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Microbial communities in paleosoils of Southern Russian steppes

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Ground monuments (kurgans) emerged about 6000 yr ago in the steppes of Eurasia; the funeral ceremony of erecting kurgans existed till XVth century. Today they have become an integral part of steppe landscape. Excavations of kurgans provide information about culture of steppe inhabitants and also open paleosoils buried (conserved) beneath from the time of kurgans erecting. Paleosoils in situ buried beneath kurgans and excluded from the further soil-forming process, imprint the conditions of past environment in a number of their properties, in carbonate, gypsum and salt profiles, etc. Among important indicators characterization of soil microbial communities is a promising and yet undeveloped field. The adaptive strategy of microorganisms, which allow them long withstand stressful conditions, is transformation to a resting state. We suggest that despite of possible time-connected changes, microbial communities from dry environments conserved within the paleosoils, might maintain some features of their structure from the time of paleosoil burial.
The aim of the work was to trace the amount and composition of microbial communities in paleosoils buried under kurgans of different ages located in southern Russia steppes in connection to the dynamics of environmental conditions. We estimated total and alive (dormant) microbial biomass, the morphological peculiarities of microbial cells, the diversity and relative abundance of microorganisms of different trophic groups. It was shown that the number of microorganisms in A1 horizon of the buried paleosoils is an order higher than in the kurgan embankments that points to the integrity of microbial society from the moment of the kurgan erection. Within the paleosoil profiles the parameters studied did not decrease monotonously with the age of burial but had a specific dynamics. The microbial biomass from different horizons of under-kurgan paleosoils ranged in 600-1700 g C/g soil, while the share of microbes able to reactivate after the glucose addition was about 0.4-90 g C/g. The morphological peculiarities indicate adaptation mechanisms for unfavorable conditions: the formation of organic-mineral covers, fine sizes and presence of nanoforms. The diversity of microbial communities of paleosoils differed from modern ones: besides common the specific filogenetic groups were registered. In paleosoils buried within paleoecological crisis (around 4000 years ago) the impoverishment of genetic diversity was not found. The change in environmental conditions resulted in succession of the communities with features of original diversity.

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