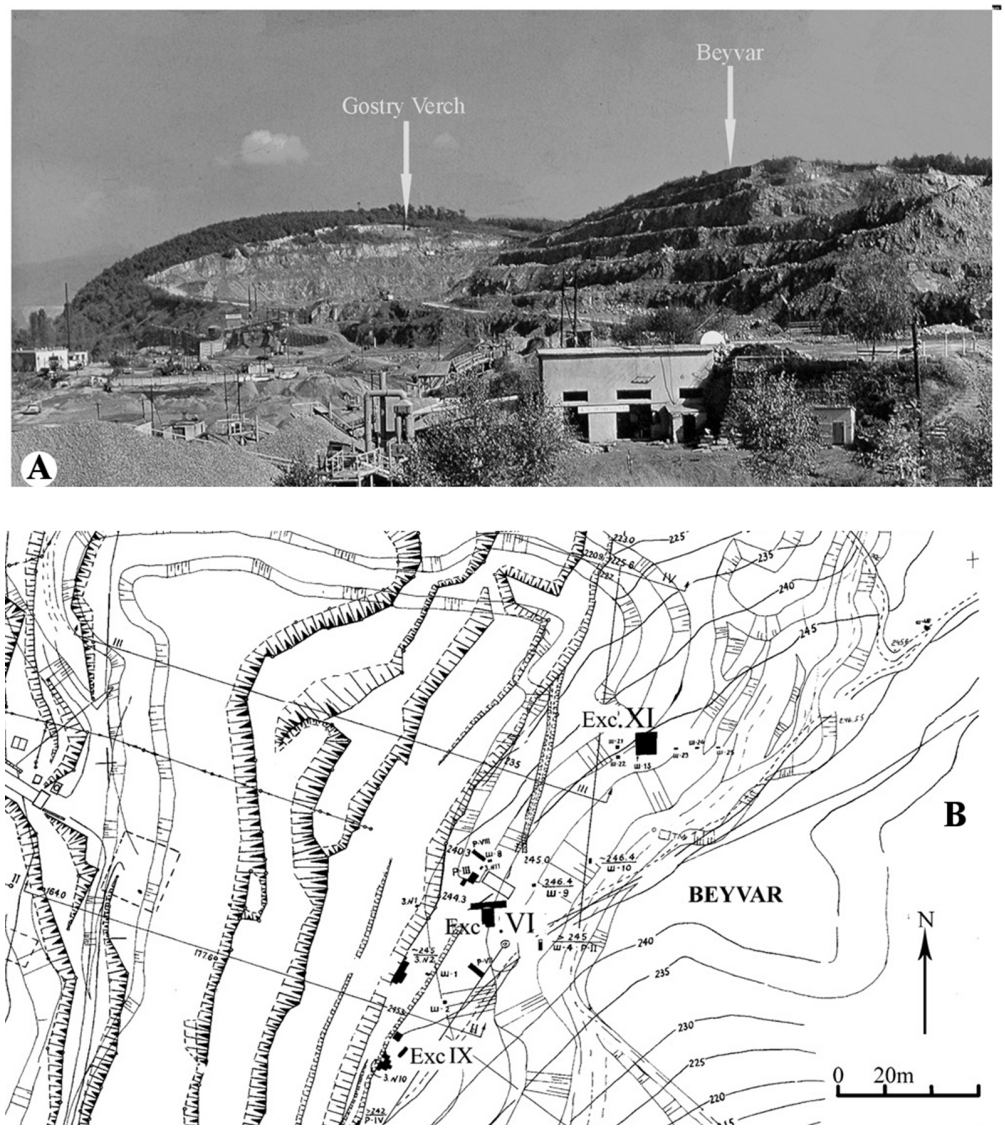

Fig. 10. A: a general overview of Korolevo I with the Gostryi Verkh and Beyvar hills/peaks (after Koulakovska et al., 2010, Fig. 1B); B: topographic plan with all excavation blocks at the Beyvar site in Korolevo I up to 1988 (modified after Koulakovska et al., 2010, Fig. 2B)

However, in the 1970s and 1980s, Gladilin was still added non-*in situ* hyalodacite finds to respective *in situ* horizon finds in Korolevo. Before the 1984 excavation of block XIII and units 26 and 27 in it, he defined the presumably lowermost and most archaic find complexes (VII and VIII) based on redeposited and surface hyalodacite finds.

The Korolevo I site (or more correctly, the Korolevo Palaeolithic site complex including the nearby Korolevo II, see Demidenko & Rácz, 2024), (Fig. 10A) is composed of two hills, Gostry Verkh and Beyvar. Beyvar (Fig. 10B) is the archaeologically richer location where most of the MP horizons (II, IIa, III and V) and the LP horizon VI were found *in situ*, providing a large number of lithic artefacts. At Gostry Verkh (Fig. 3A), all archaeological horizons are poorly represented, except the Early UP horizon Ia (sondages of 1979 and 1986, excavation block XII), and the MP horizon IIb with pointed Levallois-Mousterian (excavation block XIV). On the other hand, Gostry Verkh has a longer, more complete stratigraphic sequence compared to Beyvar. The lowermost find complexes (VII and VIII) were defined based on redeposited and surface artefacts in Beyvar, and the only chance to find them *in situ* was in Gostry Verkh.

Respectively, sondages 18 and 26 at Gostry Verkh, excavated in the late 1970s and early 1980s, were opened to provide the longest stratigraphic profiles in Korolevo I (up to 12 thick Pleistocene sequences) and to find *in situ* LP archaeological material, first of all, horizons VII and VIII. The two sondages lacked such horizon VII and VIII finds *in situ*, having only horizon VI material as their lowermost archaeological finds. Horizon VI was already well-known from Beyvar excavation block IX, at the top of paleosoil VII in lithological unit 17, from the inter-Mindel or MIS-14 (e.g., Haesaerts & Koulakovska, 2006, pp. 24, 28, Fig. 2; Koulakovska, Usik & Haesaerts, 2010, p. 120, Fig. 3). However, these two sondages provided the most

complete stratigraphic sequences for Korolevo I, described by geologist Adamenko with Gladilin in the 1980s. Following excavation, they used these profiles for the publication of the combined Korolevo sequence, even after the excavation of block XIII (e.g., Adamenko *et al.*, 1989, pp. 6, 9–16; Gladilin, 1989, pp. 96–97; Gladilin & Sitliviy, 1990, pp. 28–30). In these complete sequences, large- and medium-sized pebbles were only recognized in unit 27 with alluvial gravels and not in unit 26 with silty-sandy alluvium. Further stratigraphic data of these early periods came from the 1998 and 2006 profile cleanings *ca*. 75 m from excavation block XIII dug in 1983–1986, the latter of which finally provided *in situ* lithic artefacts belonging to horizons VII and VIII.

5.2. LP lithic artefacts

For the analysis of the lowermost lithic artefacts at the Korolevo site complex, it is needed to take a closer look at such hyalodacite pieces. At first, even an experienced Palaeolithic archaeologist might not recognize hyalodacite objects as human products. This is especially true for pieces with significant chemical destruction, like the ones from horizon III, where MP Levallois-Mousterian with Levallois centripetal flake technology have been excavated *in situ* at "*the top of paleosoil K-IV (sub-unit 8a)*" (Haesaerts & Koulakovska, 2006, pp. 28, 33–37). This horizon probably has an MIS 5a age, *ca*. 80 ka BP (see also Koulakovska & Usik, 2011a, p. 133) on geochronological grounds. Similar altered pieces are also known through the archaeological sequence in the lower MP and LP horizons, even reaching the LP archaeological horizon VI, with an MIS 14 with age, *ca*. 550 kyr BP. Seeing in their original contexts, these hyalodacite artefacts became recognizable with time. However, the situation is different with the non-*in situ* hyalodacite pieces, found in the first half of the 1980s, which Gladilin added to the suggested lowermost cultural-chronological complexes VII and VIII. The personal experience of the present author with these latter finds, who often helped V.I. Sitlivyi in the field to catalogue LP artefacts, is that these are *not* man-made artefacts. Other members of our team, including Usik and Kulakovskaya (who quit fieldwork after she defended her PhD on the Mousterian in Korolevo in 1982), had a similar opinion about these objects, so I wonder why Gladilin and Sitlivyi recognized those as artefacts. However, Gladilin divided the team according to periods, and the LP belonged exclusively to Gladilin and Sitlivyi, while other team members were working on various MP and UP materials from Korolevo and other Transcarpathian sites. Anyway, as the present author clearly remembers, hyalodacite artefacts from Korolev I non-*in situ* complexes VII and VIII were not well understood and recognized by us as artefacts in the first half of the 1980s, being of rather dubious character.

