

Goethe's Alchemical Experiments

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Goethe was undoubtedly Germany's best-known literary figure during the Age of Enlightenment. He is most famous for his two-part drama *Faust*, which he started writing in his early twenties, and which he completed just months before his death. His ongoing interest in the human potential for both good and evil, as exemplified by Faust, ran parallel to another enduring passion, one which was kindled at an even earlier age. This was his lifelong interest in the evolution of a living Earth. To support his developing ideas, he assembled a collection of more than 9000 rocks and minerals over a period of more than 50 years. His interest in geognosy (as geology was called in those days) began as a result of a serious illness shortly after his nineteenth birthday.

Goethe's mother, Katharina Goethe (1731-1808). Copy of a 1776 painting by Georg Oswald May (1738-1816), City Museum, Offenbach

Goethe's Illness

Johann Wolfgang von Goethe was born on 28 August 1749 in Frankfurt, a major German city on the river Main, just before it joins the Rhine. He was in his second year of law studies in Leipzig when in July 1768 he became seriously ill, and was forced to return home the following month, arriving in the care of his worried mother on his 19th birthday. He was suffering from haemorrhaging, problems with his digestion, and had developed an abscess on his neck which refused to heal.

His mother was a devout person, and belonged to a Pietist community¹. She was a close friend of Susanne von Klettenberg (1723-1774), abbess and a member of the Moravian Brotherhood. Other members of the Pietist circle were the family doctor, Dr Metz, and the surgeon who eventually had to lance the abscess. In these circles a last remnant of the Rosicrucian spirit of the

¹ Pietism originated in Germany in the late 17th century within the Lutheran church. As the name suggests, piety and devotion to their fellow human beings laid the foundations for the movement. The emphasis was on personal transformation through spiritual rebirth.



Pure quartz at Senckenberg
Natural History Museum



alchemists was still living. In order for the medicines he prescribed to have an effect, Dr Metz recommended that Goethe study the alchemical writings of Georg von Welling², Paracelsus, van Helmont, and others.

Together with von Klettenberg, Goethe began by studying von Welling's *Opus Mago-Cabbalisticum*, which brought together Kabbalistic alchemy with scientific and mathematical ideas current at the time. They both struggled with the contents of the book, and in his autobiography³ Goethe explains that they therefore turned to the works of von Welling's sources: Paracelsus, Valentinus, and van Helmont.

In December 1768, Goethe suffered another major crisis, both a physical and an emotional breakdown. His desperate mother, who had been nursing her son for almost four months, knew about a "Universal Remedy" prescribed by Dr Metz only in extreme conditions. She implored him to prepare it for her son, as it was his only hope. In his autobiography, Goethe remembers that Dr Metz hurried home in the middle of the night, returning with a crystalline salt. He dissolved it in water and Goethe recalls that it had a distinctly alkaline taste. The effects were immediate, and the crisis was abated.

Goethe's near-death experience at the end of his first moon node period (eighteen years and seven months) had a decisive effect on his further development, both as a poet and as a scientist. He was well aware of the changes brought about by the crisis. In January 1770, he wrote to a friend: *The redeemer finally caught up with me. I had been too fast for him for a long time, but he caught me by my hair... I am at peace, especially when I am quiet and very still... and feel the Good which has flowed to me from the eternal source.*⁴

A year later he wrote: *I am changed, much changed, and for that I thank my Redeemer. ("Heiland")*⁵

Rudolf Steiner comments that Goethe experienced a kind of unconscious initiation. His life forces, on the point of permanently leaving his physical body, were somewhat "loosened".⁶ It enabled him to pick up on super-sensible percepts, which worked as a poetic stream in his soul, and found expression particularly in his fairy tale *The Green Snake and the Beautiful Lily*, and in his poem *Die Geheimnisse*.

2 Georg von Welling (1655–1727) was a German alchemical and theosophical writer. He was a mining engineer by profession, and became a director in the Baden-Durlacher Office of Building and Mines. The first complete publication of his major work, *Opus Mago-Cabbalisticum et Theosophicum*, was printed in 1735.

