Island Arc

Island Arc (2014) **23**, 251–253

Preface

Petrogenesis and chemogenesis of oceanic and continental orogens in Asia: Current topics, Part I

In the last two decades, understanding of both igneous and metamorphic petrogenesis has been progressed. Many new research concerning Asia (*sensu lato*) has begun to share new knowledge and perspectives in a wide geologic context. This thematic issue of Island Arc entitled 'Petrogenesis and chemogenesis of oceanic and continental orogens in Asia: Recent progress', is dedicated to examples from mainly northeast to southwest Asia, including the Sanbagawa metamorphic belt (Japan), the Dabie–Su-Lu orogenic belt (China), Oman ophiolite, and Rio Grande rift zone. The contributions shed light on controversial issues related to the role of fluid activity, modulation of the pressure–temperature–time paths in high- and ultrahigh-pressure rocks, the prograde and retrograde/decompression paths preserved in zoned minerals, the formation and recrystallization of minerals during crustal and mantle evolutionary processes, and the impact of regional and local deformation preserved within single grain of minerals and in mineral aggregates. These topics enhance our understanding on the geodynamic evolution of continental and oceanic orogenic belts.

The thematic issue was planed after the international symposium '**Collision, subduction and metamorphic processes**' which was held at Makuhari Messe, Chiba, Japan, in May of 2013.

The international session focused on magmatic, metasomatic and metamorphic processes related to the subduction of oceanic slabs and the collision of continents. Contributions were dominantly multi-disciplinary and involved structural geology, geophysics, petrology, geochemistry, and experimental petrology/mineral physics, related to major orogenic belts in Asia, in particular, and those world-wide in general. Specific topics included the linkage between hydration and dehydration within subduction channels, the recycling of continental and oceanic crust through the mantle, deformation mechanisms within subduction/collision regimes, formation and exhumation of high- and ultrahigh-pressure metamorphic rocks, and the correlation between field data and laboratory experiments in geosciences. In total 15 studies were presented and were called for publication in this special issue.

In response to the call, five articles among the presented papers have been selected for publication in Part I (this volume) of the special issue. Remaining manuscripts of the special issue will be published in the forthcoming volume as Part II. The special issue contains original research papers from different geological locations in Asia and related regions. We believe this volume provides an opportunity for the earth scientists to witness the recent progress on oceanic and continental orogenic settings and their geodynamic interpretations.

CONTRIBUTIONS INCLUDED IN THIS ISSUE

The first paper, by Wei and Tian (2014) titled 'Modeling of the phase relations in high-pressure and ultrahigh pressure lawsonite-bearing eclogites', presents a general overview of thermobarometric results and software-based modelling of phase relations in high-pressure (HP) lawsonite eclogites, lawsonite blueschists and ultrahigh-pressure (UHP) eclogites. The authors used a wide range of geochemical data from HP and UHP rocks and modelled pseudosections on the basis of average mid-ocean-ridge-basalt (MORB) composition with excess quartz and H_2O. From the MORB composition, they deduced the occurrence of major mineral phases (e.g. glaucophane, garnet, omphacite, lawsonite, phengite, quartz with minor talc) that have a major role during the metamorphic evolution of HP eclogites. They explain the effect of pressure and temperature on the chemical composition of specific minerals that is advantageous for the interpretation of a metamorphic P-T trajectory. For example, a metamorphic temperature increase correlates with an increase in the pyrope component in garnet. In contrast, with increase in pressure gradient, a decrease in the grossular component was observed. Similar observations

doi:10.1111/iar.12097

and interpretations were made when the authors modelled the phase relations or pseudosection using Si-content in phengite as previously proven in high-pressure experiments. They also found that the grossular component in garnet increases with increasing pressure and temperature conditions. They demonstrated equilibrium phase modelling as a powerful tool to document metamorphic evolution of lawsonite-bearing eclogites.

The second paper of the special issue by Kouketsu *et al.* (2014), titled 'Composite metamorphic history recorded in garnet porphyroblasts of Sambagawa metasediments in the Besshi region, central Shikoku, Japan' uses the compositional zoning of garnet, mineral inclusions, and the residual pressure of quartz inclusions in garnet, they assigned a prograde eclogite facies stage followed by a decompression and hydration stage of epidote–amphibolite facies stage. Their new findings suggest eclogite facies rocks to be widely distributed as a coherent body in central Shikoku of the Sanbagawa metamorphic belt, and challenge the tectonic block hypothesis of the Sanbagawa eclogites.