Later, in 1984–1986, artefacts belonging to complexes VII and VIII were found *in situ* at excavation block XIII in Korolevo I: 26 pieces belonging to complex VIII and 33 pieces belonging to complex VII (Koulakovska & Usik, 2015, pp. 13, 19). In addition, we still have to note the following non-*in situ* finds of these two lowermost LP complexes at Korolevo: *ca*. 400 pieces in complex VIII and *ca*. 1500 pieces in complex VII (Gladilin & Sitliviy, 1990, pp. 37–41, Tab. I–VI).

5.2.1. Horizon VIII finds in excavation block XIII (1983–1986)

The reviewed 2024 article presents horizon VII lithic artefacts as the lowermost *in situ* archaeological finds in Korolevo I without mentioning complex VIII (Garba *et al.*, 2024). The reason for this may be that Kulakovska and Usik, during their previous study of the stratigraphy and artefacts belonging to complexes VII and VIII, concluded that horizon VII is the only "archaeological representative" for the lowermost artefacts at Korolevo I.

"[...] *the stratigraphic-depositional conditions of artefacts in layers VIII and VII are identical following the scheme of O. Adamenko – P. Haesaerts (fig. 4). The state of destruction of the surface of andesite finds from layer VII and the so-called layer VIII are absolutely the same. Some differences that are traced in a few cases are connected with the chemical structure of andesite pieces. Artefacts from "both" layers have the same morphology, and several pieces of the so-called layer VIII do not have traces of real primary flaking and secondary treatment (Koulakovska, Usik & Haesaerts, 2010; Koulakovska & Usik, 2011b). Thus, a part of the finds from excavation block XIII are not real artefacts, while other finds belong to layer VII. This allows us to conclude the absence of layer VIII in the Korolevo site*" [translated by the present author] (Koulakovska & Usik, 2015, p. 19).

Here, it is worth citing more details on horizon VIII artefacts from excavation block XIII: "*The final reports of the 1984–1986 excavation seasons describe only a small collection* […] *The same report mentions a large number of andesite chunks and "dozens of cracked pebbles of sandstones and quartzite, but it is difficult to tell about the artificial origin of it" [Gladilin et al., 1985 final report ., 1985, pp. 5–6]. After further analysis, it was determined that the andesite chunks are natural, not artificial. [Gladilin, Field Diary 1986, 10 July record]. On pebbles "with the traces of the reduction" made on sandstone, quartz and quartzite, there is no evidence of artificial human production – these are not artefacts*" (Koulakovska, Usik & Haesaerts, 2010, p. 129).

Although the rejection of an LP layer VIII at Korolevo I quickly became accepted among colleagues working on the LP in Central Europe (e.g., Valoch, 2011, p. 10), the topic needs further comments.

First, the statement of Kulakovska and Usik on stratigraphy that there were the same "*deposition conditions for artefacts of layers VIII and VII*" within "*alluvial deposits of Tisza terrace*" (Koulakovska & Usik, 2015, p. 19) is surprising from a geological point of view. The alluvial deposits were divided by Adamenko into three lithological units, 25, 26 and 27. Then Haesaerts combined Adamenko's units 25 and 26 into one unit, 25–26 and retained unit 27. Lithologically, as it was already shown above, these units are all different. Moreover, in the stratigraphic description of sondage 18, among others (Adamenko *et al.*, 1989, pp. 15–16), the sediment package of units 25–27 has a considerable thickness: 0.35 m for unit 25, 0.80 m for unit 26 and 0.30–1.50 m for unit 27, that is, only the upper part of unit 27 has no less than 1.3 m thickness. In excavation block XIII, where lithics of horizons VII and VIII were discovered, sediment units 25–27 reach an almost 1-metre thickness in profile а-д – 6, and more than 1 metre in profile д-10 (Koulakovska, Usik & Haesaerts, 2010, Fig. 10). Nevertheless, it was recently proposed not only to reject the existence of horizon VIII in Korolevo but to accept that the few lithic artefacts (the 33 proposed pieces) were actually (!) distributed all along this lithologically variable and thick sediment package at an excavated area of 128 m² – "*objective data indicate that layer VII in situ is distributed within the boundaries of the terrace alluvium horizon, and not only in its upper part*" (Koulakovska & Usik, 2011b, p. 15).

Second, the presence of "*a large number of andesite chunks"* and *"dozens of cracked pebbles of sandstones and quartzite*" among horizon VIII finds in excavation block XIII (Koulakovska, Usik & Haesaerts, 2010, p. 129) shows that Gladilin and Sitliviy rendered natural hyalodacite and non-hyalodacite pieces from the pebble alluvium unit 27 to horizon VIII in the middle of 1980s. However, while rejecting the existence of horizon VIII in excavation block XIII, Kulakovska and Usik never published any data on their analysis of the 26 *in situ* lithics belonging to horizon VIII, to show the unworked stones and the artefacts apart, the latter of which had to be reclassified into horizon VII. Gladilin and Sitliviy published artefacts of complex VIII without distinction between the suggested *in situ* lithics from excavation block XIII, and non-*in situ* lithics from the Beyvar hill (Gladilin & Sitliviy, 1990, pp. 37–39; Tab. I–III, IV: 1, V: 1). Before finalizing their 1990 book, they note about complex VIII lithics (as mentioned, irrespective of their places of recovery): "*the collection in this layer consists of more than 400 artefacts, but is represented only by two inconclusive tools, the rest are flakes and fragments*" (Gladilin & Sitliviy, 1987, p. 203). Then, strangely, they write in their 1990 book that the complex VIII lithic assemblage consists of 11 cores, five pre-cores and 12 tools, including five choppers, four examples of two types of proto-handaxes, as well as a doubtful tool and two unidentifiable tools (Gladilin & Sitliviy, 1990, p. 38). Most likely, Gladilin and Sitlivyi tried to substantiate the complex VIII assemblage with more cores and tools in the final 1990 publication but from where they got some "extra" cores and tools, remains unknown.

In summary, hyalodacite and non-hyalodacite (siliceous sandstone and quartz) lithics of complex VIII indeed look like geofacts, pseudo-artefacts or eoliths. This conclusion pertains to the entire "cultural-chronological complex VIII", i.e., lithics found at Gostryi Verkh, excavation block XIII, as well as pre-Middle Pleistocene natural hyalodacite pieces from the surface and in redeposited contexts from the Beyvar area.

