

A History of Geochemistry and Cosmochemistry by Robert W. Boyle: an updated reference work for the 21st century

Graham C. Wilson¹

¹ Turnstone Geological Services Ltd., P.O. Box 1000, Campbellford, Ontario K0L 1L0

Many members of AAG will have met, and many more have heard of, the late Geological Survey of Canada geologist and geochemist Robert W. Boyle (1920-2003). Boyle's best-known works were books and monographs on the occurrence and ore deposits of gold, silver and other metals, and accounts of famous Canadian mining camps such as Yellowknife, Keno Hill, Bathurst and Cobalt. He helped to pioneer methods of geochemical surveying, and advanced the concept of pathfinder elements, such as arsenic and antimony, for delineation of hidden mineralization. His influence is still felt today, as articles he wrote and samples he collected reappear in new work (e.g., Wilson, 2018). He published many articles, most appearing circa 1951-1993. However, he was not idle, certainly not resting on his laurels, in the final two decades of his life.

Instead, Boyle travelled extensively, visited many libraries around the world, and compiled voluminous notes on the vast project that headlines this brief summary. He was clearly fascinated with the Earth sciences in a broad, "Renaissance" manner, and eschewed narrow specialization. His writing ranges over many facets of field geology, mineralogy and geochemistry, and – in this final work - soars off into many other fields of scholarship in a one-man attempt to encapsulate the long history of human endeavours concerning rocks and minerals, metals and materials science.

Boyle's original draft was completed just before his death. The product of his efforts was rather formidable: an 1,827-page double-spaced manuscript in binders, entirely lacking in illustrations, with a giant bibliography of 2,875 references at the end. The author organized the work in a logical chronology, in 15 chapters of wildly uneven length, from far prehistory to the end of the 20th century. The work was split into three volumes of similar length, as follows:

1. Prehistory to the end of the Classical Period (A.D. 476),
2. Early Medieval Period through the 19th Century, and
3. The 20th Century.

The author's passing posed a challenge to third parties, even though the draft text was complete. The task was formidable and, as with any large mineral deposit, progress was and continues to be episodic, with a build-up of pressure, periods of rapid activity, quiescent phases, and more pressure.....

The work had been completed with the aid of friends, colleagues, family. However, there was no formal publication agreement in place. Some years passed. At length, Charles Butt, an eminent geochemist with CSIRO in Australia, agreed to judge whether the original manuscript was suitable for publication. Happily, he far surpassed his mandate, and eventually provided annotated suggestions for all three volumes. Bob Garrett, one of Boyle's colleagues at the GSC, provided further commentary. This done, a consolidating edit, update, and – in particular – illustration was required. In 2015, twelve years after the author's passing, the topic arose with the AAG. Ryan Noble, then vice-president of AAG, published a note in **Explore**. The project thus became known to a wider audience. Graham Wilson, a geoscience consultant of diverse interests, was intrigued and – critically – had the freedom to tackle the challenge of final editing, albeit sans institutional funding. Once the AAG approved Wilson to tackle the task, the project evolved as time allowed, with occasional communications to an ad hoc community of seven persons, as named herein. Over two years, the text and its edits were considered, the vast bulk of Dr Butt's suggestions were acted upon. Inevitably, the burnishing of "Boyle" involved a little bloat of the bare text, with the finished manuscript of volume 1 now a hefty xxxviii+706 pages, including 104 figures (comprising some 145 individual illustrations), 6 numbered tables and 585 references (Fig. 1).

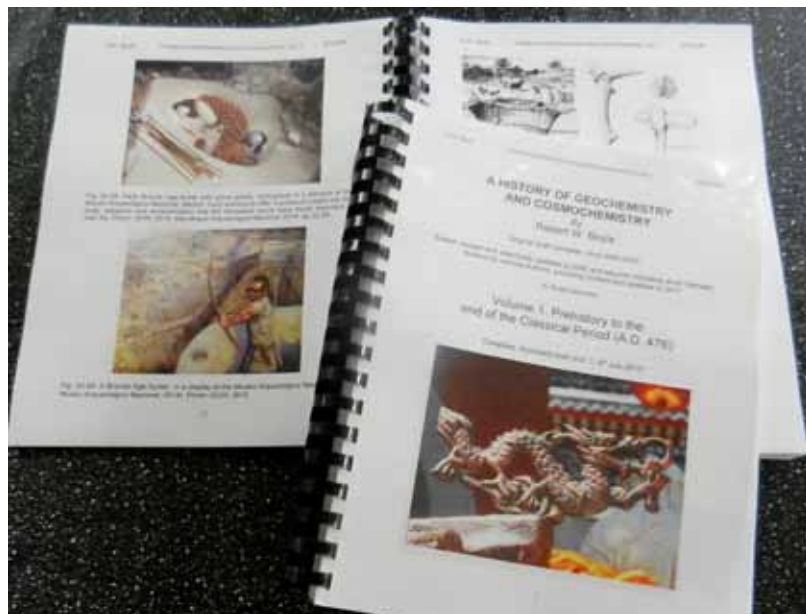


Figure 1. The editor's bound draft copy of Volume 1, complete.

