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Ecology and evolution of gleysols in the Russian sector of the Arctic

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A riddle of tundra soils which has been attracting the attention of investigators of the North is most brightly incarnated in phenomenon of tundra gley (homogenous-gley) soils – TGS. These soils are spread everywhere, though irregularly in different geological-geomorphological regions of the Arctic. They occupy the area of Holocene sea transgressions, and glacial regions as well as the territories beyond the limits of the Upper Valdai glacial covers (areas with ice complex sediments, so called edomas, and covering loams). The paleohydromorphic signs are present into the soil profiles generated on more southern terrains, had far enough from edge of last glacial cover. For example, into holocenic profiles of the Humic Luvisols formed on the Late Valdai (MIS 2) cover loessial loams there are the clarified gleying horizon changing the degree of thixotropy depending on the landforms of an ancient daylight surface on which it was formed. Paleohydromorphic phase is an indisputable fact in Holocene history of the North. In different sectors of the Arctic it derived from different reasons resulting in different soil-landscape consequences in the modern tundra. TGS are timed to Holocene accumulative surfaces where they occupy "neoautomorphic" positions on different altitudinal levels. Morphotypes of gley of Arctic upland soils, being the key to understanding of their hydromorphic past, reflect landscape-geomorphological conditions of their profile formation. Profiles with "ochre-spotted" mottling are the derivative of ancient floodplain (lakes, rivers) regime; predominating dove-color with brightly expressed features of thixotropy indicates the "true gley" of fens. Botanical-geographical zonality in the Arctic corresponds to modern bioclimatic conditions, but, against this background, the TGS's geography is controlled by different regularities. The evolution of vegetation of paleohydromorphic surfaces into the zonal one goes on continuously-interruptedly being affected by planetary cooling, reduction of lake surfaces, bogs drying, decrease in water level of rivers and termination of floodplain regime in vast areas. The variety of transitional stages of surface development is reflected in vegetation, which is a sensitive indicator of additional moistening over the atmosphere one. For example, sedge-cotton grass hillocky tundra indicates the youngest neoeluvial surfaces on edomas of the continental sector of the Arctic (the North of Siberia, Chukotka, Arctic Alaska). In the Eastern continental sector of Arctic as a result of sheet thermokarst and lake transgression in Early Holocene two genetic types of surfaces occur in the interfluves within the area of ice complex deposit distribution. These are edoma remnants and extensive accumulative surfaces of different altitudinal levels, the alases. The latter are watered and paludificated in different degree, and the process of relief transformation is continued within their limits. Significant areas in alases have now an autonomous regime. They are covered by moss-dwarf shrub vegetation, that differs insignificantly from the sites on edoma remnants. Hydromorphic (lake-floodplain) past of these alas sites is reflected in "ochre-spotted" suprapermafrost-gley profiles of the tundra gley soils (TGS) developed in them. However, younger surfaces covered by sedge-cotton grass hillocky tundra with Carex lugens and Eriophorum vaginatum are wider spread in the alas plains. Soils here have similar gley profile, showing, not frequently, evidences of peat formation. Finally, the youngest, "amphibian" link in the evolutional series of neoautomorphic surfaces is the massifs of rim-polygonal swamps – tundra-swamps. The rims bordering swampy basins are covered by moss-dwarf shrub vegetation indispensably including above mentioned sedge and cotton grass species. Evolution of tundra swamps leads to decrease in watering and gradual tundrification of the polygons (basins). As a result, upland soil variety in the region will be supplemented in the future with a morphotype of tundra soils with dove-colored horizon of "true gley". Many investigators appeal to "a radical change in landscape geochemistry" at the Pleistocene-Holocene transition while compare edoma deposits and TGS, the latter being an indispensable upland component in modern tundra. The change, however, not directly reflects the increase in climate humidity in Holocene; in fact, it results from evolution of paleohydromorphic (floodplain, swampy) landscapes into the autonomous ones. Chronosequences of gley sols in Holocene accumulative surfaces of different age represent the same process in modern conditions.