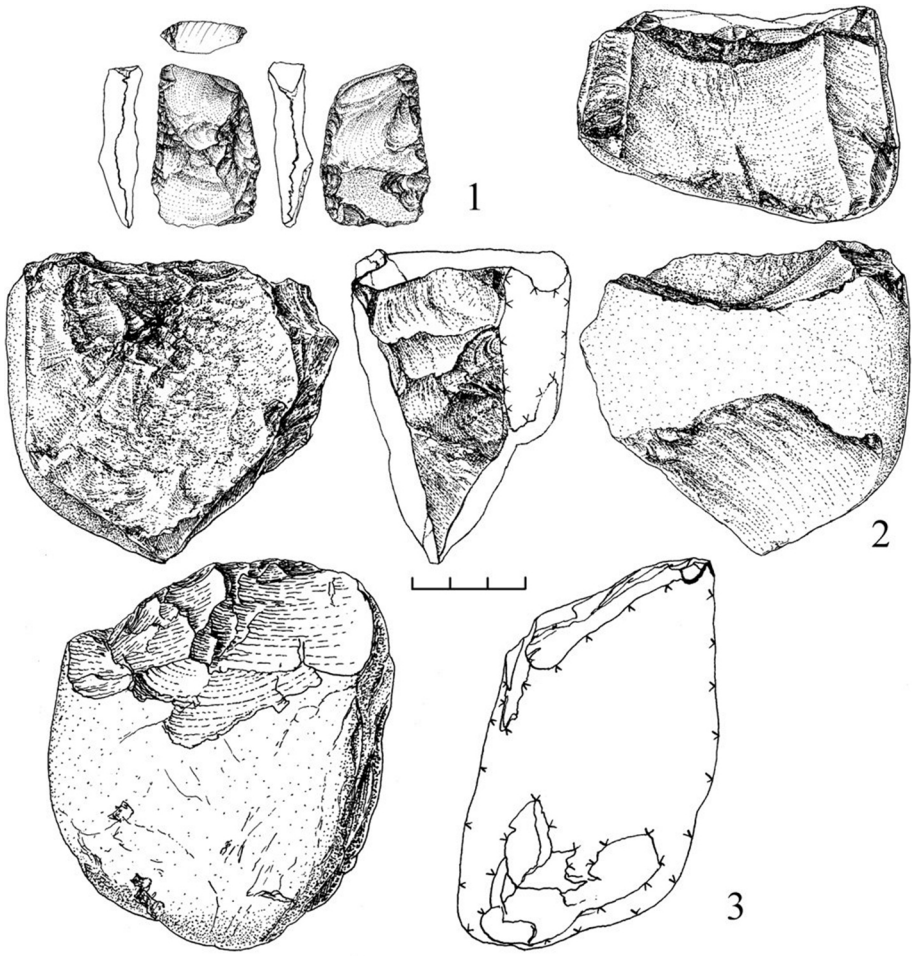

Fig. 11A. Excavation block XIII, Gostryi Verkh area, Korolevo I (1983–1986). Drawings of three non-hyalodacite lithic finds from archaeological horizon VII, as determined by Kulakovska & Usik. 1 – a "*bifacially formed tool made on a primary flake*" on siliceous sandstone; 2 – a "*multi-platform core*" on siliceous sandstone; 3 – a "*chopper/core-chopper*" on quartz (?) (after Koulakovska & Usik, 2015, Fig. 11 and 14)

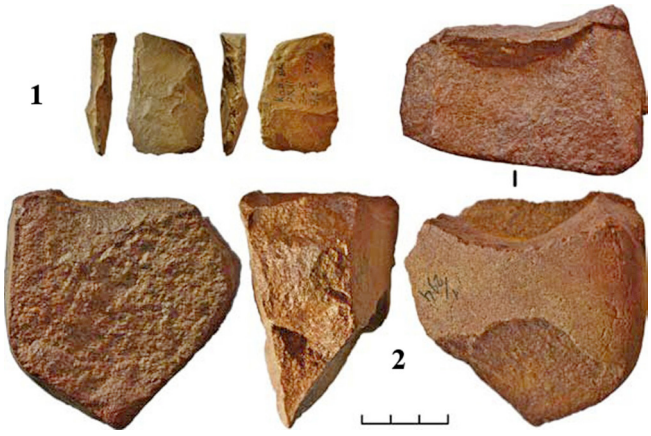

Fig. 11B. Excavation block XIII, Gostryi Verkh area, Korolevo I (1983–1986). Photos of two non-hyalodacite lithic finds from archaeological horizon VII, as determined by Kulakovska & Usik. 1 – a "*bifacially formed tool made on a primary flake*" on siliceous sandstone; 2 – a "*multi-platform core*" on siliceous sandstone (after Koulakovska & Usik, 2015, Fig. 12)

5.2.2. Horizon VII finds in excavation block XIII (1983–1986)

If the lithics of archaeological horizon VIII are most probably not modified by humans, the question should be asked, for the first time: is the small assemblage of horizon VII man-made? The most practical way to review this question about the proposed oldest *in situ* LP artefacts at Korolevo I is to cite the results published by Kulakovska and Usik, shortly summarized by Usik in Garba *et al.*, 2024.

"*All artefacts that were found in excavation area XIII during the 1984–1986 seasons were studied. In general, they consisted of isolated finds (from one to five) distributed throughout separate squares (Fig. 9c,d). Artefacts were noted at different depths (from - 9.40 to - 12.0 m), which can be explained by the substantial dip of the lithological layer towards the southeast (Figs. 9 and 10). In squares a/b-6, which are located near the represented profiles, the findings are distributed evenly from -9.5 to -9.92 m within the bounds of a single geological layer (Fig. 10). In square d-10, lithological layer 26 is divided by a horizon of diluvium, suggesting a localized episode of disturbance within the stratigraphic sequence (Fig. 10). Above horizon 3, level VII artefacts were found (Fig. 10). Beneath this horizon, one flake and two chunks were found. There was no diluvium observed either above or below. Level VII is located within the alluvium of the terrace, but not within the upper portion as marked by Gladilin (1989a, p.10). In sondages 18 and 26 and also in the 1998 season profile, which represents the main stratigraphic sequence of Korolevo, level VII artefacts are absent*" (Koulakovska, Usik & Haesaerts, 2010, pp. 126–127).

The following comments on these observations can be made. First, archaeological horizon VII's 33 artefacts were found as "*isolated finds*" in groups "*from one to five*" in a few 2×2 m squares (4 m² each). Looking at the grid of excavation block XIII excavated to the pebble alluvium (32 squares = 128 m²) (Koulakovska, Usik & Haesaerts, 2010, Fig. 9c–d; Koulakovska & Usik, 2015, Fig. 5), horizon VII artefacts were randomly found in just 16 squares or 50% of all squares (64 m²). Moreover, these artefacts do not show any concentration(s) or cluster(s) within the excavated area. Of the 16 squares with horizon VII artefacts, half of them (8 squares, 32 m²) contain a single find, again in a 4 m² area each. Accordingly, the word "random" fits the spatial distribution of horizon VII lithic artefacts within excavation block XIII. Second, all lithological units in the longitudinal profiles of excavation block XIII incline from north to south, which is especially well seen in the case of unit 26 with a diluvium level within it. Keeping in mind the transversal northern profile of excavation block XIII with a kind of compressed stratigraphy, Usik's observation (2009, p. 104) is indeed right on the location and influence of a "*ravine and the ancient relief*" on the vertical distribution of artefacts in horizon V. This observation seems especially true for the stratigraphically lowermost finds as well. Indeed, the small amount of randomly distributed artefacts of horizon VII "*within an alluvial channel deposit*" (Garba *et al.*, 2024, p. 2) certainly does not represent any kind of Palaeolithic living floor of an archaeological horizon. However, our close look at the characteristics of these 33 artefacts may offer a clue to the reason for their distribution.

Kulakovska and Usik published data on these 33 lithics two times (Koulakovska, Usik & Haesaerts, 2010, pp. 127–129; Koulakovska & Usik, 2015, pp. 11–18). The 2015 data set is more detailed, including the square number and elevation measurement of each find, as well as metrical parameters, drawings and even high-quality photos of the so-called best or most indicative pieces.

The 33 artefacts are grouped by us into the following five categories, in Kulakovska's and Usik's artefact terminology:

- True cores (5) and associated flakes (11);
- Core-like chunks (3) and associated chunk-flakes (4);
- Chunks (7);
- Chip (1) – a piece under 3 cm;
- Tools (2).

Of these items, 30 are hyalodacite and 3 are non-hyalodacite specimens. Our re-analysis logically starts with the non-hyalodacite items, which are easier to read than the hyalodacite ones: two quartzites (siliceous sandstones) and a quartz with a question mark. Following the published drawings, all three pieces initially look as they are defined: a "*multi-platform core*" (siliceous sandstone) (Fig. 11A: 2), a "*bifacially formed tool made on a primary flake*" (siliceous sandstone) (Fig. 11A: 1), a "*chopper/core-chopper*" (quartz?) (Fig. 11A: 3).

However, on the published high-quality photos, the "*multi-platform core*" (siliceous sandstone,

