Kostenki 14

Earlier investigations

The earlier investigations at this site are well summed up in Sinitsyn (1996). It is particularly instructive to note the differences between the sections on the west, the centre, and the east of the promontory (1996, Figure 2). At the time, not much was known about the deposits below the volcanic ash layer (the lower humic bed) and most attention was devoted to the deposits above that layer (the upper humic bed and overlying colluvial loams). Nonetheless, cultural layer 4 had been recognised and divided into two (4a and b) largely on the basis of the evidence from the eastern part of the site. This is no doubt why the more recent excavations have been concentrated there (Sinitsyn et al., 2004, Figure 1). Also instructive is the summary of the earlier discussions concerning the nature of the humic beds. The majority opinion was that these beds did not constitute buried soils as such. M.N. Grishchenko however disagreed and argued that (whatever colluviation may have taken place) soils of normal profile were present. It seems that recent investigations, both at Kostenki 12 and 14, have borne this out.

There is mention of the earlier pollen work done by Malyasova and Spiridonova and a pollen profile by Spiridonova (1996, Figure 17). There is no indication of which section this relates to, nor whether it is a composite, but among other things she did do some work in the stratigraphic sounding at that time. AP is dominated by coniferous species all through the profile, and there is a significant NAP component, so this is broadly consonant with her more recent results. There is also mention of earlier palaeomagnetic work carried out by S.A. Pisarevsky and V.A. Zubakov, much of it also related to the stratigraphic sounding. Traces of the Laschamp-Kargopolovo event were found here "in a fossil soil comparable to the lower humic bed".

Recent work at the site

The most up to date general account of the site which we have is the report presented to the Kostenki conference in 2004 (Sinitsyn et al., 2004). This was published both in Russian and English, the English version evidently being done by Sinitsyn himself. Attached is the stratigraphic sequence for the eastern portion of the site as published in that volume (Table Ia) and the dates for the lower part of the section as known at that time (Table II) (the dates for the upper portion are referred to only in the text). The stratigraphic sequence is the same as that published by Sinitsyn in 2002, where more details are given about the lower layers at the site. The section reproduced here is from that paper (Sinitsyn, 2002, Figure 2). This diagram contains not only the stratigraphic and cultural layers, but also the pollen and palaeomagnetic sample numbers and positions. It is our best key to the stratigraphy. The most recent palaeomagnetic results are described by Gernik and Gus'kova, from whose article the relevant diagram is taken (Gernik and Gus'kova, 2002, Fig. 1). Spiridonova's most recent results were also published in the same volume, unfortunately in diagrams with a very poor resolution (Spiridonova, 2002, Figs. 1 and 2). Levkovskaya has also made available a pollen diagram by Spiridonova which apparently relates to the stratigraphic sounding, but at the moment we have no bibliographical reference for this.

The description of the stratigraphic profile (Sinitsyn et al., 2004, Table Ia) is a fairly literal rendering of the Russian version, but (aside from some obvious typos) there are one or points which do require clarification on the basis of a comparison to the Russian text. Layer 6: pore = porous. Layer 10: delete charcoal. Layer 13: in any places = in some places. Layer 20: the grey fossil soil is "in local depressions". Layer 24: slope of a flow bord means "the slope of a stream bank". Layer 25: flow = stream.

As Sinitsyn says, the new evidence we have about Kostenki 14 (particularly the lower layers) comes about as a result of excavations which were renewed in 1998. The reports mentioned above take the story up to 2002, and as we know the work has continued since then. A cultural horizon within the volcanic ash layer (stratigraphic layer 15) was discovered for the first time in 2000. Cultural layer IVa, characterised by a large number of horse bones (Sinitsyn, 2002, Fig.5), occurs in a brown fossil soil (stratigraphic layer 17). The remains of two further fossil soils, and scattered cultural remains, were found in stratigraphic layers 20 and 22 in 1999-2000. A complete mammoth skeleton (without any traces of human activity) was found in stratigraphic layer 23 in 2001. Cultural layer IVb as a whole extends over three stratigraphic layers 24, 25, and 26. Layer 26 is also referred to as a "hearth horizon", and it certainly has distinctive characteristics of its own (Sinitsyn, 2002, Fig. 10), but as from 2001 it was decided to treat it as an integral part of cultural layer IVb. From the above, therefore, it is clear that there are traces of at least three fossil soils below the volcanic ash layer. In this respect there is a parallel with the situation as now revealed at Kostenki 12, except that it is claimed that there were four fossil soils at that site. The base of the sequence at Kostenki 14 is much influenced by the fact that it formed part of a small stream bed or bank, as is clear from the section (Sinitsyn et al., 2002, Fig. 2). Details of the cultural layers in the stratigraphic section, as described by Sinitsyn, are given below.

