THE KOROLEVO PALAEOLITHIC SITE:
RESEARCH METHODS, STRATIGRAPHY

SUMMARY — The multi-layered Palaeolithic site Korolevo, in the Soviet Transcarpathia appears to be one of the most important sources for studying the problems of the Palaeolithic of the south-east of Central Europe. In the course of many years of complex research into this unique site there was found a 12 m thick cover of deluvial loams with seven palaeosols and with the underlying alluvium of the 109—120 metre terrace on the left bank of the Tisa River and 16 cultural-chronological complexes (stone industry horizons): 7 Azelian, 7 Mousterian and 2 of the initial phase of the Upper Palaeolithic. These were dated thanks to the use of micromorphological, palaeopedological, lithological, radioisotopic, thermoluminescent, palynological and palaeontological methods from Glins to Weimar 2 of the French stratigraphic scheme. The massive occurrence of archaeological materials (in total more than 70 000 artefacts) offer a unique opportunity for studying the often repeated environmental changes in the Bølling-Allerød to the south-eastern part of Central Europe. Special focus should be concentrated on the evolution of the stone tool technology and on the collection of industries of this culturally unique Early Palaeolithic settlement. This all can be followed during a long section of time ranging from Azelian to Mousterian and from Mousterian to Upper Palaeolithic.

KEY WORDS: USSR — Transcarpathia — Korolevo — Pleistocene — Stratigraphy — Chronology — Palaeolithic.

All papers of Soviet authors in this issue are based more or less on the materials of the multi-layered palaeolithic site Korolevo, in Soviet Transcarpathia. This is easy to understand. The Korolevo site appears more and more as a basis for the study of the contemporary palaeolithic science. The point is, however, that the existing information appears in preliminary publications only. It seems therefore to be purposeful to give here at least a general description of the site, with special regards to the methods of its research, and finally to its stratigraphy.

The site was discovered by V. N. Gladilin in 1974, and since then continue annual expeditions of the Ukrainian Academy of Sciences headed by him. Since 1976 the expedition realized the research in co-operation with the State University of Uzhgorod.

FIGURE 1: The situation of the Korolevo site. A political-administrative sketch.
The site was discovered in the region of the so-called Khunt Ghat located in the towns of Vigna-
duro and Khunt, in the vicinity of the village Korolevo. The region of the Khunt Ghat is one of the most picturesque corners of the Soviet Transcarpathia. The Tisa River after breaking through the Vihorlat-
Gutinian Ridge enters the Middle-Danubian (Hunga-
rian) Lowlands. Along the road from Vignaduro to Khunt between the villages Malaya and Velkaya Kopanina there is an excellent view of the surrounding terrain. On the right, lower along the valley of the river we can see Chornaya Gora (Black Hill) covered with
beech woods and of an absolute height of 568 m above
the sea level. It is a long cone whose shape
massively projects the area against the air currents
from north-east, securing thus a mild microclimate
for the region. On the left, upstream behind the
village Rosokho and behind the stone quarries in its
south-eastern end, toward one of the highest
peaks of the Vihorlat-Kunst Ridge (783 m). On the
opposite (left) bank of the Tisa, on a solitary extinct
volcano we can see the white ruins of a former
hunting-lodge of the Hungarian Kings in the village
called "Kirdy Haus" ("The King’s House"). This
place name appears also on the Ukrainian name of the
village situated beneath the hill (Zoukovaya Gora—
"Castle Hill") with the hunting-lodge ruins (Korolevo — "The King’s"). The village has been con-
ected with other villages against the flow of the river,
with the village Veryatsya. At its north-eastern
margin begins the range of the foothills along the Tisa River from the south to the north. It forms a
100-120 m high neck of land, the so-called Kopa-
nokryskaya Terrace (VIP above the flood plain).
The terrace in the region of the Khunt Ghat has a wide
terrace bench and a thin boulder bed in the vestige-
holding on the left bank of the Tisa, in the surround-
ings of Korolevo, and many metre thick boulder
beds on the right bank, near the villages Malaya and
Velkaya Kopanina. The southern end of the range
with the three peaks — "Vinnytschik", "Beyvar" and
"Gostriy Verkh", are separated by gorges. In the
past they formed the western slope of the Sor Mount
(Sasihoriy — "Barren Mountain"), corres-
ponding to the higher, 200 m high level of the terrace
of the Tisa River. From here we can overlook the
surroundings: the valley of the Tisa with its numerous
deep arms and branches, the stately house in Korolevo,
the village Korolevo, the not-too-high terraces
on the south-east near the village Gorbki, the steep
right bank with the stone quarries near the village
Rosokho, Chornaya Gora (Black Mountain) and the
fortified settlement from the beginning of our era
near the village Malaya Kopanina. Two of the north-
ern peaks — "Gostriy Verkh" and "Beyvar" have been damaged by stone quarrying, the third and
southernmost peak — "Vinnytschik" serves as a
dangerous barrier.
In these places appeared the Palesithic finds. The first finds were located on the central of the three
mountains in the surface of the sandy loams "supglini" opened by scrapers at various depths in the wall of the quarry. It was established that the latter was intensively used by the people that lived in the area. The material found in the terraces were the remains of the characteristic levels of the Palesithic culture. The finds included the stone tools and ornaments made of raw materials, such as obsidian, are of the more frequent, larger and deeper, the older are the arti-
facts. More accurate stratigraphic and planigraphic observations alongside with the characteristic features allow the possibility to offer an explanation of the stratigraphic and rhythmological phenomena in the material found in the region. The material found in the region is a part of the collection of the National Museum of Ukraine. The material found in the region is a part of the collection of the National Museum of Ukraine. The Chornaya Gora (Black Mountain) and the fortified settlement from the beginning of our era near the village Malaya Kopanina. Two of the north-
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Figure 2. A view of the palaeolithic site in Korolevo, from the Sea River. I — "Gortsey Verkh", II — "Hoverov", III — "Vsevolotki", IV — Korolevo I.