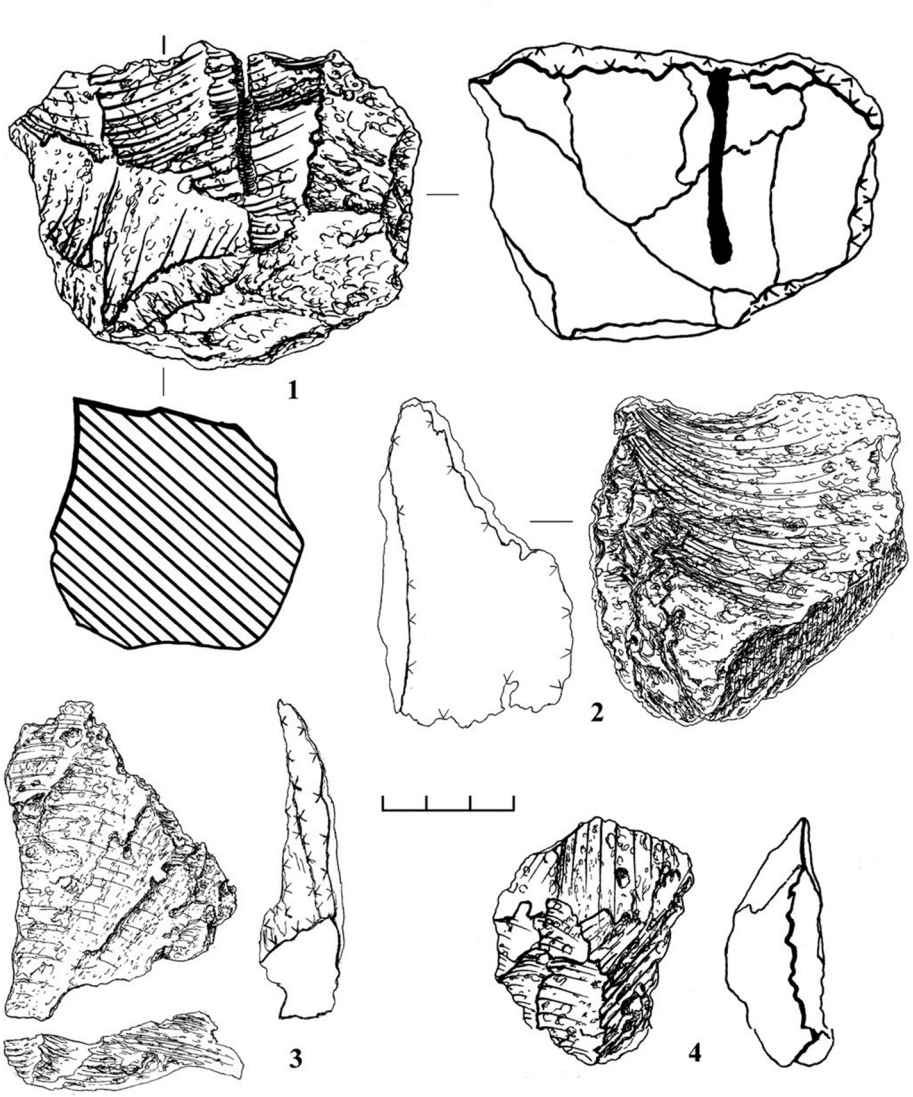

Fig. 12. Excavation block XIII, Gostryi Verkh area, Korolevo I (1983–1986). Drawings of four hyalodacite lithic finds from archaeological horizon VII, as determined by Kulakovska & Usik. 1–2 – so-called true cores; 3–4 – so-called flakes (after Koulakovska & Usik, 2015, Fig. 13)

83.74×84.15×53.69 mm) (Fig. 11B: 2) does not show any true debitage removal negatives on its surface, just natural-looking damage. This piece was found at the greatest depth among horizon VII artefacts, 12.00 metre, in square з-10 as a single piece in an area of 4 m², suggesting its origin from the gravel pebble alluvium unit 27. The "*bifacially formed tool made on a primary flake*" (siliceous sandstone, 42.28×27.83×9.12 mm) (Fig. 11B: 1) again does not show any true removal negatives on its surface having instead natural-looking damage. Moreover, edge damage on the piece indicates rolling in a hard (pebble?) matrix. Although all colleagues underlined that horizon VII lithic artefacts have no natural damage, this so-called bifacial tool seems to have it. Finally, this object comes as a single find from square г-5 at a depth of 9.65 m, from an area without well-controlled stratigraphy. The "*chopper/core-chopper*" (102.81×84.78×53.40 mm) (Fig. 11A: 3) was found in square б-6 at a depth of 9.98 m, which is the deepest measurement in the western part of excavation block XIII (Fig. 7). There was no good published photo of it in the 2015 article but a photo was eventually published in 2024 (Garba *et al.*, 2024, Fig. 3a). This third non-hyalodacite piece is also dubious, there are removal negatives only on one surface without any striking platform or another edge usually a chopping tool-like piece has. It also has an interesting "taphonomic feature". This "*chopper/core-chopper*" is illustrated as belonging to cultural-chronological complex VIII in the 1989 and 1990 publications (Adamenko *et al.*, 1989, Fig. 7, 3; Gladilin & Sitlivyi, 1990,

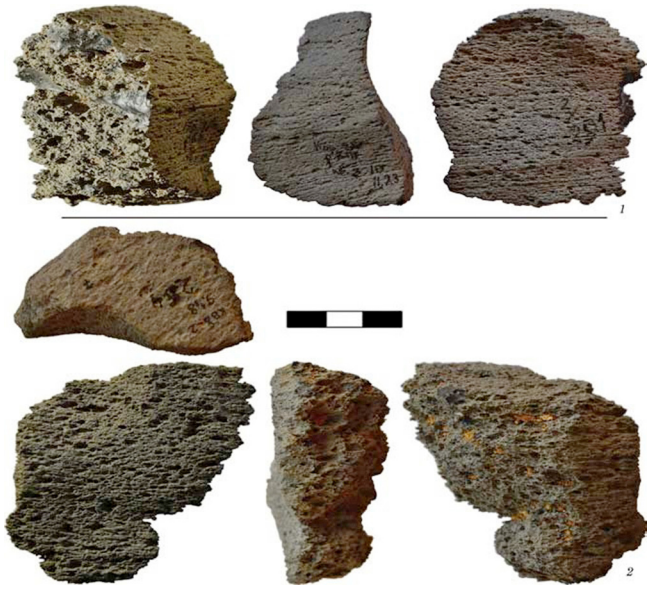

Fig. 13. Excavation block XIII, Gostryi Verkh area, Korolevo I (1983–1986). Photos of two hyalodacite lithic finds from archaeological horizon VII, as determined by Kulakovska & Usik. 1 – a so-called chunk-flake; 2 – a so-called core (after Koulakovska & Usik, 2015, Fig. 8)

Tab. III, 1). This drawing was published in 1989 and 1990 and then reproduced by Kulakovskaya and Usik in their 2015 article but as an artefact belonging to horizon VII, not VIII (Koulakovska & Usik, 2015, Fig. 14).

Thus, the second and third discussed non-hyalodacite pieces are items found in unit 27 and connected to horizon VIII by Gladilin and Sitlivyi. Then Kulakovska and Usik reclassified these as human-modified objects, and consequently, as not horizon VIII but horizon VII artefacts. Finally, the most promising "*chopper/core-chopper*" from horizon VII actually comes from the archaeologically sterile pebble alluvium unit 27 and looks-like a naturally damaged piece.

There is one more technological peculiarity in connection with the three non-hyalodacite specimens. By definition, the suggested primary and secondary treatment of these pieces surely had to produce flakes and chips. However, not one debitage-like non-hyalodacite piece was found in horizons VII and VIII in excavation block XIII. It leads to a conflicting situation, with the occurrence of three (!) objects at various stages of reduction and the absence of any other products linked to these reduction events. It is highly unlikely that early humans (*Homo erectus*) planned such a behaviour, and brought non-hyalodacite products knapped elsewhere to a hyalodacite outcrop. We suggest a more plausible interpretation. These three pieces most probably are naturally damaged sandstone and quartz pebbles from the pebble gravel unit 27, which have been classified into unit 26 and horizon VII. More than that, there is a common, obvious pebble alluvium feature, be it a fossil or a modern gravel bed: you can always find some "core-like and chopper-like pieces" there but you hardly find the detached flakes because they were carried away by fluvial processes. The present author observed this situation several times, with siliceous sandstone pebbles in the modern bed of the Tisza River in Transcarpathia, and with Lower Eocene flint cobbles in a fossil fluvial bed around the Hummal site in the El Kowm region of central Syria in 2010. Similar reasonable doubts on suggested LP loci in Bohemia were also expressed by K. Valoch (2013, p. 54):

"*It is known from indisputable European settlements from the early Lower Palaeolithic that, as long as they are in situ, they always also contain flakes and additional accompanying material. Grouping of only quartz and quartzite pebbles and fragments of siliceous schist probably indicate separation by running water*".

Thus, all three non-hyalodacite pieces in the collection of so-called *in situ* horizon VII lithics do not look like real artefacts, based on stratigraphy and spatial data, and archaeological characteristics.

