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BOOK REVIEW

OPHIOLITES AND OCEANIC CRUST: NEW INSIGHTS FROM FIELD STUDIES AND THE OCEAN DRILLING PROGRAM Y. Dilek, E. Moores, D. Elthon, and A. Nicolas, Eds. GSA Special Paper 349, 2000, 552 p. $84.00 for GSA members, $105 nonmembers.

Every few years the people who work on ophiolites and the people who work on oceanic crust decide that it is time to get together and compare notes. The ophiolite people are primarily but not exclusively traditional "land" geologists who combine geologic mapping with structural, petrologic, and geochemical studies; the ocean crust people are primarily (but not exclusively) marine geologists and geophysicists who drill and dive on the real thing. There is some overlap of people who do both, but since most do either one or the other, these get-togethers are a critical reality check for everyone.

GSA Special Paper 349 "Ophiolites and Oceanic Crust: New Insights from Field Studies and the Ocean Drilling Program," presents results from a Penrose Conference on this topic convened by the editors in 1999 in northern California. In Penrose tradition, the meeting combined keynote speakers, short oral presentations, and poster sessions with extended discussion sessions, moderated and summarized, on the full gamut of topics central to this comparison. The Special Paper presents a good representation of the topics and areas that were central to these discussions, and in many ways captures the true spirit of that meeting.

There are 39 chapters organized into six sections. The first section, *Ophiolites, ocean crust, and global tectonics*, looks at the big picture with several papers that reinforce the paradigm of ophiolites as onland oceanic crust formed at mid-oceanic spreading centers. This conclusion is argued most forcefully in the lead paper by Moores et al., who suggest a model in which the chemical signature of an ophiolite is contingent on the prior history of the asthenosphere it was derived from, and in the paper by Sturm et al., who show that arc-like geochemical signatures can leak into subducting crust along slab windows. Rampone and Piccardo show that, in the Apennines, basalts and peridotites represent distinct mantle reservoirs of different ages that formed during the rifting of continental crust, while Fryer et al. examine the significance of serpentine mud-volcanoes in the Mariana forearc, a classic area that may represent our best analogue for where most ophiolites form.

Subsequent sections include *Oceanic lower crust and upper mantle; Structure and physical properties of upper oceanic crust; Hydrothermal processes; Pacific rim ophiolites;* and *Ophiolites of the Iapetus, Rheic-Pleionic, Neotethyan, and Indian oceans*. The first three of these sections focus on processes of ocean crust formation and evolution, based on detailed studies of oceanic crust, ophiolites, or both. There are several review papers that summarize current knowledge—my favorites are those that look at hydrothermal processes (papers by Humphris and Tivey, Kelly and Früh-Green, Manning et al., Alt and Teagle, and Gillis and Bannerjee), largely because that is an area where much has been learned over the last decade. There is also an excellent review of the Hole 735B gabbros by Robinson et al., which represents our best view to date of in situ lower oceanic crust. Bedard et al. review their concept of the lower oceanic crust as a reactive filter, driven by the process of syntexis (assimilation and reaction of new primitive magmas with previously intruded cumulates).

The last two sections contain a range of papers that describe new ophiolites in exotic locales (e.g., Iran, the Urals, Timor), present new data on some old ophiolite friends (e.g., Bay of Islands, western Greece, Maquarie Island), or present new views of ophiolites whose origin and significance have been debated for years (e.g., Oman, Caledonides, and five papers on ophiolites in California). Space prohibits a complete discussion of all the papers included in these sections, but all present the latest (and in some cases, only) data on their respective locales.

Should you buy this book? If you work on ophiolites or oceanic crust, you probably already have (I bought mine long before being asked to do this review). If you work in peripheral areas and need to know what's going on in oceanic crust or ophiolites these days, you will also want to read it. Some of the individual papers are also a great resource for students who are interested in more limited aspects covered here, such as magmatic or hydrothermal processes.

I do not agree with the conclusions of some of the papers, and readers who are unfamiliar with the gang warfare of ophiolite studies need to be aware that many people who think that ophiolites make good analogues for ocean crust also conclude that most ophiolites do not *represent* oceanic crust formed at mid-ocean ridge spreading centers. This consensus is not immediately apparent, and readers should be aware that significant controversy still exists and is not resolved here. . . but this did not stop me from buying my copy early.

JOHN SHERVAIS
Utah State University
4505 Old Main Hill
Logan, Utah 84322-4505

STABLE ISOTOPE GEOCHEMISTRY by John W. Valley and David R. Cole, Eds., Reviews in Mineralogy & Geochemistry (2001) vol. 43, 662 p. Mineralogical Society of America, Washington, D.C. $32 ($24 for MSA members).

