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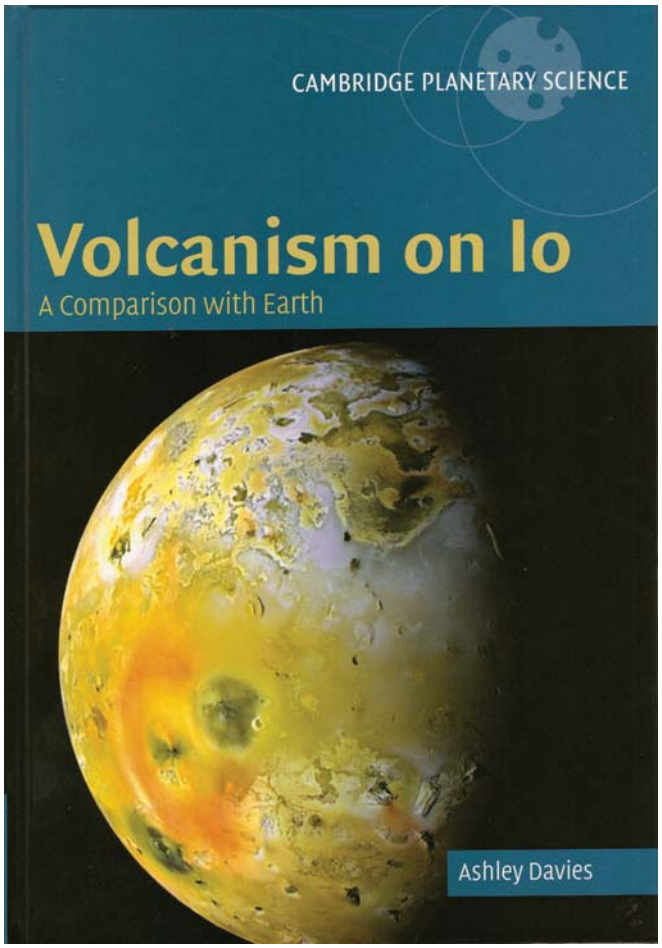
Book Review

Volcanism on Io: A comparison with Earth, by Ashley Davies. Cambridge: Cambridge University Press, 2007, 460 p., $133, hardcover (ISBN 978-0-521-85003-2)



Volcanism on Io: A comparison with Earth, by Ashley Davies of the Jet Propulsion Laboratory, is in the vein of other solar system science summary works that inevitably follow the end of major missions (and mark the beginning of long spans of time devoid of spacecraft visitations, in the case of the outer solar system). Several such works follow the end of the Galileo tenure in the Jovian system, such as *Jupiter: The planet, satellites, and magnetosphere*, edited by Bagenal, Dowling, and McKinnon, *Io after Galileo*, edited by Lopes and Spencer, and an upcoming Europa summary book. This book is dedicated to a single process, albeit the most prominent visually if not the dominant one operating on Io. Ashley Davies, a member of the Galileo NIMS Team and an active Io (and solar system) volcanology researcher since the mid-1980s, is well poised to pen this work.

It is fitting that the book begins with a quote from Peter Francis, one of the pioneering scientists who linked volcanism on Earth with that on other planets, and author of everyone's favorite book, *Volcanoes: A planetary perspective*. Francis's quote (p. 1) outlines the basics of planetary volcanism, and indeed, Davies also spends some time on the basics of volcanic eruptions throughout the solar system as well as delving into the details of volcanic eruptions on Io. This section on planetary volcanism, beginning with the formation of the solar system, is rather ambitious and necessarily lacking in breadth and depth, yet its inclusion bolsters its titular claim to draw solid comparisons between volcanism on Io and on Earth. Indeed, a driving reason for detailed studies of Io is found on p. 3: it "allows us to study eruptions that may have occurred in Earth's past."

Section 1, a background on the exploration of Io, is rich and detailed, and it is nice to have a strong chapter on modeling of lava flows (now in a single volume by Parfitt and Wilson, Blackwell). Davies's strength is in Section 3, on observing and modeling volcanic activity—research areas in which the author has been highly active for both Io and Earth for over the past decade. There is a nice "bestiary" of several major individual volcanoes. This includes descriptions of their eruption style fundamentals and is followed by expositions heavy on the details of his own work on multi-instrument and two- temperature fits to thermal emission data. The discussion of our current state of knowledge about one of the more puzzling and important sagas of Io research—the temperatures of the erupting lavas—is well done. This discussion of the ongoing temperature research is posed as a series of sections entitled "Re-evaluation," and concludes with the well-stated "ultramafic magmas may be present, but . . . are not expressly required to explain observations to date" (p. 174).

The style of the book is detailed yet fluid. Topics can be short and can lack a measure of connectivity, yet I cannot think of any that are missing. Figures and graphics are aptly chosen, especially the color plates. Some new sketches by the author illustrate well our collective vision of Io's surface and subsurface on a broad scale (e.g., p. 289).

It is too bad the book could not include the spectacular New Horizons spacecraft images and data, but that just illuminates the problem we face in publishing works in the rapidly evolving field of solar system research. This book

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would make for a nice companion to any upper-level volcanology or remote-sensing course text.

As Chapter 19 outlines, our wish list for future Io observations is long and distinguished. While Davies describes well our current understanding of volcanism on Io, he (and all who contributed to the research behind this book) has presented a picture that is likely to be wrong in many ways. There are still major aspects of the processes acting on and in Io that remain unknown, notably composition, magma transport mechanisms, and lifetimes of volcanic centers, all related to our understanding of tidal energy and the state of existence of the other Jovian satellites. As Davies states (p. 1), the discovery of volcanism at Io is "one of the most important results from NASA's planetary exploration programs." It is clear there is much more that awaits at Io.

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