

***Mantle Plumes and Their Record in Earth History* by K. C. Condie, 2001: Cambridge University Press, 40 West 20<sup>th</sup> Street, New York, NY 10011-4211 USA; hardcover, US\$110, ISBN 0-521-80604-6; soft cover, US\$40 ISBN 0-521-01472-7., 306 pages.**

This book is a synthesis of much of the work on mantle plumes that has occurred over the past 10 - 15 years. As such, the information is current and relevant to research on the origin and effects of plumes. Half of the 700 plus cited references were published in or after 1995, making this book an excellent research reference. Additionally, the text is well designed for being a usable textbook for advance undergraduates and graduate students. In essence, this book is an expanded compilation of recent publications by Condie with the addition of introductory chapters that provide a review of mantle plume hypotheses and supporting data. Although the book is geared toward igneous geochemists and petrologists, it also addresses some sedimentary topics related to the effects of plumes.

The book contains nine chapters that cover most aspects of mantle plumes. The organization of the book follows a format of presenting the observational, geochemical, and experimental evidence supporting the existence of mantle plumes, followed by the more speculative hypotheses, including the role of plumes in the evolution of the earth. Chapter one presents an overview of the structure of plumes and the mantle. Chapter two discusses hotspots, including their tracks, geochemistry, and relationship to geoid highs and mantle upwellings. Chapter three covers large igneous provinces (LIPS), including those in the oceans, on the continents, and on Mars and Venus. Most of the major flood basalt provinces are discussed along with giant dike swarms and a few of the largest layered mafic intrusions. Chapter four provides a review of the generation and melting of mantle plumes and is a good compilation of the experimental, both analog and numerical, and observational evidence of their structure and behavior. Chapter five reviews the isotopic and trace element characteristics of basalts and what they reveal about mantle sources. The chapter ends with a summary of the latest models of mantle convection, mixing, and heterogeneity.

Chapters six through nine comprise the second part of the book that seeks to relate processes and events in Earth's history to mantle plumes. Chapter six investigates the possible role of mantle plumes in the growth of continental crust. Two processes are examined that might relate plume activity to the growth of continents. The first is accretion of plume created oceanic plateaus, and the second is magmatic underplating during active continental rifting. Chapter seven discusses greenstone belts and komatiites and what they reveal about the geochemical and thermal nature of the Archean mantle. The last portion of chapter seven raises the question of whether mantle plumes were more common during the Archean and sets up the discussions for chapter eight. Chapter eight starts to pull together all the evidence concerning plumes to address the possibility of superplume events. Superplume events are the occurrence of multiple plumes that mostly originate from the D" layer near the core-mantle boundary over a time period less than 100 Ma. The proposed mechanism that initiates a superplume event is an episodic and catastrophic slab avalanche through the 660 km mantle discontinuity. This hypothesis is quite speculative, but Condie does a good job of discussing the relevant data and assumptions. Chapter nine is the last chapter in the book and it takes a broad look at the possible effects of mantle plumes on the ocean, atmosphere, and biosphere systems. The first portion of the chapter examines the consequences of mantle plumes on the carbon cycle, sea level, global warming, the biosphere, and sedimentary systems. This is the area which will be of greatest interest to sedimentary geologists, particularly those interested in strontium isotopes in marine carbonates,

phosphates, black shales and stromatolites. The remaining portion of chapter nine examines the geologic history of these earth system and how that history may indicate the occurrence of superplume events in the Earth's past.

To conclude, this book is an excellent compilation of data and hypotheses related to mantle plumes which are drawn from a wide variety of geologic disciplines, including sedimentary geochemistry. For the student or researcher who is new to the subject, the book provides an excellent review of terms and concepts which are generally used with little or no explanation in journal articles. This is particularly useful to the sedimentary geochemist who wishes to delve deeper into the igneous mechanisms behind some secular geochemical cycles (e.g., strontium). For the researcher whose work involves plumes this book provides a handy and concise reference, including a currently up to date and exhaustive reference list.

Kyle Mayborn  
Department of Geology  
Western Illinois University  
Macomb, IL 61455