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# The Last Billion Years: A Geological History of the Maritime Provinces of Canada

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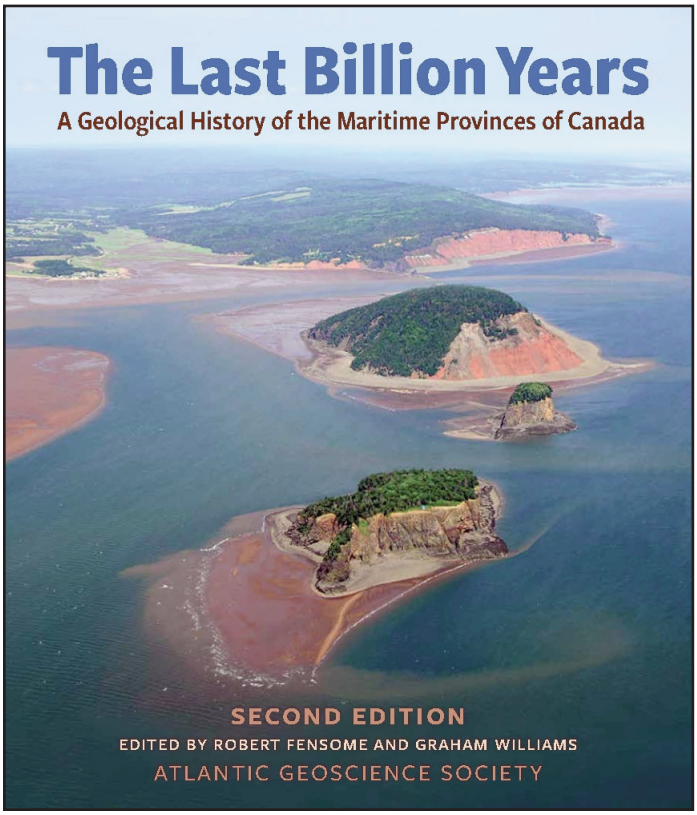
# REVIEW




## The Last Billion Years: A Geological History of the Maritime Provinces of Canada

**Robert Fensome and Graham Williams (editors)**

*Co-Published by: Nimbus Publishing Limited and the Atlantic Geoscience Society*
*Published: Second Edition 2022; 260 p.*
*Purchase price: $39.95 (CND, Softcover)*
*https://nimbus.ca/store/the-last-billion-years.html*

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The much-anticipated second edition has arrived, just in time for its grand unveiling at the GAC-MAC-IAH-CNC-CSPG conference recently held in Halifax, Nova Scotia, in May 2022. A wonderfully informative book, it covers the intriguing geological history of New Brunswick, Nova Scotia, and Prince Edward Island. These provinces are recognized also as the traditional unceded territory of the Wolastoqiyik (Maliseet) and the Mi'kmaw Peoples. This book is intended to enhance the understanding of the geological development and evolution of the Maritime Provinces for all readers, whether the reader has a formal background in the earth sciences, or is generally interested about the land around them, and how it has changed.

Over the past two decades since the first edition was published, new technologies have enabled geologists to collect more data, and further develop the stories captured in the rocks and new fossil discoveries. These stories create a more comprehensive understanding of what has happened over time – in millions and billions of years! To set the stage for exploring these stories, the authors have divided the book into chapters that describe aspects of the given topic. Terms are well-explained and easy to grasp, as the writing style is informative and appealing. Between some of the chapters, additional information is highlighted by supplementary discussions, such as *Box 2: From Crystals to Rocks*, for those who are particularly curious about the given topic.

