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Guidebook for Field Excursions

XIIth International Symposium and Field Seminar on Paleopedology

"Paleosols, pedosediments and landscape morphology as archives of environmental evolution"

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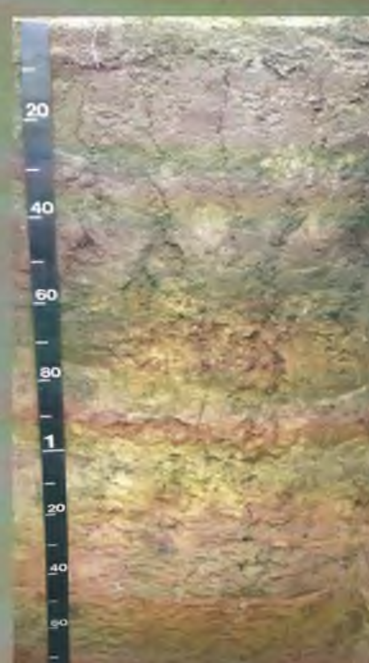

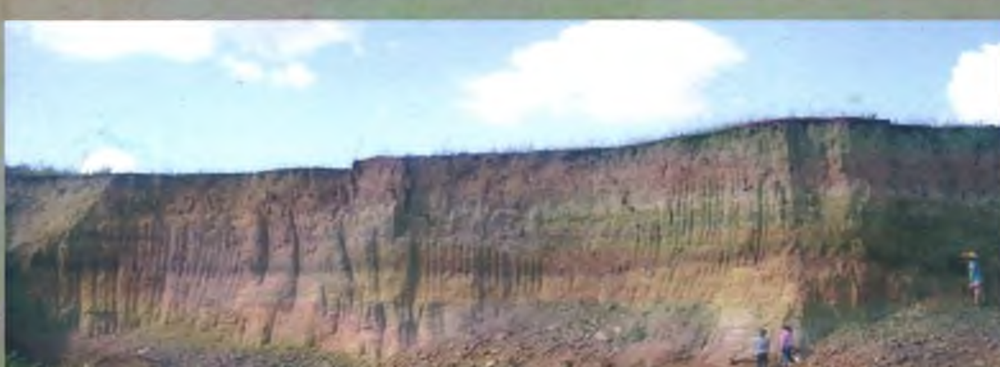

Moscow 2013

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10. GEOARCHAEOLOGICAL SITES DIVNOGORIE 9 AND 1 (PALEOSOLS AND SEDIMENTS MIS 2)

10.1. General Information and History of Research

Divnogorie group of Palaeolithic sites is situated in the territory of Divnogorie museum-Resort located on the right bank of the Tikhaya Sosna River in ~ 3 km from the confluence with the Don River. There are two Palaeolithic sites and several localities of chipped stone concentrations here.

Divnogorie 9 was discovered in 2004 in the deposits of the right-bank ravine tributary in lower reaches of Golaya balka (35-40 m above the modern river level) discharging into the Tikhaya Sosna River. By now, its studied area is about 180 m^2.

The site represents a place of multiple evidences of the kill-butchery of wild horses. The site contains seven levels of bones in low-humus light-brown layers of loess-like loam, which are separated by chalk blocks and chipping lenses (Fig. 10.1., inset). The lowest (seventh) layer occurs in colluvium in a re-deposited form. Osteological collection from the whole set of layers includes 7887 bones, and the vast majority of them belong to wild horses. There are also few bones of polar fox and wolverine.

At the first and second levels, the bones are, as a rule, located chaotically; at lower levels they lie essentially *in situ* in anatomical order, sometimes there are complete skeletons only slightly shifted along the slope (Fig. 10.2.). Bones are more weathered and often broken at the upper levels. Lower levels are characterized by quite good preservation and low weathering of bones. Levels 5-6 contain essentially complete skeletons of horses in ideal preservation, including undamaged skulls. It testifies that horses were buried immediately or very soon after their death.

Fig. 10.2. Divnogorie 9 – Accumulation of horse bones at Level 3

Several long bones from Layer 4 were split in prehistoric times, which may be connected with extraction of bone marrow. Processes of butchering on site were reliably testified by the discovery of horse costal carts with cuts.

Analysis of osteological collection showed that it included all parts of skeletons, the ratio between left and right bones is almost equal (except for Layer 2), which testifies to the absence of deliberate sorting. Bone remains belong to different age groups - from 1-2 week animal units to horses older than 15 years. Only in Layers 1 and 4 there are tushes and massive bones belonging to mature stallions. The degree of epiphysis accretion and teeth wearing of young animal units shows that the horses died in spring or in summer. Thus, sex and age composition of the horses from Divnogorie 9 allows us to acknowledge that there were several harem groups killed there.

The stone assemblage is not numerous (~ 70 units) – the most interesting is a series of truncated blades and backed implements.

