

SWEDENBORG'S MISCELLANEOUS OBSERVATIONS

ALFRED ACTON *

When, in 1715, Swedenborg returned from his first journey abroad, he was a man of twenty-seven without an occupation. While at home in Brunsbo he made excursions in the neighborhood, curiously examining the phenomena of nature: soils, clays, springs, etc. He visited the neighboring mountain Kinnekulle with the idea of selecting a site for an observatory by which to supply the facts needed to establish his discovery as to finding the longitude. But he remained without an occupation. His thoughts then turned to a professorship. He even made formal application to Upsala University that he might be kept in mind in case of a vacancy. But before the Upsala authorities came to consider his letter, all thoughts of a professorship had left him, for in 1716 he was appointed by Charles XII as Assessor Extraordinary in the College of Mines, but temporarily assigned as Polhem's assistant in the building of the dry dock and the extension of the Gothenburg Canal from Trollhätten to Stockholm, and in the work of establishing bineries in Sweden.

Owing to the wars of Charles XII, imported salt commanded a prohibitive price, and in Sweden there were but a few primitive bineries; and the salt, in limited quantities and poor in quality, was known only locally. Swedenborg and Polhem therefore explored the west coast of Sweden with the object of selecting sites where salt could be obtained from sea water and refined by ways invented by Polhem. They also explored the country east of Lake Venner, to lay out a route for the projected canal.

With the death of Charles XII, in November 1718, all this work came to an end, and Swedenborg was once more without an occupation. During these years he had written several small works, some of which he published in Swedish, but he was greatly discouraged at the small interest that they aroused, and he determined to translate his essays into Latin and try his fortune on the Continent.

With this in mind, he set forth in June 1721 in company with his cousin John Hesselius, who was to pursue medical studies in

* Probably written in 1954 or '55.

Holland, for Amsterdam. There he published what came to be known as his *Chemistry*. This consisted of many of the small Swedish writings translated into Latin, together with new matter. At the same time he published small tracts on Iron and Fire, Finding the Longitude at Sea, the Construction of Docks, and the Testing of Ship Models. To his great satisfaction, these works were favorably received by that prince of learned journals the *Acta Eruditorum*. He had at last made his entry into the learned world of Europe.

He did not stop here, however. Wherever he travelled he made keen observations on the natural phenomena that came to his attention, and committed these observations to paper.

In Leyden, where he stayed for some time, he wrote on *The Crystalline Forms Assumed by Ice* (M.O. 81). These he ascribed to "the form, position, equilibrium, etc., of particles. . . . By the simple deprivation of fire, and consequently of motion in the interfluent subtle matter, the purest particles of water arrange themselves into these crystallizations"; and he hopes that "by a skillful application of geometry, the shapes of these particles may at last be discovered." *On the Cause of the Fluidity of Water* (M.O. 94). This he ascribes to the interfluence between the water particles of "some very subtle igneous matter of great mobility." When this escapes, the water becomes ice; but when fire is applied, it again becomes fluid. *On the Impossibility of Transmuting Metals, Especially into Gold* (M.O. 75)—a transmutation which "is encouraged by numerous stories and anecdotes, and by a flood of alchemical writers who, having for long lost their time and pains, but perhaps found something which in their imagination was a kind of philosopher's stone, wished to teach others by the darkest enigmas, to travel over the same road, and to allure them onwards." Swedenborg ascribes the impossibility of such transmutation to the fact that "every metal has particles of its own of a peculiar form," and by no human power can these be changed. *On the Figure of the Elementary Particle* (M.O. 83), *Its Power and Motion* (*ibid.* 87) and *Its Undulation and Vibration* (*ibid.* 90), *According to the Bulbular Hypothesis*. Here Swedenborg makes a distinction between undulation and vibration (*ibid.* 90) which is interesting in connection with the *volumatim* and *singulatim* spoken of in AE 726:3. In these three chapters, which are translations and adaptations of

