

Plates, Plumes, and Paradigms

edited by Gillian R. Foulger, James H. Natland, Dean C. Presnall, and Don L. Anderson

This beautiful compendium of work on hotspot volcanism documents the development, current state-of-play, and future prospects of all branches of the subject. It contains extensive and indispensable reference resources in the form of hotspot, tectonic, volcano and tomographic maps and cross sections of Earth. Some chapters outline the history of the plume hypothesis and other theories for the genesis of hotspots, and several provide tutorials that will be valuable to students and cross-disciplinary scientists. Other chapters present innovative models and theories for individual localities, volcano genesis processes, and related global observations. Many of these include subject reviews, making them doubly valuable to specialists and non-specialists alike. The book is fully inter-disciplinary, encompassing geophysics, geochemistry, noble gases, heat,

temperature, tectonics, petrology, mantle dynamics, impacts, and syntheses reconciling several branches of earth science. Included are chapters that advocate the plume model and ones that advocate alternative models. The book will enjoy a long lifetime of usefulness and functions as a reference work for students, scholars, and informed lay people. It is equally valuable for supporting advanced undergraduate or post-graduate courses and research scientists working at the forefront of hotspot science. It is an essential addition to the bookshelves of every science library, earth science teacher, and research scientist who aspires to understand the frontiers of this exciting subject. With over 150 color plates, it makes a beautiful addition to the library of anyone fascinated by volcanoes—one of nature's most exciting and extraordinary phenomena.

> SPE 388, indexed, ISBN 0-8137-2388-4. Note: in press at this time.

GSA Sales and Service

P.O. Box 9140, Boulder, CO 80301-9140, USA +1.303.357.1000, option 3 +1.888.443.4472 fax +1.303.357.1071 (24-hour line)



www.geosociety.org/bookstore

This beautiful compendium of work on hotspot volcanism documents the development, current state-of-play, and future prospects of all branches of the subject. Alongside extensive and indispensable reference resources, subject reviews, innovative models and theories for individual localities, the volume also contains philosophical and historical material. This book will enjoy a long lifetime of usefulness on your shelf.

Contents

Preface

Scope of the Volume, the Review Process, and Acknowledgments

The Global Picture

- 1. Global tectonic maps
- 2. Global seismic structure maps
- 3. Global hotspot maps
- 4. Scoring hotspots: The plume and plate paradigms
- 5. Evaluation of radiometric ages pertaining to rocks hypothesized to have been derived by hotspot activity, in and around the Atlantic, Indian, and Pacific Oceans
- 6. Ages of seamounts, islands, and plateaus on the Pacific plate

History of the Plume and Plate Hypotheses

- 7. The origins and early trajectory of the mantle plume quasiparadigm
- 8. A brief history of the plume hypothesis and its competitors: Concept and controversy

Seismology

- 9. The robust aspects of global seismic tomography
- 10. What can seismology say about hotspots?
- 11. Shear wave splitting around hotspots: Evidence for upwelling-related mantle flow?
- 12. The deep mantle thermo-chemical boundary layer: The putative mantle plume source

Heat and Temperature

- 13. Carbonate-rich melts in the oceanic low-velocity zone and deep mantle
- 14. Primary magmas at mid-ocean ridges, "hotspots," and other intraplate settings: Constraints on mantle potential temperature
- 15. Komatiites in the plume debate
- 16. Hotspots: A view from the swells
- 17. Sedimentary evidence for moderate mantle temperature anomalies associated with hotspot volcanism
- 18. Heatflow and mantle convection in the triaxial Earth

Ocean Island Basalt Geochemistry

- 19. The streaky-mantle alternative to mantle plumes and its bearing on bulk-Earth geochemical evolution
- 20. Mass flux across the lower–upper mantle boundary: Vigorous, absent, or limited?
- 21. Models for noble gases in mantle geochemistry: Some observations and alternatives

Continental Melting Anomalies

- 22. Repeated, synchronous magmatism within Africa: Timing, magnetic reversals, and global tectonics
- 23. The Hoggar swell and volcanism: Reactivation of the Precambrian Tuareg shield during Alpine convergence and West African Cenozoic volcanism
- 24. Giant dikes, rifts, flood basalts, and plate tectonics: A contention of mantle models
- 25. Compositional variations of Plio-Quaternary magmatism in the circum-Tyrrhenian area: Deep versus shallow mantle processes
- 26. No plume, no rift magmatism in the West Antarctic Rift
- 27. Continental magmatism caused by lithospheric delamination
- 28. Malani magmatism: An extensional lithospheric tectonic origin
- 29. From Deccan to Réunion: No trace of a mantle plume
- 30. Age-progressive volcanism of the Oregon High Lava Plains: Overview and evaluation of tectonic models
- 31. Thermal models, magma transport, and velocity anomaly estimation beneath southern Kamchatka

Oceanic Melting Anomalies

- 32. Plate tectonic processes in the South Atlantic Ocean: Do we need deep mantle plumes?
- 33. Paired basement ridges: Spreading axis migration across mantle heterogeneities?
- 34. Stress-induced seamount formation at ridge-transform intersections
- 35. Genesis of the Iceland melt anomaly by plate tectonic processes
- 36. Fixity of the Iceland "hotspot" on the Mid-Atlantic Ridge: Observational evidence, mechanisms, and implications for Atlantic volcanic margins
- 37. North Atlantic topographic and geoid anomalies: The result of a narrow ocean basin and cratonic roots?
- Crustal formation and magma genesis beneath Iceland: Magnetotelluric constraints
- 39. Fissure control on volcanic action in the Pacific
- 40. Modeling impact volcanism as a possible origin for the Ontong Java Plateau
- 41. What built Shatsky Rise, a mantle plume or ridge tectonics?
- 42. On the shallow origin of hotspots and the westward drift of the lithosphere
- An undeformed ophiolite in the Alps: Field and geochemical evidence for a link between volcanism and shallow plate tectonic processes

Planetary Volcanism

- 44. Plumeless Venus preserves an ancient impact-accretionary surface
- 45. Venusian craters, size distribution, and the origin of coronae
- 46. Impact craters as indicators of tectonic and volcanic activity in the Beta-Atla-Themis region, Venus
- 47. Large topographic rises, coronae, large flow fields, and large volcanoes on Venus: Evidence for mantle plumes?

Index