The 30 hyalodacite pieces are reassessed as follows. Two object classes should be straightaway excluded from artefacts due to the absence of any visible traces of anthropogenic modification: seven chunks (square а-4, 9.48 m depth; square б-4, 9.70 m depth; square а-6, 9.57 m depth; square д-10, 11.95 m depth, below the above-noted diluvium horizon in that square, see Koulakovska, Usik & Haesaerts, 2010, p. 126; square б-5, 9.65 m depth; square а-4, 9.54 m depth; square а-1, 9.45 m depth), and a single chip (square д-10, 11.95 m depth, below the above-noted diluvium horizon in that square, described as a flake – Koulakovska, Usik & Haesaerts, 2010, p. 126), with no published data on their metrical dimensions. Two of these eight specimens were situated in the lower part of unit 26 in square д-10, below the diluvium horizon, where no modified artefacts were found. Six chunks were unearthed in the upper, northern squares of excavation block XIII. They have the uppermost depth measurements for horizon VII

artefacts, between 9.45 and 9.70 m. One of them was in square a-1 and two of them were in square a-4. These squares did not have unit 26 sediments, which makes the number of chunks belonging to horizon VII from seven to four.

Two flakes, from the upper squares with high depth measurements again, also have to be excluded – a "*fragment of unidentifiable flake*" (square a-6, 9.80 m depth) and a "*dubious flake*" (square б-6, 8.98 m depth). The depth of the latter piece is less than 9 m, while Kulakovskaya and Usik state that horizon VII artefacts were found between 9.40–12.00 m (Koulakovska, Usik & Haesaerts, 2010, p. 126; Kulakovska & Usik, 2015, p. 11). Accordingly, this "*dubious flake*" either indicates even a more extended occurrence of horizon VII finds, enlarging its depth interval to more than 3 m, or it is a redeposited piece that was still included in the horizon VII assemblage. In sum, we are speaking about only 20 possible (!) artefacts in 128 m² of excavation block XIII, instead of 30.

Turning to the remaining four "true cores" and 10 associated flakes, three of the four cores are illustrated and not one is regarded by the present author as an artefact modified by humans.

Object #1 (Fig. 12: 2), square a-6, 10.00 m depth, 77.21×72.39×41.72 mm. It is a fragment of a hyalodacite "bomb" and its missing part was interpreted by Kulakovskaya and Usik as a flake removal negative. However, the object lacks a striking platform and the detached piece is also missing, it is just a fragmented "natural" piece. With its 10.00 m depth, this is the lowest-lying piece in the square (this depth is missing (!) from the excavation block XIII plan and profile at a-б, see Kulakovska & Usik, 2015, Fig. 5), compared to the other recorded items found between 9.50 and 9.83 m. Thus, this natural "bomb" probably either originated from lithological unit 27, or it was a redeposited piece like the above-discussed "*dubious flake*".

Object #4 (Fig. 12: 1), square б-6, 9.89 m depth, 59.33×83.24×59.18 mm. This piece looks similar to object #1, it is a fragment of a hyalodacite "bomb" and its fragmented part was probably assumed by Kulakovska and Usik as having two flake removal negatives. Again, the object lacks a striking platform and the detached pieces are also missing, it is just a fragmented "natural" piece. There is, however, one more specific feature of the object not mentioned by Kulakovska and Usik. Like the already discussed quartz "*chopper/core-chopper*", this so-called core is also illustrated in the 1989 and 1990 publications (Adamenko *et al.*, 1989, Fig. 7, 2; Gladilin & Sitlivyi, 1990, Tab. II, 3) as a "*chopper*" from cultural-chronological complex VIII. So, it is again a hyalodacite natural piece from the archaeologically sterile gravel pebble alluvium unit 27.

Object #2 (Fig. 15: 2), square б-2, 9.48 m depth, 68.53×73.87×42.29 mm. The photograph of the objects shows a more than 7 cm wide hyalodacite natural fragment in our opinion.

None of the three illustrated cores look like cores. Two of them are damaged hyalodacite bombs and one more piece is just a natural fragment of hyalodacite. Moreover, two of these pieces certainly come from the archaeologically sterile gravel pebble alluvium unit 27. The same attribution, unit 27, is possible for the fourth, not illustrated core #3 (10.21×70.06×51.40 mm, square л-10, 12.05 m depth), which is the single identified "artefact" for not only square л-10 but also for the two adjacent squares к-10 and и-10. Thus, there are no real cores in horizon VII.

Of the nine "*flakes*", four have published illustrations (Kulakovska & Usik, 2015). Two flakes were both drawn (Fig. 14A: 1–2) and photographed (Fig. 14B: 1–2), which certainly helps to discuss why they are not flake-looking pieces. They don't have flake traits such as removal negatives of previously detached flakes, a butt, point and/or bulb of percussion, fissures and ripples. In addition, their different degrees of weathering prevent us from classifying them into the same archaeological horizon. The object classified as a "*Kombewa flake*" (square a-6, 9.70 m depth, 113.94×111.44×26.81 mm, Fig. 14A: 1; Fig. 14B: 1) is significantly more weathered than the other flake (square д-10, 11.23 m depth, 142.53×120.79×29.33 mm, Fig. 14A: 2; Fig. 14B: 2). Moreover, the latter piece from square д-10 was found above the diluvium horizon so it cannot be securely linked to unit 26.

Two other illustrated flakes cannot be securely evaluated without photographic illustration. One of them (square д-10, 11.95 m depth, 71.63×58.52×9.05 mm, Fig. 12: 3) originates below the diluvium horizon and probably from unit 27. The other flake (square б-1, 9.65 m depth, 54.52×40.54×20.21 mm, Fig. 12: 4) comes from an area where no unit 26 sediment is known, and it is *ca.* 11 m from the eastern, well-controlled

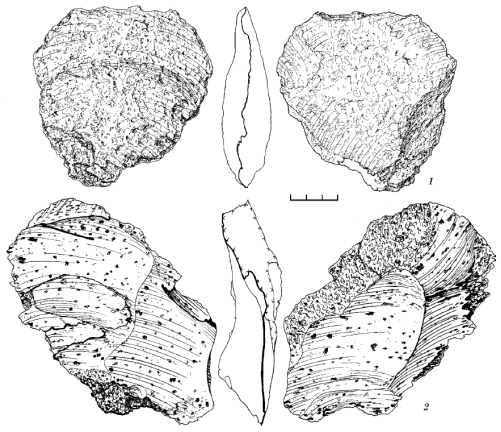

Fig. 14A. Excavation block XIII, Gostryi Verkh area, Korolevo I (1983–1986). Drawings of two hyalodacite lithic finds from archaeological horizon VII, as determined by Kulakovska & Usik. 1 – a so-called "*Kombewa flake*"; 2 – a so-called flake (after Koulakovska & Usik, 2015, Fig. 9)

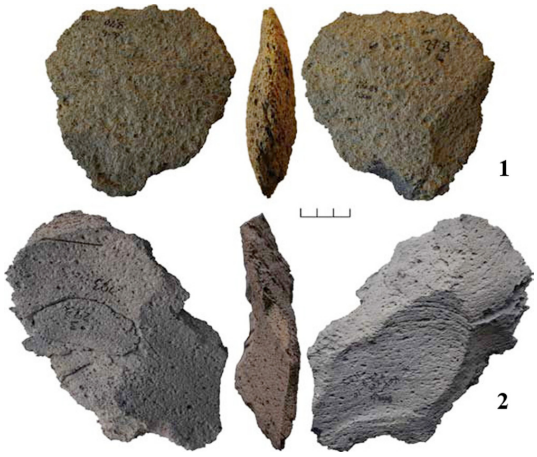

Fig. 14B. Excavation block XIII, Gostryi Verkh area, Korolevo I (1983–1986). Photos of two hyalodacite lithic finds from archaeological horizon VII, as determined by Kulakovska & Usik. 1 – a so-called "*Kombewa flake*"; 2 – a so-called flake (after Koulakovska & Usik, 2015, Fig. 9)

stratigraphic profile. Thus, this piece can not be reliably included in horizon VII and lithological unit 26.

The four illustrated flakes do not look like detached flakes and they can not be securely associated with lithological unit 26. There are no illustrations of the remaining five flakes to discuss them in detail. However, it is a usual practice in Palaeolithic archaeology publications that illustrated pieces are the most indicative of a particular artefact class. The five not illustrated flakes perhaps can not serve for any argument on their origins and makers.

There are also two more additional observations concerning the nine flakes here. The first is their dimensions. Taking either length or width data for all 7 complete pieces (one more flake with a fragmented distal part is 33.01 mm long; another flake with a fragmented lateral part is 54.52 mm long), their average maximum dimension appears to be 80.97 mm. Two pieces measure over 10 cm, and there is no flake under 5 cm, which makes this small assemblage "large". Second, of the nine flakes, two were classified as "*Kombewa flakes*". One of these flakes and the fragmented lateral part of a "*radial flake*" were said to have specific lipped or semi-lipped butts that do not correspond to the claimed use of an LP hard-hammer technique. We think that these butt definitions are the result of the misreading of the hyalodacite pieces found in lithological unit 26 at Korolevo I, especially taking into account the absence of any Kombewa cores on flakes in horizon VII.