As a rule here appear only fossil soils III and IV of the regional stratigraphic. Earlier horizons (Vth and partially VIth fossil soil of the Transcarpathian section) have been preserved only in the fillings of the fossil ravines eroded in the mounded crust of rocks. At Korolevo II, below the mountain "Vsevolotki" (three palaeosols have been found: III, IV and V).

Lithology. Below follows the description of the sections in trenches Nos. 18 and 20 on "Gortsey Verkh" Mountain (fig. 3).

1. Recent brown forest soil that has arisen under deciduous forest. The thickness of the layer is up to 0.5 m.

2. Loamy-like loam, light-yellow, reddish, coarse porous, thickness up to 0.25 m.

3. Loamy-like loam, whitish with slight admixtures of manganese-iron concretions; their content is growing downwards, the thickness reaches up to 0.35 m.

4. Light-brown loam with light ochre-red hue, and with numerous bean-shaped concretions of iron and manganese hydroxides. The content of these admixtures is growing upwards; it is fragmented by vertical fissures (cravities after the plant roots filled with loam from the higher layer IIIrd fossil soil of the regional section of the Transcarpathian Anthropogene; it is up to 0.40 m thick.

5. Light-yellow loamy clay, porous; interrupted by fissures filled with grey-white loam; it is up to 0.15 m thick.

6. The same loam containing grained and flat iron-manganese concretions; thickness is up to 0.40 m.

7. Brown loam with ochre-red hue and with numerous bean-shaped concretions, of nut-like structure, aggregated; with vertical fissures filled with white loam and with layer of 5; the upper horizon of the IVth fossil soil of the anthropozone section of Transcarpathia; it is up to 0.20 cm thick.

8. The same brown loam, but without significant iron-manganese concentrations (the iron content appears in the form of mould in the fissures; with vertical fissures filled with whitish loam and with layer from layer 5: lower horizon of the IVth fossil soil of Transcarpathia; its thickness is up to 1.40 m.

9. Light-brown loam, porous with rare and small iron-manganese concentrations; thickness up to 0.46 m.

10. Light-brown loam with light ochre-red hue and with frequent small and medium-sized bean-shaped and blotchy iron-manganese concentrations; top horizon of the VIth fossil soil of Transcarpathia's general stratigraphic section; thickness up to 0.30 m.

11. Yellow-brownish loam of ochre-red hue, greyish, porous, with fissures, with scattered small iron-manganese concentrations in the fissures, looking like mould — the fissures are filled with whitish loam: the second horizon of the VIth fossil soil; thickness up to 0.65 m.