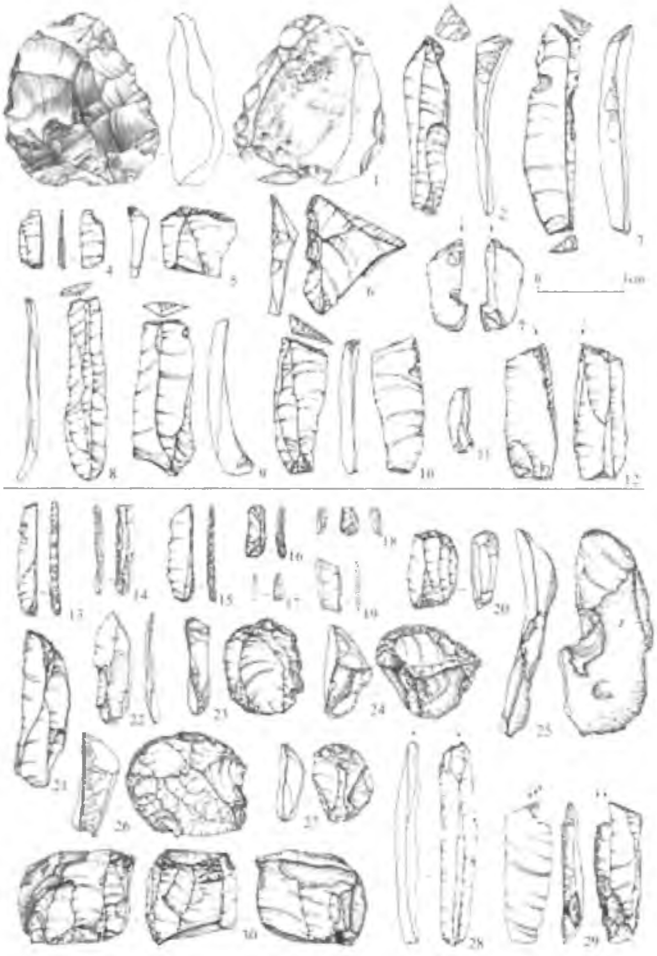

Fig. 10.3. Stone tools from Divnogorie 9 (1-12) and Divnogorie 1 (13-30). 1 – unifacial tool, 2,3,8-10 – truncated blades; 4,11,13-19 – backed bladelets; 5,20,23-27 – end-scrapers; 6 – retouched flake; 7,12,28,29 – burins on truncation; 21,22 – truncated pointes; 30 – prismatic core.

The ***Divnogorie 1*** site was discovered in 2008, and was studied during 2008-2011. It is situated 2.5 km South-West from Divnogorie 9 on a low hill on the right bank of the Tikhaya Sosna River, with the height of 3-5 m above the modern channel. There is an opinion that the site is connected with the deposits of the low terrace (Bessudnov and Bessudnov, 2010, 2012; Bessudnov et al., 2012). According to Lavrushin and Berezhnoy this cusp-shaped hill represents a fragment of proluvial shelf, since there were no alluvial deposits found during excavations.

The cultural layer in the excavated area contains individual finds of bones, chipped stones, flat stone plates and pieces of red ocher. A faunistic complex is represented by wild horse (789/8) and reindeer (24/2).

Stone assemblage comes to more than 1.500 finds. The most typical tools are simple end-scrapers, burins on truncation, backed tools, points and truncated blades. Such a tool-kit is present at most of sites belonging to the Late Valdai age of the Russian Plain and is characteristic for sites of so-called 'Eastern Epigravettian'.

The obtained data about chronology and occurrence conditions, as well as composition of the stone tools of the Divnogorie sites afford ground for a conclusion that they were simultaneous and, perhaps, belonged to one culture. At the same time, analysis of the occupation layers of Divnogorie 1 and 9 allows speaking about different functionality of the sites.

Predominance of bones from limbs (essentially – foot bones), i.e. 'low-meat' parts, the tool-kit and thinness of the cultural layer at Divnogorie 1 testifies that it represents remains of short-term (probably, seasonal) site specialized in butchering.

The multilevel accumulation of complete horse skeletons with inconsiderable number of flint-stone artifacts in Divnogorie 9 allows interpretation of the site as a place of multiple slaughter or killing of the whole herds. Man-made character of this bone bed is also testified by cuts on costal carts of horses, left after butchering.

10.2. Stratigraphy and Radiocarbon Dating

Geomorphology and stratigraphy of Divnogorie 9 are described in detail (Lavrushin et al., 2010, 2011). There are two strata distinguished in the structure of excavated section (more than 14 m). The upper stratum under the recent Chernozem reflects the processes of slope denudation, and is represented by two types of colluvium separated by two horizons of soil-formation. The upper buried soil is dated back to Allerød period. The lower stratum (8-10 m) constitutes deposits of estuary extension of the ravine. It is represented by thin-layered carbonate siltstone separated by horizons of debris and small blocks of chalk. In Y.A. Lavrushin's opinion, the thin stratification of deposits in the lower part of the section is determined by the activity of dammed lakes, which existed in the ravine estuary (see Section 10.3).

The cultural layer in Divnogorie 1 occurs at the depth of 1.4-1.8 m from the surface in the upper part of light-brown sandy loam underlying a thick (1.2-1.5 m) recent Chernozem.

There is a series of radiocarbon dates obtained in three laboratories for both sites.

The radiocarbon dates for Divnogorie 9 become older from the upper level to the lower one (Table 10.1). Insignificant inversion in dating is traced only to the third level, which may be explained by the errors of radiocarbon method. The dates obtained by pyrolysis could be re-juvenated, since the method was under elaboration in the Laboratory of Archaeological Technology, Institute for the History of Material Culture, RAS at the time when the dates were obtained. Thus, the time of the bone bed formation stays within the period from ~ 15 to 17.5 cal B.P.

