



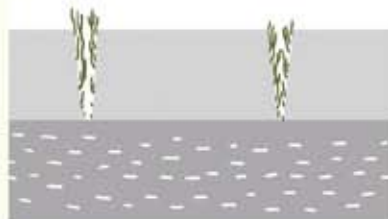
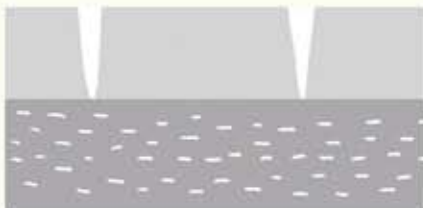
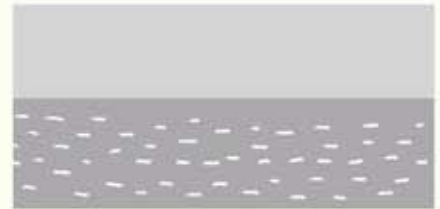
The Driving Force of Frost Boils and Hummocks Formation

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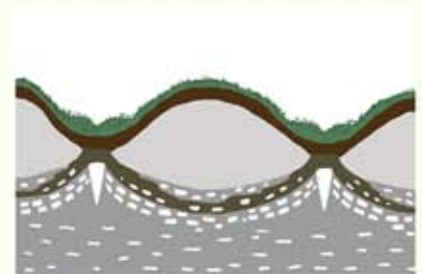
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Frost boils and inter-boil areas form a well-organized and long-term functioning system closely linked to upper permafrost dynamics.

Genesis of frost boils and hummocks have been widely attributed to cryoturbations – a complex of seasonally interchanging processes of frost heave and thaw settlement. Existing hypotheses do not consider changes in the upper permafrost as factors of frost boil and hummock formation. They cannot explain the bowl shape of boils, the formation of an organic layer at the periphery of the frost boils, the elevated center of the boils.



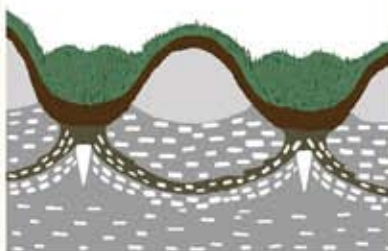
Formation of the system begins with the occurrence of vegetation in inter-boil areas in shallow thermal cracks limited by the thickness of the active layer.



Vegetation and its decomposition change the thermal properties of the active layer that steadily decreases with formation of aggradational ice and perennial frost heave beneath vegetated inter-boils.

The organic matter formed in inter-boil areas intrudes under boils due to formation of frost cracks and thawing of ice lenses and layers at the bottom of the active layer.

Penetration of organics along the active layer – permafrost boundary from an inter-boil area leads to formation of additional aggradational ice in the intermediate layer at the top of the permafrost accompanying the intruding organics.



Vegetation development on the boil surface and readjustment of the upper permafrost lead to the development of hummocks.

The development of vegetation and accumulation of organics at the surface of frost boils leads to decreasing active-layer thickness, accumulation of aggradational ice, incorporation of the previously intruded organics underneath the frost boil into the upper layer of permafrost, and increased perennial heave of the surface.