Stratigraphy

Cultural layer I. Stratigraphic layer 8. (Earlier said to be in stratigraphic layer 5 or 6; Sinitsyn, 1996; Sinitsyn, 2002: 234). Attributed to the Kostenki-Avdeevo culture, as known at Kostenki I (layer I), Kostenki 13, and Kostenki 18. C14 dates quoted are 22,500±1000 (LE-5274) and 22,780±250 (OxA-4114) BP. Regarded as reliable. Gleyified soil horizon equated with the Gmelin fossil soil as detected at Kostenki 21.

Cultural layer II. Stratigraphic layer 12. UHB. Attributed to the Gorodtsovskaya culture "traditionally appreciated as a most important and unusual complex". C14 dates quoted are 28,200±700 (LU-59b), 28,380±220 (GrN-12598), 28,580±420 (OxA-4115), and 29,240±330/320 (GrA-13312) BP.

Cultural layers III and IIIa. Stratigraphic layers 13 and 14. UHB. Cultural layer III in stratigraphic layer 13 in places penetrates into layer 14 beneath, and that is why it is given a separate designation IIIa, but the cultural material is the same. The cultural attribution of the assemblage is said to remain "unknown". C14 dates quoted are 29,320±150 (no lab number), 30,080±590/550 (GrN-21802), and 31,760±430/410 (GrA-13288) BP. In Sinitsyn's view, the dates "appear to approximate" to the actual age of these layers.

A burial was found in 1954 in the western part of the site beneath cultural layer III (Sinitsyn, 1996, Figs. 2 and 4C). As Sinitsyn said (1996: 285) "Most probably the burial belongs with cultural layer III but there is no direct proof of this". The characteristics of the skeleton are summarised in that article.

The cultural horizon within the volcanic ash layer. Stratigraphic layer 15. Ignoring the younger date on bone, Sinitsyn finds the date of 32,420±440/420 BP acceptable because it coincides with other such dates for similar archaeological assemblages, particularly Kostenki I (layer III). But so far as he is concerned, one is immediately confronted by the contrast between a "short" and a "long" chronology, on the assumption that this layer really does equate to the Campanian Ignimbrite. The cultural layer is of limited extent. The volcanic ash layer itself is not continuous, and fills natural depressions in the ancient land surface. It is the product of colluvial action, and usually is not more than 10 cm thick. When the ash is pure it is light green in colour, but it is usually mixed with loam and takes on a reddish-brown tinge. It is considered that it must have been rapidly covered by the deposits above. The cultural layer can be up to 15 cm thick. There are no features such as hearths or pits, although there are traces of red and yellow ochre. There are many complete bones of small mammals (arctic fox and hare) plus fragmentary bones of mammoth, horse, bison, wolf, and bear, as well as birds and rodents. There are 340 flint artefacts, with comparatively few complete tools and no cores. Most characteristic are Dufour bladelets (of Roc de Combe type) which unequivocally class this assemblage as an Aurignacian of the well known Dufour variety. There are relatively large numbers of worked bones and shells (Sinitsyn et al., 2004, Fig. 12). They include 4 incised fragments of arctic fox long bone (one may be from a bird) which served as beads and 3 pierced shells which served as pendants. The shells have been identified as Neritidae (Theodoxus fluviatalis) which can be found today in the Don Basin. Such beads are also an Aurignacian characteristic.

