Journal of Earth Science, *Vol. 32*, *No. 6*, *p. 1287–1288*, *December 2021* *ISSN 1674-487X*
Printed in China
https://doi.org/10.1007/s12583-021-1320-7

Preface

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Post-collisional settings have long been discussed, both in the aspect of nomenclature, tectonic significance, sources of magmatism, and their relations to pre-collisional and intraplate settings. To many authors, it should be synonymous with late-orogenic or late-collisional settings because the setting itself is defined as the period following the main impact of the colliding landmasses. On the other hand, terms like post-tectonic should be avoided when referring to post-collisional associations. In such a geotectonic setting, tectonics is strongly active, especially when the stage is just established, i.e., right after the main crash. The most important difference is that flat-lying movement planes tend to become progressively less important, giving place to steeply-dipping structures. Both movement planes may be active depending on the collision angle, as is the case of transpressional orogens resulting from docking. In such situations, orthogneisses produced by collisional metamorphism over arc plutonic and/or volcanic associations will likely be intruded by syntectonic post-collisional magmas that register deformation in the presence of variable amounts of magmatic liquid or due to high-temperature conditions lasting through the subsolidus state.

In contrast to the small volumes of syn-collisional magmas, where ascent channels are scarce, the post-collisional setting is characterised by large volumes of magma. Considering that the end of collision heads towards cratonization, post-collisional magmas may be either early- or late-tectonic. The very last batches may even be post-tectonic, as they are emplaced at the waning stages of orogenic stress fields and well into recently cratonized or intraplate areas. Additionally, sub-environments related to lithosphere delamination, subduction of small oceanic plates and rifting are also tend to coexist in such geodynamic setting. Depending on each specific orogenic condition, this transition may take several tens of million years, and the best example is the modern environment of the Himalayan orogenic chain.

The common sources of magmatism in post-collisional settings, in general, attest to a previous subduction event responsible for metasomatism of the mantle wedge to enrich it in LILE, particularly K and LREE. Moreover, they tend to show relatively low contents of Nb, Ta and HREE. Many authors have referred to a common succession of magmatic associations from subalkaline high-K series to shoshonitic and sodic silica-saturated ones, marking the change from post-collisional to intraplate settings. Crustal melting may also occur, although it is more common and abundant in the collisional stage.

In this special issue, we bring together several approaches to the various aspects of post-collisional settings, ranging from Paleoproterozoic to Neoproterozoic from different shield areas, such as Scandinavia, South Africa, Scotland, Turkey and Brazil. Part of the papers were presented at the IXth Hutton Symposium at Nanjing, October 2019, and part are invited contributions from researchers in post-collisional settings.

Andersen and Rämö use thermodynamic modeling with Rhyolite-MELTS to investigate the potential of supracrustal rocks from the Paleoproterozoic Svecofennia Province, southern Finland, to give rise by dehydration melting to peraluminous leucogranites close in age, and to Paleo- to Mesoproterozoic metaluminous rapakivi granites. Their results indicate the generation of anatectic melts close in composition to the Paleoproterozoic leucogranites by a batch melting process. However, the residue is unable to produce further anatectic melts of metaluminous granitic composition unless heated above 1 000 °C, as the extractable melt fractions will be granodioritic or tonalitic, rather than granitic composition. The authors further conclude that the rapakivi granites would result from mixing of mantle-derived magma and anatectic melts from source rocks that were unaffected by the earlier partial melting event in the region.

From South Africa, Bailie and Leetz analyse the post-collisional tectono-magmatic evolution of the Mesoproterozoic Namaquan Metamorphic Province (NMP) by investigating the role of two magmatic successions, a bimodal volcano-sedimentary and a plutonic one. Both units are interpreted to be associated with extensional regimes subsequent to the main deformational episode in the orogen. The authors conclude that the granites were formed largely by partial melting of crustal mafic igneous sources, whilst the volcano-sedimentary succession was derived by partial melting of subduction-influenced enriched mantle giving rise to mafic magmas that fractionated to give rise to rhyolitic porphyries. The upper succession rhyolites were derived by crustal melting due to the input of mafic magmatism. Crystal fractionation was the main compositional driver for both successions.

Goodenough et al. present a thorough review of carbonatites and alkaline igneous rocks in post-collisional settings worldwide from the Neoarchaean to the present day. They focus on examples from Namibia (Neoproterozoic), Scotland (deeper, Silurian), and Turkey (shallow, Oligocene) to illustrate the structure of

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Bitencourt, M. F., Janasi, V. A., 2021. Preface. *Journal of Earth Science*, 32(6): 1287–1288. https://doi.org/10.1007/s12583-021-1320-7. http://en.earth-science.net

these systems and demonstrate some of their key physical and chemical features. The authors use geochemical data from the literature to build a broad model for the REE mineral system in post-collisional environments. Some examples from Northwest Scotland studied in their paper illustrate the different possible relations of post-collisional magmatism with regional tectonics, as some plutonic bodies overlap in time the main thrusting event whilst others postdate it. They conclude that immiscibility of carbonate-rich magmas and fluids plays an important part in generating mineralisation in these settings, with REE, Ba and F partitioning into the carbonate-rich phase. They also conclude that post-collisional alkaline-carbonatite complexes with REE mineralisation occur in orogenic belts of all continents and have formed since the Paleoproterozoic.