3 Johann Wolfgang von Goethe, *Dichtung und Wahrheit*, (Poetry and Truth), Eighth Book, written 1813-1814, passages quoted are my translations.

4 Quoted in Dankmar Bosse (1995) *Goethe's Initiation und die Ursphäre der Erde*, Verlag Freies Geistesleben, Stuttgart, p 12, my translation.

5 Op. cit. p 11.

6 GA 99 *Theosophy of the Rosicrucians*, Lecture One, 22 May 1907; also in GA 97 (13 Oct 1906) and GA 172 (5 Nov 1916).

Still confined to bed during the following spring, Goethe wrote about this time: *In my present situation I am dedicated to philosophy... Alone; compass, paper, pen and ink, plus two Books, are the only tools in my armoury. And on this straightforward journey I am gaining knowledge of the truth, often more so than those with their libraries... helped by the ingenuous Book of Nature. Yet nothing is true which is not simple.*⁷ Goethe's second book was the Bible, which he considered to be an important source of mythology for eighteenth-century humankind, much as Homer's Odysseus had been during Greek times.

Goethe kept a notebook summary of his interests in philosophy, literature and science during this time, published as the *Ephemerides* (1770). Paraphrasing Spinoza, he wrote (in Latin): *To speak separately of God and of Nature is as difficult and as delicate as thinking of the body and the soul as separate entities. We know the soul only through the body. We know God only through Nature.* His supreme confidence in the Book of Nature never left him.

With the return of warmer weather in the spring, he was able to return to his gabled room under the roof, where he installed a small air furnace. His friend Susanne von Klettenberg had already acquired her own: *and because we had read in all the books that "air salts" ("Luftsaltz") played a crucial role, we acquired for our work alkalis, which, [after mixing and melting with silica] dissolve in air, and as they did so, united with super-earthly things, to bring about a mysterious "middle salt".*⁸

According to von Welling, middle salts are formed from processes taking place within the living Cosmos, processes that occupy a middle ground between the Mineral and the Plant Kingdoms. Experiments with water glass were an indicator of such processes.

Goethe was here following an alchemical recipe by Sincerus Renatus (Samuel Richter), which appeared in his book *The Truthful and Complete Preparation of the Philosopher's Stone of the Brotherhood of the Golden and Rosy Cross* (Breslau, 1710). Goethe had great respect for him; he later kept a fragment of the alchemist's handwriting in his collection of manuscripts.⁹

Goethe gives more details of his experiments in the next paragraph of *Poetry and Truth*:

*What most intrigued me however was so called Liquor silicum (Kieselsaft)*¹⁰ *which arises*



Johann Wolfgang
von Goethe



Susanne von Klettenberg
(1723-1774)

7 *Poetry and Truth*, Eighth Book.

8 *Poetry and Truth*, Eighth Book.

9 Otto Krätz (1998) *Goethe und die Naturwissenschaften*, p 24. The water glass Goethe made was potassium silicate. Today sodium silicate is known as water glass.

10 In 1646, Johann Rudolf Glauber (1604-1670) made potassium silicate, which he called *liquor silicum*, by melting potassium carbonate, obtained by calcinating (= decompose by heat) cream of tartar and sand in a crucible, and keeping it molten until it ceased to bubble (due to the release of carbon dioxide). The mixture was allowed to cool and was then ground to a fine powder. When the powder was exposed to moist air, it gradually formed a viscous liquid, which Glauber called *Oleum oder Liquor Silicum, Arenæ, vel Crystallorum*, i.e. oil or a solution

when pure quartz sand is heated with the correct amount of alkali. A transparent glass arises, which melts in the air, and appears as a beautiful clear liquid. Whoever has made this, and seen it for themselves, will not reproach those who believe in a virgin Earth, and in the possibility of a further development of the same.

Goethe synthesized potassium silicate by heating silica (pure quartz sand, which he found in abundance along the banks of the Main) with potassium hydroxide (caustic potash, also readily available). In its simplest form, the following reaction takes place: $\text{SiO}_2 + 2\text{KOH} = \text{K}_2\text{SiO}_3 + \text{H}_2\text{O}$. The resulting solution is highly alkaline. Addition of an acid causes the re-formation of silica.