Cultural layer 4a. Stratigraphic layer 17. The two oldest C14 dates, 33,280±650/600 and 33,200±510/480 BP, are evidently preferred by Sinitsyn. Called by him "the uppermost possible limit of the real age" for this layer. >50 individual horses have been identified, and it is probable that this was a "kill site". There are some patches of ash and charcoal concentrations, but few artefacts and practically no finished tools.

Fossil soils in stratigraphic layers 20 and 22. In 1999 traces of a fossil soil were detected in what is now stratigraphic layer 22. Discounting a date on bone with insufficient collagen there is a C14 date on charcoal from this layer of 34,550 ±610/560 BP. Subsequently, scattered bone fragments and two flint flakes were found here. According to Sinitsyn's account (2002: 241) a further fossil soil above this one in what is now stratigraphic layer 20 was located in 2000. It was observed in a limited area on the north and west of the excavation where it filled a depression, and was separated from the soil beneath by a layer of light grey layered loam. The upper soil is grey and sandy whereas the lower one is brown and loamy. They are claimed to be quite distinct.

Mammoth skeleton horizon. Stratigraphic layer 23. These were layered sediments filling the bed of a small ravine or an intermittent water course. The position of the

bones in relation to one another suggests that the animal sank into swampy ground and that the carcass was exposed for a long time before its final decomposition.

Cultural layer IVb and the hearth horizon. Stratigraphic layers 24-26. The different units here are interpreted as stages in a process whereby the stream bed at the base of the section was filled up by deposits which essentially had a single origin. First is IVb/1, an initial cycle of deposition on the slope by the edge of the stream, detected on its right bank. Second is IVb/2, the next stage of accumulation at the base of the stream, where the material is preserved in natural depressions. Third is IVb, the final stage whereby the stream was filled up with deposits after water action had ceased. The hearth horizon, on the left bank, consists of thick lenses of brick red burnt loam in a black humic horizon, arranged stepwise in conformity with the stream bank contour. The burnt lenses are interpreted as the remains of hearths. 10 C14 dates on charcoal are listed and 3 IRSL dates. It is specifically mentioned that the C14 date 36,540 ±270/260 (GrA-15961) and the IRSL date 46,570±3880 (UIC-1128) BP are associated with IVb/1. Three other C14 dates and two IRSL dates are listed as being associated with the hearth horizon: C14 36,320±270/260 (GrA-15956), 36,010 ±250/240 (GrA-15965), and 37,240±430/400 (GrA-10948) BP, IRSL 34,300±2900 (UIC-749) and 44,900±3800 (UIC-748) BP.

The lithic assemblage is said to be characterised by blade technology, but there are few tools, and on this basis Sinitsyn concludes that so far it has no specific analogies in the Kostenki area or elsewhere, but it can be generally classified as a very early Upper Palaeolithic. There are a significant number of bone, antler, and ivory artefacts. These include bone points of two varieties, a rib with a pointed end and another with a longitudinal groove, antler mattocks, and an incised ivory rod. An antler mattock fragment found in the hearth horizon confirms its similarity to the other components of layer IVb. It is claimed that one object represents the head of a human figurine in ivory, broken during the course of manufacture (Sinitsyn et al., 2004, Fig. 14.1). There is a pendant made from a seashell (Columbellidae) with two perforations. The modern ecology of this species indicates a link to the Mediterranean. Finally, a tooth crown of a 10 year old child has been determined (by I.I. Gokhman) as modern in physical type (belonging to Homo sapiens sapiens).

Summing up the archaeological significance of the new finds in the lower humic bed (LHB) Sinitsyn claims that the old dichotomy at Kostenki whereby there was an apparent coexistence of two contrasted cultural traditions at the beginning of the Upper Palaeolithic (Streletskaya and Spitsynskaya) is superseded, and we now have two different "cultural-chronological structures", as follows.

