A little history: The study of mineral deposits and the advent of modern geology

Antonio Arribas
Akita University
Some time ago I was telling a colleague at a university geology department in Europe about the strong connection between mining/the study of mineral deposits and the development of geology. I was disappointed because either he didn’t believe me, or didn’t want to believe that his beloved, clean and environmentally sensitive science owed so much to the extraction of the Earth's raw materials. Times have changed, people evolved, and society has learned to regard mining from a very different, more informed and sensitive perspective. However, the connection between the study of mineral deposits and modern geology is clear.

As lucidly exposed in Mike Leddra's (2010) *"Time Matters: Geology’s Legacy to Scientific Thought”* (London, UK: Blackwell Publishing Ltd.) the stratigraphic column – the sequential order of rocks – as we know it today was virtually complete by 1840. Thus, modern geology was firmly on its way. But how did we get there? What were some of the key intellectual and scientific breakthroughs in understanding Earth? Who were the key players and in what context? What follows is a brief timeline, informed by Leddra’s account, of some contributions of early students of mineral deposits. It is telling that three of them, Arduino, Werner and Smith, are individually regarded as the "Fathers of Italian, German and English Geology," respectively.

Perhaps the first classification of the rock sequences of the Earth, based on three groups (Primitive mountains, Secondary mountains, and Tertiary rocks) was proposed in 1756 by Johan G. Lehman (1719-1767).  Lehman was a physician, a Professor of Chemistry, and a copper producer.

In 1760, Giovanni Arduino (1714-1795), a Mining Inspector and Professor of Mining in Venice, improved Lehman’s classification with a four-fold division that will sound familiar to any geologist today: 1. Primary rocks, which included crystalline rocks with metallic ores; 2. Secondary rocks, which were hard, stratified rocks without ores but with fossils; 3. Tertiary rocks, which were volcanic rocks and weakly consolidated strata usually containing shells of marine origin; and 4. Alluvium, which consists of material washed down from mountains.

In 1775, Abraham G. Werner (1749-1817) was appointed as an Inspector and Teacher of Mining and Metallurgy at the Freiberg Mining Academy. The location of this school, the oldest university of mining and metallurgy in the world, was, of course, directly associated with the rich, polymetallic deposits of the nearby Erzgebirge (‘Ore Mountains’). Apart from being the most visible leader of the Neptunist views (the idea that all rocks formed in the seas) on the history of the Earth, Werner is widely regarded as the person who established mineralogy as a distinctive science.

In 1815, William Smith (1769-1839) published the first nationwide geological map. Where did Smith learn his trade? As an engineer and surveyor working at the canals and coal mines of Somerset county, Smith developed his hypothesis of the stratigraphic sequence (he also coined the term “stratigraphy”), including the value of understanding the fossil assemblage of a sequence of rocks. This knowledge enabled him to predict where particular sequences of rocks, such as coal seams, would occur and allowed him to link together rocks of similar age in different places. In turn, this made him a valuable consultant to the British coal mining industry, supporting both the Industrial Revolution and himself in his quest to complete the geological map of Great Britain, a true treasure in the annals of geology (see S. Winchester, *2002, "The Map that Changed the World: A Tale of Rocks, Ruin and Redemption".* London, UK: Penguin Books).