Thus, horizon VII flakes look unusual. They do not demonstrate convincing *sensu stricto* artefact morphological features, they show a varying degree of weathering, and they are unusually large for an LP assemblage prior to the appearance of Acheulean with hand-axes and/or cleavers. Finally, some of their features do not correspond to Early Pleistocene LP lithic assemblages older than one million years (core technologies resulting in Kombewa flakes and flakes with specific lipped/semi-lipped butts).

Apart from the so-called true cores and associated flakes, another part of the assemblage consists of lithics which Kulakovska and Usik suggest represent "*Pre-Oldowan smashing technology*" as defined by Gladilin and Sitlivyi in the late 1980s (Gladilin & Sitlivyi, 1987, p. 203; 1990, p. 8). These are three "*core-like chunks*" and four "*chunk-flakes*" associated technologically with the core-like chunks. The former are not cores as follows from their description. "*The polyhedron and core-like chunks have very similar flat and convex* [underlined by the present author] *negatives on their surfaces. The morphology of the chunk-flakes conforms to these negatives. Chunk-flakes typically possess concave or flat ventral surfaces without clear traces of intentional reduction by hammering*" (Koulakovska, Usik & Haesaerts, 2010, p. 128).

Of the three core-like chunks, two are illustrated. One of them (square r-4, 10.14 m

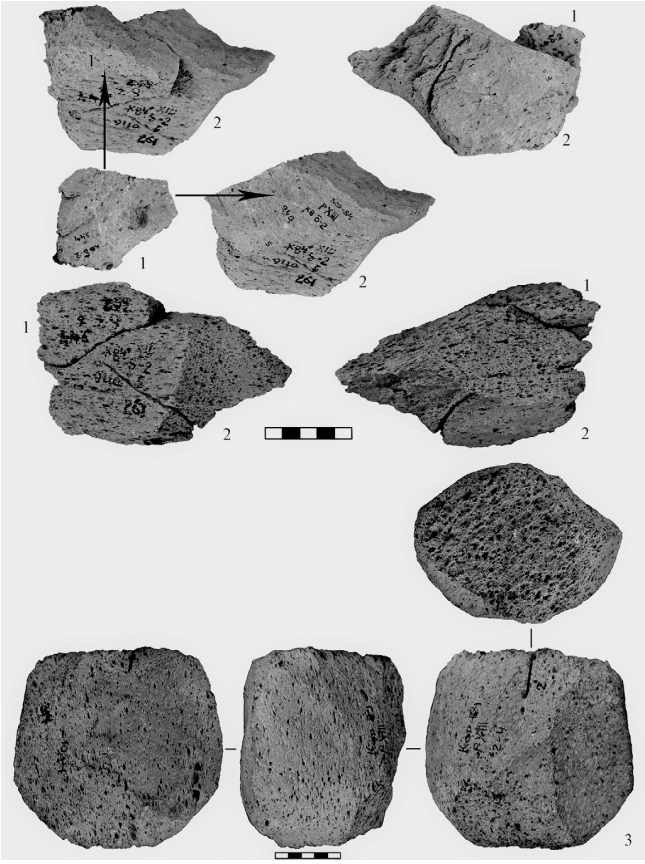

Fig. 15. Excavation block XIII, Gostryi Verkh area, Korolevo I (1983–1986). Photos of three hyalodacite lithic finds from archaeological horizon VII, as determined by Kulakovska & Usik. 1 – a so-called chunk-flake; 2 – a so-called core-like chunk refitted with a chunk-flake; 3 – a so-called polyhedron (after Koulakovska *et al*., 2010, Fig. 11)

depth, 132.67×146.53×106.14 mm, 3124 g) was classified as a large "*polyhedron*" illustrated with a photo (see Koulakovska, Usik & Haesaerts, 2010, Fig. 11, 3; Koulakovska & Usik, 2015, Fig. 7, 3) (Fig. 15: 3). The photo shows that the piece is more weathered in the upper and lower parts, and less weathered in the middle. The differently weathered surfaces were interpreted as a core-like piece with a natural cortical striking platform, and the negatives of some detached flake-like pieces. However, the so-called removal negatives do not correspond to any kind of intentional flaking when "*most surfaces along the perimeter have a convex configuration*" [translated by the present author] (Koulakovska & Usik, 2015, p. 15). Another illustrated core-like chunk (square б-2, 9.40 m depth, 129.82×71.41×71.38 mm) (see Koulakovska, Usik & Haesaerts, 2010, Fig. 11, 1–2; Koulakovska & Usik, 2015, Fig. 7, 1–2) (Fig. 15: 1–2) looks like two refitted chunk-flakes at first sight. However, it is interpreted by Kulakovska and Usik as a chunk-flake refitted to a core-like chunk with, again, one negative being "*convex and morphologically similar to removal negatives on the polyhedron*" [translated by the present author]. (Koulakovska & Usik, 2015, p. 15).

Some core-like chunk data deserve special attention. First, the two core-like chunks and the refitted proximal fragment of a chunk-flake (>79.51×59.33×28.04 mm) (Fig. 15: 1–2), demonstrate about the same degree of weathering. They are more "fresh" than the already discussed, more weathered flakes of layer VII (Fig. 14B: 1–2). Second, the illustrated polyhedron and core-like chunk are characterized by the presence of so-called "convex removal negatives" which, by definition, can not occur in the primary phase of an intentional reduction sequence done by humans. Third, the two refitted pieces have depth measurements of 9.40 m and 9.44 m in square б-2, while the polyhedron has 10.14 m in square г-4. The depths of the two refitted pieces are the highest among horizon VII lithics that were established by Kulakovska and Usik between 9.40 m and 12.0 m. They were also found in a square located far from the longitudinal eastern profile, so their stratigraphic position can not be established. As was noted above, the northern transversal profile a/A 1 to 6 in excavation block XIII (Fig. 8A) has a much shorter stratigraphic sequence, where lithological unit 26 is missing from the line of squares' a/A 1–4. This opens up the possibility that lithics found in squares а-б – 1 – 4 and perhaps square г-4 in horizon VII / lithological unit 26, represent either some artefacts from archaeological horizon VI or some redeposited natural hyalodacite objects. Looking at the northern profile (Fig. 8A), it is seen that in squares а-б – 1 – 4, paleosoil VII with lithological unit 17 and the LP archaeological horizon VI is about lying on the gravel pebble alluvium of lithological unit 27. This way, some lithic pieces from archaeological horizon VI could be attributed to horizon VII due to the noted gross excavation technique with arbitrary levels. So, the discussed objects are perhaps not related to horizon VII at all, besides, they look like unworked hyalodacite pieces instead of cores and detached flakes.

Concerning the "polyhedron" from horizon VII, these objects, together with spheroids and bolas (PSBs) (Cabanès *et al.*, 2022), are known from the oldest LP assemblages up to the Neolithic period (e.g., Cropper, 2006) in current Old World

Stone Age archaeology. Specifically, studies of LP artefact assemblages show that most polyhedrons are not just enigmatic, natural-looking stone objects but they usually demonstrate intentional flaking at least on a part of their surfaces, aiming a rounded shape, whatever function(s) of these items had (e.g., Cabanès *et al.*, 2022, Fig. 1–2). In the case of Korolevo I horizon VII, only one such item is identified without (!) intentional detachment negatives on its surface. The so-called core-like chunks associated by Kulakovska and Usik with the polyhedron do not look like human-made artefacts either. The true "artefact character and properties" of these two object types are dubious, they are perhaps a "natural" hyalodacite bomb and fragments, possibly coming from lithological units above. For example, archaeological horizon VI contained many unworked hyalodacite objects from *in situ* excavated trenches.

One more chunk-flake (square д-10, 11.23 m depth, 65.65×70.69×52.67 mm) was presented in a photograph (Koulakovska & Usik, 2015, Fig. 8, 1) (Fig. 13: 1). Its position below the diluvium horizon suggests its original deposition in lithological unit 27 of gravel pebbles. Additionally, it does not look like an artefact, being only a "natural" and very thick chunk (too thick to be a flake detached by humans in the Early Pleistocene LP) with two different weathering surfaces. In contrast to Kulakovska and Usik, the present author considers such pieces with no debitage stigmata and different degrees of weathering on their surfaces as a result of the natural breakage of hyalodacite bombs at various times.