1. An Aurignacian of Dufour type (Kostenki 14 cultural horizon within volcanic ash) coexisting with the Streletskaya culture (Kostenki I layer III). This fits in with a general European scenario whereby an "intrusive" Aurignacian confronts various local "transitional" cultures.
2. An earlier phase, in which there is coexistence during the Initial Upper Palaeolithic of industries such as are found at Kostenki 14 layer IVb and Kostenki 17 layer II. These industries had no clear "genetic" predecessors nor successors.

Palaeomagnetism

According to Sinitsyn et al. (2004) a palaeomagnetic excursion equivalent to Kargopolovo-Laschamp was detected in stratigraphic layer 22, and it is said that this occurrence was confirmed by Professor F.Heller (Zurich), whose personal communication to that effect is quoted. Further details are provided by Sinitsyn (2002), in the same volume which contains the specialist report on the matter by Gernik and Gus'kova (2002). Here he states that a palaeomagnetic excursion was located in layer 22 in 2000, and that in 2001 traces of the same event were found in layer 20, but not in layer 21. This layer (loessic loam) intervenes between 22 and 20, both of which are fossil soils. He therefore suggests that there may have been a double palaeomagnetic excursion of the type noted by Gillot et al. (1979).

Gernik and Gus'kova's own report contains the diagram featuring the palaeomagnetic characteristics of the section which is reproduced by Sinitsyn et al. (2004, Fig. 5). The sample locations are shown in Sinitsyn et al. (2004, Table Ia) and in Sinitsyn (2002, Fig. 2). According to Gernik and Gus'kova, 112 samples were taken in cubes of various sizes, some quite big because of the friable nature of the sediments. Partly because of this, their experimental errors were also quite large. The greatest values of **I** and **k** occurred in samples in the present day black earth [1-9], light brown loams [10-12], chalk rubble horizon [44-52], upper humic bed [53-64], volcanic ash layer [72 and 73], and hearth horizon [98]. The most homogeneous in terms of their magnetic qualities were samples 74-104 in the lower humic bed. **D** and **j** were double checked for their reliability, and it was confirmed that they do reflect fluctuations in the geomagnetic field. Significant deviations were detected in samples 91 and 92 (which appear to be in layer 23). The position of the virtual magnetic pole was calculated for samples 81-98 and these results were compared with those earlier obtained at Kapovaya cave (Gernik and Gus'kova, 2002, Fig. 3). According to them, points 2-6 on these diagrams are in agreement. Their conclusion is that, "with a considerable degree of certainty it can be stated that the excursion noted in layers 18-19 is Kargopolovo" (Gernik and Gus'kova, 2002: 266). Layers 18 and 19 are of course above both layers 20 and 22 and layer 23. The apparent discrepancy as to which layers showed evidence of the Kargopolovo excursion needs to be sorted out.

Palynology

Spiridonova's study is based on 43 samples collected from the eastern profile in 1998. Their position in relation to the section is shown in Sinitsyn et al. (2004, Table Ia) and Sinitsyn (2002, Fig. 2). To check certain points, some additional samples (50-55) were taken in 1999. The results for samples 50-54 (relating to cultural layers IV a and b) are shown in Spiridonova (2002, Fig. 2). The section as a whole was divided into 15 spores and pollen complexes, as indicated in the diagram in Spiridonova (2002, Fig. 1). A schematic table summarising the characteristics of these complexes was provided by Spiridonova (2002, Table 1). This has been incorporated into the account that follows, which proceeds from the base up, according to the descriptions given by her. She emphasises the importance of the hiatuses in the section, which are evident in her diagram, therefore each complex does not necessarily follow on directly from the preceding one.

Early Valdai Interstadial. Complexes I-IV.

I. Samples 1-3. Stratigraphic layer 28. AP 29-32%, NAP 45-50%, spores 20-23%. AP dominated by spruce 48-60%, pine 21-33%, birch 10-19%. NAP dominated in turn by varia, then Poaceae, then Chenopodiaceae. Some Asteraceae and Cichoriaceae, plus Fagopirum, Polygonum sp., Polygonum bistorta. Spores, Bryales 70%, Polypodiaceae30%. This is basically a Siberian taiga landscape, with wooded areas in the ravines. The increased importance of Chenopodiaceae may have been connected with colluvial processes. Overall, this is the beginning of an interstadial.

