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## Review of: Hjalmar Fors, *The Limits of Matter: Chemistry, Mining, and Enlightenment*

Jan V. Golinski

*University of New Hampshire, Durham*, [jan.golinski@unh.edu](mailto:jan.golinski@unh.edu)

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literature, similar conventions prevailed, and the narrators of novels, such as *Robinson Crusoe*, employed complex rhetorical strategies to vouch personally for the veridicality of their stories. Schmidt's fascinating volume offers a corrective to these historiographies and reveals how, in the case of geography, the internationalization of the European market created a demand for impersonal accounts of exotic lands. Geographical atlases did not only blend Caribbean seashells, African crocodiles, and Chinese emperors in a nondescript space of the foreign; they also mixed together narratives from different sources, obliterating the individual voices of the authors in the process. *Inventing Exoticism* thus offers an expert and highly original contribution to the history of early modern globalization, revealing the intricate connections between global expansion and the internationalization of markets in the early modern age. It should be required reading for historians interested in science, geography, and global expansion across the ages.

Dániel Margócsy

*Dániel Margócsy is Associate Professor of History at Hunter College—CUNY and the author of Commercial Visions: Science, Trade, and Visual Culture in the Dutch Golden Age (University of Chicago Press, 2014).*

**Hjalmar Fors.** *The Limits of Matter: Chemistry, Mining, and Enlightenment.* (Synthesis.) 241 pp., illus., bibl., index. Chicago/London: University of Chicago Press, 2015. \$40 (cloth).

Hjalmar Fors has written a meticulously researched study of chemistry and mineralogy in Sweden, especially at the Bureau of Mines in Stockholm, in the period from 1680 to 1760. The bureau was an administrative and legal arm of the Swedish state, devoted to adjudicating mining privileges and monitoring the quality of minerals extracted. It provided career opportunities and training for officials and possessed, from 1683, a laboratory where they could learn chemical methods of assaying. It was there, Fors claims, that minerals and metals came to be understood as resources available for economic exploitation. He celebrates the bureau as the place where the movement of the Enlightenment gave birth to a distinctively modern conception of matter.

Fors builds his argument by describing the careers of several individuals associated with the bureau, beginning with Urban Hiärne, a physician and chemist who became the first director of its laboratory. Hiärne explored Cartesian and Paracelsian natural philosophies while struggling with the question of the existence of the spiritual entities supposed to inhabit mines. Trolls, demons, and kobolds were believed to guard metals and other minerals underground, deterring human attempts to extract the deposits. Hiärne did not dispute the existence of these spiritual beings, though he denounced other popular superstitions and generally favored chemical explanations of metallic development. Such explanations left open the possibility that metals might undergo artificial transmutation in the laboratory.

Hiärne's student Erich Odhelius, who was sent on a European tour to learn the skills of pharmacy and mineralogy, brought back an enthusiasm for the mechanical philosophy from his encounters with Robert Hooke in London and Wilhelm Homberg in Paris. The mechanistic outlook was consolidated by Georg Brandt, who became director of the Stockholm laboratory in 1727, after reading the Newtonian lectures on chemistry delivered by John Freind in Oxford and studying with Herman Boerhaave in Leiden. By this point, the bureau was shifting its focus toward mineralogical analysis and assaying and away from the pursuit of metallic transmutation. By the middle decades of the century, Fors claims, minerals had been categorized as resources, their spiritual or supernatural qualities stripped away. He associates this development with the cameralist program for harvesting the assets of the nation, which also inspired the natural-historical enterprise of Linnaeus in nearby Uppsala. He also links it with the emergence of a pragmatic concept of a chemical element as the end product of the available methods of analysis. This notion underpinned the isolation of three new elements at the bureau: cobalt, nickel, and molybdenum.

Stepping back from the details of his narrative at its conclusion, Fors explains that the story is not a straightforward one of the "disenchantment" of the mineral realm. Rather, beliefs no longer credited

among the elite were displaced and compartmentalized. Axel Fredrik Cronstedt, in a manuscript written while he was employed by the bureau in 1758, was highly critical of alchemy, which he viewed as an ignorant superstition. But he had to be cautious about offending patrons of the institution, including the mineralogist and visionary theologian Emanuel Swedenborg, who still clung to the hope of metallic transmutation. Criticism of alchemy gradually became more overt in the 1760s, but the topic was still politically sensitive. It is clear that what Fors calls “the limits of matter” remained subject to dispute, and the course of enlightenment did not always run smoothly toward the goal of a disenchanting mineral realm.

The slow and uneven decline of belief in metallic transmutation during the eighteenth century has been taken up by several historians recently. Fors has done a great service in directing their attention toward the Swedish context. *The Limits of Matter* is grounded in a thorough exploration of the archives of the bureau and such other institutions as the Royal Swedish Academy of Sciences and the University of Uppsala. His bibliography and endnotes also provide ample citations to the secondary literature on early modern chemistry in several languages. But his concentration on conceptual analysis left me wanting to know more about the practical side of the bureau’s work. Fors says little about the actual methods of assaying or the equipment of the laboratory, though he cites the work of such scholars as Pamela Smith and Ursula Klein on the methods used by German chemists of the period. Cronstedt became internationally famous for devising a portable laboratory that could be taken into the field, but Fors does not discuss it. It would be interesting to know more about the intersection of fieldwork and laboratory analysis. A more thorough account of the practical dimension of Swedish mineral chemistry would help substantiate Fors’s claim that it was in this setting that the modern understanding of matter was forged.

Jan Golinski

*Jan Golinski is Professor of History and Humanities at the University of New Hampshire. His books include British Weather and the Climate of Enlightenment (2008) and The Experimental Self: Humphry Davy and the Making of a Man of Science (forthcoming, 2016), both published by the University of Chicago Press.*

### Modern (Nineteenth Century to 1950)

**Jeffrey P. Moran.** *American Genesis: The Evolution Controversies from Scopes to Creation Science.* xi + 216 pp., illus., index. Oxford: Oxford University Press, 2012. \$34.95 (cloth).

The Scopes “monkey trial” of 1925 occupies an iconic place in American history. *Tennessee v. Scopes* saw a young substitute teacher prosecuted for teaching human evolution in opposition to the Butler Act, which had become law earlier that year. The first in a series of trials culminating in *Kitzmiller v. Dover* eighty years later, it has become enshrined in American popular culture through the 1955 play *Inherit the Wind* (and the later movie). Within the academy, the events in Dayton have provided rich pickings for historians in the years since. While the standard treatment remains Edward Larson’s Pulitzer Prize–winning *Summer for the Gods* (Basic, 1997), Jeffrey Moran’s *The Scopes Trial: A Brief History with Documents* (Bedford/St. Martin’s, 2002) presents primary documents that are particularly useful in the classroom. In the work under review, Moran builds on the introduction to that work and gives a thoughtful analysis of antievolutionism in the early twentieth century, along with a discussion of the subsequent diversification of young-earth creationism into intelligent design creationism.

Moran’s introduction offers a whistle-stop tour through the history of evolutionary thought and its interactions with religion. Starting with the ancient Greeks, all the familiar names appear before a brief discussion of the Scopes trial itself. Once done, Moran offers succinct summaries of the five chapters of