

# Geoarchaeological study of big Essentuksky 1 kurgan in Ciscaucasia, Russia

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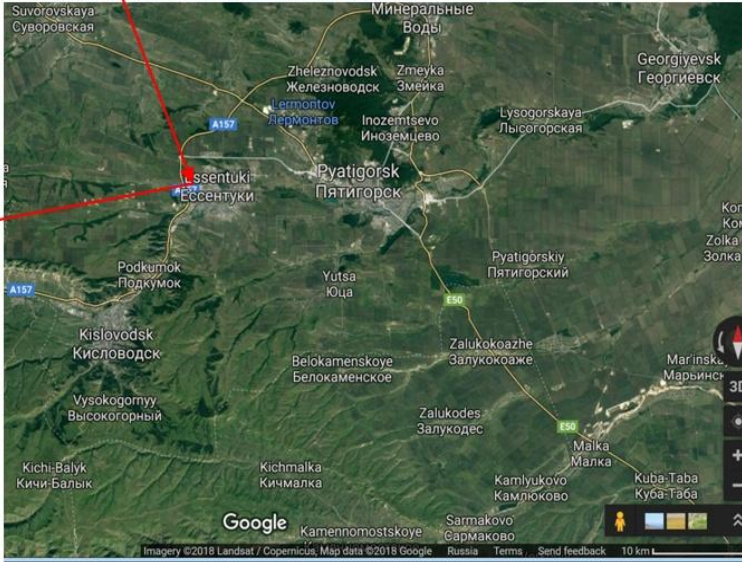
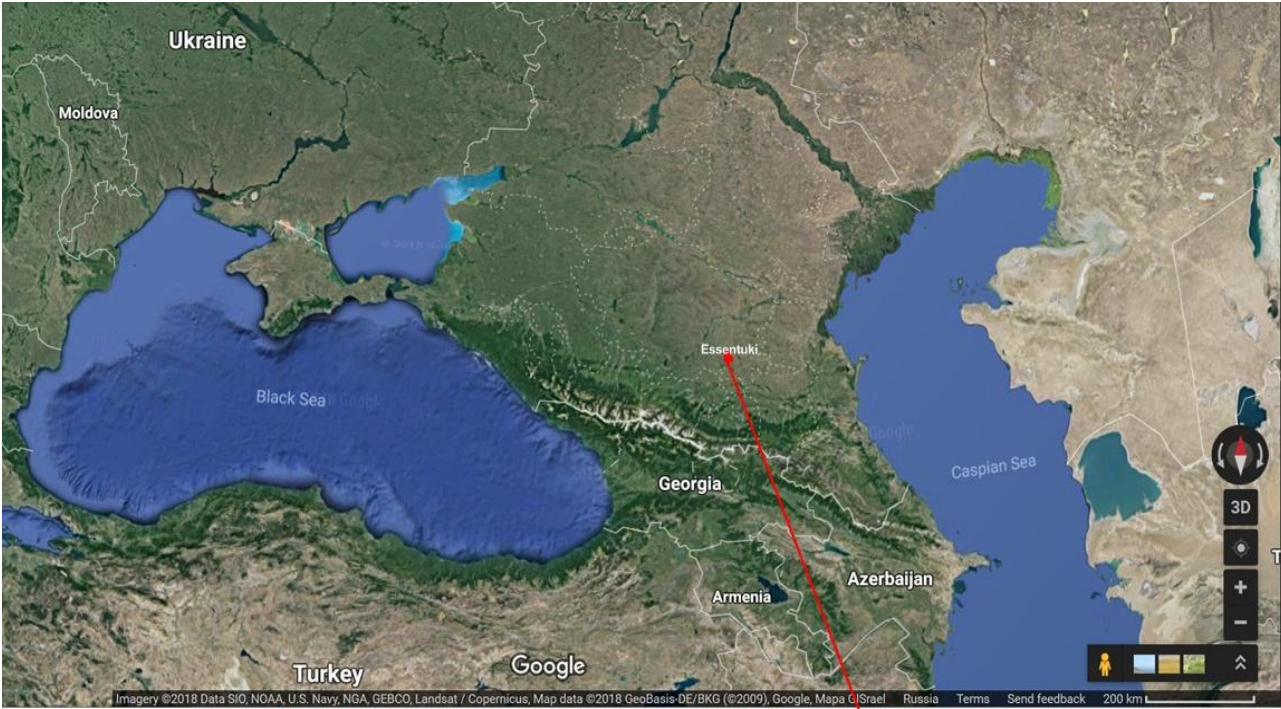
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In 2017-18 the security and rescue excavations of big kurgan Essentuksky 1 were carried out by the archaeological expedition of "Heritage" Co Ltd under the leadership of archaeologist Kalmykov A.A. This kurgan was located on the northern outskirts of Essentuki-city, Stavropol Territory, between the private houses on the Atamanskaya street. Paleopedological study of this kurgan was conducted in June 2018.