12. Light-brown loam, similar to layer 10, but with somewhat less frequent iron-manganese concretions; third horizon of the VIth fossil soil; thickness up to 0.05 m.

13. Yellow-reddish loam, similar to layer II, but of more pronounced ochre-red hue, with frequent fissures filled with whitish loam; it is the fourth lower horizon of the VIth fossil soil of the regional section of Transcarpathia; thickness up to 0.30 m.

14. Somewhat lighter and less ochre-brown loam, the higher situated layer (Nr. 13), the fissures filled with whitish loam are less frequent; thickness up to 0.30 m.

15. Yellow-brownish loam with rare iron-manganese concentrations in the form of concretions and moulds; numerous fissures, filled with whitish loam; Vth fossil soil of the general Transcarpathian section; thickness up to 1.35 m.

16. Light-yellow loam with rare and small iron-manganese concentrations; thickness up to 0.35 m.

17. Brown loam with small and medium-sized iron-manganese concentrations, more frequent than in the higher layers (Nr. 16); fragmented by fissures, filled by layer of layer 16; upper horizon of the VIIth fossil soil; thickness of the layer is 0.40 m.

18. Red-brown loam with ochre-red layer; in the upper half there are vertical fissures filled with whitish loam; in the lower half there are horizontal streaks of the same loam (gleyification); it is the lower horizon of the VIIth fossil ridge soil; thickness up to 0.40 m.

19. Yellowish-light loam with thin fissures filled with whitish loam; mould-like traces of iron; thickness up to 0.10 m.

20. Loam similar to the above mentioned (Nr. 19), but with ochre-red hue with relatively frequent small iron-manganese concentrations; the upper horizon of the VIIIth fossil soil of the Transcarpathian Anthropogene; thickness up to 0.85 m.

21. Brownish loam with ochre-red hue and with relatively frequent small iron-manganese concentrations; the upper horizon of the VIIIth fossil soil; thickness up to 1.00 m.

22. Greyish loam with frequent small, medium-sized iron-manganese concentrations; the upper horizon of the IXth fossil soil; thickness up to 0.10 m.

23. Loam analogous to that of layer 21; lower horizon of the IXth fossil soil; thickness up to 0.35 m.

24. Ochre-red loam containing smaller fragments of dolomite of crust, weathering crust of rocks; thickness up to 0.10 m.

25. Multicoloured loam, spotty (spots of yellow, grey, dark grey) with large voids; in the upper part there are horizontal streaks of whitish loam, alluvion of the river terrace; thickness up to 0.30 m.

26. The same loam with small pebbles (up to 5 cm); alluvion; thickness up to 0.80 m.

27. The same loam with marked ochre-red hue and with big pebbles; alluvium; thickness up to 0.30 m.

28. The weathering crust of the dune.

Palaeoecology. Spores and pollen analysis of the samples of the Korolevo sediments was realized by G. A. Fudkevich (1964) (layers 2—14), and by G. M. Levkovskaya (1980) (layers 15—27). Layers 2—3. The spore and pollen analyses have proved the presence of coniferous and deciduous woods. Willows were the pine woods combined with shrubs, with not too significant presence of oak, hornbeam and hazel-nut shrubs in the undergrowth. The gradual replacement of grass polies above the level of the sea shows that there existed extensive formations of mixed meadows. The climate was cooler and drier than today.

Layer 4. At the time of the formation of this layer (soil fossil soil Nr. III) there were spruce woods in the mountains and oak-pine woods in the foothills and in the lowlands. Characteristic is the absence of fir trees, indicating that the climate had become drier. From the deciduous trees, besides two species of oak there were also ash-, elm- and lime-trees. The grassy cover of meadow character was well developed. The climate was milder than now, but the annual mean temperatures were lower than the case in the period of the formation of the earlier fossil soil IV, and also lower than now.

Layer 5. In that time (upper horizon of the IVth fossil soil) the river valleys were dominated by coniferous forests, with fir prevailing, but there were also cedar pines and larches. The drier talus slopes were covered by common pine and cedar pine. The climate was steady, without violent changes of temperatures and humidity, with heavy precipitation (not less than 600 mm per annum).