The third paper is by Fukuyama *et al.* (2014), titled 'The formation of rodingite in the Nagasaki metamorphic rocks at Nomo Peninsula, Kyushu, Japan Zircon U–Pb and Hf isotopes and trace element evidence'. The authors reported two types of rodingites in the serpentine-matrix mélange of the Nagasaki metamorphic rocks of Japan. Type-one occurs as dykes whereas type two appears as blocks. Type-one contained grossular, vesuvianite, diopside, apatite, titanite, and two generations of zircons (prismatic and porous types). Type-one is composed of zoisite, clinozoisite, diopside, chlorite, apatite, titanite, and zircon. Authors reported primary fluid inclusions from the prismatic zircons and interpreted them to have crystallized in the presence of fluids. In contrast, the porous zircons with extensive filled fractures were of a hydrothermal origin. The prismatic zircon from the rodingites yielded U–Pb weighted mean age of 108–105 Ma, which the authors interpreted as the time of rodingitization in the subduction zone. In addition, from the Hf isotope data from these zircons which closely relate to those of MORB, the authors suggested a MORB source for the prismatic zircons. In contrast, they interpreted that the porous zircons with low εHf values (11.8 to 18.9) were precipitated by the contamination of the subducted sediments in the MORB. The authors concluded that trace elements compositions of the rodingites, such as highly enriched in Sr, depleted in LILE (i.e. Cs, Rb, Ba), and more or less similar compositions with MORB, indicate a relatively immobile nature of these elements during the rodingitization process.

The fourth paper, by Park *et al.* (2014), is titled 'Petrofabrics of olivine in a rift axis and rift shoulder and their implications for seismic anisotropy beneath the Rio Grande rift'. In this paper the authors reported mantle-derived xenoliths associated with continental rifting and discussed the physicochemical properties of deformation processes in the upper mantle. They investigated the metasomatized spinel peridotites from the Adam's Diggings (AD) located at a rift shoulder and Elephant Butte (EB) at a rift axis in the Rio Grande rift (RGR) for understanding the deformation processes and seismic anisotropy at the upper mantle. In this study the authors conducted lattice-preferred orientation (LPO) of olivine using a scanning electron microscope equipped with electron backscatter diffraction (SEM/EBSD). Their analytical results show that the AD peridotites exhibited C-type LPO of olivine indicating a dominant slip system of (100)[001] at the rift shoulder. In contrast, the EB peridotites exhibited A-type LPO indicating a dominant slip system of (010)[100] at the rift axis. The authors interpreted that, based on both the geochemical data and microstructural observations, the localized mantle enrichment processes, including melts with hydrous fluids, controlled multiple mantle metasomatism and deformation of rocks under wet conditions (with olivine C-type LPO) at the rift shoulder (AD) and mantle depletion by decompression partial melting caused deformation of rocks under dry conditions (with olivine A-type LPO) at the rift axis (EB). These observations provide evidence for localized hydration and physicochemical heterogeneity of the upper mantle in the RGR zone. From the seismic anisotropic observations, they suggested a transtensional rupture beneath the study area.

The fifth and last paper of Part I (this volume) is by Akizawa and Arai (2014), and is entitled 'Petrology of mantle diopsidite from Wadi Fizh, northern Oman ophiolite: Cr and REE mobility by hydrothermal solution'. The authors presented the occurrence of a new type of diopsidite. In general, diopsidite is mainly composed of diopsidic clinopyroxene which usually precipitates from high-temperature hydrothermal solutions rich in silicate components in the mantle peridotites. The new type of diopsidite, which the authors reported from Wadi Fizh of northern Oman ophiolite, represents the uppermost mantle section which contains Cr-rich minerals such as chromite, Cr-rich diopside (<2.5 wt% Cr_2O_3) and Cr-rich grossular (<7 wt% Cr_2O_3). They discussed the occurrence of chromites within the diopsidite as subhedral, anhedral, film-like, or sometimes with globular inclusions of grossular and chlorite. Based on petrographic and geochemical characteristics, the authors interpreted that the diopsidite (surrounded by a whitish rock composed of tremolite with traces of chromite, diopside and grossular) and the vermicular shape of coarse chromite within the whitish rock suggest that hydrothermal solutions collected Cr by partial to complete dissolution of chromite during the replacement of the mantle peridotite. They further concluded that the trace elements were highly mobile when the mantle diopsidites were migrating upward during which the hydrothermal solutions brought Cr along with those mobile elements.

ACKNOWLEDGEMENTS

We thank all the authors for their valuable contributions to this special issue. We express our sincere thanks to the Journal, *Island Arc*, for accepting our proposal and giving us the opportunity to publish this special issue. Due thanks to Prof. Umino Susumu (Editor-in-Chief, *Island Arc* [IAR]) for his cooperation during the whole process. We also thank Ms. Akiko Anan of the IAR editorial office for the through correspondence and Prof. Takuya Itaki for his help during the editorial process. We appreciate the cooperation of the following reviewers who spared their precious time and provided constructive comments which greatly improved the quality of the manuscripts: S. Arai, J.L. Bodineir, R. Compagnoni, K. De Jong, S. Ferrero, K. Ishii, A. Ishikawa, T. Itaya, T. Kawakami, H. Kitagawa, T. Kobayashi, T. Kogiso J.G. Liou, M. Murata, M. Ogasawara, T. Ota, M. Petterson, M. Python, E. Takazawa, T. Takeshita, T. Tsunogae, H. Yamamoto, J.J. Yang, and M. Yeh.

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