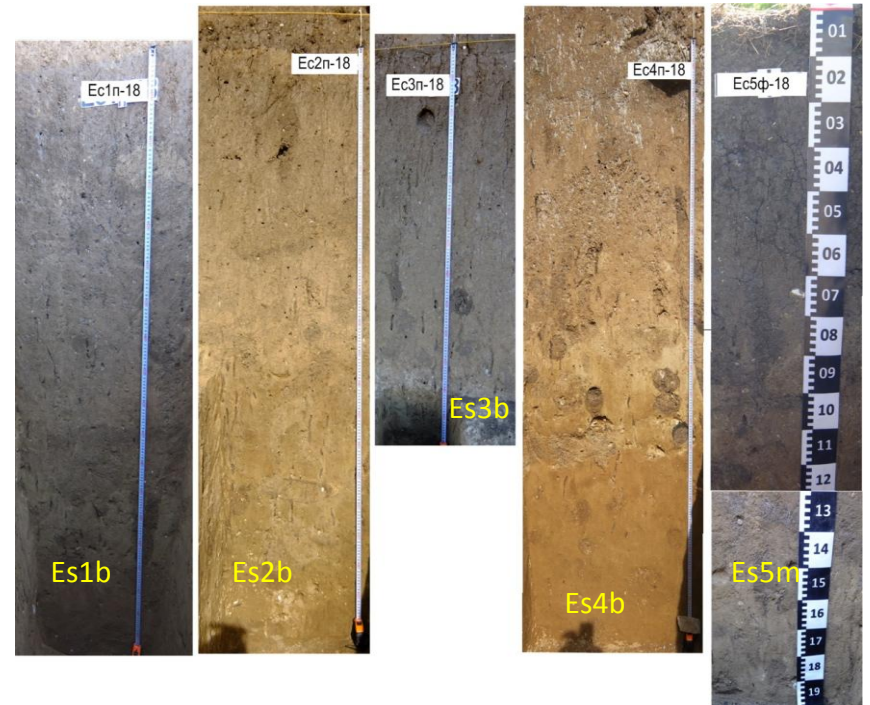


The height of the Essentuksky 1 kurgan was 5.5-6 m and diameter – more than 60 m. According to archaeological data and radiocarbon dating, the kurgan was built by people of the Maikop culture in the second quarter of the 4<sup>th</sup> millennium BC for some decades, i.e., very quickly.





The kurgan had four earthen constructions (1ec-4ec) and three – made of stones (5sc-7sc). All stones in the kurgan were fastened by earthen cement. At the center, there was a robbery pit which destroyed the kurgan. Soil pits were dug under first, second, third and fourth earthen constructions (Es1b, Es2b, Es3b and Es4b, respectively). The surface soil on the area adjoining to the kurgan was also studied (Es5m)



# Results

We studied the composition of the material of kurgan's earthen constructions (**EC**) and cements of stone constructions (**SC**).

In direction from the first to the fourth ECs, the content of organic carbon decreases and carbonate carbon, magnetic susceptibility, LOI (loss of ignition) increases.