Layer 8. The spore and pollen spectra from this layer (lower horizon of the IVth fossil soil) documents that the landscape of the epoch was dominated by deciduous forests — by oaks, hornbeam with oak and beech trees. There are few coniferous tree forests represented by pine and spruce. There was well-developed grass cover in the forests, and the latter were combined with meadows. The climate was warmer and more humid than now, with higher winter temperatures. This is typical of the Riss-Würm Interplacial, when the weather conditions were well-developed from the lower part of the Ukraine.

Layer 10. According to the results of the spore and pollen analyses of the landscapes of corresponding periods prevailed coniferous woods. The grassy cover of meadow character was also areas of meadows with a rich variety of plants and also with steppe elements.

Layer 13. In the time of forming this layer in the river valleys prevailed coniferous forests (three types of pine — common pine, cedar pine and European pine); there were also spruce forests, and the higher plateaux of lowlands and the foothills of the mountains were covered with common pines, perhaps also with cedar pines. There were also deciduous trees and shrubs. The climate was mild with considerable amount of precipitation.

Layer 15. In the section of the lower part of trench Nr. 18 from the VIth fossil soil to the formation of the alluvium (layers 15—17) a number of pollen-zones appeared, indicating that the favourable climatic conditions — thermomes, alternate with cold condition — cryomes. In layer 15 (the VIIth fossil soil) from below upwards thermomer X, cryomer XI and thermomer X have been determined. It means that to the VIIth fossil soil correspond two optima, separated by a short period of cooling down, and by the extension of the area covered with spruce (cryomer) and birch, as well as by the formation of deciduous trees. The climate of which was more humid than the climates of the earlier mentioned. The period of formation of this layer was mostly covered with forests. In the samples appeared pollen of xenilous trees (tork-elm, hornbeam) and grass species forming xerikous.
The period we are studying was cooler and drier than the climate of thermom 1er IV. In the drier xerophilous phases of thermom 1er IV are represented by the cultivation of oak, hornbeam, and hornbeam, and by the presence of deciduous trees, such as hornbeam, elm, and oak. In the study of the thermom 1er VIII phases of the forest, oak and hornbeam are still the dominant species. In this time larger areas were occupied by xerophilous woodland associations formed by oak-weather, like chicory, and boxwood. These areas were less extensive, but still significant, in the period of the thermom 1er VIII phases. The climate was characterized by a very

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The period of the thermom 1er VIII phases was characterized by a cool and dry climate, with a significant increase in the presence of deciduous trees, such as oak, elm, and hornbeam. The climate of the thermom 1er VII phases was similar, with a slight decrease in the presence of deciduous trees. In the period of the thermom 1er VI phases, the climate was characterized by a mild and dry climate, with a significant increase in the presence of deciduous trees, such as oak, elm, and hornbeam. The climate of the thermom 1er V phases was similar, with a slight decrease in the presence of deciduous trees. In the period of the thermom 1er IV phases, the climate was characterized by a cool and dry climate, with a significant increase in the presence of deciduous trees, such as oak, elm, and hornbeam. The climate of the thermom 1er III phases was similar, with a slight decrease in the presence of deciduous trees.
The page contains a text that is not clearly legible due to the quality of the image. It appears to be discussing geological topics, specifically the stratigraphy and geology of a region. The text mentions the presence of fossilized soils and the dating of these formations. There are references to the use of radiocarbon dating and other geological dating techniques. The text also discusses the geological layers and their relationships, possibly in the context of paleoclimatic changes or geological events.

Without clearer visibility, it is difficult to extract precise details or to confirm the exact content. The text seems to be part of a larger discussion on geology, potentially for students or professionals in the field.

