# The Roof at the Bottom of the World: Discovering the Transantarctic Mountains

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Source: Arctic, Antarctic, and Alpine Research, 44(2) : 259-260

Published By: Institute of Arctic and Alpine Research (INSTAAR), University of Colorado

URL: https://doi.org/10.1657/1938-4246-44.2.259

The last part is short and covers the Great Basin as encountered by the early Europeans, and looks into the future. Finally, he hunts through the environmental record for an analog of the future, and concludes this is no easy task.

There are a few other observations I want to add. One interesting choice is the use of English units of measure throughout. I believe the reason for this is stated in the preface—he wrote the book for those with little knowledge about the environmental history of the region, rather than for hard-core professionals. That aside, scientists of the disciplines covered (e.g., geologists) can learn a lot about other aspects of the natural history of the region (e.g., ecology) by reading this book.

Another deviation from the norm is to not include references in the text, except in rare instances. In lieu of references, at the end of each chapter are ''chapter notes'' which go over all information sources used, written in an interesting style. I believe this decision helps with the readability of material unfamiliar to many.

The style of writing is good and keeps the readers' interest. Commonly he talks about the pertinent workers either by last name or first and last name. This gives the impression that Grayson personally knows these workers, and in many case he well might. He also is good at covering all aspects of an argument, and for many he offers his opinion. And, at times he gets downright folksy, as when he talks of donating blood to mosquitoes.

As I read the book I kept thinking how I would use it, as I never taught such a course. However, the Quaternary group in our department commonly took extensive field trips, with a few into the Great Basin. What I would do now is have students pick topics unfamiliar to them but covered in the book, and lead a group discussion at appropriate geographic localities. In fact, Grayson hints at this application in the last sentence of the book. For a detailed geological field guide for such a trip I would start with D. E. Easterbrook (ed.), 2003, Quaternary Geology of the United States, Desert Research Institure, Reno, NV.

As I finished this review I learned that the author has been elected to the National Academy of Sciences. Based on the broad scholarship exhibited by this book, I thought this prestigious honor was well deserved.

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The Roof at the Bottom of the World: Discovering the Transantarctic Mountains. By Edmund Stump. New Haven: Yale University Press, 2011. 254 pp. $29.95 (hardcover with numerous colored photos, illustrations, and maps). ISBN: 978-0300171976

A century after Amundsen and Scott's field parties first reached the South Pole, Edmund Stump has published a book about how various regions of the Transantarctic Mountains were first explored. The title, The Roof at the Bottom of the World: Discovering the Transantarctic Mountains, is appropriate because it describes the exploration of a 1200-mile-long chain of mountains that reach to within 176 miles of the South Pole. This is the third recent book on Antarctic exploration published by Yale University Press, preceded by Susan Solomon's Coldest March in 2001 and Edward J. Larson's An Empire of Ice, also in 2011.

The author wants the reader to ''visualize the trails blazed by these explorers who bore first witness to the wonders beyond the icy sea.'' Included with a superb narration of exploration of each part of the Transantarctic Mountains are shaded U.S. Geological Survey (USGS) topographic maps with routes followed by explorers marked in color, maps constructed by explorers, satellite images, and Stump's photos. These photos show landscapes that have not changed since seen by the first explorers. In his 13 expeditions Stump has seen more of the Transantarctic Mountains on the ground than any other scientist. His experiences of being the first person to stand in many places and to be in places last visited by the early explorers, traveling on glaciers, making first ascents on mountains, and surviving storms in a tent, add realism to his descriptions. Within the book is another ''book'' with passages of Stump's own experiences inserted within the text.