This volume was prepared for a like-titled short course that took place at the 2001 Geological Society of America annual meeting in Boston. The objective of the course was to review

select topics within the field of stable isotope geochemistry that the organizers felt had emerged or greatly advanced since 1986, the year of publication of an earlier volume in the Reviews series that focussed on stable isotopes (*Stable Isotopes in High Temperature Geological Processes*. J.W. Valley, H.P. Taylor Jr., and J.R. O'Neil, Editors, Reviews in Mineralogy, vol. 16).

Stable Isotope Geochemistry consists of 13 separate chapters authored or coauthored by 17 leading researchers. The chapter titles are: (1) *Equilibrium Oxygen, Hydrogen and Carbon Isotope Fractionation Factors Applicable to Geologic Systems*, (2) *Rates and Mechanisms of Isotopic Exchange*, (3) *Fractionation of Carbon and Hydrogen Isotopes in Biosynthetic Processes*, (4) *Stable Isotope Variations in Extraterrestrial Materials*, (5) *Oxygen Isotope Variations of Basaltic Lavas and Upper Mantle Rocks*, (6) *Stable Isotope Thermometry at High Temperatures*, (7) *Stable Isotope Transport and Contact Metamorphic Fluid Flow*, (8) *Stable Isotopes in Seafloor Hydrothermal Systems*, (9) *Oxygen- and Hydrogen-Isotopic Ratios of Water in Precipitation: Beyond Paleothermometry*, (10) *Isotopic Evolution of the Biogeochemical Carbon Cycle During the Precambrian*, (11) *Isotopic Biogeochemistry of Marine Organic Carbon*, (12) *Biogeochemistry of Sulfur Isotopes*, and (13) *Stratigraphic Variation in Marine Carbonate Carbon Isotope Ratios*.

Five of the chapters provide updates and expansions of topics that were treated in Reviews in Mineralogy vol. 16. These include chapters 1 and 2, which cover the state of knowledge of equilibrium fractionation factors and of the rates and mechanisms of isotope exchange, and chapters 4, 5, and 6, which cover carbon, hydrogen, nitrogen, and oxygen isotopes in extraterrestrial materials, oxygen isotopes in basaltic and mantle rocks, and carbon- and oxygen-isotope thermometry of metamorphic rocks, respectively. New to vol. 43 are treatments of isotope behavior in biogeochemical processes (chapters 3 and 10–13), paleoprecipitation (chapter 9), metasomatic events associated with contact metamorphism (chapter 7), and the global carbon and sulfur cycles (chapters 10–13). Major topics that were covered in Vol. 16 and are not updated in Vol. 43 are isotopic characteristics of natural waters and fluids, oxygen and hydrogen isotope variations in felsic igneous rocks, and stable isotopes in hydrothermal ore-forming systems, although chapter 8 in vol. 43, which contains much new data, reviews hydrothermal systems associated with seafloor spreading ridges.

Stable Isotope Geochemistry will be an important read for those with broad interests in stable isotope geochemistry, and will provide state-of-the-art reviews and perspectives for those with research interests that fall within the chapter topics. One hundred ten of the 662 pages are filled with up-to-date references. The scientific range of the volume is broad enough that one wonders about the underlying rationale for the short course. It is clear from the preface that the implementation of new analytical technologies was a criterion for inclusion of topics and authors. However, whereas new methods such as microbeam analysis and compound-specific analysis of organics have been key for some of the reviewed research topics, other topics appear to have advanced mostly through application of long-established methods. There is also a range of perspectives among the authors of the different chapters with some devoting considerable page space to explaining the benefits of newer analytical methods over established ones, and others making little or no mention of developments that were true watersheds in the field, perhaps the most notable being the advent of continuous-flow isotope ratio monitoring mass spectrometry. In a few spots authors are overzealous in setting up "conventional" techniques as straw men to be knocked down by the "modern" or "best" methods. While there is no question that recent analytical advances have been impressive and important, it is also a fact that many of the tried-and-true methods remain extremely useful and have distinct advantages in some applications. It would be very unfortunate if readers were to conclude that data obtained by fluorination in nickel vessels or by combustion in a vacuum line, to mention just two examples of tried-and-true techniques, are somehow inherently unreliable.

Minor problems aside (some typos, switched figures on p. 307 and p. 309, missing text on p. 320; an errata sheet is provided for chapter 2), *Stable Isotope Geochemistry* is a terrific and extremely useful book. The editors, both of whom carried heavy writing loads, deserve to be congratulated, as do the other 15 authors. Volume 43 is a steal for the price, enough so that buying multiple copies for office, home, laboratory, etc. might make sense. I myself have managed to accumulate three and am happy to have them all.

CRAIG A. JOHNSON
U.S. Geological Survey
Box 25046, MS 963
Denver, CO 80225