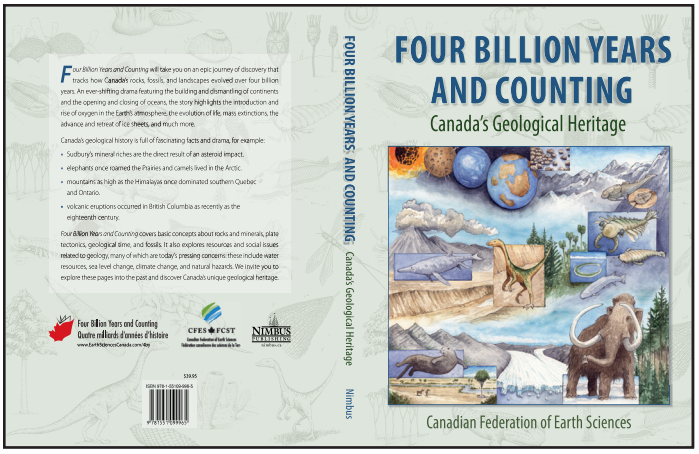
REVIEW



Four Billion Years and Counting: Canada's Geological Heritage[1]

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A hundred authors crafted this delightful volume. It is one of Canada's contributions to the United Nations-initiated 2008 program, *The Year of Planet Earth*. One might wonder how the editors managed to smooth the inevitable prose bumps with such a large authorship, but they have done so very effectively. The book reads smoothly and engagingly. And what a topic they discuss—the geology of one of Earth's most geologically diverse and intriguing land masses.

To fully appreciate geology some background scientific introduction is needed. The first section of the book, "Foundations," provides the necessary introduction in a succinct, four-chapter treatment of physical geology, how surface and subsurface maps are prepared, and the importance of fossils in understanding Earth's history. The second section, "The Evolution of Canada" is a six-chapter discussion of the formation and growth of Canada as a continental land mass and the life forms that have been its inhabitants through time. The final section, "Wealth and Health" is a ten-chapter introduction to the economic and social issues that both support and challenge the human population that inhabits Canada today.

The great ice sheets that covered Canada in recent geological times have exposed a wealth of evidence by clearing and polishing ancient rock surfaces. Our understanding of the geological evolution of Earth rests heavily on glacially exposed evidence from Canada. For example, how and when the cratons in the cores of today's continents were assembled is best understood from Canadian evidence. And much of our knowledge of the diversity and uniqueness of the earliest forms of macroscopic life comes from evidence discovered in Canadian rocks. These stories and many more are related in "The Evolution of Canada." I particularly like the human touches added through vignettes of early Canadian scientists, and stories of discovery by those who first saw and realized the importance of the evidence in Canadian rocks. One story concerns Stanley Tyler. As a graduate student, I happened to be at the 1953 Geological Society of America meeting in Boston when Tyler presented his evidence of possible microscopic fossils in the 1.9 billion year old Gunflint Formation from Ontario. He created quite a buzz, though no one knew just how important his epochal discovery really was. The discoveries by pioneers such as Billings, Logan, the Dawsons, Coleman and many others make clear just how important the roles played by Canadian scientists have been in the development of geology as a science.

For the past 150 years, Canada has played a world-leading role in the discovery and exploitation of natural resources, particularly gold, ferrous and non-ferrous metals, coal, petroleum, fertilizers, and most recently, diamonds. The resource story is succinctly related in Chapter 13. The final short chapters of this engrossing volume cover topics that are all too often overlooked in geological discussions. Chapter 14, "Building Canada" discusses the stones with which dwellings and many iconic public buildings in the older cities are constructed. Chapter 15 covers Canada's abundant water supplies, and Chapter 16,

[1] "Four Billion Years and Counting" is a project of the Canadian Federation of Earth Sciences (CFES). The book's website (www.fbycbook.com) provides information not only about the project, but also about the authors, organizers and sponsors. For those interested in the potential of the book for education and outreach, many figures, maps and photographs are available for direct download for such use, as long as the sources are duly acknowledged. The book is also available in French, and is entitled "Quatre milliards d'année's d'histoire."

"At the Beach," discusses shoreline erosion, the tides, and the effects of rising sea level. Chapter 17 concerns a topic that is becoming increasingly important as the population density increases—natural hazards and natural disasters, such as floods, landslides, tsunamis, and even meteorite impacts. Chapter 18 addresses the environmental challenges facing Canada's growing population as it moves from a rural base to an urban base—another issue concerned with population density. Chapter 19 concerns a topic that has only recently demanded attention of the geological community, though it has always been there—geology and health—which is discussed in "Toxins in the Rocks."

The final chapter of this ambitious volume is titled "Canada's Geological Heritage." It is a tightly written summary of the key steps along the way as separate fragments of crust aggregated to form the proto-continent Laurentia, the subsequent history of Laurentia, and the final steps in the assembly of North America and Canada's importance in unravelling the story.

The authors are all geologists and experts in their respective areas of expertise. They clearly had a diverse readership in mind as they wrote their chapters and they have been very successful. This is a volume that, once opened, is difficult to put down—it is a pleasure to read and beautifully illustrated with clearly drawn maps and striking photos. The writing is smooth and always clear and balanced. Short of a continent-wide field trip to actually see all the evidence, I can't imagine a better way to introduce a Canadian citizen to the geology of his or her fascinating country.