

Book Review

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Antarctica: Earth's own ice world

Michael Carroll & Rosaly Lopes

Berlin: Springer, 2019

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This book concerns the (ad)venture of the two authors, as participants in the US Antarctic Program's (USAP) Artists and Writers Program. Their quest was to explore Mount Erebus on Ross Island. As it happens, I met them in the cafeteria at McMurdo station in December 2016, just after I had come down the volcano at the end of my field season, and shortly before they went up. Given this encounter, I was all the more curious to read and review the fruits of their expedition and collaboration.

The first comment to make about the book concerns the backgrounds of the authors and the nature of their partnership. Lopes is a Senior Research Scientist at NASA's Jet Propulsion Laboratory and a specialist in planetary geology and remote sensing. In particular, she has studied moons of Jupiter and Saturn using data gathered by the Galileo and Cassini spacecraft, respectively. Carroll, on the other hand, is an artist and novelist with a penchant for the extraterrestrial. The outcome of their alliance is an engaging amalgam of polar history, comparative planetology, space art and expedition journal. It is richly illustrated in colour throughout, and I particularly appreciated Carroll's artwork depicting other worlds, inspired by the polar atmospheres and icescapes he observed.

Loosely, the book tells the authors' story of participation in the USAP; what lured them to 'The Ice'; and how what they saw helped them to imagine the geomorphology and geological processes of rocky or icy moons and planets throughout the Solar System. Chapter 1 reviews the history of polar exploration and scientific endeavours in Antarctica with vignettes on artists on the continent, polar transportation, the Antarctic Treaty, and the USAP. Though not so evident from the title of the book, the authors' central mission was to visit Mount Erebus, and Chapter 2 summarises the pioneering exploration, geodynamic setting, and present activity of this active volcano. Erebus is renowned for its perpetual lava lake, and comparison is

drawn with the extraordinary volcanism of Jupiter's moon, Io.

Chapters 3 to 5 chronicle the authors' journey South and their time at McMurdo station. To an extent, polar research outposts deal with some of the issues that are faced by extended human space missions, and Carroll and Lopes digress on the infrastructural needs of future scientific stations on Mars. Chapter 5 elaborates on selected avenues of the scientific research carried out by the USAP, including the Antarctic Search for Meteorites (ANSMET).

The authors are processed through McMurdo's field safety programmes and are now ready to head up Erebus. Chapter 6 recounts their journey to Lower Erebus Hut via an acclimatisation camp (to adjust to the altitude) at the head of the Fang glacier. They explore the upper flanks of the volcano, and consider the last decades of geological field missions led by Philip Kyle of New Mexico Tech. Of most interest to them on the mountain are extraordinary fumarolic ice towers that gently puff steam into the freezing atmosphere on the slopes of the summit crater. Typically, these chimneys crown fissures and caverns through which warm gases flow. The hydrothermal manifestations inspire Carroll and Lopes to imagine the nature of cryovolcanism on Saturn's moon, Enceladus. This theme of comparative planetology is developed further in the next Chapter, which introduces further icy worlds of the Solar System – Titan, Europa and Pluto – and considers analogies in landforms and processes that can be made with Antarctic geological and geomorphic expressions. Chapter 8 anticipates the future of space and Antarctic exploration and includes some splendid artworks by Carroll inspired by the wonders of Mount Erebus. The final Chapter collates assorted emails and journal entries to provide further insights into the authors' expectations and experiences.

In summary, this book relates the adventures of two individuals – one an artist and novelist, the other a planetary scientist – with a shared interest in understanding what terrestrial analogues might be able to tell us about the nature of geological forces that shape distant planets and moons. It is a very distinctive contribution to the polar canon, offering fascinating insights into planetary and terrestrial geology, as well as an informal narrative of a unique collaboration.

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