The neglected early history of Geology: The Copernican Revolution as a major advance in understanding the Earth

Alessandro Iannace
Dipartimento di Scienze della Terra, Università Federico II, 80138 Naples, Italy

Alvarez and Leitão (2010) propose a completely new way to look at the early history of geology, with the declared purpose of raising awareness among earth scientists of the historical development of their discipline, and giving a better place to earth sciences with respect to what is generally considered to constitute science within contemporary society. To that aim, they defend the thesis that the Copernican Revolution, generally assumed as the founding event of modern science, could actually be viewed as offering the very first understanding of Earth as a planet, and hence as a major advancement not only in astronomy and physics but also in the field of geology.

The aim of the present discussion is to analyze the epistemological idea of geology on which the thesis defended by Alvarez and Leitão is grounded, because, despite the positive intentions of the authors, it risks lowering the appreciation of geology as a discipline, heavily rooted in a different and specific epistemology, namely that of the historical sciences. Their reasoning, by contrast, is completely biased by the definition of science generally assumed for physical–mathematical sciences.

The idea of seeing heliocentric Copernican theory as a truly Earth-centered theory in the Alvarez and Leitão paper is based more on social-psychology arguments than on analytical or epistemological grounds. It is certainly appealing to call attention to the change introduced by the Copernican Revolution of the meaning of the word “earth” itself, and the derivative general perception of 17th century society. However, the “word counting” deployed by Alvarez and Leitão gives the impression of semantic tricks performed around the word “earth” or “geo” in the evolution of science that does not involve any methodological relationship with what would become the new practice of geology. Following their reasoning, one could equally propose to elect as the very first act in the birth of geosciences the publication of the De Magnete of William Gilbert in A.D. 1600, or even the calculus of the length of the earth meridian by Eratosthenes during the blooming of Hellenistic science, which has been interpreted as an aborted early modern scientific revolution (Russo, 1996).

None of these significant episodes in the investigations of our planet can be considered significant in the birth of geology as a specific science. A new science cannot be characterized merely by the object of its research, Earth in this case, but requires in addition the utterly original epistemological foundation of its approach to the object itself—an approach that can be summarized in the use of history as the main tool for the investigation of the planet.

Every geologist would claim to have an appreciation of this basic principle, but I do believe that we still need, as a scientific community, to fully grasp how it defines our scientific identity. Particularly, we need to assert more consciously that, despite a still-dominating Popperian blame toward “historicism,” the fact that the main core of geological science is based on an historical approach, does not by definition exclude geology from the enclave of sciences.

It is worth mentioning here the founding work of Simpson (1963) and specific contributions by Middleton (1988), Rogers (1989), Frodeman (1995), Dott (1998), and Baker (1999), who have stressed the role of the historical approach against the physical in geological investigation, the specificity of geological reasoning with respect to physics, and even the analogy with hermeneutics in the ways we interpret outcrops. I find particularly significant the title of Laudan (1987)’s book, “From Mineralogy to Geology: The Foundations of a Science,” to emphasize the discovery of the time record in rocks as the main event for the differentiation of modern geology. However, I believe that no one has struggled more than S.J. Gould, throughout his amazing literary production, to give to the historical approach of investigation, in evolutionary biology as well as in geology, the status of true science, well epitomized by the title of his article, “Evolution and the Triumph of Homology, or Why History Matters” (Gould, 1986).

The attempt of Alvarez and Leitão goes in the wrong direction, trying to catch the leading wagon of “modern science” as figured in popular misconception, i.e., represented by physics, with arguments that could be easily falsified by specialized historians.

Geology has its own epistemological identity, and a date of birth that can be traced back to the second half of the 17th century with the work of Steno. His observations about the bedding planes around Florence, Italy, contain the fundamental discovery that Earth has a history that can be decodified through a new way of looking at landscapes. The contribution of Steno is generally reduced, in most textbooks, to the introduction of his three rules, but, as Ellenberger (1988) demonstrated, Steno established the foundations of a complete and new methodology, only abstracted in his Prodromus (1669) and never developed into a full treatise. His breakthrough paved the way for the collective intellectual endeavor that eventually resulted in the foundation of geology at the beginning of the 19th century (Hallam, 1989; Vaccari, 2001; Rudwick 2005). In that respect, Steno should be regarded as the Galileo of Geology.

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