

MICRORELIEF FORMS IN THE TUNDRAS IN PRIAMUR'E

Sochava, V. B., Tundrovye formy mikrorel'efa v Priamur'e: 1/
Akademia Nauk SSSR, Priroda, no. 5-6, pp. 107-109, 1944

Condensed and emended by I. V. Poiré
U. S. Geological Survey, 1949

Cemetery hummocks, 2/ pingos, bowl-like hollows, and spot-medallions are thermogenetic forms of mesorelief and micro-relief. Changes in them occur very quickly. Cemetery hummocks were found in some kinds of bogs and in some regions of swampy mineralized soils overgrown with larch wood.

The spot-medallions are very common in the basin of the Amur River. They are similar to those of the Karskaia tundra, of the Yenisey forest tundra and of the basin of the Anadyr' River. They are similar to the modified forms of these spots which occur in the southern parts of the tundra where there is a swampy Sphagnum cover underlain by a thick peat layer. These spots have not been found in the north Yakutian area. They are sparse in the Anadyr' Basin, but very abundant in the area adjacent to the Penzhinskaya Guba (Gulf of Penzhina). Spots of this kind are very common on

1/ Priamur'e is the country adjacent to the Amur River. It means "Near Amur".

2/ For explanation of terms see Glossary at end.

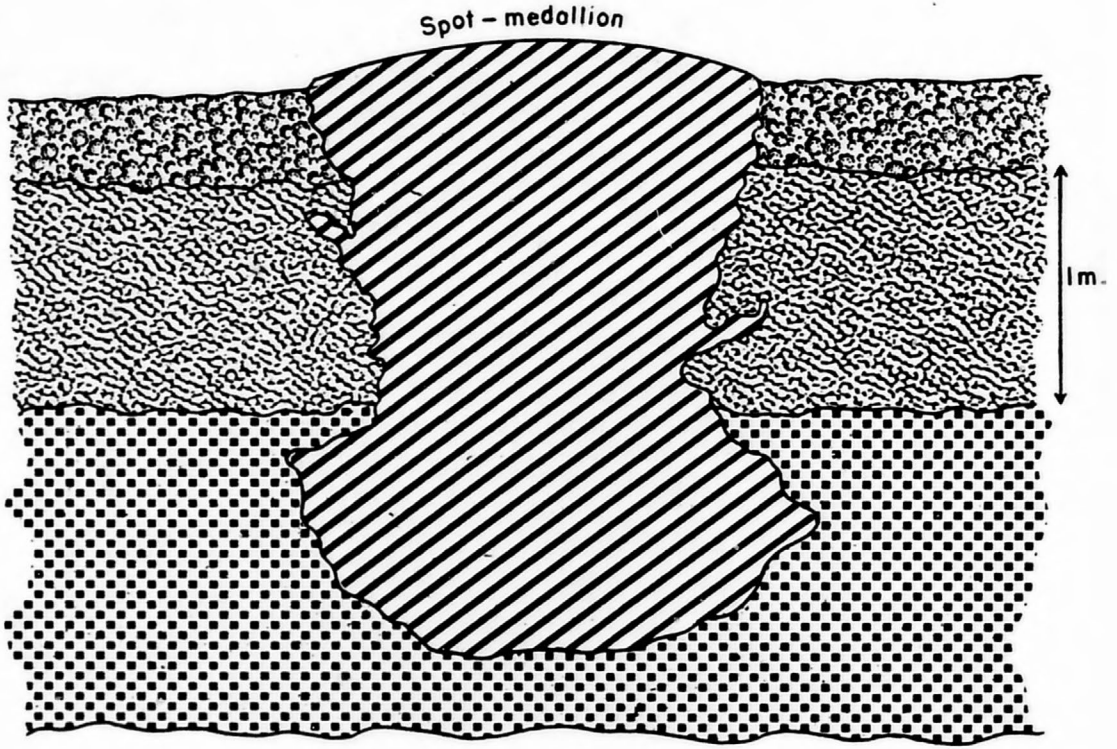
the foothills of the North Ural Mountains.

The spots are areas of exposed sticky, loamy ground. As the cross section (fig. 1) shows, they are columns of loamy ground in a layer of peat, whose thickness is more than 1 m.; the peat is overlain by a Sphagnum sod. In the Anadyr' region such spots occur on the clayey lacustrine formations, on the sedge nummocky tundra overgrown with green moss. The origin of these spots is the same as that of cemetery hummocks. The impetus for their formation is the stress in the ground resulting from the uneven freezing of the active layer and its adfreezing to the merzlota. The imperative condition for the formation of cemetery hummocks is a sufficient thickness of the active layer. Where the thickness of the active layer is small, as in bogs, in valleys, and in lowlands, the spots (medallions) occur. They actually form right before your eyes; old cemetery hummocks and old spots decrease at the same time new ones are forming.

