

EARLY DISCOVERERS
XXII
GOETHE—DISCOVERER OF THE ICE AGE

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“No, I do not fear the reproach, that a contradiction led me from the contemplation of the human heart, that youngest and most fickle creature of creation, to the observation of rock, the oldest and most unshakeable part of nature, for all natural things exist in an exact connection” (Goethe, 1957, Bd. 2, p. 1087*). Thus wrote Johann Wolfgang von Goethe in his essay, “Der Granit”. That Goethe was one of the world’s greatest poets is well known. It is less well known that he was a scientist, a geologist, and that among his achievements he was one of the first to attribute the transport of erratic blocks to glaciers, and to believe that an ice sheet covered northern Germany; furthermore, he was the very first to believe in an ice age. Jean de Charpentier in *Essai sur les glaciers* not only credited Goethe with antedating him in his opinion that alpine erratics were transported by glaciers (Charpentier, 1841, p. v), but also prefaced his great work with that paragraph from *Wilhelm Meister* which presented Goethe’s theories of glacial transport and the Ice Age. Louis Agassiz, considered to be the founder of the theory of the Ice Age, because in his paper “Discours sur l’ancienne extension des glaciers”, presented before the Société Helvétique des Sciences Naturelles on 24 July 1837, he was the first to detail the theory in a scientific manner (Agassiz, 1837), states his debt to Goethe: “In respect to the theory of the ice-age, it can be found most clearly from Goethe what I learned later. . . . Goethe alone unified all the indications into a definitive theory” (Hildebrandt, 1947, p. 308, see also Schmid’s foreword in Magnus, 1949, p. xvii). Agassiz based his statement, perhaps partially upon *Wilhelm Meister*, but probably more upon seven fragments: “Herrn von Hoff’s geologisches Werk”, written in 1823, “Geologische Probleme und Versuch ihrer Auflösung”, “Kälte”, “Gebirgsgestaltung im Ganzen und Einzelnen”, “Umherliegende Granit”, “Erratische Blöcke” (Goethe, 1892–94, Bd. 9, p. 280–87, p. 253–57, Bd. 10, p. 95, Bd. 9, p. 241–52, Bd. 10, p. 90–91, p. 92–94) and “Eiszeit” (Goethe, 1949, p. 625), all written in 1829 and 1830. While the contents of all these fragments (entitled not by Goethe, but by the editors of the various editions) are essentially the same in regard to the glacial and ice-age theories, Goethe was casual and ambiguous towards the details.

First let us consider his discussion of the erratics lying on the North German plain. He often included the bizarre explanations accepted by others at that time, such as this one:

“They might have been pushed by means of irresistible pressure from inside the earth, through the crust into the air, splintering where they fell” (*Wilhelm Meister* (Goethe, 1957, Bd. 2, p. 708)).

Immediately after this, he presented his own theory of transport by an ice sheet, which was formed during an ice age:

“. . . a period of grim cold . . . the transport of big blocks was made possible by floating drift ice” (*Wilhelm Meister* (Goethe, 1957, Bd. 2, p. 708)).

“Big ice rafts carry granite blocks in the Baltic” (“Umherliegende Granit” (Goethe, 1892–94, Bd. 10, p. 90)).

Although Goethe clearly preferred the theory of ice transport of the erratics, he erred in his belief in a floating ice sheet, rather than land ice. He also erred when he did not completely rule out the possibility of other causes for the blocks—namely, that they might have been the

* Quotations have been translated into English by the author.

remains of an old mountain range which weathered away. In *Wilhelm Meister* he indicated the drift theory. In his geological fragments he envisioned something more in accord with present-day theory: a period of great cold, during which Germany lay under an ice sheet. Then, the ice rafts that had been jammed together melted. The melting action, plus storms, drove the granite-laden ice rafts towards the south where the granite was finally deposited ("Geologische Probleme" (Goethe, 1892-94, Bd. 9, p. 255, 256)). Goethe was guided in his thinking by Johann C. W. Voigt, Counselor of Mines at Illmenau. At first, Goethe treated the idea as a joke, but later, after hearing confirmation from other sources, adopted it as true. It was not generally accepted that North Germany had lain under an ice sheet until many years later, following the appearance of a paper by Otto Torell in 1875. Acceptance was unusually slow because there were few striated surfaces, and no high mountains whence ice could have come (Charlesworth, 1957, Vol. 2, p. 627)—the only clues were the erratics. Then there was a scholarly gap in German glacial research caused by the departure of Agassiz to America in 1847, and by Leopold von Buch's opposition. Although von Buch had proved in 1810 that the North German erratics had come from Scandinavia, he opposed the theories proposed during the 1840's by the Swiss glacialists that there had been an epoch of more extensive glaciation, and his great influence retarded scientific inquiry in Germany (Zittel, 1901, p. 229). Thus Goethe was among the first to envision an ice sheet of large dimension, and to realize that this ice carried and deposited material.

