Isotopes in Environmental and Health Studies
Vol. 46, No. 4, December 2010, 506–507

Taylor & Francis
Taylor & Francis Group

Book Review

Radiogenic isotopes in geologic processes, by S.V. Rassakov, S.B. Brandt and I.S. Brandt, Springer Science+Business Media B.V., Dordrecht, 2010, 306 pp., 107 (Germany), ISBN 978-90-481-2998-0.

The authors – experienced scientists from the Institute of Earth Crust of the Siberian Branch of the Russian Academy of Sciences – jumped at the chance to present their rich knowledge about radiogenic isotopes to a wider circle of English speaking geoscientists worldwide. A former volume about this topic was edited in Russian in 2006 and was also reviewed in this journal (Vol. 43, Issue 1, p. 82; 2007).

The Springer book at hand, however, is extended in pages and updated by global references. It should be noted that the authors Sergei Brandt and Sergei Rassakov pay tribute to their co-author Ivan Brandt who deceased.

The authors follow the principle to use a basic approach and to apply secondary investigations and examples. To understand natural isotopic systems they point to 'a deliberate selection in geological processes of the main and secondary effects'. This red thread runs through the book to link basic phenomena with examples from the authors' and scientific community's research. This means that basic knowledge and principles are explained in the first three chapters as 'Theory and Experience' (1), 'Geochronometric Models' (2), and 'Principle Geochronometric Isotope Systems' (3).

In the following chapters, the authors elaborate on the behaviour of radiogenic isotopes in geological processes and their use for geochronology. They emphasise the K–Ar system and develop its application for age dating and investigation of detailed geological processes in different compartments.

Before coming to the argon distribution within the solid Earth crust, two basic reservoirs are considered: the atmosphere (4) as accumulation space of argon along the Earth history, and minerals (5) which serve as hosts for radiogenic argon, but are very sensitive systems concerning the argon loss by low-temperature diffusion processes. Here, the authors introduce the α-factor which describes the argon release, and its application for dating of geological events. In laboratories, argon is yielded by thermal releasing, where as in nature, thermal events may change the radiogenic argon isotope composition causing problems for the temporal reconstruction of geological processes. The different behaviour of the radiogenic argon isotopes during such procedures, the kinetics of diffusion, peculiarities of the Ar–Ar-spectra are reported in detail in Chapters 6 and 9. They are proved by theoretical considerations of argon release from model-like geological formations such as cooling dikes (7) and exocontact zone of magmatic bodies (8). These model-like theoretical considerations underline the authors' expertise in the field of K–Ar dating and radiogenic argon isotopes.

ISSN 1025-6016 print/ISSN 1477-2639 online
DOI: 10.1080/10256016.2010.519124
http://www.informaworld.com

Starting with Chapter 10 (Early Earth), the reader is introduced to several methods for dating early solid systems (U–Pb, Rb–Sr, K–Ar, and others) in the Solar system (i.e. meteorites) and on the Earth (Priscoan and Archean crusts). Moreover, the authors consider the application of radiogenic isotopes on dating problems and peculiarities of remarkable transitions in the Phanerozoic era of our planet: the Vendian–Cambrian, the Permian–Triasic, and the Cretaceous–Tertiary transitions (11). The use of radiogenic isotopes in dating the magmatic evolution in the Late Phanerozoic of Asia (12), North America and Northeast Africa (13) is discussed explicitly in numerous geological examples of these regions. At the end of each of the application-oriented Chapters 11–13, which comprise about one third of the book, the authors sum up the results concluded from the examples. This gives the reader a good overview and conclusion to the geological processes discussed in detail within the chapters.

Difficulties in dating of ore deposits by radiogenic isotopes arise from the processes occurring during ore formation. Here, the authors point to the application of lead isotopes in separated lead evolved from Th, U–Pb isotope system (14). They discuss the Concordia–Discordia model explicitly, and interpret lead isotope data from the Siberian Craton near their home study area at the Lake Baikal.

Forty pages of references and a 16-page index complete the well-structured English edition. Moreover, numerous well outfitted figures, tables, and equations lead the reader clearly through the content. In the preface, the authors mention among other things that the book should help students (hopefully not only of the Irkutsk State University) to understand the application of radiogenic isotopes in geological processes.

The book can be warmly recommended to young and senior scientists starting in dating geological processes as well as already engaged in this field of geological sciences.

Gerhard Strauch
Helmholtz Centre for Environmental Research, UFZ,
Leipzig,
Germany
gerhard.strauch@ufz.de