There are two ^{14}C-dates obtained for Divnogorie 1. One of them (12 050 ± 170 (~ 13.7-14.1 cal B.P., Le-8649)) appears as rejuvenated. According to the absolute dating, the bone bed at Divnogorie 9 site was formed simultaneously with the functioning of the Divnogorie 1 site.

10.3. Divnogorie Paleo-Lake: Sediments and Paleoenvironment

Lake sediments were identified and investigated in the archaeological site Divnogorie 9 at the depth between 9 and 14 m. The total excavated thickness more than 5 m includes ~ 3 m of fine grained limnic fine-laminated packets intercalated with some coarse pebble and boulder layers of

Table 10.1. Summary of 14C-dates for bone material and charcoal

Lab index	Material, Level (L)	^{14}C-date, yrs. BP	Calibrated range 1σ (BP) start– end relative area	Source*
		Divnogorie 1		
Le-8649	Horse bones	12 050 ± 170	13 707 – 14 136 1.000	1
Le-8648	"	13 380 ± 220	15 931 – 16 803 1.000	1
		Divnogorie 9		
IGAN-4247	Charcoal, upper part of soil Bølling(?)	12 060 ± 80	13 816 – 14 000 1.000	3
GIN-14547	"	11 880 ± 140	13 510 – 13 536 0.058	4
GIN-14548	Charcoal, bottom part of soil Bølling(?)	12 090 ± 100	13 817 – 14 043 1.000	4
Le-8137	L I, horse bones	11 400 ± 120	13 156 – 13 372 1.000	1
Le-8135	"	12 980 ± 180	15 165 – 16 078 1.000	1
Le-8136	"	13 150 ± 200	15 524 – 16 494 1.000	1
Le-8134	L II, horse bones	13 100 ± 200	15 267 – 15 328 0.056 15 471 – 16 389 0.944	1
AA-90650	"	13 430 ± 130	16 329 – 16 827 1.000	2
Le-8130	"	13 370 ± 240	15 881 – 16 810 1.000	1
Le-8131	"	13 560 ± 240	16 212 – 16 975 1.000	1
Le-8955	L III, horse bones	12 250 ± 350	13 813 – 14 894 1.000	1
GIN-13192	"	12 350 ± 200	14 032 - 14 685 0.885 14 712 – 14 815 0.115	1
Le-9250	"	13 820 ± 130	16 788 – 17 041 1.000	1
AA-90652	"	13 870 ± 140	16 814 – 17 094 1.000	2
Le-8956	L IV, horse bones	13 200 ± 300	15 507 – 16 641 1.000	1
GIN-14540	"	13 560 ± 320	15 943 – 17 003 1.000	4
AA-90653	"	13 830 ± 150	16 784 – 17 072 1.000	2
GIN-14541	L V, horse bones	12 600 ± 250	14 191 – 15 177 1.000	4
Le-8957	"	13 100 ± 500	15 092 – 16 715 1.000	1
Le-8932	"	13 270 ± 630	15 045 – 16 931 1.000	1
AA-90654	"	13 900 ± 140	16 832 – 17 120 1.000	2
GIN-14543	"	12 140 ± 300	13 667 – 14 631 1.000	4
GIN-14544	"	12 540 ± 470	13 899 – 15 556 1.000	4
LE-9620	L VI, horse bones	13 100 ± 600	14 932 – 16 805 1.000	3
Le-9619	"	13 800 ± 150	16 763 – 17 048 1.000	3
Le-8958	"	13 920 ± 175	16 853 – 17 114 1.000	1
Le-9102	"	13 940 ± 180	16 820 – 17 198 1.000	1
Le-9618	"	14 080 ± 190	16 928 – 17 408 0.152	3
AA-90655	"	14 430 ± 160	17 245 – 17 336 0.152 17 367 – 17 791 0.848	2

* [1] – *Bessudnov et al., 2012;* [2] – *Lavrushin et al., 2011;* [3] – *Bessudnov, etc., 2013;* [4] – *not published*

mudflow (Lavrushin et al., 2010). Lacustrine sediments occupy the area ~ 1 ha in the mouth of the ravine; they are overlain by carbonate mantle loam merging into the talus and stone-blocky sediments closer to the paleoslope. Divnogorie soil complex (10.4) above the limnic material including 2–3 embryonic soils separated by loams is capped by a Holocene soil.

10.3.1. Structure and texture of sediments. The material is light grayish–white, compact, slightly hard, chalk-like, heterogeneous with clear fine stratification.

The sediments consist of fine and pellitic material with few sand grains and micro-lenses of fine sandy material, coarser intercalations were not found. Texture is not uniform: fine (≤ 1 mm) horizontal light-colored carbonate lamina alternate with dark clayey ones. This microlamination is complicated by lenses and pockets, along with whirl-like layers even at a limited distance. Pockets are filled with a coarser aleuritic (silt) material.

The probable model of the formation is the following: silt material fell down on the unconsolidated liquid clay-carbonate suspension and produced deformation of fine laminated deposits. Additionally, micro slides were possible on the inclined slope surface.

10.3.2. Analytical data. Macro- and microfossils were not found, except for the few shell fragments of terrestrial mollusks. OC content is < 0.1 %.

According to the particle-size analysis, this terrigenous material consists predominantly of fine aleurite (i.e. clay and fine silt fractions, > 90 %) with some admixture of coarser silt and fine sand (9.7 % in total) (Table 10.2).