II. Sample 4. Stratigraphic layer 28. AP 48%, NAP 41%, spores 10%. AP dominated by pine 47%, spruce 40%. Birch and elm present. NAP Poaceae 33%, Chenopodiaceae 24%. Spores, Polypodiaceae 90%. A further stage of slight warming characteristic of an interstadial.

III. Samples 5-7. Stratigraphic layer 27. AP 43-57%. Spruce clearly predominant, with some pine. NAP, varia and Poaceae up to 36%, Cyperaceae 14%. Varia dominated by Compositae (up to 29%) plus Umbelliferae and Polygonacae. Fewer Chenopodiaceae and Artemisia. Spores, Bryales up to 87%, Polypodiaceae on average about 30%. Another phase in the interstadial, with an increase in summer temperature and in moisture.

IV. Samples 9-10. Stratigraphic layer 27. AP 38%, NAP 45-58%, spores 20%. AP dominant spruce up to 69%, followed by birch and pine. NAP Poaceae up to 32%, Artemisia 28%. Varia are basically Compositae 10% and Cichoriaceae 18%. Spores, dominant Bryales, fewer Polypodiaceae, plus Equisetum.
There seems to be a gap between this and the preceding stage. Sample 8 yielded nothing. The climate was colder but also wetter, leading to swampy conditions around the site. On low ground there may have been clumps of willow. Onagraceae in sample 10 may be connected to a fire. In general, these conditions reflect the end of an interstadial.

Middle Valdai. Early (Grazhdanskii) Interstadial. Complexes V and VI.

V. Samples 11-13. Stratigraphic layers 26 and 24. AP 38-47%, NAP 33-42%, spores about 20%. AP birch predominant up to 80%, spruce up to 36%, pine up to 25%. Alder absent. NAP Poaceae up to 46%, fewer Chenopodiaceae and Artemisia, varia include Cichoriaceae, Compositae, Caryophyllaceae, Cyperaceae, Polygonum, and Plantago. Spores, Bryales up to 94%, Polypodiaceae up to 14%. Colder and damper than the preceding episode. The substitution of birch for spruce constitutes a kind of *perestroika*. This phase marks the end of a stadial period, hence a gap between stages IV and V is implied. The change marks the transition from the early to the middle Valdai. Hitherto this transition had been evident only in the stratigraphic sounding.

Compare these results with samples 53 and 54 for cultural layer IVb (Spiridonova, 2002, Fig.2). The differences are so marked that in Spiridonova's opinion these samples probably reflect complex VII, although it is not explained exactly how that could come about.

VI. Samples 14-18. Stratigraphic layer 23. AP mainly spruce 71-82%, pine 10-22%, birch 3-6%, a few alder and oak. NAP dominant Poaceae up to 43%, many Artemisia and Chenopodiaceae. Varia include Compositae, Cichoriaceae, Geraniaceae, Polygonum sp., Polygonum bistara, Armeria elongata, Fagopirum. Spores, Bryales 80-91%, Polypodiaceae 9-17%, Botrychium 3%. In general, increased woodland probably means that this was an interstadial maximum. Another stratigraphic hiatus follows.

Middle Valdai. Middle (Kashinskii) Interstadial. Complexes VII-IX.

VII. Sample 19. Stratigraphic layer 22. AP reduced. Pine dominant 68-70%, birch 13%. NAP increased. Poaceae down to 30%, Artemisia and varia up to 34%, plus Chenopodiaceae, Cichoriaceae, Compositae, and Polygonum. Spores. Bryales, Polypodiaceae, Sphagnum. Another *perestroika*. Compared with the preceding episode, less wooded, colder and drier, followed by a further stratigraphic hiatus.

The apparent similarity to samples 53 and 54 suggests to Spiridonova that layer 22 may have had something to do with the formation of cultural layer IVb, although again the mechanism by which this could have happened is not clear.

