

**INFLUENCE OF BEDROCK COMPOSITION  
ON THE CONTENT OF BIOGENIC ELEMENTS  
IN THE HUMUS HORIZON OF SOILS IN ESTONIA**

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Composition of soil in Estonia is influenced by the geochemistry of Paleozoic bedrock and Quaternary sediments. The parallel bedrock succession is slightly inclined to the south, 3 m per 1 km, and their composition changes from the north towards the south. The oldest Cambrian clays and sandstones crop out between the seashore and the North Estonian cliff. The subsequent zone to the south is composed by Ordovician and Silurian carbonaceous bedrock. In South Estonia, the bedrock is represented by Devonian sandstone and aleurolite. Glaciation has transported from Fennoscandia metamorphic and igneous rocks, which have an impact on the soil composition.

Vegetation needs 10 macrobiogenic elements as main nutrients: O, H, C, P, N, S, Ca, Mg, Na and K for plant cell construction. For regulation of normal growth, numerous microbiogenic elements: As, B, Br, Cd, Co, Cr, Cu, F, Mn, Mo, Nb, Ni, Pb, Rb, Se, Sr, V, Zn etc. are required (Thornton, 1983; Kabata-Pendias, Pendias, 2001).

The geochemical atlas of the humus horizon of Estonian soil, with explanatory notes, covers the whole territory of Estonia, 45 200 sq. km (Petersell et al., 1997). The sampling network had the density of one point per 30–35 sq. km. Thickness of the humus horizon varies between 12 and 35 cm. Organic matter content varies from 2 to 10%, being 3.2% in average. The atlas consists of 37 maps, 30 of which characterizing single-element concentration in the humus horizon of the soil.

Distribution of macrobiogenic elements is not uniform. Carbonaceous rocks, with CaO content up to 55% and MgO content up

to 21%, prevail in the northern part of Estonia. Ca content in soil is 1–5%, but is less than 1% in areas covered by sediments deposited from the Baltic Ice Lake and various stages of the Baltic Sea in Quaternary time. Across Estonia, from Pärnu to 30° NE, there is a swamped zone, where Ca content is somewhat lower. In south Estonia, CaO content in bedrock is very low, 0.05–0.5%, and amount of limestone pebbles decreases, as they were leached out while the glacier was moving. Ca content in soils is usually less than 0.75–1.6%. Extremely low Ca content, 0.20–0.44%, characterizes soils around the Lake Peipsi, as well as SE and SW Estonia. High Mg concentration characterizes dolostone zone in the eastern part of the Saaremaa Island, and continues some 75 km to continental Estonia. Mg content in soil here often reaches 3.5%. Low Mg (0.07–0.44%) content is observed around the Lake Peipsi, in the soil of Hiiumaa island and in a zone stretching from SE Estonia to NE 30°.

High K content (>4%) occurs in the Cambrian clays in the north, but the main source of K and B is Precambrian rock transported from Fennoscandia. K concentration in the soil is monotonous and varies between 1 and 2.5%. Na content in the soil is similar to potassium, but concentrations are lower, less than 1.8%. In SE Estonia Na content remains between 0.17 and 0.63%. The reason is low Na content in sandstones, amount of Na<sub>2</sub>O being less than 0.3%.

Concentration of microbiogenic elements in the humus horizon is similar to the amount of Ca: higher content characterizes north and central Estonia, but lower concentrations are common in the south and seashore areas. Generally, microelement concentration is near the average of continental soils (Brooks, 1972). Concentration of Zn, Cr, Cu, Mn, Mo, Sr, P is up to three times lower than average, concentration of B, Hg, Pb, F two or more times higher. Content of Zn, Sn, Mn, Cu, Cd, Co, V etc. is usually lower than is required by vegetation. Along the North Estonian cliff, there is a ~15 km wide zone, where high content of Mo, U, P, F, As and V often occurs in the soil, the reason being the existence of Lower-Ordovician argillite shale and phosphorite-bearing sandstones.