Table 10.2. Particle-size analysis of fine limnic sediment

Particle size fractions, mm	Content, %
0.5 – 0.25	0.1
0.25 – 0.1	2.7
0.1 – 0.01	7.0
<0.01	90.2

Quite a few flat and rounded limestone fragments (> 0.5 and 0.5-0.25 mm in size) were found.

The chemical analysis has shown the following pattern for the main oxides: CaO – 35.52 %; MgO – 0.65 %; MnO – 0.03 %; FeO – 0 %; CO_2 – 28.03 %. Calcite predominated in the investigated carbonate material ($CaCO_3$ – 63.4 %), while dolomite is very low ($MgCO_3$ – 0.29 %); other carbonate minerals were not found.

The clay fraction was studied by XRD method. High content of calcite, some quartz and possible smectite and mica were identified in the powder-triturated specimens (Fig. 10.4).

10.3.3. Interpretation. The occurrence of fine pelitomorphic carbonate material in combination with silt and clay testify to the erosion and re-deposition of surrounding chalky Cretaceous rocks i.e. about the short-distance translocation. Fine detritus size and its well sorting permit to suppose a low fluvial dynamics and absence of water stream. Very fine horizontal lamination (< 1.0 mm) and alternation of carbonate and clay lamina are the indicators of seasonal sedimentation. During cold time with higher carbonate dissolution clay material was accumulated; under higher temperature more calcite was precipitated.

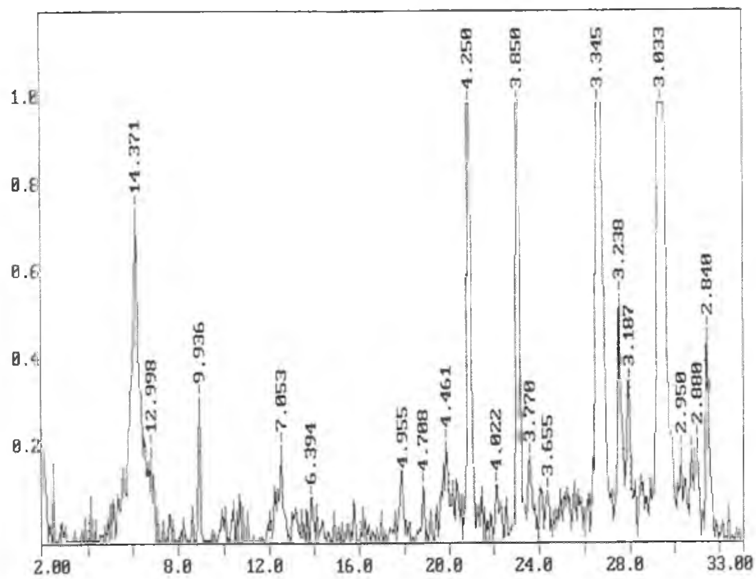

Fig. 10.4. XRD pattern of powder-triturated lacustrine specimen

The content and composition of clay minerals were specified in oriented samples: smectite > kaolinite > mica > chlorite (Fig. 10.5).

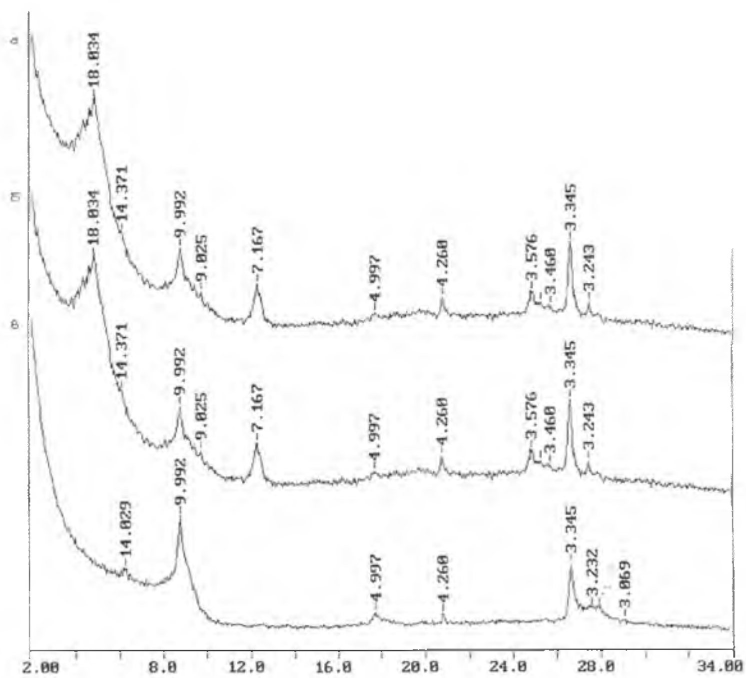

Fig. 10.5 XRD patterns of the oriented specimens:
a – initial form;
b – saturated with glycerin;
c – heated at 550 °C

Convolute stratification and lenses of coarse aleurites evidence the short periods of the accumulation of coarser material, probably due to temporal high slope erosion by snow-melting waters. Almost complete absence of organic plant matter allow to suppose very poor vegetation cover and weak pedogenesis at that time.

The formation of lacustrine sediments was taking place at the time of permafrost melting and solifluction slope flows. As a result, the specific *limnic cryosuspensites* have been formed in Divnogorie paleo-lake, similar to Khvalynean "chocolate clays" or cryosuspensites (Lavrushin et al., 2010). Various thickness of lamination allow supposing several sedimentation e cycles: meter thickness can correspond to millennium cycles. decimeter thickness – to centennial. centimeter layers – to decades, and millimeter-thick fine lamina – to the annual ones.