Kurgan construction	Fraction <0.01 mm, %	Fraction <0.001 mm, %	C organic, %	C carbonate, %	Magnetic susceptibility, 10 <sup>-8</sup> units SI	LOI, %
First EC	65.0-67.1	35.8-36.8	1.3-1.4	1.3-1.6	45-50	12.9-13.3
Second EC	59.1-62.5	29.4-31.7	1.0-1.3	1.4-1.8	43-45	12.0-13.3
Third EC	57.6-66.5	25.2-29.2	0.9-1.3	1.1-2.1	56-67	11.7-13.9
Fourth EC	62.1-67.6	30.2-37.5	0.7-0.9	2.1-2.5	66-81	13.8-15.4
Fifth SC - cement	64.1	33.3	1.1	2.1	68	14.4
Sixth SC - cement	64.4-66.6	33.0-36.1	1.1-1.4	2.7-2.7	88-89	16.9-17.1
Seventh SC-cement	65.4-66.8	35.3-37.0	1.1-1.2	1.6-2.3	78-87	12.2-15.0

The cement of SCs is characterized by comparatively high content of organic and carbonate carbon, high values of magnetic susceptibility and LOI.

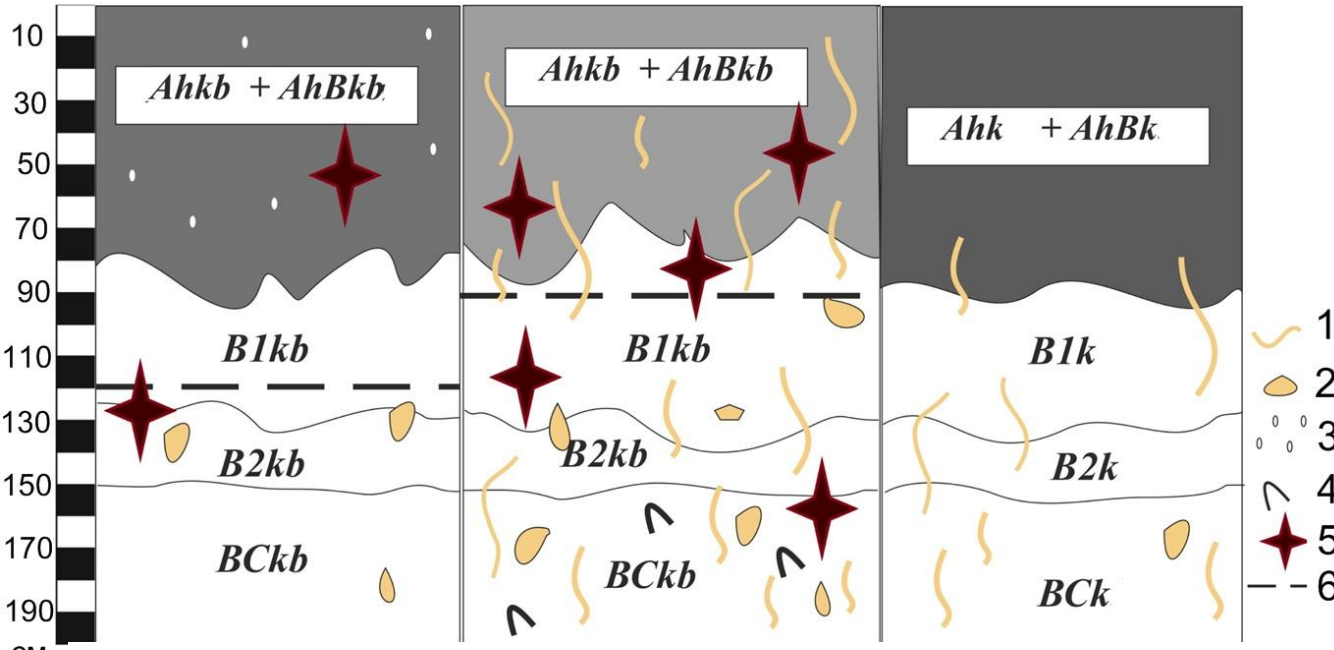
There are the higher amounts of particle size fractions <0.01 and <0.001 mm in the cements of SCs as compared with the material of ECs.



