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Editorial

Minerals, rocks, and mountains: Linking petrology, geochemistry, and geochronology

1. Introduction

Multiple records of the Solid Earth's (SE) processes and their interaction with the hydrosphere, biosphere, and atmosphere have been preserved in terrestrial materials in various scales ranging from single minerals, rocks to mountain belts. Decoding those records from such materials is one of the most fundamental but rather critical approaches to reveal the physical phenomenon of the Earth's system. By studying them geologically (*sensu lato*), we can uncover the past history of various SE processes and their changes. For instance, mountain building processes with crustal deformation, uplift, and erosion/denudation lead us to understand the basic principles of the Earth's dynamics. Moreover, processes which alter the Earth's surface topography and subsequently change the global climates bring new tasks that Earth scientists have to solve interdisciplinary in the near future.

This special issue is the outcome of the International Symposium "minerals, rocks, and mountains: linking petrology and geochemistry" held at the Japan Geoscience Union (JpGU) Annual Meeting 2011, where 16 papers were presented; the session aimed at exchanging ideas among international geoscientists applying different approaches, tests, and challenges on problems related to the themes.

In response to call for submission of papers for the special issue, six articles were contributed from the authors/authors groups who have presented their research at the International Symposium. In addition, one review article, presented at the International Symposium "Misasa-IV" held at Kurayoshi, Japan in 2012 (organized by ISEI, Okayama University) was included. The remaining three articles were contributed from authors working on the Himalayan metamorphic belt whose work was also related to the topic of the special issue.

The special issue "minerals, rocks, and mountains: linking petrology and geochemistry" contains research papers from different geological locations across the globe. We hope that this volume provides an opportunity for the earth science community as well as common citizens to witness the results related to the mountain building processes, evolution and modification in the Earth's crust and mantle, and the human health interaction with various earth materials.

2. Contributions included in this issue

The first paper, by Shah et al. (2012), reports on the origin and tectonic significance of millipede inclusion trail microstructures preserved in garnet porphyroblasts of typical Barrovian-type schist from the Swat region of the Himalayas in Pakistan. The authors present two possible kinematic models i.e. (1) bulk coaxial shortening and (2) progressive simple shear. They report on poly-phase deformation history from the inclusion trails within the garnet porphyroblasts.

Wilke et al. (2012) report on apatite fission track and apatite and zircon (U–Th)/He ages from the high- and ultra high-pressure rocks of the Kaghan Valley, Pakistan. The apatite fission track ages range between 24.5 ± 3.7 and 15.6 ± 2.1 Ma and apatite (U–Th)/He ages range between 21.0 ± 0.6 and 5.3 ± 0.2 Ma. Based on their apatite fission tack ages, authors discuss the cooling history and exhumation processes of these deeply-subducted high-grade metamorphic rocks.

Siddiqui et al. (2012) present a geological, petrological, and geochemical study of volcanic rocks from the Raskoh arc, Balochistan, Pakistan. They consider this arc as an accretionary complex which formed in the Early to Late Jurassic. The arc consists of basaltic to andesitic lava flows and volcaniclastics with subordinate sedimentary rocks. Based on major, trace, and rare earth element geochemistry, authors suggest these volcanics as oceanic island arc tholeiites whose parent magma was generated by a 20–30% melting from a depleted mantle source. Based on their study, they propose that the arc formed due to an intra-oceanic convergence in the Ceno-Tethys during the Late Cretaceous.

Khan et al. (2012) present a petrological, geochemical, and geochronological study of granites from the Nagarparker area, Pakistan. The authors discuss and compare their results with the granites of the Seychelles islands (SI) and the Malani Igneous Suite (MIS) of the Indian peninsular shield. They interpret that those granites are post-orogenic A2-type which were formed possibly by partial melting of the island arc crust in a rift-related within-plate tectonic setting. From the similarities in their age ca. 700–1100 Ma with the granites of the SI and MIS, the authors suggest that they were once part of the Rodinia before the supercontinent rifted in Neoproterozoic.

Miura et al. (2012) revisit the structural classification of podiform chromitites. They report two types of podiform chromitite, concordant and discordant from the mantle section of northern Oman ophiolite along Wadi Hilti. They present a comparison between the two types of chromitites on the basis of geochemistry, inclusion phases, and micro-textures and discuss their origin. They interpret that concordant chromitite cannot be formed from discordant simply by metamorphic conversion because the former is of deep magmatic origin whereas the latter one is of shallow magmatic origin.

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Fukui et al. (2012) report on the K–Ar age of the Tia Complex in the southern New England Fold Belt. They discuss that the complex is a poly-metamorphosed Late Paleozoic accretionary complex and it consists mainly of high-P/low-T type metamorphic rocks associated with granodioritic plutons (Tia granodiorite). They report on white mica and biotite K–Ar ages which distinguish Carboniferous subduction zone metamorphism and Permian granitic intrusions. The white mica ages become younger from the lowest-grade zone (339 Ma) to the highest-grade zone (259 Ma). Based on the available geological data and geochronological study the authors postulate a model of the eastward rollback of a subduction zone in the Early Permian.

Osozawa and Wakabayashi (2012) describe exhumation and deformational events recorded in the Triassic blueschist facies metamorphic rocks (Tomuru Formation) of the subduction complex of the Ryukyu arc, Ishigaki-jima, Japan. Authors present deformational features (D1 and D2) related to the subduction of the arc, their undergoing into blueschist facies metamorphism, and the possible early stages of their exhumation. They interpret that D1 structures are related to subduction, blueschist facies mineral growth, and possibly the early stages of exhumation. D2 structures, represented by several anticlines with a number of parasitic overturned folds, appear to reflect the last stage of exhumation.

Osozawa et al. (2012) report on a geological and petrographic study of the early Cretaceous granitic plutons which have been intruded into the Kitakami zone, northeast Japan. The southern and northern regions of these plutons consist of a forearc basin and accretionary complex rocks. All country rock of the Kitakami zone exhibit prominent pressure-solution cleavage and associated folds formed during shortening with a small component of sinistral shear, whereas most plutons show only igneous textures.

Tomonaga et al. (2012) present noble-gas concentration profiles in the water column and in the sediment pore water of the Earth's largest soda lake: Lake Van (eastern Anatolia, Turkey). They report that the concentrations of noble gases (in particular Ar, Kr, and Xe) in the water body deviate significantly from the expected equilibrium concentrations from the in situ temperature and salinity of seawater. They suggest that the specific chemical composition of the water of the soda lake is responsible for the observed deviations. Their measurements allow the identification and quantification of salinity factors which can be applied to correctly calculate the noble-gas equilibrium concentrations for the lake. These salinity factors provide a solid and robust empirical basis for the interpretation of noble-gas concentrations measured in the sediment pore water of Lake Van in terms of palaeosalinity and palaeotemperature.

The final paper of this special issue, by Ernst (2012), is a review article on the naturally occurring earth materials. In this paper the author, based on investigations by many earlier workers (references cited in the original article) and his observations, summarizes some of the natural impediments to enhanced health and longevity. The author makes an attempt to encourage closer global research ties and fruitful collaborations between Earth materials scientists, and public health workers and/or epidemiologists in order to increase the quality and length of human life.

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