10.4. Paleosols of MIS 2

The shoulder thickness of Divnogorie 9 is represented by alternation of weakly developed soils with alluvial-colluvial loams (Fig. 10.6., inset). The outcrop is capped by well-developed Holocene Rendzina overlain by agrogenic colluvium with the newly formed Rendzina (≈ Rendzic Chernozem) on the very top.

10.4.1. Morphological description of pedocomplex. The structure of the upper units was studied in several outcrops. The section 2/10(2) is the most representative. It is located upstream the ravine, at a distance of 10-15 m from the excavation Divnogorie 9, at the place of the footslope and the bottom of a shallow flattened hollow, formed after filling of the paleo-lake.

Table 10.3. Morphological description of the units

Unit	Depth, cm	Description
1	AB 0-10	Zooturbated horizon of the modern soil
2	Pr 10-85	Heavy loam, light pale-yellow, heterogeneous, slightly compact; few pores; chalky angular inclusions of fine gravel up to stone size, with light yellow ferruginous coatings; sharp wavy upper boundary with zooturbations; clear smooth lower boundary.
3	Bs,b 85-105	Silty loam, rusty-yellow with yellowish hue; non-uniform; granular; up to 60-70 % of chalk fragments, they are more rounded with thick ferruginous coatings; abrupt smooth boundary.
4	2ABb 105-130	Silty loam, grayish-brown, heterogeneous, weak crumb and granular structure, more porous; abundant chalk gravel, relatively uniform in size, including weathered thin angular flat stones with thick brown coatings; smooth, clear to abrupt boundary.
5	2Bc,b 130-150	Clay loam, light pale; with fine soft calcareous concretions; many angular chalk fine gravel to stone with thick dark-yellow coatings; smooth clear boundary.
6	3Ab 150-190	Silty clay loam, pale-light gray, common chalk stones; gray finely porous fine crumbs; abrupt smooth boundary.
7	3Cb 190-240	Lenses of clay loam, light pale, partly laminated, more uniform; different-size porosity, many fine pores; very few calcareous pedofeatures, very few fine chalk inclusions; irregular boundary.
8	Pr 240-250	Loam, pale, granular; many large angular chalky inclusions 5-15 cm in size, with Fe coatings; fossil remains of horses (the first level of bones occurrence).

10.4.2. Analytical data. Particle-size composition (Table 10.4) confirms the existence of two strata: the lower limnic (unit 7) and the upper pedogenic (units 3, 5, 6), and proluvial-alluvial (units 2 and 4). The lake sediments are depleted in coarse fraction (~ 1 % sand, ~ 7 % coarse silt), and enriched in clay (> 33-35 %) and fine silt (47-48 %) fractions.

The upper pedogenic-proluvial-colluvial strata is marked by a significant increase of sand and coarse silt fractions (3-4 times), and the medium silt together with the decreased fine fractions, such as clay and especially fine silt fractions. In turn, this layer is divided into 3-5 layers according to sand and coarse silt fractions. Intermediate paleosol (unit 4) is the most sandy, the lower paleosol (unit 6) is the least sandy (Table 10.4.).

Table 10.4. Particle-size analysis of Divnogorie pedocomplex, section 2/10(2)*

Soil, Sediment	Unit	Horizon	Depth, cm	Particle size fractions (mm), %						
				Loss from 10 % HCl	1.0-0.25	0.25-0.05	0.05-0.01	0.01-0.005	0.005-0.001	<0.001
Pr	2		60	0.80	1.08	6.46	19.31	13.51	37.30	22.34
			75	0.60	1.71	12.33	20.25	13.88	35.49	16.34
Pd 1	3	Bs,b	95	1.12	0.79	4.31	24.07	13.79	38.88	18.16
Pd 2	4	2ABb	115	0.64	2.83	11.10	22.74	12.12	34.78	16.43
	5	2Bc,b	135	0.58	2.91	12.60	21.61	13.15	33.31	16.42
Pd 3	6	3Ab	150	0.95	0.36	3.93	25.00	12.84	35.82	22.05
		3Ab	165	0.78	0.72	7.24	22.58	14.67	37.05	17.74
		3Ab	185	0.89	0.59	6.62	24.10	13.24	35.27	20.18
	7	3Cb	215	1.03	0.11	1.15	7.40	9.09	47.21	35.04
		3Cb	220	0.93	0.02	0.72	6.72	10.25	48.82	33.47

** after Kachinsky with the preliminary 10 % HCl decalcination*

Buried soils (units 3, 4, 6), and particularly the two lower paleosols display a small increase in organic carbon up to 0.61-0.73 % in the bottom soil (unit 6), and 0.61 % in the intermediate paleosol (unit 4). Carbon content in the lacustrine sediments (unit 7) and proluvial-colluvial deposits (unit 2) is minimal – 0.2-0.3 % (Table 10.5.).

The content of carbonates is high in all layers – more than ~ 70 %, which corresponds to their formation on weathered and re-deposited products of the Cretaceous chalk rocks. Minor fluctuations in $CaCO_3$ content occur depending on the genesis of the units: limnic, pedogenic or proluvial-colluvial. The content of $CaCO_3$ reaches 84 % in the unit 5, and is identified as a carbonate horizon of the intermediate paleosol (Table 10.5.).