papers written in Brunsbo in 1716, he outlines theories which were later further developed in the *Principia*, but he states several times that his theory is merely an hypothesis as yet unproved (*ibid.* pp. 87, 88, 90); "because all assertions regarding invisible things require to encounter many doubts unless we should place an overweening confidence in our own opinion" (*ibid.* 92). Speaking of the beginning of creation as being motion, just as the geometrical point is the beginning of geometry, he says with regard to the cause of the motion: "No finite mind can penetrate into this; for the first motion must clearly arise from the Supreme Mover, from the Supreme Life, from God, the Creator of all things, Who, by means of His primeval motion, according to our axiom, impressed upon His world of nature the identical principle that prevails in geometry" (*ibid.* 86). *Blood Circulates Through the Capillaries more Easily than Through the Trunks of the Arteries* (*ibid.* 78). Swedenborg illustrates his thesis by citing a number of experiments showing that liquids mount upward through very narrow channels. Thus sap mounts upward in the bark of a tree, so the tops of lofty trees "are supplied with a larger quantity of moisture than the lower parts." Another illustration shows some knowledge of minute anatomy. "In the spleen we see nothing but the most delicate arterial ramifications, together with a kind of spongy substance; and when the blood enters them, it runs from one end to the other as through a moistened sponge" (*ibid.* 79). These illustrations show that the blood will mount upward in the finest capillaries, but modern observation demonstrates that the blood flows more slowly in the capillaries than in the arteries. *On Keeping Heat in Rooms*, This is the only article that was printed in the *Acta Literarium*, for which reason it was not included in *Miscellaneous Observations*.

In Liege, where Swedenborg stayed several days, he wrote the following articles: *The Circular Crusts Found in Certain Stones* (*ibid.* 23). This is based on sound observations he made on a hill in the neighborhood of Liege. There he found a hard stone like that used for shaping scythes. When broken into blocks, it showed circles of different colors from center to circumference, the stone between being almost colorless. In some hard stones he counted ten such circles all differently colored, while soft stones showed but two or three circles with more space between them. "To make

this observation," he says, "I broke a great number," and he gives nine drawings of stones he had seen. As to the cause of these circles, this he ascribes "to some kind of fluid surrounding the surface of the stone and penetrating into it" (*ibid.* 26); but whether the fluid was pure water or alum, vitriol or other substance, "must be left for further inquiry" (*ibid.* 26). *The Salt Works on Parts of the Swedish Coast* (*ibid.* 65). Swedenborg wrote this after he had read an article in the Breslau journal *Sammlung von Natur und Medicin Geschichten*, for 1717. The article concerned the production of salt from sea water which was then being promoted by Polhem, and it predicted that the work would never succeed. This induced Swedenborg "to state all that I know on the subject, especially as it has been my office to visit those parts of our shores which are best calculated for this purpose, and to propose the most eligible for selection (*ibid.*). *A Method of Ascertaining, by Means of a Triangle, the Individual Weights of Mixed Metals* (*ibid.* 70), and *The Glass of Archimedes* (*ibid.* 72), an ingenious but very simple contrivance invented by Swedenborg, whereby to find out the proportion of alloys in a mixed metal. *On Stony Marl or Margenstein* (*ibid.* 22)—a specimen of which Swedenborg found in the environs of Liege. Here he describes some experiments he made with this material, but advances no theory. *The Causes of Smoke in Rooms* (*ibid.* 61)—a very practical little essay giving both the cause of smoke in rooms and the remedy. At Liege* he had also written *On the Petrified Plants at Liège* (*ibid.* 9), where he found "vast quantities" in what is now a part of the city park. He gives a drawing of seventeen of these petrifications which he had evidently collected and taken to his lodging. They show very clearly the impressions of leaves, flowers, stalks and twigs. He considers them to be "indubitable evidence that an ocean formerly stood at a height of at least 100 ells above the level of the present sea"—an ocean which uprooted vegetation and mingled sand, clay and rock together. He did not send this or any of his subsequent papers to Benzelius.