**FIGURE 4.** Kuroko, Stratigraphic section. 1 - turf layer, 2 - loam, 3 - slightly peatigenous clay, 4 - fossil soils, 5 - defluviated crust of weathered bedrock, 6 - horizon of the underlaying loam, 7 - alluvia of the river-bank deposit, 8 - the crust of weathered bedrock, 9 - stone tools, 10 - the condition of the palaeobotanical layer, 11 - cultural horizons, 12 - fossil soils, 13 - peatigenous horizons, 14 - palaeomagnetic anomalies.
The formation of fossil soil VI is determined reliably. The Mindel-Riss age of this soil is reliably documented with the palaeopedological, paleomagnetic and thermoluminiscent data and also by the palynological research by G. M. Levkovskaya, determining the pollen and spore content and pointing to corresponding ages. As shown by G. M. Levkovskaya (Adamenko et al. 1988) in the warm phases appearing in the interval from the Brunhes-Matuyama dividing line to the Riss-Würm interglacial the warmest climate has been fixed by numerous palaeobotanical data. They were registered in Western and in Eastern Europe in the Riss-Würm and Mindel-Riss interglacials (Holstein in Central Europe, Lichivinski, Aleksandriy, Butenaynik interglacials in various regions of the European part of the U.S.S.R.). The optima corresponding to soil VI resemble the optimum of the Holstein type. In a score of diagrams representing North European sections the optimum of Holstein type is determined in its final phase by the presence of fir and occasionally of a solitary Pine in the conditions of the warmer and temperate Carpathian region the corresponding phase has more more Picea and fir, and less hornbeam. At present in a number of regions appeared two optima of the Holstein type. In the territory of the Soviet Union similar data have been obtained in the Krushnichki section situated in the Lev region. Soil VI of the Korolovo section corresponds to the full section of the deposits of the Lichivinski interglacial with two optima. Of course there are some differences in the palynological characteristics of the optima of the Mindel-Riss interglacials in Korolevo on the one side, and between the Krushnichki section, on the other. In the latter the earlier of the two optima was warmer and more temperate. In the Korolovo section the thermophilic species requiring also much humidity, was most extended in the later optimum. In Western Europe some scholars point out also the existence of two similar "Holstein"-type optima. The earlier of them — "Dorniiz" — is regarded as an "Mindel-Biss Inter-stadial, preceding "Holstein" interglacial. According to other data the early optimum with its zone of fir and hornbeam ("Vogiseltod") corresponds to the end of the Mindel. It differs from the much later similar "Vogiseltod" optimum through its glauconitic sediments of the initial phase of the Elster-Glacial (Adamenko et al. 1988).

Pecools VII, VIII, IX according to palaeomagnetic, thermoluminiscent and palaeontological dating are put to Intermindel (VII) and Ginz—Mindel (VIII, IX) respectively. The alluvium in the basal part of the section, according to palaeomagnetic, thermoluminiscent and palaeontological data is put to Ginz—Mindel (the flood-plain facies layers 25—26) and to Ginz (the fluvial facies layer 27). (In the former literature, without the knowledge of the results of palynological and thermoluminiscent data, layers 12—23 and the cultural horizons included in them are regarded being much later.)

Archaeological data: On the basis of stratigraphic, planigraphic and morphological considerations on various stone tool complexes (cultural horizons) have been determined in the Korolovo site — they include seven Acheulian (VIII, VII, VI, V, IV, III, II, I) and two horizons coming from the initial phases of the Upper Palaeolithic (ID, IA); the stratigraphic situation of the complexes and their dating are indicated in Fig. 3.

According to the fulness of the cultural and chronological succession of the Palaeolithic, clear-cut geological situations, abounding and well-defined character of the archaeological materials, presence of assemblages forming the transition between Acheulian and Mousterian and from Mousterian to Upper Palaeolithic, Korolovo site has no analogues, not only in the Soviet Union: it is unique in wider regional context. The stratigraphic character of the site, the large number of cultural horizons of the Acheulian, Mousterian and Upper Palaeolithic periods are concentrated in a single place, the massive character of the stone industries found here (comprising a total of more than 70 000 artefacts), and finally its situation in the geographical centre of Europe, at the dividing line of two vast Palaeolithic regions — of the Central European and East European, all these facts make the Korolovo site one of the most important sites for studying the Palaeolithic in the south-west of the U.S.S.R. and of the neighbouring countries of Central Europe. The discovery of the site has offered us a unique opportunity to study on the background of numerous changes of the natural environment in Vogile and in Pleistocene — the evolution of stone working technique in a culturally unique Early Palaeolithic settlement during a long section of time, ranging from Acheulian to Mousterian and from Mousterian to Upper Palaeolithic.

The overlapping of Mousterian and of Upper Palaeolithic industries — the feature dealt with in detail in the contributions of Soviet authors in this issue will without doubt offer material for consideration.