All three paleosols (especially the very top soil) are characterized by increasing content of iron oxides, extracted by different methods (extracts of Tamm, Mehra and Jackson, and Bascombe). Significant increase of Al_2O_{3t} MnO_t up to 0.125 % and 0.021 %, respectively, was found in the upper paleosol. Increased content of Fe_2O_{3t} (up to 0.081 %) was found in the upper specimen of the limnic thickness, which likely was subjected to the soil processes. The lowest content of all forms of Fe_2O_3 was identified in the proluvial-colluvial deposits: units 2 and 5 (Table 10.5.).

10.4.3. Palynology. According to the palynological analysis made by E.A. Spiridonova (Lavrushin et al, 2010, 2011), it was found that the upper strata in all samples is dominated by herbaceous and shrub pollen, with a lot of *Artemisia* and *Chenopodiaceae*; pine dominates among woody species. The pollen of the upper buried soil is also dominated by grasses and shrubs, pollen grains of trees and especially of spruce were abundant in the uppermost sample. Palynological analysis is in good agreement with the results of the paleopedological study.

Table 10.5. Chemical properties of Divnogorie pedocomplex, section 2/10(2)

Soil, sediment	Unit	Horizon	Depth, cm	OC	$CaCO_3$	Fe_2O_3 [1]	$Fe_2O_{3\,t}$ [2]	$Al_2O_{3\,t}$ [2]	MnO_t [2]	$Fe_2O_{3\,d}$ [3]
				%						
Pr	2		60	0.25	76.30	0.023	0.087	0.098	0.015	0.330
	2		75	0.31	82.56	nd	0.059	nd	nd	0.235
Pd1	3	Bs,b	95	0.51	68.76	0.027	0.105	0.125	0.021	0.493
Pd2	4	2AB	115	0.61	80.59	nd	0.057	nd	nd	0.278
	5	2Bc,b	135	0.48	84.44	0.015	0.032	0.057	0.008	0.197
Pd3	6	3Ab	150	0.61	78.91	nd	0.044	nd	nd	0.366
	6	3Ab	165	0.73	71.91	0.018	0.062	0.091	0.013	0.555
	6	3Ab	185	0.56	71.35	nd	0.074	nd	nd	0.375
Pr	7	3Cb	215	0.21	72.62	0.026	0.081	nd	nd	0.355
	7	3Cb	220	0.28	70.96	0.021	0.075	0.082	0.015	0.352

[1] – after Bascombe, [2] – after Tamm, [3] – after Mehra-Jackson

10.4.4. Interpretation. The most complete section of the upper colluvial-proluvial thickness include three strata of the Late Valdai weakly developed soils of Divnogorie pedocomplex. The ***upper*** initial soil is represented by the Bs horizon. The ***intermediate*** weakly developed soddy-calcareous soil has the profile AB (25 cm) Bc (20 cm). The lower paleosol has a weakly developed profile A (40 cm)–C and is developed on a thin silty clay loam of lacustrine origin. Pale yellow loam lays below with abundant coarse fragments of chalk 5-15 cm in size, and remnants of horse bones.

The two lower soils upslope (above the excavation) are replaced by two pyrogenic layers. The obtained date 12 080 ± 80 yrs BP (13 816 – 14 000 cal. BP) for charcoal (IGAN-4247) from the lower interlayer corresponded to the ***lower*** paleosol indicating the end of Boelling interstadial. The ***two upper*** paleosols were formed in the Allerød interstadial reflecting its drier first and wetter second phases. All three soils can be named as Divnogorie Late Glacial pedocomplex – the last pedogenic formation before the current interglacial period – the Holocene.

The paleosols have different genesis. The ***upper*** paleosol (the first Allerød) is a weakly developed brown soil (≈ Cambisol, WRB) formed in a forest periglacial environment. The ***intermediate*** paleosol (the second Allerød) is the weakly developed soddy-calcareous soil or Rendzina (≈ Rendzic Leptosol, WRB). The ***lower*** soil, formed in Bølling warming was identified as a weakly developed meadow carbonate soil (≈ Rendzic Chernozem, WRB). The lower and intermediate paleosols seem to be formed in the forest-steppe zone of the periglacial environment.

11. NATURAL ARCHITECTURE AND ARCHAEOLOGICAL MUSEUM-RESORT DIVNOGORIE

Divnogorie is the reserve and the plateau near the town of Liski in Voronezh region. It is situated at the confluence of Tikhaya Sosna (Silent Pine) and Don Rivers, on the boundary of the Central Russian Upland and the Oka-Don Lowland. The museum has existed since 1988. In 1991, it became a natural resort. The total area of the museum-resort is more than 11 km² (Fig. 11.1., inset).