VIII. Samples 20-24. Stratigraphic layers 18-16. AP 35%, NAP 42-54%, spores 1-17%. AP increases up the section. Spruce 55-60%, pine 34-36%, no broad leafed species. NAP varia up to 40%, fewer Cyperaceae, Chenopodiaceae, Artemisia. Polygonum bistorta could be linked to damp clearings in woods, also indicated by spores, which include Ophioglossum, as well as Bryales and Polypodiaceae.

These samples embrace cultural layer IVa. Spiridonova makes no comment on how her samples 50-52 from that layer compare with samples 20-24, except to say that layer IVa as so characterised is obviously very different from IVb (2002, Fig. 2).

Sample 25 Stratigraphic layer 15 (the volcanic ash layer) produced no pollen or spores.

IX. Samples 26-27. Stratigraphic layer 14. AP 19-28%, NAP 53-64%, spores about 17%. AP decreases up the section. Spruce 54-56%, pine 36-42%. NAP dominant, fewer Poaceae and varia, Artemisia up to 30%, quite frequent Compositae, Cichoriaceae, Chenopodiaceae, a few Cyperaceae and Plantago. Not too dissimilar to the preceding complex, but further shrinkage of the wooded area is evident. The interfluves were dominated by Artemisia and Chenopodiaceae. Complexes VIII and IX together correspond to the end of an interstadial period.

Middle Valdai. Bryansk Interstadial. Complexes X-XI.

X. Sample 29. [Sample 28 was devoid of pollen and spores]. Stratigraphic layer 13. NAP predominant, AP 27.6%, spores 19.4%. AP spruce dominant, birch 33.3%, pine 18.5%. NAP dominant Poaceae and varia, fewer Artemisia and Chenopodiaceae. Spores, dominant Bryales, fewer Polypodiaceae. Though spruce is more widespread, the frequency of birch indicates that conditions were both cold and damp. Probably marks the beginning of an interstadial.

XI. Samples 30-36. Stratigraphic layers 13-8. AP 8.8-30.7%, NAP 60-70%, spores about 20%. AP as in the preceding stage, spruce dominant, with less birch and more pine, willow appears in layer 11. NAP dominant Poaceae, many varia, Cyperaceae 13-17%, Artemisia and Chenopodiaceae not more than 16%. In layer 11 Onagraceae could be linked to the occurrence of fire. Spores include many Bryales, fewer Polypodiaceae, some Sphagnum and Lycopodium. A damp climate is coincident with the prevalence of colluvial processes, which may also affect the pollen spectra. Open spaces are still widespread. It appears that these deposits indicate both the beginning and the end of an interstadial, so this complex may be subdivided into XIa (samples 30-33) and XIb (samples 34-36).

The transition to the following complex XII is very sharp, and is marked by another hiatus. Additional samples were taken from stratigraphic layer 8 (the Gmelin fossil soil) denominated 36 a,b,c. AP included birch and pine, as well as Alnus, Quercus, and Tilia. NAP apart from varia and Poaceae included Polygonum and Fagopirum. Spores apart from Bryales and Polypodiaceae included Sphagnum. The spectra of all three sub-samples were very similar, and can be taken to characterise one phase of the soil formation, which probably coincides with cultural layer I.

Late Valdai. Ostashkovo Stadial. Complexes XII-XV.

XII. Samples 37-39. Stratigraphic layers 7-5. AP 5-12%, NAP 53-65%, spores 29-41%. AP pine 54-85%, birch 14-28%, a little spruce. NAP dominant Poaceae, varia, Cyperaceae up to 20.7%. Spores, practically confined to Bryales. Cold and damp climate, dominant meadows of various types, some swampy.

XIII. Samples 40-41. Stratigraphic layers 4 and 3. AP 5-7%, NAP up to 72.4%, spores 22-30%. AP pine 44-60%, birch 20-33%, spruce 4%. NAP Poaceae 21-26%, varia 40% with predominant Cichoriaceae and Compositae. Spores mainly Bryales. Cold glacial climate, but marginally warmer than the preceding episode. Small islands of woodland in a mainly open landscape.

XIV. Sample 42. Stratigraphic layer 2. Similar to XII. A few pine and birch, mainly NAP, Poaceae and varia. A maximum stadial episode.