The first three chapters provide a foundational background that cover the concepts of geological processes. The first chapter, *The Dynamic Earth*, includes discussions of plate tectonics, from the life cycles of mountain ranges and orogenic belts, to folding and faulting. The rock cycle is presented with many examples of how this process affected present day landforms, such as describing the formation of the South Mountain Batholith in southwestern mainland Nova Scotia (as seen at Peggy's Cove), and the formation of Mount Carleton, New Brunswick. The impact of time is considered in Chapter 2, *The Fourth Dimension*, and provides the reader with an appreciation of how we view time. New technologies improve the ability to relate time and events through correlation and using tools such as radiometric dating, helium thermochronology, fission track dating, and dendrochronology. Chapter 3, aptly titled *Tales of Trails and Ancient Bodies* is an excellent introduction into understanding the development and evolution of life forms, and their place and role throughout the evolving Earth over time. Together, the Maritime Provinces have an amazing variety of fossil sites, with many representatives of fossil life over the periods of time. Fossils provide a wealth of information about the paleoclimate, the diversity of populations and their distributions, to extinctions and the evolution of new fauna. Even astronomical information can be determined, such as the daily

Typical subhorizontal joints (prominent fractures) in granite at Pabineau Falls, New Brunswick, caused by release of pressure over time as overlying rocks were removed by erosion. Photo credit: R. Fensome.

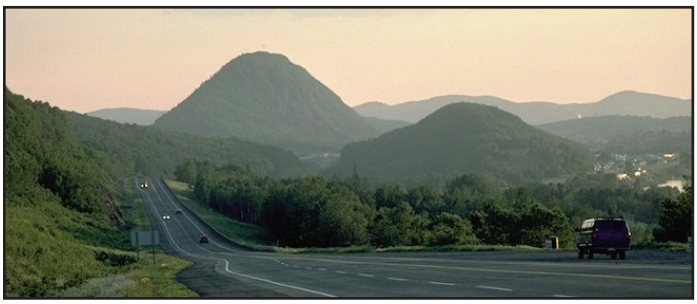
Sea stacks formed from Carboniferous sedimentary rocks under attack from stormy weather, Pokeshaw, New Brunswick. Photo credit: R. Fensome.

Trackway of a Permian tetrapod (a four-legged animal) on a sandstone block discovered in Lord Selkirk Provincial Park, Prince Edward Island, dating from about 290 million years ago. Photo credit: M. Stimson.

Aerial view of the cliffs at Five Islands Provincial Park, Nova Scotia, showing a faulted block of Late Triassic North Mountain Basalt (dark grey), Early Jurassic fluvial and lacustrine red sedimentary rocks (left of the faulted block) and Late Triassic lacustrine red sedimentary rocks (right of the faulted block) overlain by North Mountain Basalt. Photo credit: L. Podor.

growth rings of Devonian corals indicating that the length of a day was then only 22 hours long!

The puzzle pieces of the geological stories are pulled together starting in Chapter 4, *Into Deepest Time*. The processes involved in producing the first land masses, to the first life forms and banded iron formations, build on previously explained concepts. The growth and demise of supercontinents to microcontinents, along with changing oceans are framed within the rock formations of the Maritime Provinces over time, with many local examples given. *Box 4: Rock Stars* illustrates the key discoveries and life stories of several prominent individuals who made exceptionally noteworthy contributions to Maritime geology and geoscience education. Chapter Five, *The Pieces Come Together*, further explores the significant tectonic, climatic, and biotic changes from the Proterozoic and Cambrian to the Devonian, setting the stage for the introduction of the Carboniferous – a particularly rich period of the ancient Maritimes. *Box 5: Granite* is an analysis of the granite batholiths and related features found as distinct landforms, such as the South Mountain Batholith in Nova Scotia, and the Pokiok Batholith in New Brunswick. *Box 6: Fish Tales* goes through the evolution and classifications of fishes, linking certain specimens to various Maritime localities. Chapter Six, *Basins and Ranges*, describes the development of the coal fields, from the changing seas and climate – producing a great "drying off" (creating the red soils of Prince Edward Island for example) to the greatest known extinction of approximately 90% of all living organisms. *Box 7: Old Salt and Lime* relates to the impacts of these times of great aridity, while *Box 8: Flowing Through Time* describes the effects of fluvial environments on both landforms and organisms, including human habitation impacts. Chapter Seven, *An Ocean is Born*, shows how the North Atlantic Ocean grew over time during the breakup of Pangea, and makes connections to the Mesozoic to Cenozoic rocks formed across the region. Some of the basalt flows that heralded the birth of the Atlantic Ocean contain many types of zeolites, and the Bay of Fundy is a world-famous site for collecting these minerals. Several extinction events took place during these times and the extraordinary fossil evidence for one of them is found in several key locations in the Maritimes, especially the "Fundy Fossils" section. During the Cenozoic,