These ambiguities around core-like chunks and chunk-flakes lead us to revisit the ideas and data of Gladilin and Sitlivyi in the late 1980s, about a "*Pre-Oldowan LP stage and its smashing technology*", and their possible connection to horizon VII lithics in Korolevo I. Gladilin well recognized that a significant amount of finds from complexes VII and VIII lacks debitage features, looking like unworked objects and their fragments or chunks. These are the "*questionable debitage pieces*" and "*chunks*" in the assemblages of complexes VIII (33.3% of 415 lithics) and VII (62.8% of 1522 lithics), not counting chips (which were re-calculated by the present author using data in Gladilin & Sitlivyi, 1990, pp. 37, 39). Moreover, the ratio of "*flakes and blades*" and "*questionable debitage pieces and chunks*" is 1.83:1 in complex VIII (236 flakes and 15 blades to 138 chunks) and 0.57:1 in complex VII (525 flakes and 19 blades to 959 chunks). So, Gladilin had to find an explanation for the overwhelming presence of seemingly unworked pieces in the assemblages he collected mostly from the surface, and he considered the oldest in Korolevo, based on their degree of weathering. The problem brought him and Sitlivyi to a hypothesis of a special smashing technology used by early LP humans, which resulted in mostly shatter and chunks, and only a few pieces with a flake morphology. This presumed technology could explain the LP finds in Korolevo I, and various Oldowan assemblages from East Africa known at that time. Their paper on the topic is interesting and thought-provoking even today, more than 35 years after its publication (Gladilin & Sitlivyi, 1987). They proposed the existence of a Pre-Oldowan stage in the LP with the following primary flaking methods and products:

"*1. Predominance of shapeless splinters and fragments over the flakes;*

2. The technique of flaking is characterized by an utterly primitive method – i.e. by breaking or shattering or by acquiring flakes from rare, non-expressive polyhedric cores;

3. Microlithism of the artefacts;

4. Utter absence of intentionally manufactured tools, namely of choppers;

5. The use of non-worked fragments, flat stone splinters and flaked-off pieces of stones as working tools" (Gladilin & Sitlivyi, 1987, p. 202).

Gladilin and Sitlivyi also emphasized (1987, p. 203) that all these traits are characteristic of *in situ* and well-excavated (!) LP site clusters dated to even before 2 Ma in East Africa, such as Olduvai George, Koobi Fora, Shungura, and Omo. They also note that these primitive primary flaking methods persisted for a long time, this is why they were present at Korolevo I *ca*. 1 Ma ago and even further on during the Middle Pleistocene, in both Africa and Eurasia.

Perhaps Kulakovska and Usik used these ideas and data of Gladilin and Sitlivyi and applied them again to the LP material in Korolevo I without a critical reassessment. However, it is all about one of the basic preassumptions of Palaeolithic archaeology that still occurs today, to consider almost all lithics within an archaeological layer and its respective lithological unit as *in situ* artefacts brought, made, and re-shaped by Palaeolithic humans. This assumption is

highly contested today, especially in the case of Palaeolithic sites with their artefact-bearing levels in fluvial sediments (see, for example, for LP sites – Dibble *et al.*, 1997; Müller & Pasda, 2011; Pasda, 2012). New high-quality publications are available today about some of the oldest LP site clusters in Africa, at Olduvai Gorge Bed I (Tanzania) and Koobi Fora (Kenya) (e.g., de la Torre & Mora, 2005a; 2005b; Merino-Pelaz *et al.*, 2024), the materials of which were used by Gladilin and Sitlivyi for the Pre-Oldowan smashing technology hypothesis. These publications are, among some other topics, also devoted to taphonomic research of Oldowan sites, with reconstructions of palimpsest situations formed by human and carnivore on-site activities, and natural damage processes as well. Lithic assemblage revisions have shown a variety of artefact types and their quantitative data at numerous Oldowan sites. At the Olduvai Bed I sites, numerous "*manuports*" are now considered "*unmodified materials*" occurring in the archaeological horizons due to natural processes – "*deposited naturally*" (de la Torre & Mora, 2005a, p. 17; 2005b, p. 284). Concerning the numerous seemingly unworked pieces at Korolevo, it is worth citing the ratio of non-debitage-looking "*angular fragments*" in the Olduvai Bed I lithic assemblages. At Olduvai Bed I DK site, dated to *ca.* 1.85 Ma, there are 132 angular fragments (14,9%) in the assemblage consisting of 881 pieces (excluding chips), and the ratio of flakes (n = 666) to angular fragments is 5.1:1 (de la Torre & Mora, 2005a, p. 15, Tab. 2.1). At the Olduvai Bed I FLK Zinj site, dated to *ca.* 1.75 Ma, there are 131 angular fragments (10,6%) in the assemblage consisting of 1237 pieces (excluding chips), and the ratio of flakes (n = 990) to angular fragments is 7.6:1 (de la Torre & Mora, 2005a, p. 35, Tab. 3.1). The present author did not consider the chips in his Olduvai calculations to conducting a more correct comparison with the Korolevo I material, where the chips size category is underrepresented due to the mostly non-excavated context of the assemblage. Compared to the Olduvai data, chunks/angular fragments are far more frequent in Korolevo I than in the most well-dated and well-studied LP Oldowan sites in the Old World. Another difference is shown in artefact sizes. The Korolevo I horizon VII lithics are well over 5 cm and even over 10 cm in length and/or width (mean maximum dimension is 80.97 mm), while the Olduvai Bed I pieces are considered microlithic. The mean length and width of complete flakes are 4.0 cm and 3.7 cm respectively in the DK site, and 3.7 cm and 3.3 cm in the FLK Zinj site (de la Torre & Mora, 2005a, Tab. 2.3, 3.4). The metrical data in Olduvai recall the "*microlithism of the artefacts*" of pre-Oldowan sites due to the smashing lithic technology, which is certainly not the case with the so-called *in situ* LP Korolevo material.

Prior the appearance of the LP Acheulean with hand-axes and/or cleavers (Large Cutting Tools – LCTs) around 1 Ma, "*whose biface blank production was primarily based on large flake technology*" (Sharon, 2010, p. 230; see also Sharon, 2007) almost all LP assemblages are characterized by the reduction of technologically rather simple cores which resulted in small products because there was apparently no need of large flakes for "complex tools" like various bifacial implements. Accordingly, the presence of large lithic implements in the Korolevo I horizon VII assemblages, including the so-called "giant polyhedron" (over 13 cm long and 14 cm wide, more than 3 kg), has to be taken with due caution. The late appearance of large flakes in the LP was not obvious in the late 1980s when Gladilin and Sitlivyi worked with the Korolevo material but currently, it is.

Thus, the core-like chunks and chunk-flakes should be regarded as "natural" hyalodacite objects and fragments, not as remnants of a primitive LP smashing technology. If we accept the arguments listed above, no data supports the presence of the so-called smashing technology, producing mainly chunks and almost no debitage, in archaeological horizon VII/lithological unit 26, excavation block XIII, Gostryi Verkh area, Korolevo I.

Summarizing this section, the presented horizon VII lithics do not allow the present author to postulate an *in situ* and intentional LP artefact horizon VII in unit 26 at Korolevo I. The 33-piece assemblage consists of mostly natural-looking objects, a handful of intentional artefacts partly from sediments above, partly in uncertain stratigraphic contexts. This assemblage does not support the claim of the presence of an LP artefact-bearing horizon as the result of human activity, and it is certainly not a living floor. Instead, it most probably is a random occurrence of 33 redeposited objects alone or in groups of 2–5 pieces, scattered over an area of 128 m² (32 squares) which was excavated to the basal lithological unit 27 in 1983–1986. Even without

considering their morphology, these objects do not constitute any clusters or concentrations in the excavation block as residues of human activity usually do. Their distribution, as well as the complex nature of unit 26, is better explained by natural formation processes (see below).

6. The lowermost lithological units of Korolevo, and the presence of silicified sandstone and hyalodacite pieces

In the previous sections, we argued that the lithic assemblage in the lowermost layers of Korolevo consists mostly of a few hyalodacite bombs, their fragments and silicified sandstone pebbles in unit 26. Besides, these finds occurred only in half of one 128 m² trench, only (*sic*!) in excavation block XIII, Gostryi Verkh. No such lithics were found at other locations within the Korolevo site where excavation proceeded to the basal gravel unit 27. Accordingly, the most attention should be paid to this area. However, numerous surface and/or redeposited hyalodacite pieces were collected in the Beyvar Hill area, which were also attributed to the so-called "cultural-chronological complexes" VIII and VII, by Gladilin and Sitlivyi in the 1970s–1980s.