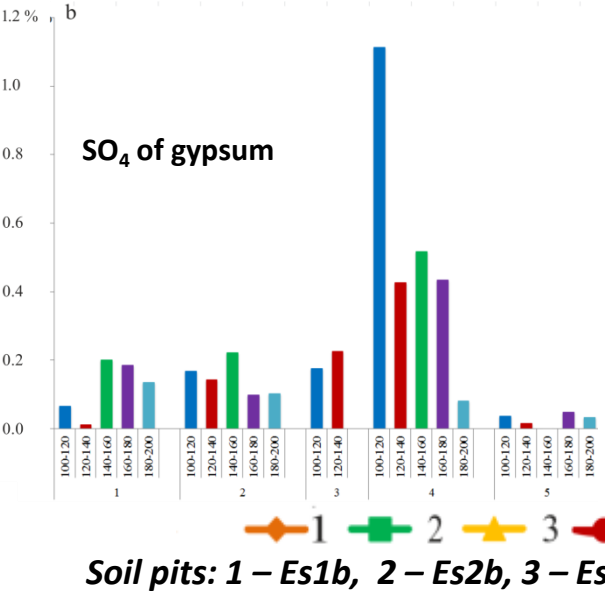
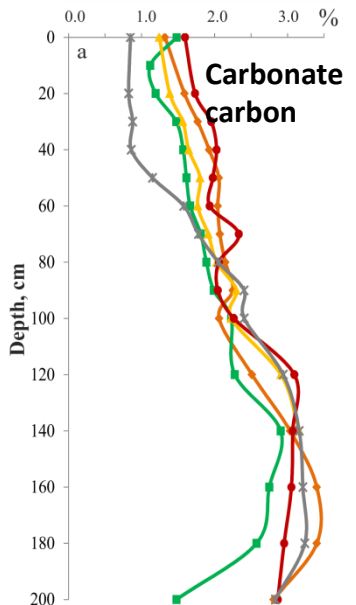
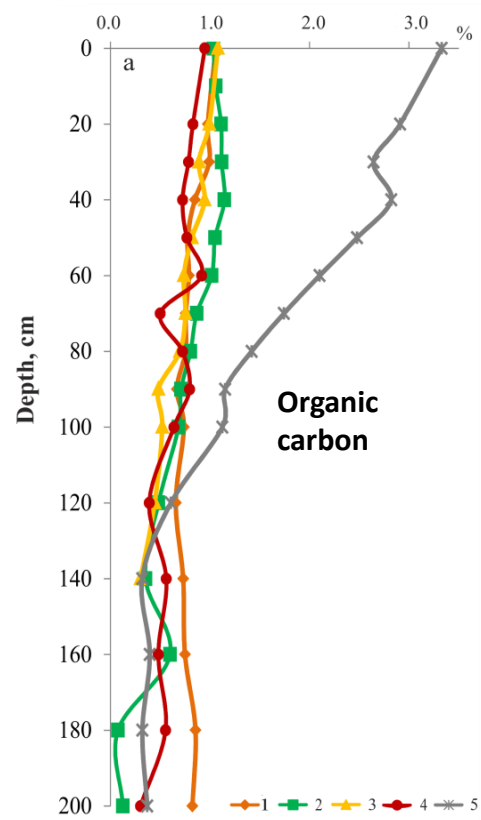
**Pits: Es1b, Es2b, Es3b**

**Es4b**

**Es5m**



1 – carbonate pseudomycelium, 2 – white soft carbonate spots, 3 – carbonate impregnation, 4 – gypsum veins, 5 – animal holes, 6 – the depth of appearance of carbonate pedofeatures

