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BOOK REVIEW

PALEOALTIMETRY: GEOCHEMICAL AND THERMODYNAMIC APPROACHES, editor Matthew J. Kohn. (2007) Reviews in Mineralogy and Geochemistry, vol. 66, 278 p., Mineralogical Society of America, Chantilly, Virginia. ISBN: 978-0-939950-78-2.

The topographic configuration of the continents plays a central role in the many facets of the Earth sciences. However, despite the utility of information concerning the height of various portions of the Earth's surface in the past, reliable and quantitative reconstructions of paleoelevation or paleorelief have been sadly lacking. In the past 10 years or so this situation has begun to be turned around with the development and refinement of several new geochemical and thermodynamic techniques that are nicely reviewed in "PALEOALTIMETRY: Geochemical and Thermodynamic Approaches" volume 66 of the *Reviews in Mineralogy and Geochemistry* series. Despite this volume being slightly biased toward the insights one can gain into paleoaltimetry using oxygen isotopes, which partly reflects the value of such studies, the wide range of other available tools are discussed in some detail, and they are generally well illustrated with examples. Marin Clark puts the significance of paleotopographic reconstructions into a tectonic context in the opening chapter. Four chapters dealing with oxygen-isotope based paleoaltimetry then follow this introduction. The theoretical basis of these techniques is well summarized by David Rowley in the second chapter. This is then followed by a review of oxygen-isotope paleoaltimetry from pedogenic carbonates (by Jay Quade and others), silicates (by Andreas Mulch and Page Chamberlain), and from fossils (by Matthew Kohn and David Dettman). Because these four chapters all deal with oxygen isotopes there is some repetition of theory, but by splitting this topic into four parts the required amount of time is given to the pros and cons of each archive. The next two chapters deal with paleobotanical methods, the first (by Herbert Meyer) uses paleotemperature gradients reconstructed from fossil plant physiognomy or from the environmental conditions of the fossils nearest living relative. The second (by Chris Forest) also uses fossil plant physiognomy, but rather than reconstructing temperature gradients, the more robust thermodynamic approach is used.

The methods described in these opening chapters are those most frequently applied in the literature. With the exception of the clumped isotope technique described in Jay Quade's chapter they all suffer from the same weakness—which is the difficulty of separating a signal relating to changing global climate from one relating to local surface uplift. The next four chapters in the volume describe techniques that do not involve a climatic component. The first of these by Dork Sahagian and Alex Proussevitch deals with the novel approach of using bubble size in vesicular basalts as a means to estimate air pressure and hence elevation at the time of basalt emplacement. This chapter is followed by an introduction to using changes in stomatal frequency over altitudinal gradients as a means to estimate paleoaltimitry (by Lenny Kouwenburg and others). The final two chapters both use chronological approaches. Peter Reiners discusses in some detail how low temperature thermochronology can be used to investigate the landscape and Catherine Riihimaki and Julie Libarkin briefly introduce the potential of cosmogenic isotopes as paleoaltimetric proxies.

It is apparent from reading this volume that, in common with many other proxy approaches, each technique has its weaknesses, but it is clear that the future lies in the multi-proxy approach that is now possible. This latest volume in the RiMG series, like many of the volumes that preceded it, does a great job summarizing the state of play in the new topic of paleoaltimetry and is a must see for anyone interested in this rapidly expanding field.

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