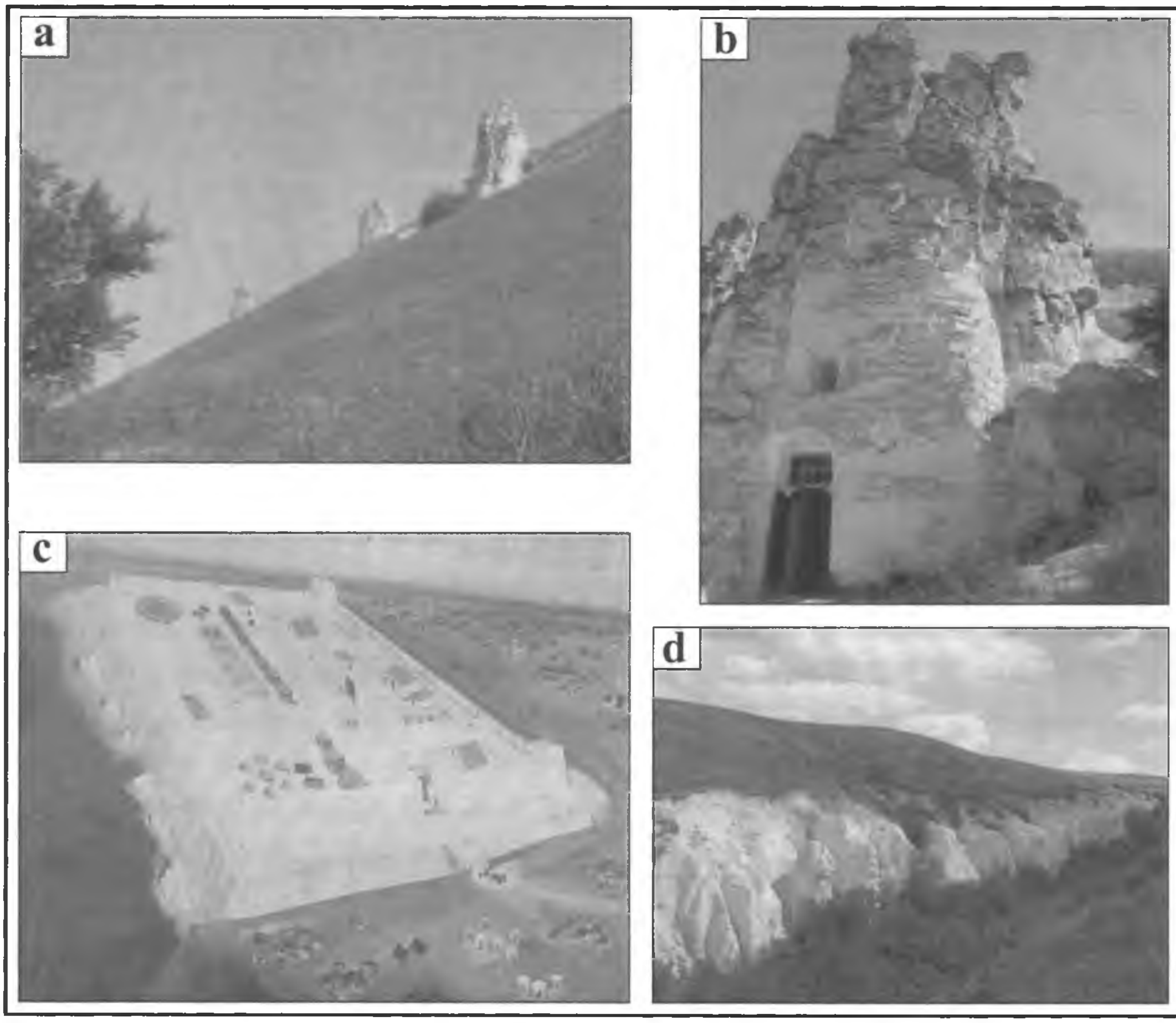

Fig. 11.2. a – chalky pillars – divas; b – cave church of Our Lady of the Sicilian (middle of the XVII c.); c – reconstructed model of Mayatsky fortress (IX-X c.); d – Chalk Canyon

Archaeological findings show that these areas have been reclaimed by people in the Stone Age. The geology of this territory is dominated by Cretaceous sediments. The area has received the name *Divnogorie* for whimsical residual chalk pillars up to 30 meters high, named by local people “diva” (a miracle). Cave churches have been built in the Cretaceous sediments in XVII century. The most famous is the Church of Our Lady of the Sicilian - carved out of a twenty-meter monolithic rock. It inherits the architectural traditions of the ancient temples of Mount Athos. There are several other sites of interest: Mayatsky ancient settlement of IX-century (remains of a Medieval fortress and necropolis), Chalk Canyon (balka of 500-600 m length and 30-40 m depth), Divnogorsky Holy Assumption Monastery (XVII century). From 1924 till the 1990ies, Divnogorsky monastery was closed. There are also the reconstructed archaeological park "From nomads to the cities", the outdoor geological and paleontological exposition, and the reconstructed village of potters for the visitors.

Local flora and fauna are other objects of interest in addition to the Cretaceous geology and specific forms of weathering. Several types of the steppe flora occur on the slopes of the plateau, including herb-feather grass steppes, representatives of alpine meadows and plant "settlers" from the Mediterranean, as well as relic plants. Although large mammals do not inhabit the territory of the museum-resort, the largest variety of insects can be found in Divnogorie. More than 25 species are listed in the "Red Book" as endangered.