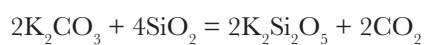
Sodium Silicates and Chemical Gardens

Sodium silicates are colourless glassy or crystalline solids, or white powders. Except for the most silicon-rich ones, they are readily soluble in water, producing alkaline solutions.

Quartz crystal – pure silica, SiO_2



of silica, sand or quartz crystal.



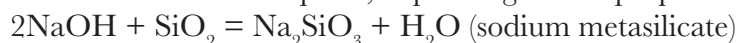
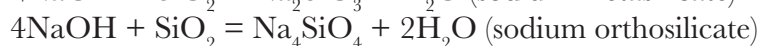
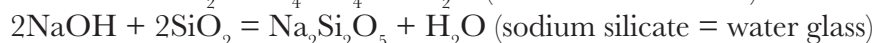
Cream of tartar (tartaric acid) is potassium bitartrate or potassium hydrogen tartrate ($\text{KC}_4\text{H}_5\text{O}_6$), an acid salt that is a by-product of wine production. During the fermenting process, tartaric acid forms and lines the inside of wine barrels, leaving behind a white sediment.

Sodium silicates are stable in neutral and alkaline solutions. In acidic solutions, the silicate ions react with hydrogen ions to form silicic acids, which tend to decompose into hydrated silicon dioxide gel. Heated to drive off the water, the result is a hard, translucent substance called silica gel, which is widely used as a desiccant. It can withstand temperatures up to 1100°C.

Modern sodium silicate is used as an adhesive, and in paints as a stabiliser of inorganic water colour pigments on cement work for outdoor signs and murals.

An experiment very similar to those performed by Goethe using silica sand and lye (caustic soda, NaOH) instead of potassium hydroxide (caustic potash) can be viewed on *YouTube*. https://www.youtube.com/watch?v=-Mx1-o1_MWo

Various reactions take place, depending on the proportions of lye and silica.



A chemical garden is an experiment in chemistry carried out by adding metal salts, such as copper sulphate or cobalt chloride, to water glass (sodium silicate). This results in the growth of plant-like forms reminiscent of seaweed. The crystallisation process is rapid, and takes place within minutes.



The chemical garden was first observed and described by Glauber in 1646. In its original form, the chemical garden involved the introduction of ferrous chloride (FeCl_2) crystals into a solution of potassium silicate (K_2SiO_3).

Left: A chemical garden

Whether Goethe actually carried out these experiments is not known. From the 1770 *Ephemerides* however,

we know that he had read Nicolas Lemery's book *Reflexions et observations diverses sur une vegetation chimique* and that he was therefore aware of the plant-like growths occurring in liquor silicum when certain salts are introduced¹¹.

Potassium Silicates and the Silica-Life-Sphere

Soluble silicates of alkali metals (Na or K) had been observed by alchemists already in the 16th century. Giambattista della Porta observed in 1567 that *tartari salis* (cream of tartar) caused powdered *crystallum* (quartz) to melt at a lower temperature. Other early references to alkali (Na and K) silicates were made by Basil Valentinus in 1520, and by Agricola in 1550.

¹¹ Otto Krätz (1998) *Goethe und die Naturwissenschaften*, p 25.

One hundred years later, Jean Baptiste van Helmont reported the formation of alkali silicates as a soluble substance made by melting sand with excess alkali, and observed that the silica could be precipitated by adding acid to the solution. In 1644 he wrote (in *Opuscula medica inaudita*, Part I: De Lithiasi), that alkalis dissolve silicates: *Furthermore, stone, gems, sand, marble, silica, etc., become glassy by the addition of alkali: but if roasted with more alkali, they are dissolved in moisture: and the former weight of the stone powder is separated from the alkali and released by simply adding acid.*

For the alchemists, water glass was a representative of the *Prima Materia*, the first manifestation of an emerging, immaculate planet Earth. All the beings of the Kingdoms of Nature, including the Human Kingdom, were contained inseparably within her. What the alchemists had attempted in earlier days was to get a sense of the activities of elemental forces/beings weaving in the silica-life-sphere between the Mineral and Plant Kingdoms. By carefully observing the visible chemical and physical transformations of flocculation, precipitation, and coagulation, and experiencing them with the greatest possible sensitivity and empathy as inner processes, they hoped to discover the hidden processes of Nature. But in the rational 18th century this was no longer possible, not even for Goethe. External physical and chemical processes now hid from view what had earlier been perceived within the process.