The current goal is to see "Boyle" conclusively edited, illustrated, revised and selectively updated, including as many as 14 short thematic reviews ("text boxes") by various authors, most slated for Volume 3, providing context and updates

A History of Geochemistry and Cosmochemistry... *continued from page 23*

to the time of publication, circa two decades into the 21st century. The trilogy is an ambitious history of science, of potential interest to scholars and students of diverse fields, including geology, mineralogy, mining, metallurgy, archaeology and ancient history. A non-specialist can also glean a lot from this book. Each volume in the upgraded version is designed to stand alone. Boyle's references and selected additional citations all reside in a database to facilitate dispersal amongst the volumes and within specific sections, to minimize the need for a reader to flick back and forth.

The completed volume 1 commences with a preamble, an appreciation of R.W. Boyle (reprinted from Garrett, 2003) and a new, biographical note by Boyle's daughter, the biochemist Heather Robinson. As per the long development of the operation, the roster of help includes editors: Graham Wilson, Charles Butt and Robert Garrett, with a range of advice, insights and text boxes extant or planned by a flexible cast of experts (Table 1). The evolving volumes are summarized below.

Table 1. Key project personnel, "pre-publisher" stages.

Name	Specialities, tasks in Boyle "History" project	Country of residence
Rob Howell	Geochemistry, exploration, hydrogeochemistry, mineralogy, environmental geochemistry	U.K.
Charles Butt	First detail editor; geochemistry, exploration	Australia
Fiona Eddison	Chapter edits; deposit models, alteration, mineralogy	Australia
Robert Garrett	Early concept editor; geochemical surveys, exploration	Canada
Ray Lett	Chapter edits; geochemistry	Canada
Heather Robinson	Administration; biochemistry	Canada
Graham Wilson	Final detail editor; bibliography; exploration, mineralogy, geoarchaeology, meteoritics	Canada

Volume 1 is a particularly attractive text, of interest to archaeologists as much as geologists, and to a wide range of chemists, metallurgists and historians. The text is worldwide, not just the Near East in ancient times, but also the Greek and Roman empires, ancient Egypt, the successive kingdoms and empires of India and China, and shorter notes on other human endeavours across six continents, to the fall of the Roman Empire in the West. A sprawling chapter 3, split into six sections, is perhaps the standout feature, with historical notes on many metals and non-metallic minerals.

Volume 2 will also have some alluring highlights, including the flowering of science under Islam in Al-Andalus (the Iberian peninsula) and the Moghuls of India, the 18th and 19th century rise of inorganic chemistry, and early insights into modern materials science, such as the Periodic Table and the discovery of radioactivity.

Volume 3 will obviously highlight the staggering progress of science in the 20th century and the early 21st century, approaching 120 years of advances. Obvious highlights will include facets of modern economic geology (mineral exploration and mining of critical resources), analytical science (technological change enabling remarkable amplification of sensitivity to trace elements) and applications to both the latest developments (environmental geochemistry and global change) and the search for origins (analytical work on meteorites, cometary and planetary materials, shedding light on astrophysical processes that in some cases predate our solar system, some 4,570 million years and more into the past).

In conclusion, the work is proceeding in episodic bursts of productivity. Progress is ongoing, with minimal budget. In 2017, as Volume 1 was completed, second thoughts arose concerning the best publisher for such a detailed scientific work. At the time of writing, the final choice of publisher remains to be confirmed. Funding of editorial and related expenses would speed publication, but the goal remains in sight.

Queries on this project may be addressed to:

Content: Graham Wilson, turnstonerocks@yahoo.ca

Administration: Heather Robinson, harobinson123@outlook.com

References

- GARRETT, R.G. 2003. Robert William Boyle - a tribute: 3 June 1920-5 August 2003. *Geochemistry: Exploration, Environment, Analysis* **4**, 3-5. Also available at: <https://www.appliedgeochemists.org/index.php/component/content/article/2-uncategorised/34-memorial-bob-boyle>
- WILSON, G.C. 2018. Galena from two mining camps in North America. <http://www.turnstone.ca/rom200ga.htm>

