

# REVIEW

## Ghost Mountains and Vanished Oceans: North America from Birth to Middle Age

By John Wilson and Ron Clowes

Key Porter Books

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Reviewed by Eileen Van der Flier-Keller

School of Earth and Ocean Sciences

University of Victoria

Victoria, BC, Canada, V8W 3P6

E-mail: [fkeller@uvic.ca](mailto:fkeller@uvic.ca)

*"For twenty years, the scientists of the Lithoprobe Project pounded the ground around Canada in a unique seismic survey of our country's lithosphere - the deep crust of rock, tens to hundreds of kilometers thick, beneath our feet. In doing so, they built up a cross section of the country's geology, answering many questions about the geological history of our continent and, by extension, the world." Quirks and Quarks, May 30<sup>th</sup> 2009.*

From the foreword by Bob MacDonald, to the very last "Sh.., there we were" personal anecdotes from Lithoprobe scientists, this book, which is in essence the story of our science, is a well written, entertaining, and thoroughly gripping read. The book is in part about Lithoprobe and the stories this amazing Canadian scientific endeavour uncovered, but it 'is also a book about wonder'. *Ghost Mountains and Vanished Oceans* is an important book about Canadian science for the

public, as it highlights the Canadian scientists who contributed to the rapidly developing understanding of the world as we know it, and provides a fascinating glimpse into how scientific knowledge and understanding move forward.

This is the story of how a thousand or so Canadian scientists sought to understand not just the surface of our amazing planet but 'what's going on below our feet?' specifically within the 200 kilometers of the continental lithosphere. Lithoprobe ran from 1984 to 2005, and combined geological and geophysical techniques to probe the third dimension of crustal geology. The project was funded by the Geological Survey of Canada, the Natural Sciences and Engineering Research Council of Canada, provincial and territorial governments, and industry. Lithoprobe directed its awesome geoscientific resources 'to solve key geological problems in ten specific corridors or transects across Canada' from the 'crumpled fender of North America', the West coast, to the origin of the oldest rocks on the planet, the Acasta Gneiss.

The book is well designed, and arranged by geological age into five parts, each containing a combination of narrative written by John Wilson ("an ex-geologist and frustrated historian") and sidebars with more detailed scientific information written by Ron Clowes (the director of the Lithoprobe project). The fieldwork 'Interludes' are contributed by various Lithoprobe geologists, and add a very human and 'hard-to-put-down' dimension to the text. The black and white illustrations are clear and enlightening, and include actual Lithoprobe scientific images.

Part 1: The Introduction,

begins with 'A Vast Jigsaw Puzzle', stories of how our planet has been progressively mapped from Cabot's first sketches of the East coast of Canada, to Smith's earliest geology maps, and finally to Lithoprobe's concern with how 'the pieces of Canada's geological puzzle interact and fit together not only in three dimensions, but also in the fourth: the dimension of time'. 'Floating Continents', the second introductory chapter, is one of the best-written and most fascinating accounts I have read of the development of our understanding of plate tectonics, brought to life by stories of people (including the author), of "the most significant paper in the Earth sciences ever to be denied publication", and containing wonderful analogies such as the coffee shop gravity anomalies.

Part 2: Birth to Childhood (4 billion years to 2.5 billion years), takes us to the oldest rocks in Canada, the Acasta Gneiss and the Slave Province, and asks 'Has it always been this way?', pulling together the evidence to answer the question "Just how far back can we push plate tectonics?". This is fascinating stuff! Mini lessons in the sidebars of this chapter include Rocks and Minerals: The Foundation of Geological Studies, The Dating Game, The Slave Province, and The Superior Province.

In Part 3: Tumultuous Teens (2 billion years to 1 billion years), includes chapters 4 and 5. Chapter 4, 'Gluing It All Together' takes us from the Plains of India and the Great Trigonometrical Survey, to indulging in the "endless pleasure to be derived from continuing Alfred Wegener's work in fitting the continents back together". The authors then consider how Australia's motion north into Asia may be a model for the Trans-Hudson orogen, and explain the science that

helps unlock the story of how the North American continent was almost assembled by 1.8 billion years ago. In support of the scientific results of the numerous Lithoprobe researchers, the authors bring in evidence from many facets of Earth Science, including fossils, the atmosphere, and sedimentary rocks, to address the question “It’s a great story, but is it true?” Chapter 5, ‘Breaking Up’, takes us to Africa and our own origins, a 1698 ‘pygmy’ on a ship in London, and the rifts where ‘Africa is busily trying to tear itself apart’ – possibly a modern analogy to the billion year old Keweenaw rift in North America.

Part 4: Midlife Crisis (the past billion years) includes chapters 6 and 7. Chapter 6, ‘False Starts’, begins with Scottish and Greek tales of incest and cannibalism, and a young John Wilson’s continuing search for rocks and fossils as a starting point to discuss the breakup of Rodinia, the subsequent closing of oceans and formation of Pangaea, and the related glamorous as well as not-so-glamorous causes of change to the progression of life during these last billion years. In this chapter the sidebars include The Newfoundland Appalachians: Exposing the Opening and Closing of Ocean Basins, and a very brief but fascinating glimpse into The Geological Survey: Canada’s Oldest Scientific Organization. Chapter 7, ‘Our Very Own Mountains’, takes us to the West coast, a place where “geology and plate tectonics can (not) be taken for granted”, a place where “the lives of thousands of people depend upon our knowledge of what is going on beneath our feet”. “In looking at jigsaw puzzles of Earth, we’ve graduated from a simple Sesame Street puzzle of the world, through a more complex collection of pieces that built Laurentia and the other continents, to the three-dimensional master’s puzzle that is British Columbia”. The authors introduce us to the 200 or so bits of the West coast puzzle, Lithoprobe images that show the North American prow ‘like an extended version of the ramming prows on Greek and Roman triremes’, and the records of successive earthquakes related to the Cascadia Subduction Zone.

Part 5: Old Age the next billion years, begins with a quote from

Confucius “Study the past if you would define the future”, as a start to the final chapter ‘A Quiet Old Age? Not Likely’. The authors present some thought-provoking possibilities and future scenarios that play the cycles and processes of the past chapters out into the future. They mention supervolcanoes, more vanished oceans and ghost mountains, and conclude that “things will continue to happen”, but that a problem with “predicting the future (as with interpreting the past), is that we can only see what we can imagine”.

This book will be a fascinating read for anyone interested in the planet on which we live and how it came to be as it is. As a ‘brief history of geology’ I would recommend the book for any undergraduate student and my guess is that we will all learn something from this and enjoy the read in the process. Make sure there is a copy in the university reading room, and pass it along to students you know. If you want to give your friends an insight into what you do beyond the stories you may tell over a beer, this is the book. “Mother Earth is a complex old lady”! Find out more - buy your friends a copy or amaze your family with how thrilling the science of our Earth can be.