

FIRST APPROACH TO MINERALOGY

In one of his lectures, at the opening of his Waldorf School, Rudolf Steiner told his teachers that the age of twelve is an important turning point in a child's development. We have all noticed that just before and at about the age of puberty, children gradually lose their grace of movement. They become clumsy and crude in the use of their limbs, their manners and even their facial expressions. Their long arms hang awkwardly in sleeves which are always too short. In fact, at this phase of life, we can say a child is actually under the domination of his bony structure, his skeleton. Parallel with this physical phenomenon there awakens within the child a more independent attitude toward his environment and his judgment of parents and teachers becomes more critical.

This is the age at which a child should learn the fundamentals of physics and approach, for the first time, abstract arithmetic in algebra. It is also at this time when he is under the influence of his own bony structure, that a child can best learn about the "bony" structure of the earth.

Nature Study in a Rudolf Steiner school begins in the fourth grade with "Man and Animal", and continues in the fifth with botany. During these two years the natural science classes, which always keep man in the center of his natural surroundings, work their way closer and closer to the earth until, in the sixth grade, we reach the study of geology and mineralogy.

Rudolf Steiner advised the widest sort of approach toward the study and understanding of nature as a whole and of minerals in particular. Following his valuable indications we make our start with geography, and in close connection with geographical teaching the children learn to discriminate between a primitive mountain range (granite) and a limestone range. For a class in New York City it seems natural to start with a study of the geological formation of Manhattan's own granite foundations. The countless subterranean tunnels of the subways and the iron foundations of the highest buildings on earth are only possible because of this solid ground. Even the inner vigor of this city's inhabitants appears to depend upon these layers of granite.

It is important that children should learn and actually grasp the fact that granite originated from the oldest era of our earth's development and is for that reason the firmest and strongest of stone formations. Countless ages ago granite was a vast mass of fiery-fluid substance which cooled slowly while other rocks formed a covering over it. During later ages these overlying rocks were destroyed by water and glaciers until granite appeared as the axes of the highest mountains.

In telling of these slow, majestic changes the teacher should try to arouse a feeling of devotion towards the "oldest altar of the world's creation"—and let the children dwell upon these words of Goethe.

The children draw and paint the stages of the earth's development with pleasure and a sense of discovery. Through poetry, too, a feeling for the earth's wonders and hidden beauties can be brought to the child.

"From placid mountain brow, so solemn, old,
the mysteries of days long fled unfold.
There in time's far-distant dawning morn
the word of worlds in trinity was born.
Its first faint echo, rising from this hour,
bespeaks primeval harmony of power
and strives in white of quartz and dark-hued gneiss
and golden mica like rosin bound in ice
to spread forth pure the altar-table here,
presented long ago to that first year."*

The opposite of granite mountains, are the limestone ranges which were created by erosion, as the granite mountains are the products of fiery eruption. Fire and water as the primeval forces in the development of our earth's surface are understood by children without giving them theories. They seem able to grasp how creative and divine forces were at work much as in olden times Vulcan and Neptune were understood when spoken of in connection with the earth's development.

Here is the place for a sketch or diagram of a volcano and the children draw the different layers of the earth's surface descending from sandstone, limestone, coal, devon, gneiss, to granite and the magma, the fiery original foundation of earth.

We soon find out that our whole subject can be divided into four parts: rocks, minerals, metals and gems. Rocks contain many minerals and they in turn are composed of numerous chemical substances which often contain a metal. Minerals and metals can appear on a higher level of development under the special condition of crystallization. Crystals and gems are the rarest and noblest forms of the solid element. And so we lead the children from the description of the rocks and minerals to that of metals and crystals, stressing the point that within these minerals the architectural plan of the earth has become far more spiritual and refined than it is in the crude forms of rocks and of minerals.

As we always try to proceed from the whole to the details, from the original to the descendants, quartz appears as the primeval phenomenon of all mineral substances.

