Copper in the Crust of the Earth

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The word "crust of the earth" for the upper mineral strata of our planet indicates a life-process in which a hardening and a solidification have arisen in the course of time. As in many other cases, the wisdom of language brings to expression a fact which no longer lives in human consciousness.

In connection with water, air and heat, forces are active in the mineral earth which are related with the processes of life. When primary rock crumbles away under the influence of the elements, it yields an excellent and fruitful soil for the growth of plants. Plants could never draw from it the forces they need for their development unless the soil contained formative forces. They could never grow upon a completely lifeless soil.

Also in the depths of the earth's crust there are formative forces which work in the mineral sphere, bringing about a definite guidance of the processes and definite laws. In this connection it is interesting to study how the metals, embedded in their ores, are distributed in the different kinds of rock and in the different regions.

Tin has the tendency to insert itself in granite, i. e. in quartz. It is evident that this metal has a predilection for quartz, since both are in many respects related.

Different from the behaviour of tin is that of copper and its ores. Here, too, and this is generally the case in the whole mineral realm, the etheric formative forces are not on the physical plane. They produce no life upon the mineral stage, but they work in definite processes corresponding to the nature of the metal. This appears, for example, in chemical processes, but also in the way in which a metal seeks its paths within the crust of the earth.

Copper has a different behaviour from that of tin, indeed in many respects the very opposite behaviour. The formative forces of tin come from the planetary sphere of Jupiter. They prevail in the flowering processes of plants. The formative forces of copper, on the other hand, belong to the sphere of Venus and unfold their activity chiefly in the leaves of plants, not in the blossoms.*)

The connection with the formative forces of the leaf appears in the crystallizations of copper salts, e. g. of copper chloride with its fine stalk-like ramifications, or of copper nitrate with its leaf-like forms. (Tin chloride, instead, has flower-like forms).

*) See W. Pelikan: *Sieben Metalle* (Seven Metals), and H. Knauer: *Erdenantlitz und Erdenstoffe* (The Countenance and the Substances of the Earth). Also Rudolf Steiner: *Spiritual Science and Medicine*, 6th lecture.

The formative forces of copper reveal a strong and manifold formative capacity in its crystallizations and in the metamorphoses of leaves, and they are just as manifold in their distribution over the earth and in the way in which they permeate the crust of the earth. The most striking quality of copper ores is their strong tendency for the leafy structure.

In primary rock mica represents the leafy element. This is evident in the thin, fine leaflets which may form large stratified slabs. In slate these formative forces assert themselves even more. Here they influence the formation of the whole rocky structure, appearing widely in the crystalline slates of primary rock or in the different aluminous calcareous slates of sediments, where the earth's crust tends to take on leaf-like forms.

Copper has a predilection for these kinds of rock. As a trace element, it may be found everywhere in the soil and also in plants. Copper shortage leads to chlorophyll damages and the leaves fade. Copper collects especially where the rock corresponds to its own nature. Generally in slate, in crystalline and aluminous calcareous slate, designated as copper slate. Copper penetrates into slate in a fine destribution, as copper pyrites. The quantiy of bitumen contained in these slate rocks — and bitumen is the product of disintegrating organic substances — indicates the connection of this metal with life-processes.

A well-known site for this kind of copper ore, where copper pyrites appear in the black bituminous marly slate, is Mansfeld, to the East of the Harz. But copper slate appears in the whole region of the Harz; on the northern and southern slopes of the Thuringian Forest, and in Hesse, where copper slate mines once existed. Copper mines also exist in the Saar and Lorraine districts, in the Urals, and in North America.

In between the limestone Alps and the main chain, we find the slaty chains of the Tux, Kitzbühel and Salzburg Alps, running East-West and consisting of crystalline slate. Once these regions had many copper mines, but now no copper is mined there any more. Copper mining was famous especially at Schwarz (Tirol), where the mines belonging to the Fugger family flourished in the 16th century. Copper ores were also mined at Mitternberg and near St. Johann.

Crystalline copper also exists in the Swedish gneiss mountains of Falun, on the West coast of Norway, in the Alleghany mountains of the United States, and at Cororo (Bolivia).

Crystalline copper united itself with the original rock, which rose to the surface in subsequent epochs of the earth as a porphyritic magma containing very little quartz; at that time hot solutions and vapours of copper compounds arose. Here the formative forces of copper

were active in such a way that fine ramifications of the ore came into being, typically corresponding to its formative forces. This may be found in large quantities in the States of Utah and Arizona of the American rocky mountains.

It is therefore evident that copper, like tin, exists in the crust of the earth in keeping with its own nature. This, again, proves that the earth is a living organism, in which also the mineral substances insert themselves organically within the whole.