The above articles Swedenborg sent in two batches to his brother-in-law Eric Benzelius in Upsala, perhaps with a view to their publication in the *Acta Literaria Suecia*. I say perhaps, be-

* From here on, I assume the articles to have been written in the last town during the course of Swedenborg's journey mentioned herein where Observations were made.

cause in the last batch, sent on December 15, 1721, he writes: "As I have opportunity and time, I send over some cogitata which perhaps may be of use to my brother in the meetings with the members of the Society. I hope on another occasion to be able to communicate something more agreeable. Eric Benzelius reports the reception of some of these papers to a meeting of the Bokvetts Gille on February 9, 1722, but nothing was said as to printing them in the *Acta*, nor, with one exception to be noted presently, were they published there. The fact that Swedenborg kept copies of them indicates that he intended to publish them himself; but he sent no more articles to his brother-in-law.

On December 16, 1721, he left Liège for Aix-la-Chapelle (Aachen). There he wrote *On the Strata of Shells at Aix-la-Chapelle* (p. 11). These he observed on a hill there in the neighborhood of Aix-la-Chapelle. He collected a number of these shells, and gives a drawing of twenty-three of them. They included "oysters and other bivalves." Swedenborg considered them as "further proving the existence of a diluvian ocean." *On the Origin of Granite* (p. 13). Swedenborg considers that granite was originally a very fine argillaceous powder, as shown by the fact that no marine animalcules or plants are found on it. From some experiments which he instituted, he concluded that this powder for a long time slowly subsided in the primeval ocean, and, being extremely fine, hard substances sank through it, while lighter substances and marine animalcules and other living creatures would escape out of it "before the stony matter had time to assume too great a consistence." *The Origin of Hot Springs* (p. 31). Being aware that many scientific men have investigated this matter, Swedenborg "without contradicting any of them," merely gives his own opinion, based on observation, "not venturing further than experience will lead me." On the basis of a number of experiments made by himself and by "that enlightened English authority, Hauksbee"—which he describes in detail—he concludes that these hot springs are due to "the existence of a crusted fire sufficient to penetrate whole mountains." In a later essay on *The Notion of a Central Fire* (p. 100), he gravely questions the existence of fire in the earth's centre, but adds that it is undeniable that a subterranean fire exists, but only in some parts of the earth's crust, as shown by hot springs.

At Marburg Swedenborg wrote *On the Softening of Hard*

Bodies (p. 44). This he introduces by saying: "Whether hard bodies soften and decay like trees, is not as yet so well ascertained, but I wish to offer some facts to prove that such is the case." Then follow a number of the facts which he has observed at Liege, Aix-la-Chapelle, and Stolberg, some miles east of Aix-la-Chapelle, as well as such as he has observed in Sweden. "Stones of a large size" he says, "have been observed in argillaceous scissile matter and completely converted into an ochreous clay. That they were once stones was sufficiently apparent both from their external shape and from the internal arrangement and texture of their particles." Hence he confines himself to an assemblage of facts but promises further to confirm his views "at a future opportunity."

At Cassel Swedenborg wrote on *The Causes of Inclined Strata* (p. 15). This is confined to a description of the strata he has observed at Dillenburg, Marburg and Cassel.

Thus far, twenty-nine of the thirty-seven essays included in Parts 1 to 3 of *Miscellaneous Observations*. Of the other essays, some are translations or adaptations of essays written in past years in Sweden, such as *The Different Kinds of Mountains in Sweden* (p. 5) and *On the Primeval Matter of the Earth* (p. 28). Here, while admitting that only conjecture can be claimed "in treating of the remote antiquity of the earth," he gives reasons to show that its original matter was water—as he later taught in the *Principia*. "But," he concludes, "these views are put forth only in the way of conjecture." *On the Subsidence of the Seas toward the North* (p. 30); *A New Construction of Air-pump* (p. 64)—transferred from the Author's *Daedalus Hyperboreus*; *The Figure of Fire and Air Particles* (p. 92), namely that the particles of air are bullular "with exceedingly minute particles of fire on their surfaces." Therefore, in high regions where the air is rarified, flame is extinguished, while in lower regions where the air is compressed, a flame burns; for there can be no fire without air. Swedenborg did not know about oxygen. Then there are three essays on the Bullular theory, one or more of which is probably translated from the Swedish: *The Mechanism of Bullular Particles* (p. 96), *On the Centripetency of Heavy Bodies in Elements* (p. 98), the *Ignis Fatuus* (p. 103) in *Elements According to the Theory*.