Portrait of Goethe in his late twenties.
Copy of a painting by Georg Oswald May.
Oberhessisches Museum, Gießen

But in the end I grew tired of this, because I noticed that the silica was not as intimately bound with the salt as I had philosophically believed. It easily precipitated itself, and the beautiful mineral liquid which had to my great astonishment occasionally appeared to me as an animal like jelly, always reverted to a powder, which I had to recognise as the finest silica dust [Silica dust precipitates when acid is added to water glass, which is highly alkaline], but in the nature of which there were no signs of anything productive, which might have given me hope that such virgin Earth might evolve into a mother Earth.¹²

Goethe later wrote: [Primeval matter] *has to be something material, but a primal, a general, all-inclusive material – a virgin Earth. How this could be found, how it could be worked with – this was the eternal quest of alchemical writings; which, with an unbearable monotony, like a persistent pealing of bells, drives one more to madness than to devotion. Matter it must be, but unorganised, which becomes ennobled by an organic living treatment.¹³*

Whereas his Faust had come face to face with the Earth Spirit, Goethe was no longer able to do so.

Goethe's ideas of a living Earth were developed further when he worked with Johann Gottfried Herder (1744-1803) on the latter's *Ideas towards a Philosophy of the History of Mankind* (1784-1791). Herder was a theologian, and what the alchemists and the young Goethe had imagined as a silica-life-sphere they now thought of as "primal chaos", the "waste and void" of the first chapter

¹² *Poetry and Truth*, Eighth Book.

¹³ *Poetry and Truth*, Eighth Book.

of Genesis. They assumed that plants, animals and humans were contained within this primal chaos: *The bulk of inter-active forces and elements, from which the Earth came into being, probably contained as chaos everything which would and could come into being... it was an atmosphere coarser and mightier than the one we enjoy today; the waters were more intermingled, promiscuous, pregnant with possibilities... The air had not yet separated from water, nor from fire; it was impregnated with matter of various kinds, which, entering into numerous alliances, gradually settled on the foundations of the Earth.*¹⁴

Goethe returned to the idea of a living liquor in 1817. He did not think of crystalline rocks such as granite and porphyry¹⁵ as being derived from the cooling and solidification of a hot magma. He tried to explain the formation of such rocks as a curdling or coagulation process, as in milk: *We see a liquor, to all intents and purposes homogenous: milk. A minor change in circumstances causes it to curdle, revealing related parts, different, separating from each other, yet existing within each other. Moments of becoming of this nature we find in the mineral kingdom, more than is usually assumed.*¹⁶

As an example of the end result of this process Goethe collected samples of veined marble.

After the huge success of his first novel *The Sorrows of Young Werther*, Goethe was invited to Weimar in 1775. Here, in addition to tutoring the young Duke of Saxe-Weimar, Karl August, and numerous other responsibilities, he oversaw the reopening of an abandoned copper and silver mine at Ilmenau. The detailed knowledge he required for this complex project rekindled his lifelong interest in the origin and formation of the rocks of our Mother Earth, and was soon to lead him to the conviction that an archetypal clearly identifiable rock really did precipitate from the silica-life-sphere: granite.

But that is another story.

14 Quoted in Dankmar Bosse (1995) p 12.

15 Porphyry is an igneous rock consisting of large-grained crystals, such as feldspar or quartz, dispersed in a fine-grained silicate rich, generally aphanitic (invisibly small crystals) matrix or groundmass. The larger crystals are called phenocrysts.

16 Quoted in Dankmar Bosse (1995) p 26.