"As honey held within the white-brown wax
Was gathered gladly in the day-long task,
So one day with a hundred thousand suns
Saw quartz, now hid in mountain-deeps, outspun.
Beside sun-radiance of quartz appear
The many other stones but dark and drear.
For this outshines in age and naturewise
What in the other stones imprisoned lies.
It is the oldest child of light, first-born,
Reminding us how blinded we are grown."*

**The poems are written by the author, translated by B. Betteridge.*

Metals are purified ores. The obvious place to begin this study is with gold, for gold is the archetype of all metals. In teaching about gold we should never neglect to speak of the important part gold has played in all legends, fairy-stories, and myths derived from an age of mankind which we call the Golden Age. Then we speak of the unique qualities of gold in regard to its malleability, ductility, flexibility, its quality of being insoluble. We can beat gold as thin as 1/250,000 of an inch. A piece of gold less than the size of a pinhead can be drawn out into a wire 500 feet long. That is its high ductility. Finally, it never loses its color and splendor: it does not tarnish.

We must always find the threads which lead from the human being to the natural world. When we describe these five qualities of gold which make it the king of all metals, we can draw parallel lines with the five most important qualities inherent in everyone who wants to become a spiritual "king"—that is, a person who knows first of all how to lead himself. Can we not apply these five qualities to our inner and moral self education in relation to guidance of thoughts, strengthening of will, calmness of emotions, positiveness in judgment and impartiality towards life?*** In the Middle Ages there lived people who searched for gold in this way—the true students of Spiritual Science. They did not want to "make gold" in the superficial sense of the word, but to develop these five "golden" abilities for attaining their "spiritual kingdom". This is the underlying significance of gold in all fairy stories and legends. To the children, of course, the teacher never mentions these facts or comparisons in a literal form, but this connection must live as an inner impulse of conviction and enthusiasm within his own mind.

Such a presentation of the subject, including as it does a moral and uplifting undercurrent, prevents a one-sided, materialistic idea about gold and, by indirection, becomes a living force in the child-mind. It reaches the child through the wisdom of a trusted teacher, leaving an impression more lasting than would the mere statement of fact out of a text book.

It is clear that after this the study of silver, copper and iron is easier. We point out that historically gold was the first discovered metal. Silver and copper were used later and iron does not come into use until the first millennium B. C. Iron is the true Roman metal. Lead was discovered still later than iron (about 500 B. C.). We may conclude the study of metals by speaking of one of the very latest, such as radium, in connection with the tremendously mysterious X-rays.

In the final chapter of our mineralogy, we touch upon crystals and gems. Here we look at the greatest works of art which the kingdom of the minerals can produce. Crystals and gems consist of the same products as the rocks and minerals, but in them the art of building up the earthly element has reached its highest perfection. Crystals have the most amazing geometrical forms, frozen into stone after an eternal law of the world. The ancient Greeks said that "God is a geometrician", and surely crystals and gems are products of this divine geometry. Does it not seem, in precious stones, as though the splendor of the stars had been brought down into the earth itself?

Familiar to most of us is the snow flake—the simplest crystal in the making. The shape of the ice crystal is the hexagonal prism. The Greeks called the ice, "kristallos", and from this our word crystal is derived. Starting with the crystals of the quartz-family (rock crystal, amethyst, rose quartz), we go on to the garnets and to the corundum family (pointing to sapphires and

***See Rudolf Steiner's fundamental writings.

rubies, emeralds and topaz) and finally come to the diamond—truest archetype of all crystals and gems.

Diamond is the strongest of all minerals. It can not be cut by another mineral for it is 140 times harder than corundum which stands next in hardness. All other gems consist of two or more chemical substances. The diamond alone contains but one. When pure carbon, or graphite, crystallizes in the form of an octahedron, the greatest miracle of transformation takes place—from the blackest opaque substance to the whitest most transparent one: the diamond. The diamond, then, can symbolize the discrimination between good and evil. We conclude our study of mineralogy by developing moral and idealistic thoughts on this phenomenon. We can see in diamonds the pure splendor of sunlight—as though, in them, the whole earth had begun to turn toward a future in which its darkness will be overcome by the power of light.

Mineralogy brings to a close the study of Natural Science as given in a Rudolf Steiner school. It is important that we should not terminate such a period of teaching unless we have given to the children a feeling of true veneration for the greatness of nature.

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