Goethe was more explicit when he discussed the erratics in the vicinity of Lac Léman. He assumed that glaciers must have deposited them because their edges were sharp, unrounded:

"The glaciers travel through the valleys to the edge of the lake carrying the granite blocks loosed from above, as still happens today. The blocks remain on the lake plain after the ice melts, to be found today, unrounded, because they were brought there smoothly, and not forcefully" ("Erratische Blöcke" (Goethe, 1892-94, Bd. 10, p. 92)).

Goethe was unclear as to how the actual transportation of these boulders was accomplished. In "Geologische Probleme" he wrote simply that they were brought by the glaciers. In *Wilhelm Meister* he wrote ambiguously that the glaciers provided a sliding means for the boulders to be pushed out to their present positions. In "Eiszeit", and "Erratische Blöcke" he stated correctly that the advancing ice pushed and carried the debris. He also stated this in conversation. Although it is entirely possible that Goethe based his conclusions upon the previous work of Ignace Venetz, a Swiss engineer, his paper on this subject was read in 1821, attained only limited circulation, and was not published until after Goethe's death. Goethe's writing, letters, and conversations, scrupulously recorded, contain no reference either to him, or to Playfair, whose work was unknown in Germany and Switzerland at this time. It is more probable that he reached his conclusions independently. He had gained extensive knowledge when he visited Switzerland several times, making geological observations and conversing with local authorities. Others before him, J. G. Altmann in 1751, G. S. Gruner in 1806, and before them, the alpine peasants, had known about the glacial transport of erratics (Charlesworth, 1957, Vol. 2, p. 623). So, although Goethe was among the first, and he probably arrived at the theory independently, he was by no means the originator of it. None of these other men, however, carried the glacial theory to its logical conclusion: that for ice to form, for a continental ice sheet to exist, for great glaciers to accumulate and to move, there must have been a period of great cold, an ice age, a glacial epoch. Goethe deduced:

"There must have been an epoch of great cold" ("Geologische Probleme" (Goethe, 1892-94, Bd. 9, p. 253)).

"For so much ice to exist, cold is needed. I suspect that there was an epoch of great cold in Europe" ("Kälte" (Goethe, 1892-94, Bd. 10, p. 95)).

". . . a period of grim cold" (*Wilhelm Meister* (Goethe, 1957, Bd. 2, p. 708)).

It is here that Goethe was a true pioneer. Even Charpentier believed not in an ice age, but in a greater extension of the glaciers. It demanded high intelligence to observe the phenomena, evaluate the varying reports, and be correct concerning the North German and the Swiss erratics. However, to deduce from these separate occurrences that there must have been an epoch of great cold, an ice age, demanded, at this early date of 1829–30, genius.

Why was Goethe never credited except by Charpentier and Agassiz? The scientific “authorities” had previously refused to recognize Goethe as a man of science, even though he was accepted as a grand old man, and was granted honorary memberships in scientific societies. His discovery of the intermaxillary bone, his studies of plant metamorphosis, his theory of colors, all were rejected and ridiculed. Never again did he dare to propose a scientific thought seriously; never again did he systematically experiment and record his findings. He never properly presented his theories of ice transport of erratics, of the continental ice sheet, of the Ice Age. They are buried in the midst of a rambling novel, haphazardly and depreciatingly presented in seven geological fragments. He was sarcastic. After he correctly observed that big ice rafts still traverse the Baltic carrying granite, he added: “But that is a case for the customs authorities in Gothenburg.” Thus Goethe’s theories were never widely known.

That a philosopher, a poet should be the first to conceive of the ice-age theory (the term “ice age” was coined in 1837 by another scientist–poet, Karl Schimper; Goethe always used the term “epoch of great cold”), is not so strange as at first appears. To deduce such a sweeping concept, from observations of isolated phenomena, it is necessary to share a philosopher’s belief in the harmony of nature. It is necessary to connect the various manifestations into a coherent whole, into a universal law. It is necessary to see that “all things exist in an exact connection”. This could very well be impossible for a scientist who, learned in his own field, lacked the vision of an all-encompassing nature. Another concept of Goethe’s which would aid in his formation of the ice-age theory was his belief in the slow development of the earth. The earth was, in fact, still developing; there was a continual “becoming” and passing, deposition and ablation, crystallization and weathering. To Goethe, who wrote in *Faust*: “Nature and her living results were never allotted a certain amount of time. Each form is built regularly, and even the great is achieved without violence” (Goethe, 1957, Bd. 1, p. 903, lines 7861–64), the concept of vast ages of time in which the climate could slowly change, and in turn, ring changes, would be a logical deduction. However, the scientist who believed that changes were wrought quickly, by a sudden earthquake, a rain of meteorites, a flood, a rising of mountain ranges, even had he correctly assumed, in this case, that erratics had been deposited by glaciers, would be unable to carry the glacial theory to its logical conclusion, namely, the theory of the ice age.

Agassiz and Charpentier are correct when they assign to Goethe the credit for being the first to have conceived the theory of the ice age. To Goethe the poet, as well as to Goethe the scientist, science and artistic creation were but two manifestations of nature’s all-encompassing law. To close with the words of Goethe, so pertinent to the development of his thought leading to his concept of the ice age: “What the scientist carefully collects . . . the philosopher unifies . . . thus it becomes comprehensible and usable” (Goethe, 1892–94, Bd. 10, p. 205).

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