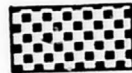
It seems as if the process of freezing of the active layer is irregular or wavelike; freezing action upon the relief also is wavelike. This means that the thermogenetic relief features are formed in places where they were absent before, and the old hummocks and spots become denuded and disappear.

The author has explained, in an earlier paper,^{3/} the formation of spotted tundra as a result of the unequal freezing of the active layer due to the change in its physical properties, and to

^{3/} Sochava, V.B., O piatnistyh tundrah Anadrynskogo Kraia [The spotted tundras of the Anadyr' region]: Akademia Nauk SSSR, Trudy Poliarnoi Komissii, vol. 2, 1930.



Sphagnum



Seasonally frozen ground



Peat



Unfrozen ground

Figure 1.— Diagrammatic cross section of a spot — medallion.

(I. V. Poiré)

the degradation of the peat. This degradation has been considered the inevitable result of the development of vegetation and soil under conditions of imperfect growth of swamps and accumulations of peat. Cemetery hummocks are lacking where moss and hummocky bogs are supersaturated with water and where the peat layer is increasing (aggrading). Swelling occurs where these bogs are decreasing and where there is a partial degradation of the peat layer, or where a delay in its growth takes place. As a consequence of the degradation of the peat layer, large pores or cracks in the form of channels of small width appear. These channels are filled with fluid ground ("subsoil") supersaturated with water. An increase in the volume of the subsoil takes place during freezing. This earth mass supersaturated with water rises towards the surface in successive years and grows wider on all sides owing to the inflow of new portions of the fluid mud. This process of spot or medallion formation does not last long. The hydrostatic pressure in this case is greater than in other types of spotted tundra, because of the supersaturation of the ground. The profile of such a medallion has the shape of a funnel or of an irregular rhomb; there are, however, spotted tundras of other origins.^{4/} The process of the upheaval of ground ceases after most of the ground has been exposed and has formed a medallion. The surface of the mud dries and the ground beneath the spot becomes porous. A porous mass can absorb a large quantity of water and consequently the volume of the spot does not increase very much when the freezing starts.

^{4/} Sochava does not explain their origin.

Merzlota was not found under the medallions in the Priamur'e, but thermal conditions of the ground there are similar to those mentioned above. In this process of spot formation in other regions merzlota acts as a water-impermeable layer. In Priamur'e other kinds of water-impermeable ground are responsible for spot formation.

Glossary

Active layer, the upper part of the earth crust, in the regions with merzlota, that is subject to seasonal thawing. In other words, the active layer is the upper part of the merzlota that is subjected to seasonal thawing. The active layer is not synonymous with the seasonally frozen layer. Its thickness and the time required for its thawing and freezing is controlled by the zero curtain. (M. I. Sumgin)

Cemetery hummocks, hummocks or mounds that are formed in marshes and bogs in regions with merzlota. The formation of the hummocks is due to the action of freezing diluted ground under hydrostatic pressure. This pressure occurs in places where the freezing of the active layer is not uniform. The dimensions of hummocks are: relative height above the bottom of the adjacent hollow, 0.2 to 1.0 meter; the diameter of the base, 1.0 to 2.5 meters. A swamp covered with this kind of hummocks resembles a Russian cemetery.

Degradation, gradual decreasing, wearing away.

Merzlota, as used by most Russian scientists, has a more restricted meaning than the American term "permafrost". Merzlota is a body (or its physical state) of sedimentary, metamorphic or igneous deposits, that has negative temperatures (below 0°C.) lasting more than two years, and that contains water and minerals whose freezing temperature is below 0°C., predominantly in solid phase.

Permafrost includes not only merzlota, but also deposits in which the water and some minerals are not in solid phase, or in which water is absent.

Naled', plural naledi, frozen sheets of water poured out above ice of rivers or lakes, or above the bottom of a valley, or between the beds of deposits. The formation of a naled' is due to the hydrostatic pressure of a dammed river or of ground water.

Permafrost, as defined by Muller, is a thickness of soil or other surficial deposit or even of bedrock, at a varied depth beneath the surface of the earth, in which a temperature below freezing has existed continuously for a long time (from two years to tens of thousands of years). This definition is practically M. I. Sumgin's.

Pingos or hydrolaccoliths, large hummocks whose formation lasts many years and is due to the hydrostatic pressure of ground-water from below the merzlota. Pingos are often related to the naledi

Spot-medallions, bare spots of ground in swamps or bogs. They are somewhat elevated above the surface of the swamp or bog and are related to hummocks. These spot-medallions are either disappearing hummocks or occur where the thickness of the active layer is not sufficient for the formation of hummocks.

Zero curtain, is a layer of soil or ground, whose temperature is 0°C ., and which hampers the heat exchange in the soil. The zero curtain can move; it can occur immediately below the earth's surface and move downwards; this movement depends on the moisture content in the ground. The zero curtain is absent in dry soil or ground where the latent heat of freezing or thawing is absent.