Regarding excavation block XIII, the following note on the unit 26 finds has to be considered: "*All artefacts made of hyalodacite show heavy surface weathering, but no evidence of damage or polishing by rolling or abrasion during fluvial transport, which suggests they were buried relatively rapidly*" (Garba *et al.*, 2024, Supplementary Information, p. 7). Excavation block XIII cut the area of an active, deep ravine, where erosion, diluvium events, a talus and altitude differences permanently affected sedimentation. This is why even the Early MP lithics of archaeological horizon V were found scattered in three (!) lithological units. These natural "destruction incidents" were strengthened and added by some fluvial events during periods of river alluvium sedimentation. During these episodes, large- and medium-sized pebbles from the alluvial lithological unit 27 were also carried into unit 26, in addition to the hyalodacite bombs and their fragments, as fluvial sediments of units 26 and 27 were partially mixed. In addition, the random horizontal and vertical distribution of the few hyalodacite pieces, usually well-separated one from another within unit 26, and found in only half of the large excavated area, indicates several (!) redeposition/movement events. The good but not perfect (without sharp edges) preservation of natural hyalodacite pieces in lithological units 26 and 27 can be also explained by such rapid transport events, followed by quick fluvial sedimentation. On the other hand, the areas of sondages 18 and 26 from the 1980s, and the two profile cleanings of 1998 and 2006, 75 m away to the east from excavation block XIII, were not affected by a ravine. Here, as expected, lithics of the so-called archaeological horizon VII are missing.

Turning to the Beyvar Hill area, almost two thousand hyalodacite pieces were found there during 15 years of fieldwork from the late 1970s to 1991, belonging to the so-called cultural-chronological complexes VIII and VII. Their presence is also can be connected to ravines, both ancient and modern, that were and are responsible for the transport, breakage, and redeposition of numerous hyalodacite bombs and their fragments throughout the area. Hyalodacite pieces were periodically reworked within the *in situ* Tertiary clayey sediments that contained them. A small part of these lithics could be human-made artefacts redeposited from archaeological horizons, such as VI and V. All of these processes led to the abrasion of the artefacts, and additional weathering after reworking within disturbed sediments. However, these characteristics of redeposited hyalodacite artefacts at Korolevo I were never explored but are much needed for a better understanding of the lithics, and the "sediment histories" at different areas of the site as well.

Lastly, in connection with the lowermost units, we have to mention the specific archaeological research approach of Gladilin. The present author remembers him well, his outstanding field and analytical work both at Korolevo and then in a Kyiv lab (see Demidenko, 2017). Understandably, when he saw the rather long Pleistocene sequence of the site encompassing 1 million years, containing a series of LP, MP and Early UP archaeological horizons, he was trying to uncover artefacts from lithological units as early as possible. Moreover, a significant hyalodacite outcrop has been found in Korolevo that was frequented by Upper and Middle Palaeolithic humans, and Gladilin also expected its exploitation in the Early Pleistocene, which was, as far as we know today, not the case. Gladilin's search for the oldest lithic artefacts at

Korolevo was also derailed by his understanding of the hyalodacite pieces, mentioned above. Proceeding deeper, from Early UP and MP horizons down to archaeological horizon VI, it became gradually harder to recognize lithic objects as artefacts. With this experience in mind, when Gladilin found hyalodacite pieces on the surface or redeposited in the ground, with a higher degree of weathering, often near the raw material outcrop, he, of course, was also trying to see them as artefacts. This eventually led him to recognize "cultural-chronological complexes" VII and VIII.

As a sort of conclusion on the so-called horizon VII LP lithic artefacts, found in lithological unit 26, excavation block XIII in Korolevo, it is useful to cite the good advice of Clemens Pasda (Jena, Germany) after his revision of lithics from the Middle Pleistocene Bilzingsleben site in eastern Germany: "*... accept stones as artefacts only when any natural forces which might have produced them can be ruled out with certainty*" (Pasda, 2012, p. 40). Maybe also some recent studies on distinguishing geofacts (pseudo-artefacts or eoliths) from human-made lithic artefacts (e.g., Wiśniewski *et al.*, 2023) will motivate colleagues to study the Korolevo materials from this perspective, that would be novel research concerning hyalodacite.

7. Conclusions

The presented arguments on the lowermost lithic finds and lithological units of Korolevo I, sprouting from the review of a current paper which states that the Korolevo LP finds represent the oldest reliably dated LP site in Europe (Garba *et al.*, 2024), allow the present author to make the following observations and conclusions.

First, the unworked large- and medium-sized pebbles and their various fragments which were dated with cosmogenic nuclides to *ca*. 1.42 Ma, can not be associated with the lithics found in the 1980s in archaeological horizon VII, lithological unit 26, excavation block XIII, Gostryi Verkh area, Korolevo I. The dated pebbles are of "intrusive" character for lithological unit 26 ("*alluvial, silt/sand*" – Garba *et al.*, 2024, Fig. 2, p. 3) representing pebbles from alluvial unit 27 ("*alluvial gravel, clay matrix*" – Garba *et al.*, 2024, Fig. 2, p. 3) stratigraphically below. As a result, the *ca*. 1.42 Ma age and the dated pebbles may be related to the archaeologically sterile gravel pebble alluvium of the basal lithological unit 27 in Korolevo.

Second, the "intrusive" occurrence of 20 large- and medium-sized pebbles in lithological unit 26 in excavation block XIII is due to the following four factors: the gross excavation methods in the mid-1980s, various diluvium episodes and erosional breaks, location of the excavation block inside a huge ravine leading to additional sediment disturbance, including redeposition of pebble gravels.

Third, based on the *ca*. 1.42 Ma date, Garba and his associates (2024) suggest that the Korolevo I horizon VII finds are associated geochronologically with three interglacial warm periods, MIS 47, 45 and 43. They hypothesize that these periods allowed the first *Homo erectus* groups to penetrate Europe from the East Mediterranean Levant, either through Asia Minor and then the Danube valley or crossing the Caucasus and then the northern Black Sea region in the southern part of Eastern Europe. These hypotheses do not correspond to the well-known paleogeographical and archaeological data of the respective regions in Western Eurasia and are considered invalid.

Fourth, the "intrusive" pebbles in lithological unit 26 and other stratigraphical problems with the unit containing archaeological horizon VII necessitated a revision of the published lithic material there. The 33 pieces of the respective assemblage were found alone or in groups of 2–5, scattered randomly in half (16) of the excavated 32 squares (2×2 m, 4 m² each) of the grid dividing the 128 m² excavation area. The finds are unworked, redeposited hyalodacite and siliceous sandstone pieces and their fragments, and a handful of human-made artefacts from sediments above the unit in question. We found no evidence of an LP living floor or artefact-bearing horizon within lithological unit 26 in the 1980s excavation block XIII in Korolevo I.

Fifth, the depositional history of the lowermost finds in excavation block XIII was turbulent because this area covers a once-active deep ravine with talus, slope, elevation differences and repeated diluvium events, as well as fluvial events causing river alluvium sedimentation. During fluvial events, large- and medium-sized gravel pebbles from the alluvial lithological unit 27 were also reworked into unit 26, which was added to a few reworked natural hyalodacite bombs and

their various fragments. The fluvial sediments of units 26 and 27 were partially mixed.

Finally, claims that artefacts constituting archaeological horizons VII and VIII in the lowermost units 26–27 at Korolevo I represent one of the oldest or oldest *in situ* LP material in Europe, dated to *ca*. 1 Ma previously, and *ca*. 1.42 Ma recently, should be dismissed. Nevertheless, the archaeological horizon VI in Korolevo I still can be considered the earliest LP occupation in East-Central Europe and Ukraine. This latter *in situ*, undeniably human-made assemblage was found in lithological unit 17 at the top of paleosoil VII, both in the Beyvar and Gostryi Verkh areas, in the 1970s–1980s. However, this horizon is dated on geochronological grounds (there are no reliable absolute dates yet) to the Middle Pleistocene inter-Mindel, MIS 14 period, *ca*. 550 ka BP. Thus, the Korolevo site complex is and will be at the centre of discussions concerning the initial human occupation of Europe in the LP.

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