

## **R.W. Boyle's History of Geochemistry and Cosmochemistry**

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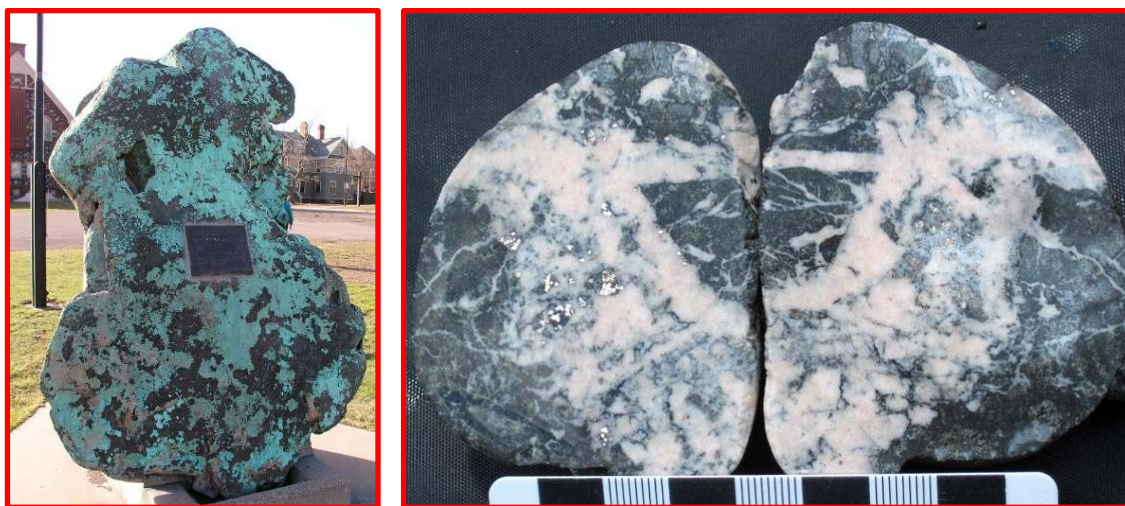
Robert W. Boyle (1920-2003) was a well-respected geochemist with a long career at the Geological Survey of Canada. He is perhaps best remembered for geological and geochemical studies of gold, silver and other commodities, and for his association with mining camps, such as Yellowknife, N.W.T. and Keno Hill, Yukon. Retiring in 1985, Boyle devoted much of his final two decades to trips to far-flung libraries, gathering information exotic and/or obscure, and penning a major 3-volume review of the evolution of human knowledge of the nature and use of metals and other materials, and of diverse fields within geochemistry, cosmochemistry and biogeochemistry. The result, with copious help in compilation, was almost 2,000 pages of discussion (90% of it typed, fortunately!), backed by a formidable bibliography of almost 3,000 references. It was essentially complete at the time of his death, but altogether lacking in illustration. In time, his G.S.C. colleague Bob Garrett made some editorial notes, and then, in 2011, Charles Butt assessed the manuscript and made a detailed scientific and editorial review, heavy in marginalia. However, the work evidently arrived too late for the glory days of Survey and Society printing budgets, and it sat upon the shelf. In 2015, Ryan Noble, of the Association of Applied Geochemists, broadcast the existence of the manuscript, which attracted Wilson, who undertook to advance the work of the earlier editors, with encouragement from Boyle's daughter, biochemist Heather Robinson.

Volume 1 of the trilogy is set for publication in 2024 (Boyle, 2024). It covers the vast span of human time from the inception of mining and agriculture to the fall of Rome in the West (476 A.D.), and so ventures onto ground traditionally left to aspects of the Classics, Ancient History and Archaeology. Despite the western time frame, it is a worldwide review, covering, besides Europe and the Middle East, India and China and the Americas, every part of the globe where Boyle found relevant knowledge to impart. The intended volumes 2 and 3 explore, respectively, history through the critical 19<sup>th</sup> century, and then the 20<sup>th</sup> century (and so to the present). Volume 1 traverses the long development of early thought on the nature of matter. In addition to the various, often conflicting strains of philosophy, there is an equal treatment of the harnessing of materials (Stone, Bronze and Iron ages), and the early stages of the broad swathe of Earth sciences, mining and metallurgy. Early practical ideas on "Earth, air, fire and water" are discussed, e.g., geochemistry and mineralogy, cosmochemistry (meteorites), and early ideas on the hydrosphere and atmosphere.

How was the raw manuscript processed? In brief, Wilson: a) ported Boyle's references into a database, the easier to split up the long bibliography by chapter, rendering each section and volume a stand-alone story; b) utilised his MINLIB bibliography to update Boyle's references, which for Volume 1 had ended in 1987; c) split up the seminal chapter 3, which provides reviews for some 29 metals and commodity groups (e.g., Au, Ag, Cu; Fe; Sn, Pb; industrial minerals, gemstones and organics); d) added a third layer of editing and consistency checks; and e)

ultimately added 132 individual or composite illustrations in 93 numbered figures, including two original versions of the periodic table. Some of the additions (mostly to post-1987 research) are inserted in the text, others are collected in endnotes to each section. Some of the additions may be skating on thin ice (in which case, it is Wilson who falls through), a problem that one suspects would not have unduly worried the author of the original text.

Boyle himself travelled widely across Canada, and the world. In terms of the Lake Superior region, Volume 1 has multiple references to the native copper and native silver of the Mesoproterozoic Midcontinent Rift (Fig. 1; see, e.g., Bornhorst and Barron, 2013; Wilson, 2023). One of two additional text boxes is devoted to native copper, while the other concerns the wider literature on the chemical elements, including some of the most accessible, popular titles. An explicit reference is made to native elements, of which Boyle was fond (e.g., Zn, Pb), including the obvious starting point of Au, Ag and Cu, and listing some 30 elements (many of them very rare in their unalloyed forms).



**Figure 1.** Samples from famous occurrences of native metals in the Lake Superior region. Left: A spectacular, 4,264-kilogram mass of **native copper**, the exterior coloured by secondary Cu salts (Calumet, Keweenaw peninsula, Michigan). Right: **native silver** revealed in sawn and polished faces of calcite-veined fractured diabase from the Silver Islet mine in northwestern Ontario, a rich but short-lived venture on the east side of the Sibley peninsula, east of Thunder Bay, in Lake Superior.

## References

- Bornhorst, T.J. and Barron, R.J. (2013) Geologic overview of the Keweenaw peninsula, Michigan. Institute on Lake Superior Geology, v. 59, part 2: 1-42, Houghton, MI.
- Boyle, R.W. (2024) A History of Geochemistry and Cosmochemistry. Prehistory to the end of the Classical Period. Cambridge Scholars Publishing, Newcastle upon Tyne, England (Wilson, G.C., Butt, C.R.M., Garrett, R.G. and Robinson, H.A., editors), *circa* 600pp., *in press*.
- Wilson, W.E. (editor) (2023) Michigan Copper Country II. Mineralogical Record, v. 54 no.1: 196pp.

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