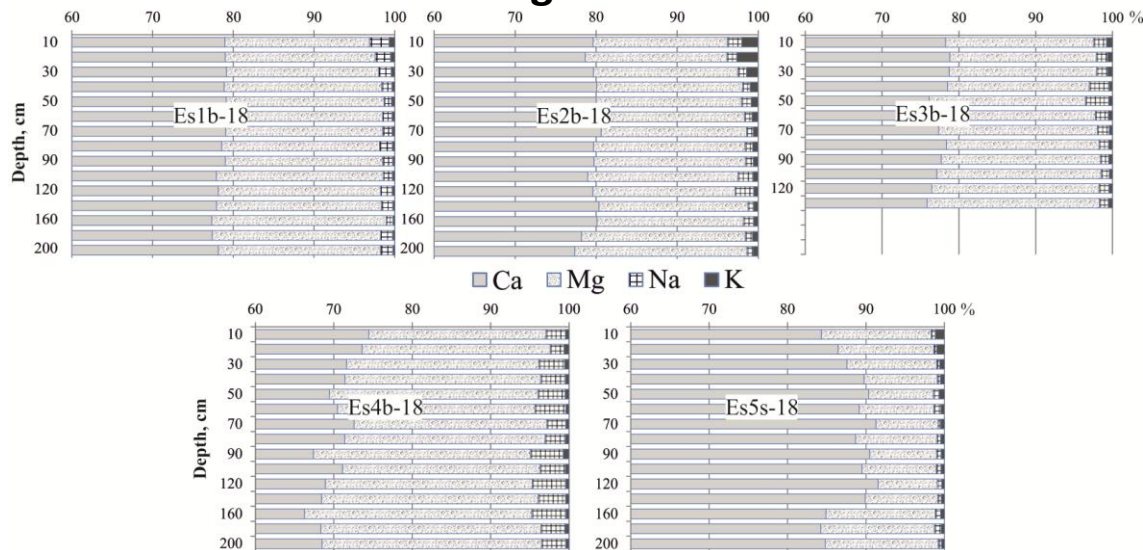


During the interval of kurgan construction, the morphological and physicochemical properties of soils changed. There is a decrease in intensity of the black color of the humus horizon and the content of organic carbon within the first 50 cm of profile, an increase in the content of gypsum, carbon of carbonates, a shift of the area of their accumulation up the profile, and transformation of the forms of carbonate pedofeatures.

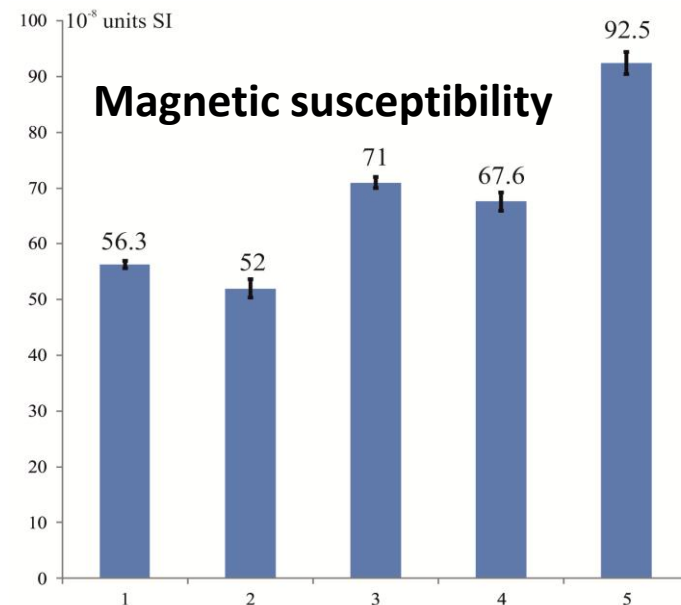
Soil pits: 1 – Es1b, 2 – Es2b, 3 – Es3b, 4 - Es4b, 5 – Es5m



