

Book Review

“Mantle Convection for Geologists”, by Geoffrey F. Davis, Cambridge University Press, 2011; ISBN: 978-0-521-19800-4 (hardback)

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Understanding convection in the mantle is not an easy matter. The convection manifests itself both on a scale of millions of years for continental movement, and in the seconds of an earthquake or volcanic eruption. The rocks creep, break or flow, changing their state depending on the temperature and pressure. The physical background of the convection, taking place in the apparently solid mantle, is the main theme of the book by Geoffrey F. Davies, internationally recognized specialist from ANU, author of “Dynamic Earth: Plates, Plumes and Mantle Convection” in 1999, published by Cambridge University Press. This is a comprehensive volume, meant mainly for geophysicists. “Mantle Convection for the Geologist” is an attempt to explain convection in a more digestible way for geologists, using as small a dose of mathematics and physics as possible. The goal has been achieved, which does not, however, guarantee the book’s success on the geological market, since geology covers many fields of research and includes a variety of specializations. The surface expression of the convection in the mantle is continental and plate movement, the most spectacular effects being in the oceanic domains and mountain building. Thus, although the book is addressed to geologists *sensu lato*, I think researchers primarily dealing with global tectonics, paleogeography, petrophysics, geochemistry, as well as structural geologists and tectonicians will primarily benefit from it.

This intelligently written, slim and handy book will be an attractive volume for earth scientists from different disciplines, offering a concise but not oversimplified guide to the physics and fluid dynamics of mantle convection. The book begins with a short Introduction in Chap. 1. Chapter 2 explains the structure and composition of the planet Earth in global dimensions, pointing to the significance and importance of the ridge system in the topographic pattern of the earth. Chapter 3 demonstrates evidence for plate movement from seismology, magnetism and petrological studies. Chapter 4 explains the inevitability of convection for the sake of the earth’s thermal gradient, which makes the mantle viscous and yielding matter. The thermal gradient from the level of almost 3,900 °C down to the surface temperature exerts convection, which is described in more details in Chap. 5. In Chap. 6 the role of the lithosphere in mantle convection is explained; also a simple theory of mantle convection capable of predicting the velocities of the plates and seafloor topography is developed. It becomes clear for the reader that plate movements are obvious surface manifestation of the convection in the mantle.

The mantle plume and the flow they drive in the surrounding mantle, hotspot tracks, and swell heat and mass transport by the plume mode are explained in Chap. 7. It is stressed that no simple model can explain the irregularities and misfits in the plumes pattern observed, and thermochemically originated plumes may account for many of the regularities. Chapter 8 describes the pictures of mantle convection developed so far. Discussed are the role of the top and bottom thermal layers in driving the mantle convection and how these two layers behave and interact.

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Also, common misconceptions are presented, which have been disproved but still persist. Some other concepts, such as the rifting model of flood basalts, superplumes or small-scale convection, are also discussed.

Chapters 9 and 10 explore the implications of mantle convection, particularly for global tectonics and mantle chemistry evolution. The short Chap. 11 summarizes the geological implications of mantle convection.

The book includes three appendices (Exponential grow and decay; Thermal evolution details; Chemical

evolution details), a list of 243 references and a subject index.

Certainly, the book will take a valuable position on the geologist's library shelf, and for graduate students in the fields of geosciences, but it will also be a useful reference for physicists willing to learn about geology and geotectonics on a more global scale.

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