XV. Sample 43. At contact with present day black earth. AP 11.3%, NAP 71.4%, spores 17.3%. AP birch 50%, pine 33.3%, a little spruce. NAP Poaceae down to 25%, Artemisia up to 40%, varia dominated by Asteraceae and Cichoriaceae, a few Umbelliferae, Cyperaceae, Caryophyllaceae, Labiatae. Spores, Bryales 89%, Polypodiaceae 10.9%. Climate improved, drier and warmer, the beginning of the end of the glacial maximum.

In her closing remarks, Spiridonova emphasises that this record is remarkable for its completeness. It allows for a comparison to the results earlier achieved at Kostenki 14 (in 1982) as well as to Kostenki I and Kostenki 17.

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Captions

Kostenki 14. Stratigraphic sequence for the eastern portion of the site (Sinitsyn et al., 2004, Table Ia)

Kostenki 14. Stratigraphic sequence with sampling locations. Columns from left: palaeomagnetic samples, palynological samples, stratigraphic layers. On right: cultural layers. ГП=horizon in volcanic ash, К=Kargopolovo, МАМ=mammoth, ГО=hearth horizon (Sinitsyn, 2002, Fig. 2)

Kostenki 14. Pollen diagram (Spiridonova 2002, Fig. 1). Key from left at top:
Depth in metres, lithology, sample numbers, overall composition.
AP, Quercus, Ulmus, Tilia, Salix, Betula albae, Betula fruticosae, Pinus sibirica, Pinus sylvestris.
NAP, Fagopirum, Polygonum bisteriae, Rumex, Onagraceae, Plantago, Brassicaceae, Ranunculaceae, Lamiaceae, Caryophyllaceae, Fabaceae, Linum, Cerastium, Apiaceae, Armeria, Cichoriaceae, Asteraceae.
Spores, Botrychium, Lycopodium elevatum, Lycopodium selago.
Pollen and spores complexes.

Kostenki 14. Cultural layers IVa and IVb compared in terms of their palynological characteristics (Spiridonova 2002, Fig. 2). Top left: overall composition (spores, NAP, AP). Top right: AP. Bottom left: NAP. Bottom right: spores.

The stratigraphic test pit pollen diagram (compiled by E.A. Spiridonova).
Key from left at top: Depth, lithology, sample numbers, overall composition.
AP, Betula albae, Betula fruticosae, Pinus sylvestris, Quercus, Ulmus, Tilia, Corylus, Salix, Hippophae.
NAP, Ericaceae, Ephedra, Asteraceae, Cichoriaceae, Achillea, Centaurea, Cirsium, Thalictrum, Rosaceae, Brassicaceae, Fabaceae, Caryophyllaceae, Campanula, Apiaceae, Polygonum, Armeria, Plantago.
Spores, Lycopodium (two varieties), Botrychium.
Pollen and spores complexes. Warm – cold, Damp --- dry fluctuations. Vegetation.

Key: 1 AP total. 2 NAP total. 3 spores total. 4 Picea. 5 Pinus. 6 Betula. 7 Alnus. 8 AP deciduous total. 9 and 23 Gramineae. 10 and 21 Artemisia. 11 and 22 Chenopodiaceae. 12 and 24 varia. 13 Bryales. 14 Sphagnum. 15 Lycopodium. 16 Polypodiaceae. 17 birch and alder woods. 18 pine woods. 19 spruce woods. 20 broad leafed woods.
Lithology: (1) present day soil. (2, 4, 6, 8, 10, 13) loams. (3, 5, 7, 9, 11, 12) fossil soils.

Kostenki 14. Radiocarbon dates (Sinitsyn et al., 2004, Table 2)

Kostenki 14. Palaeomagnetic characteristics of the section. (a) natural remanent magnetization $\mathbf{I_n}$ [1] and magnetic susceptibility **k** [2]. (b) declination **D**. (c) inclination **j**. N=sample locations. (Gernik and Gus'kova, 2002, Fig. 1).

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October 30 2006.