## Exchangeable bases



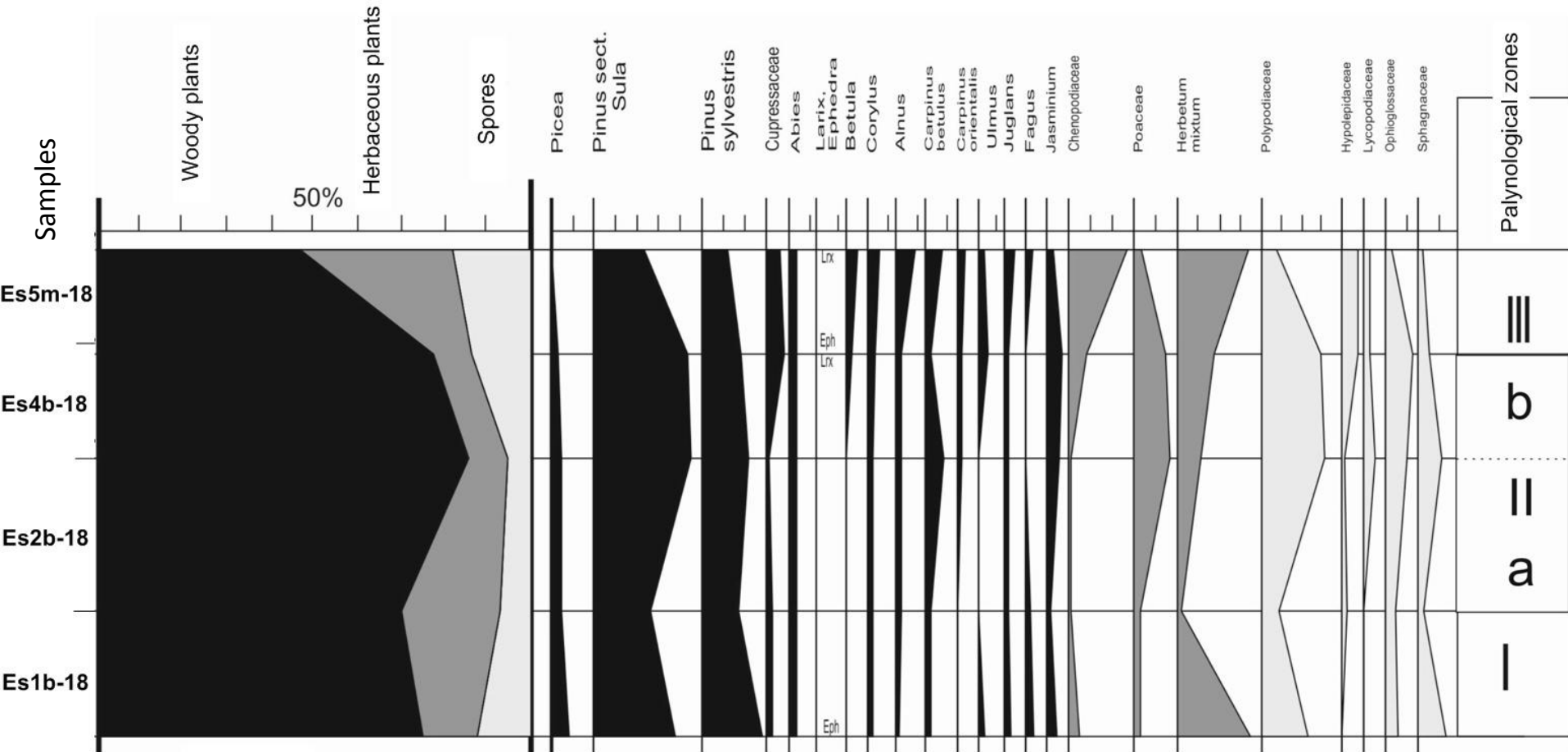
The percentage of the exchangeable sodium and magnesium in the composition of exchangeable bases increased and the magnetic susceptibility decreased.



The most “arid” properties are found in the paleosol buried last in the studied pedo-chrono-sequence (pit Es4b): the color of the humus horizon is the lightest, the profile is most enriched in carbonates, there is the highest content of exchangeable sodium and magnesium in the composition of exchangeable bases, the lowest magnetic susceptibility and the maximum amount of gypsum in the second meter of the profile.