Nardi et al. present a review paper on the shoshonitic magmatic series and the high Ba-Sr granitoids, with examples from the Neoproterozoic Dom Feliciano belt in southern Brazil and Uruguay. They describe the major features of plutonic rocks from the shoshonitic series, emphasise their importance in post-collisional settings, and describe their occurrence within shear zones, as syntectonic rocks, or post-tectonic associations emplaced out of deformational sites. The authors review the origin and source of shoshonitic magmatism and propose that the term “high Ba-Sr granitoids” should be used for those generated by crustal melting, and therefore, unrelated to the shoshonitic series. The shoshonitic plutonic associations are interpreted to be derived from mantle sources modified by previous, subduction-related metasomatism, whose compositional features are consistent with OIB-types with a strong influence of subduction.

The contribution of Silva et al. reports the study of a Paleoproterozoic high-K metagranite related to the Mineiro belt, Southeast Brazil. The authors use elemental geochemical data from minerals and whole-rock, as well as isotope geochemistry and U-Pb SHRIMP geochronology, to argue for pluton construction through several successive pulses. The authors conclude that the pluton is likely originated by partial melting of a more evolved quartz-feldspathic crustal igneous rock in a post-collisional environment, after the main collisional phase registered in the Mineiro belt.

The paper by Toledo et al. aims at identifying the sources of granitic magmatism of an Ediacaran post-collisional batholith from the South Brasilia Orogen, Southeast Brazil. The authors use whole-rock elemental and Sr-Nd isotope geochemistry and *in situ* zircon Hf isotope geochemistry, with specific attention to the three main granite bodies composing the batholith, whose magmatic activity straddles from collisional to post-collisional. The authors conclude that the main granitic magmatism of the batholith derives from mostly Paleoproterozoic crustal sources, with some contribution from the Mesoproterozoic crust. A juvenile mantle component is suggested by the relatively primitive composition of important volumes of these granites. A contribution from the enriched mantle is suggested by high mafic mineral content, presence of mafic microgranular enclaves and inferred high liquidus temperatures.

The origin of Cretaceous A-type granites from Eastern China is discussed by Fan et al., who address a long-lasting controversy about the origin of low δ^{18}O values of these granites. The authors interpret the highly variable oxygen values obtained in zircon crystals as a result of modification by meteoric water-rock interaction after the accumulation of radiation damage. It is inferred that only the least-influenced zircons, with δ^{18}O values slightly higher than the normal mantle, have preserved the magmatic oxygen isotopes. The low δ^{18}O values of the zircons are attributed to magma evolution and later radiation damage rather than to hydrothermally altered magmatic sources.

Yousefi et al. report the study of Eocene hypabyssal acidic to intermediate rocks forming domes and plugs in the Torud-Ahmad Abad magmatic belt, northern part of the Central Iran Zone. Their dataset comprises elemental and isotopic Sr and Nd geochemical data, which support their interpretation of the studied rocks to have adakite to adakite-like geochemical features with a calc-alkaline nature. The authors further conclude that this voluminous magmatism is associated with local extension in the continental arc setting that would evolve to rifting in the Neogene.

The study of Late Mesozoic mafic dykes is reported by Lei et al. in Fujian Province, southeastern China, where mafic rocks are related to the subduction of the Paleo-Pacific Plate. Whole-rock elemental and isotope Sr, Nd and Hf geochemistry are used to investigate the mafic rocks. The authors group the dikes based on underlying lithospheric thickness to examine the influence of such parameter in the petrogenesis of these rocks. The results lead them to contradict the commonly admitted origin of these magmas from a metasomatised lithospheric mantle. They admit, instead, that the mafic melts were generated by partial melting of the asthenosphere and interacted with the overlying lithosphere during ascent, thus having their composition modified.

Quelhas et al. report their study of a Mesozoic highly-fractionated aplite-pegmatite association from Macao, Southeast China. The authors use garnet composition and whole-rock geochemical data to discuss the petrogenesis of these rocks, establish their differentiation sequence and investigate the effects of fluid-melt interaction in highly evolved granitic systems. The highly fractionated granitic rocks in Macao represent the first stage in the development of granite-related W-(Mo)-Sn-Nb-Ta mineralisation associated with coeval more evolved lithotypes in SE China.

We want to thank the contributors of this issue for having endured these hard pandemic times and still completed their papers to make this volume possible. We also appreciate the efforts of those who could not make it in time due to all the limiting conditions for scientists worldwide. Finally, we thank the organisers of the IXth Hutton Symposium for their hard work and deeply acknowledge the editorial team of Journal of Earth Science for helping us to complete our task.

The final publication is available at Springer via https://doi.org/10.1007/s12583-021-1320-7.