Information from http://ru.wikipedia.org/wiki/Дивногорье

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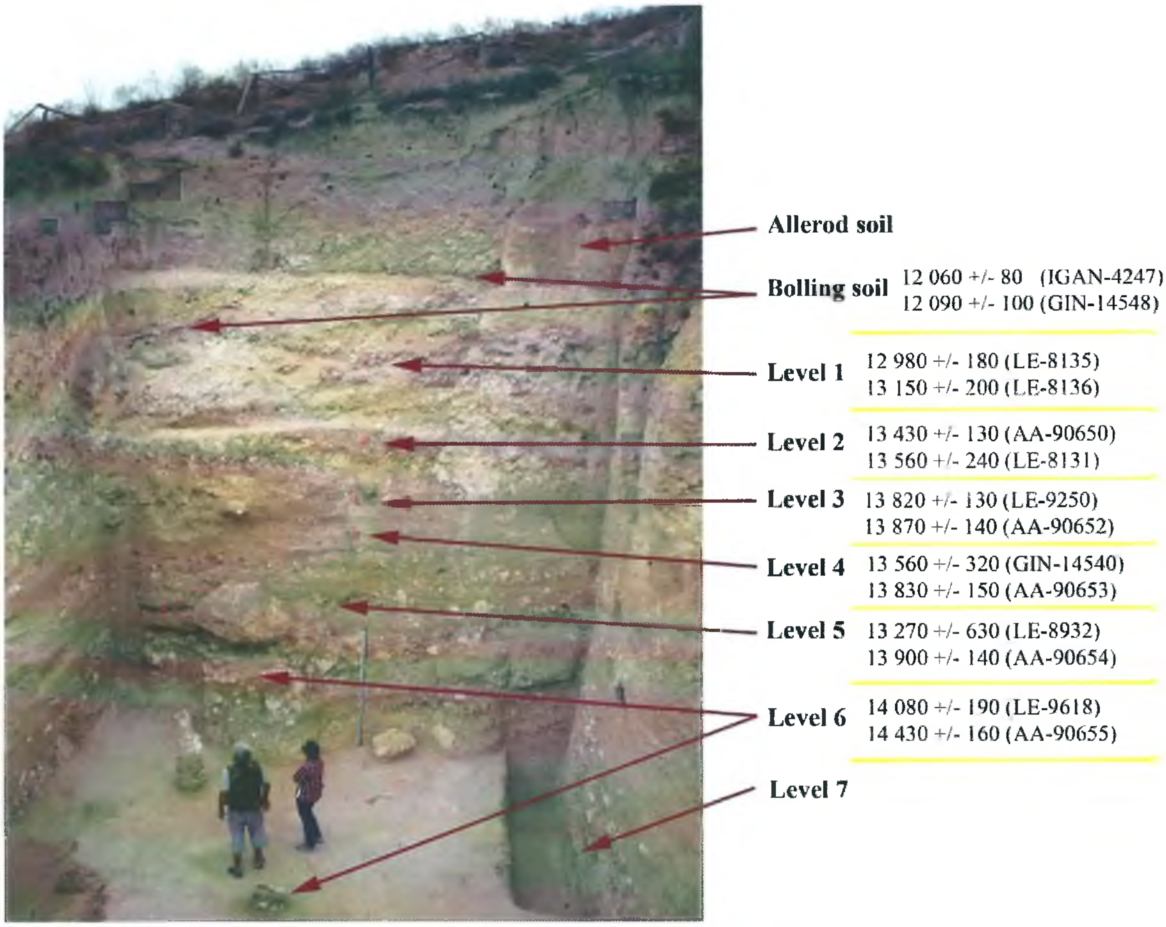

Fig. 10.1. Stratigraphy and chronology of Divnogorie 9

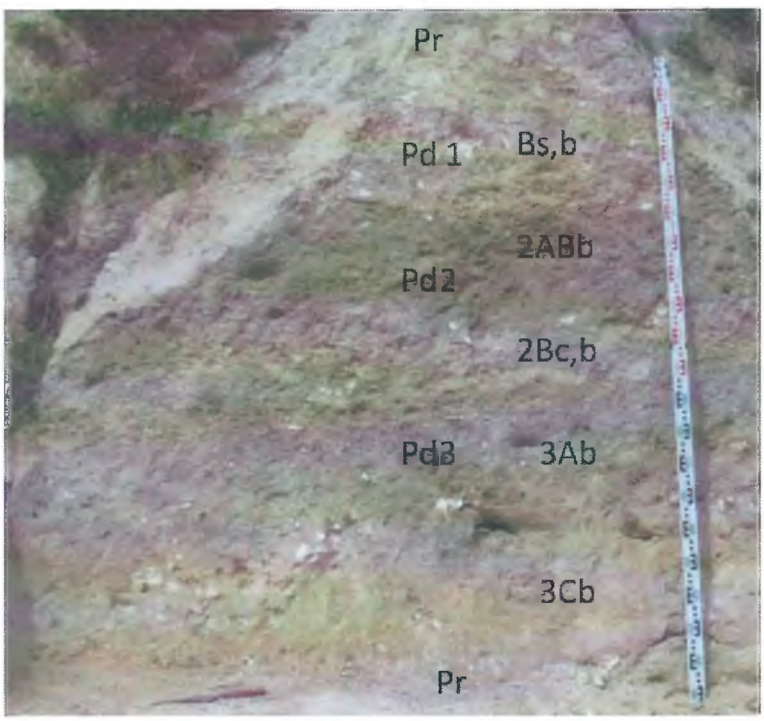

Fig. 10.6. Morphology of Divnogorie pedocomplex, section 2/10 (2)

Fig. 11.1. Overview of natural architectural and archaeological Museum Divnogorie. The circles show the points of interest; colored dashed lines correspond to the different guided tours. The length of the blue and red routes is about 3 hours