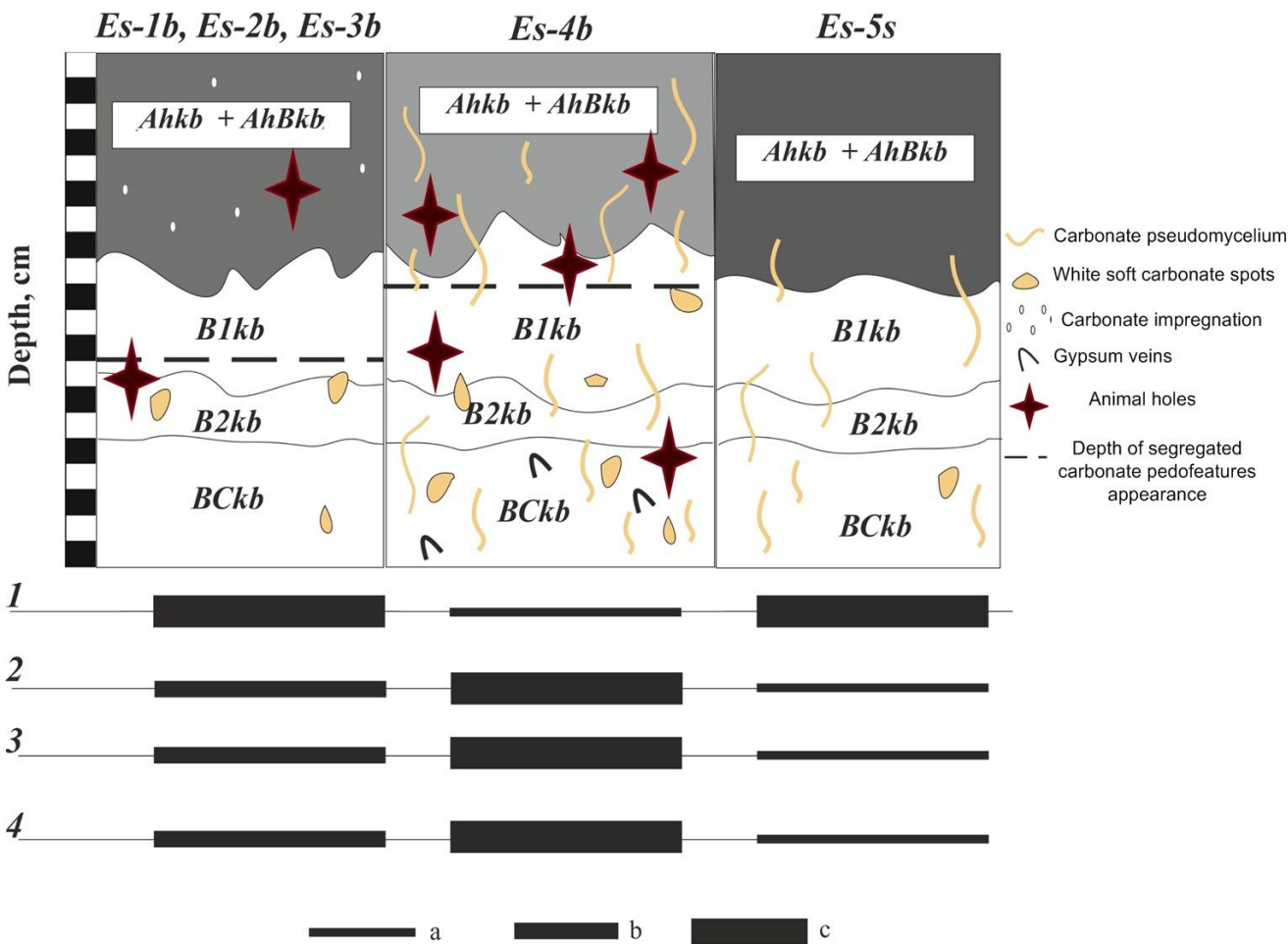
During the indicated time-span of the kurgan construction, **Haplic Chernozems Loamic** (soils under the first, second and third kurgan constructions) evolved to **Calcic Chernozems Loamic** (soil under the fourth kurgan construction).

# Palynological analysis



For the studied time interval of the kurgan construction, a palynological analysis revealed a decrease in forest area and an increase in the portion of herbaceous plants; in the composition of herbs, there was an increase in the proportion of steppe and xerophytic species (palynological zone II b).





- Pedogenetic proxies of climatic trends during the studied time interval at the early Bronze Age include:**
- ❖ 1) enrichment of the upper horizons in organic carbon;
  - ❖ 2) calcification and salinization (an upward migration of carbonates and gypsum);
  - ❖ 3) alkalinization (the share of exchangeable Na in CEC);
  - ❖ 4) bioturbation (cf. Figure).

# Conclusions

- ❖ The climate of the studied interval (the beginning of development of the Maikop culture in the Ciscaucasia, Russia) is characterized as drier and hotter in comparison with that for nowadays.
- ❖ The material for the earthen layers of the kurgan's constructions was taken from the Ah and AhB horizons of the buried Chernozems. The morphological and analytical properties of the layers from the kurgan earthen constructions show the same changes as those for the buried paleosols.

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Thank you for attention!