The erosional remnants of an Early Devonian volcanic pipe from the Tobique-Chaleur Bay Belt, Sugarloaf Mountain, Campbelton, New Brunswick. Photo credit: R. Fensome.

the Earth began cooling, leading into Chapter 8, *Into the Quaternary Ice Age*. In addition to the effects of the Ice Age on landscapes and life forms, another factor to consider is the rise and fall of sea level and our changing coastlines. The earliest humans arrived about 12,500 to 9500 years ago, and left behind several important archeological sites, mainly along waterways. *Box 9: Between Land and Sea* describes the ever-changing coastline, including the significant environmental role of coastal marshes, and how humans are affected by and play a role in causing erosion and altering the coastlines.

The last three chapters present a more in-depth look at geology and how it influences society and our daily lives. The diverse and plentiful mineral resources found in the Maritime Provinces are covered in Chapter 9, *From Rocks to Resources*. This chapter discusses the earliest Indigenous use of resources for tools and paints, to the earliest (1604) European discovery of iron in the North Mountain Basalt, to the present-day roles of mining and resources extraction, including water. *Box 10: Carved in Stone* takes the reader on an interesting journey exploring the many buildings throughout the Maritimes that have been constructed using local stone. Many homes built in the early 1800s, from churches, various government and municipal buildings to bridges and railway stations illustrate the wonderful use of stone. This section highlights structures made of sandstone, granite, limestone, quartzite, and slate, as well as the use of stones in cemeteries and graveyards. Chapter 10, *Nature's Challenges* considers the damage that can be caused by natural processes, such as earthquakes, tsunamis, submarine slides and surficial landslides, toxins in rocks and soils that leach into groundwater, to local concerns with radioactive minerals producing radon gas. Chapter 11, *The Human Factor,* is a critical look at the impacts of resource extraction and human actions. It highlights coal mining, from the tragic loss of human life to the long-term effects of coal-burning processes on the global environment, mine tailings and the toxins left over from extraction of gold from ores. For example, arsenic from old mining sites locally affects the water supply and people's health. Garbage and landfills are discussed, with emphasis on efforts to mitigate their impacts more effectively and utilizing more green technologies to help reduce negative results of climate change. Very fittingly, the last synthesis of information is found in *Box 11: Milestones*. This frames the changes over the last four billion years with colour-coded information indicating geological changes (plate tectonics and rock formations; mountain building and orogenies), mass-extinction events, to climate, oceans, atmosphere, and space events, modern landscapes, and life events. There is also a very comprehensive list of resources for those who wish to find out more information about earth sciences – from museums, pamphlets, books, websites, maps, videos, UNESCO Geoparks, earth science organizations, universities and colleges, to places and events to explore.

For those who have the First Edition, the Second Edition is well worth adding to the collection, with its updated scientific information, additional chapters and boxes, and spectacular photographs, maps, diagrams, and illustrations. The wonderful collaboration and contributions by the authors have produced a book that is both a thoroughly researched and well-written description of the topics presented, and an engaging and eye-catching volume to have gracing one's coffee table in a prominent location! From budding younger earth scientists to university geology students to general interest for those of all ages, this is a book that will foster and enhance an understanding of our planet and give Maritimers much appreciation of the geological and human prehistory of where they live.



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