The first chapter presents a succinct and informative history of early Antarctic exploration from the sea, beginning with the prediscovery voyages of Magellan, Drake, and Cook. Beginning with the discovery of Antarctica by Bellingshausen in 1821, expeditions led by Bransfield, Weddell, Biscoe, Kemp, d'Urville, and Wilkes charted most of the outline of Antarctica in sailing ships. A helpful map shows the progression of knowledge of the coastline through this time. This is followed in detail by the two voyages of Ross (1840–1843) in which the Ross Sea coast of Victoria Land was charted from Cape Adare to the edge of the Ross Ice Shelf. The mountain ranges, prominent peaks seen at great distance from Ross's ships, and the major glaciers entering the sea along this coast were named at this time. Ross's map of Victoria Land is one of the many useful illustrations in this chapter. Substantive exploration of the geography and geology on land was not made until Scott's *Discovery* expedition (1902–1904) explored the region around their base along McMurdo Sound.

In chronologic and geographic order from north to south, each of the following chapters details the exploration of a new part of the Transantarctic Mountains. Chapter 2 relates the attempts of *Discovery* field parties to find their way up glaciers through the mountains to reach the Polar Plateau. A shaded relief map shows the routes taken by each of the field parties. Encountering flat-lying sandstone beds in Beacon Valley in the upper reaches of the Taylor Glacier, Ferrar's party unsuccessfully searched for fossils to date what he named Beacon Sandstone, a term still used for the Devonian to Triassic stratigraphic sequence throughout the Transantarctic Mountains. Field parties also encountered the massive, dark-brown dolerite sills, named after Ferrar, which have since been dated as Jurassic and form resistant outcrops throughout the Transantarctic Mountains.

Chapter 3 describes the exploration by field parties from Shackleton's *Nimrod* expedition from 1907 to 1909. Because one of the objectives was finding a way to the South Pole, Shackleton first attempted to find a landing place at the Bay of Whales near the far eastern edge of the Ross Ice Shelf, where Amundsen later began his successful trip. From the standpoint of science and geography, it was fortunate that Shackleton established his camp at Cape Royds in the McMurdo Sound area. In March 1908 a party of

DOI: http://dx.doi.org/10.1657/1938-4246-44.2.259

six, including Australian geologists David and Mawson, made a harrowing ascent of Mount Erebus, observing the features of a continuously active volcano. The book includes David's sketch map of the their route and several of Stump's photos of the crater. The next summer another field party, led by David and including Mawson, sledged northward along the coast to beyond the Drygalski Ice Tongue where they ascended the Larsen Glacier to the Polar Plateau and the magnetic pole. Mawson's map of the Terra Nova Bay area is compared to the modern USGS shaded relief map. Field parties had largely completed the reconnaissance mapping of Victoria Land by this time. Field parties from Scott's *Terra Nova* expedition (1910–1913), including geologists Taylor, Debenham, and Priestley, later filled in the blank areas of the maps on separate traverses. They discovered fossil fishplates in a loose rock fragment in a moraine downstream from Mount Suess, which finally established a Devonian age for part of the Beacon Sandstone.

Chapter 4 describes how Scott's southern party (1902–1903), consisting of Scott, Wilson, and Shackleton, traversed the Ross Ice Shelf, extending mapping of the Transantarctic Mountains to the Nimrod Glacier in attempting to find a passage to the South Pole. Unable to see an end to the mountain chain to go around and running woefully low on supplies, they turned back. Their dogs were weak because of spoiled food and did not serve them well, one of the reasons that both Shackleton and Scott later used ponies, which were less suited to Antarctic travel. Stump includes a spectacular panoramic photo of this region from the summit of Mount Markham.

Leaving from Cape Royds in 1908, Shackleton's southern party, including Wild, Marshall, and Adams, charted the mountains beyond the Nimrod Glacier in another attempt to reach the South Pole. Crossing the Ross Ice Shelf, Shackleton found a passage up the Beardmore Glacier to the Polar Plateau, but wisely stopped short of the pole at 88°23'S and 162°E as their supplies dwindled. In the upper reaches of the Beardmore Glacier, Wild spotted coal in the Beacon Sandstone on Buckley Island, which was later identified as Permian in age. Near Mount Darwin at the head of the Beardmore Glacier, Shackleton picked up a limestone sample containing fossil fragments, which were later identified as belonging to Cambrian archeocyathids. These came from a widespread formation that was later named the Shackleton Limestone.

