Biogeochemical specifics of northern taiga ecosystems on hard gypsum regolith

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Ecosystems formed on hard gypsum are rare natural objects that can be observed within very small areas, where this rock outcrops. Gypsum is very poor rock in most macro- and microelements (in consists of 99% $CaSO_4x2H_2O$) and belongs to the range of extremely oligotrophic substrates (along with oligomictic sands and coral atolls). Therefore, ecosystem on hard gypsum is a good object for studying how plants accommodate to the nutrient deficiency and find sources of food. The geochemical cycle in this case is very specific because of an abundance of calcium and sulfur and a lack of such vital elements as phosphorus, potassium and many others. So, there are problems of determining the sources of elements and the mechanisms of their input and cycling in ecosystems on hard gypsum. Phytocenoses on hard gypsum are very peculiar and differ from those associated with other rocks. So, research on these unique natural objects can help to comprehend and, hopefully, to save biological diversity of the world. Northern taiga ecosystems on hard gypsum regolith were studied in Arkhangelsk region, at the area of Pinega reserve. This territory belongs to a southeast part of White Sea-Kuloy Plateau and characterized by intensive development of surface gipsum karst. Gypsum outcrops are covered by oligotrophic phytocenoses, which significantly differ from generally known boreal forests. All plants are characterized by increased Ca and Sr concentrations, and some of them (spruce, birch, mountain cranberry and blueberry) concentrate also S, Zn, and K. Apparently, for all this group of elements this increased accumulation is caused by the bioavailability in form of sulfates, and for Ca, S, and Sr – also by abundance of this elements in gypsum substrate. Elements found in plant organs in decreased concentrations belong to the group of insignificant components of gypsum substrate (Mn, Si, K, P, Mg, Fe, Al, Cl, Rb, Ni). However, each plant species is characterized by individual tendency for impoverishing in certain elements.

The income of macro- and microelements with falloff into the surface horizons of soils formed on gypsum is very important for supporting vegetation. At the initial stage of litter formation on gipsum substrate, the falloff comes from plants that obtain nutrients from small areas of loose silicate deposits covering gipsum. Thus, elements assimilated from silicate deposites (and, of cause, from the air) move into soils formed on hard gypsum. This is a most important link in the geochemical cycle in ecosystems developing on hard gypsum.