GOD'S CLAY

Gustav Weiß

Ancient peoples used to believe that humanity had been created from clay, for they saw how it was possible to recreate animate nature from the inanimate material.

It is hard for us to believe that clay, familiar to us as a plastic material, is geologically speaking in fact rock. Because we tend to equate minerals with rock. But minerals are only a single mineral and rock consists of various ones. And clay "rock" consists of a whole range of clay minerals. They differ chemically; however they are all alike in that they all consist of silicon (Si) and aluminium (Al), and together with water, these atoms form a layered structure.

Anyone who hears anything about clay immediately recalls that people say God created Man from it. Apart from this, we are familiar with clay as a formable lump from which any child can make something. However, the wondrous qualities in clay are concealed from most people. Even the ancients in the distant past were not aware of this, although they had created Man from it. What astonishes us and makes us admire age-old wisdom is the myths that imaginatively describe how the world was created. As artistically orientated people, we have a special relationship with the imagination. But in the course of time, we have become prosaic, and for some people, knowledge leaves no space for belief. What we do not know about clay is like a miracle that we only see when we are half aware of it and are curious for the other half.

So what do we know about clay? The formation of the clay minerals is called kaolinisation after the most important one, kaolinite. Clay minerals are formed by the erosion of feldspathic minerals over three to ten million years. Various conditions had to prevail for this process to happen. Firstly, there had to be volcanic eruptions, which hardened below the earth's surface. This is magma, in contrast to lava, which hardened on the surface. It had to be a magmatic, sialic (containing silicon and aluminium) parent rock, which became fissured below in the earth. Seeping water had to penetrate this fissured surface that had to have become slightly acid through dissolved carbon dioxide from plants growing above, i.e. not ground water. This means to say that precipitation and a low water table were among the prerequisites. Rainfall of at least a metre per square metre had to fall every year. And a few tens of metres deep, in consequence of moderate ground pressure, the coarse feldspathic crystals from the parent rock decomposed to form new crystals. In the parent rock, the atoms had been arranged in a three-dimensional lattice structure; roughly speaking, the new crystals had a two-dimensional layered structure consisting of two layers. Of these, one with octahedrally arranged atoms formed the outer layer containing silicon, and the other with tetrahedrally arranged atoms containing aluminium formed the inner layer. The two layers were held together by water. This was how the clay mineral kaolinite was formed, which forms the rock, kaolin – a process full of miracles because it looks as if someone had stood there and directed the arrangement of Si and Al atoms into the two layers. A further miracle was the interaction of the plant and mineral kingdoms, but no one has ever referred to it as a symbiosis, whereas the symbiosis of plants and animals is familiar, at least between the flowers and the bees. Symbiosis means both partners benefit. In kaolinisation, the plant kingdom benefits from the impermeability of the layer of clay minerals, which holds the water for the roots, and the clay mineral layer in turn needed the carbon dioxide from the plant roots to dissolve out the iron and the alkalis from the feldspar and to form alkali-free, white kaolin. The kaolinite materials that were transported away by movements in the ground and water and deposited in some depression underground or in the sea also carried parts of the parent rock: feldspar, other clay minerals, quartz and iron, and picked up other impurities along the way. That is the way it was with clay from now on.

Up until the invention of the electron microscope in 1931, the constituents of clay responsible for its plasticity were known as clay substance. It then became clear that it was not a uniform substance but it consisted of various very small crystals that could not be recognised with conventional microscopes. Even in the mid-20th century, clays were classified in accordance with rational analysis, which differentiated between clay substance, quartz and feldspar. The more clay substance, i.e. clay minerals, the more plastic the body, the more quartz the shorter and more refractory, and the more feldspar it had, the earlier it vitrified. After the clay minerals had been identified, it became apparent that the fluxes in the clay could not all be attributed to the feldspar since the clay mineral illite also exists, which contains potassium. Rational analysis was now superseded by mineral analysis. But none of this interests ceramists any more because clay bodies are now prepared for the market from a range of clays so that they can be supplied in consistent quality over long periods. There are only a few terms that still indicate a clay as it has been dug. This may be kaolinitic clay (fireclay), an illitic or low iron and low titanium kaolinitic clay (ball clay), or an alkali-rich, low firing, or a white or red firing clay.

Kaolinisation takes place in several phases, and in many deposits it is not yet concluded. This observation answers the question as to whether the formation of clay and kaolin from geological times is all over now. No. The subterranean decomposition of magmatic rock to form clay minerals will continue. Conditions in Africa are favourable with its low water table and periodic outbursts of rain that guarantee slightly acid seeping water.

And now to clay in the potter's hand. It finds its way into the flames, the symbol for intellect, learning and action. Clay consumes the heat energy of the fire until it gives off crystalline water at around 500°C, which held together its two layers. The system becomes instable. The potassium washed out during kaolinisation diffuses in again and a stable, three-dimensional atomic structure consisting of silicon, aluminium and oxygen atoms is created, arranged once more in octahedrons and tetrahedrons. Mullite begins to crystallise from the melted minerals at around 1000°C. The heat of crystallization is produced. A new metaphor forces its way into the limelight: a comparison with human life. After the absorption of intellectual energy comes the unstable period of puberty followed by the release of intellectual energy as output, which leads to something new.

Through scientific research, linking clay with human beings, thereby stumbling upon wondrous connections, has led to great profundity. Having arrived at the very depths of cognition, a maxim lights up, leading us out of the cramped spaces and the subjectivity of experience and into the area of the the universal. Einstein wrote in The World as I see it, "The fairest thing we can experience is the mysterious".

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