The first half of Chapter 5 describes how Amundsen's men methodically sledged with dogs across the Ross Ice Shelf from the Bay of Whales, up the Axel Heiberg Glacier through the Queen Maud Mountains, reaching the South Pole in December 1911. They were able to extend the map of the Transantarctic Mountains southward to beyond the horizon. Scott's concurrent expedition to the South Pole followed Shackleton's route up the Beardmore Glacier. Although they did not survive the return journey, the rock samples collected by Wilson from the east face of Buckley Island contained specimens of fossil wood and *Glossopteris* leaves, which later became strong proof that Antarctica was part of the supercontinent Gondwana.

Byrd's first expedition (1928–1930) established Little America I at the Bay of Whales. From there Byrd flew over the Queen Maud Mountains to the South Pole on 29 November 1929. Led by Chief Scientist and geologist Lawrence Gould, a field party sledged with dogs to the Queen Maud Mountains where they found that metamorphic and granitic basement rocks overlain by Beacon Sandstone continued southward from the Beardmore Glacier. They added much detail to the geography and geology of the region that had been quickly traversed by Amundsen 17 years earlier. As in other chapters, Stump's personal knowledge of this area, his excellent photos, and the original maps add much to the narrative.

In chapter 6, on Byrd's second expedition to Little America (1933–1935), a geology party led by Quinn Blackburn again visited the Queen Maud Mountains. They sledged up the Scott Glacier to the southernmost outcrops in the Transantarctic Mountains where they measured a stratigraphic section of the Beacon Sandstone on Mount Weaver. Ohio State University field parties returned to this area after IGY in the early 1960s, but the Beacon rocks here have since received little attention. Stump obviously enjoyed telling the story how Blackburn's field party ignored orders from Little America to turn back before they had completed their traverse.

The final chapter summarizes IGY (1957–1959), the signing of the Antarctic Treaty (1961), and the establishment of the U.S. Antarctic Program. Specially equipped aircraft photographed the Transantarctic Mountains and other areas of Antarctica while USGS ground parties surveyed prominent features with the help of U.S. Army helicopters. A series of 1:250,000 topographic maps were produced, which Stump uses so effectively in his book.

In the second season of IGY a tractor train field party, led by University of Wisconsin geophysicist and glaciologist Charles Bentley, found the terminus of the Transantarctic Mountains at the Ohio Range, where the East and West Antarctic ice sheets meet. They saw Beacon Sandstone resting on granite above a cliff high above the ice. Near the base of the Beacon they collected marine Devonian brachiopods, and above that they found beds containing *Glossopteris* leaves interbedded with fossil tree stumps from ancient forests. Their work completed the extension of basement rocks and Beacon strata throughout the Transantarctic Mountains. The similarity of fossils and the sedimentary sequences with those in southern Africa, India, and Australia supported the theory of continental drift, which was not widely accepted in North America and Western Europe until the theory of plate tectonics was introduced in the 1960s.

The appendices include the rock cycle and how geologic time is determined. A glossary of geologic and glaciologic terms is useful. The bibliography lists 34 books, including many of the classics written by the original explorers. The book ends with a comprehensive index, listing the many illustrations in italics.

This book is a must for readers interested in Antarctica and its exploration. The quality of photographs and other illustrations is that usually associated with coffee-table books. A major audience is the thousands of tourists who visit Antarctica each year on cruise ships. Few, except those on ships that sail in the Ross Sea along the Victoria Land coast or those on charter flights, will get a chance to see the Transantarctic Mountains. Stump's narrative, photos, and maps are the next best thing to experiencing the Transantarctic Mountains. As one who has worked extensively in the Transantarctic Mountains, this book gave me a great appreciation of the accomplishments of the field parties that preceded the modern programs.

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