5.5.15

Problems with the tectonomagmatic and alphabet classification schemes in post-accretionary granitoids in the northern Burro Mtns, New Mexico, southwestern USA

V.T. MCLEMORE[1], O.T. RÄMÖ[2], M. HEIZLER[1] AND P.J. KOSUNEN[2]

[1] New Mexico Bureau of Geology and Mineral Resources, New Mexico Tech, Socorro, U.S.A. (ginger@gis.nmt.edu; matt@nmt.edu)

[2] Department of Geology, University of Helsinki, Finland (tapani.ramo@helsinki.fi; paula.kosunen@helsinki.fi)

The ~1.70-1.65 Ga Mazatzal crust in the northern Burro Mountains region in southwestern USA hosts a distinct assemblage of areally closely juxtaposed granitoid rocks that postdate mantle-crust differentiation by several hundred m.y. This assemblage comprises (1) the 1460 Ma Jack Creek rapakivi granite, (2) ~1440-1450 Ma gneissic granite/granodiorite, and (3) the 1220 Ma Redrock granite [1, 2]. The emplacement of these granites was probably associated with repeated extensional/transtensional events along the southern margin of Laurentia and, given this monotonous overall tectonic setting, they should exhibit similar features in tectonomagmatic discrimination diagrams. However, they do not. In terms of aluminum saturation, the Jack Creek rapakivi granite is peraluminous, the gneissic granite/granodiorite and the Redrock granite straddle the metaluminous-peraluminous boundary. In the TiO_2 *vs.* Zr space, the three suites fall into distinct fields: Jack Creek is lowest in Zr, gneissic granite/granodiorite is highest in TiO_2, and Redrock is highest in Zr. In the digrams of Whalen et al., the Jack Creek rapakivi granite falls on the syn-COLG *vs.* VAG boundary, Redrock granite is in the WPG field, and the gneissic granite/granodiorite is intermediate between the two. In terms of Ga/Al, the Redrock granite is clearly A-type, whereas the Jack Creek rapakivi granite and the gneissic granite/granodiorite are transitional between the A-type and I- and S-type granites. Obviously, division according to traditional tectonomagmatic diagrams and the alphabet system does not adequately account for the compositional variation observed, and further criteria for classification should be pursued. Key issues in this pursuit will be source heterogeneity and post-accretionary mantle-crust interaction events.

References

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5.5.21

Isotope geochemistry and SHRIMP U-Pb geochronology of mafic-felsic granulites from Larsemann Hills, East Antarctica

YANBIN WANG[1], DUNYI LIU[1] AND SUOHAN TANG[2]

[1] Beijing SHRIMP Lab, Institute of Geology, Chinese Academy of Geological Sciences, Beijing, 100037, P.R.China (yanbinw@cags.net.cn)

[2] Institute of Geology, Chinese Academy of Geological Sciences, Beijing, 100037, P.R.China

The Larsemann Hills, located on the Iingrid Christensen Coast of Prydz Bay (Latitude77-75°E) comprises excellent coastal outcrops of granulite facies gneisses. Composite mafic-felsic composite orthogneiss and metasedimentary rocks are two primary associations. The composite orthogneiss largely consists of felsic gneiss with discontinuous lenses, pods, boudins and layers of mafic granulites that generally comprise around 20 %, but locally up to 85%, of the total rock volume. The predominantly felsic nature of the rocks, and their high P-T granulite-facies metamorphism, significantly complicate protolith identification, dating and geodynamic interpretation. The aim of this study is to understand the crustal evolution of the Larsemann Hills by analysing mafic-felsic rocks using major, trace-element geochemistry, isotope geochemistry and geochronology.

The felsic gneisses have mineralogies dominated by plagioclase, with no K-feldspar, suggesting tonalitic protoliths. Whole rocks geochemistry indicate a bimodal metavolcanic unit. Sm-Nd analyses have been performed on fifteen samples from Larsemann Hills. The line defined by the mafic granulites (whole rocks) gives an age of 1049±62 Ma with an initial ratio of $^{143}Nd/^{144}Nd=0.51127\pm0.00006$. Calculated T_{DM} modal ages are between 1.8-2.4 Ga. The Rb-Sr data do not give an isochron. A combined cathodoluminescence and SHRIMP single-zircon study has revealed a hitherto unrecognized morphological complexity in zircons from the granulites. Relict oscillatory igneous zoning, metamorphic overgrowths, and irregular areas of recrystallization were identified. From the SHRIMP data, an age of ca. 1100 Ma is inferred for the mafic-felsic gneiss protoliths, which were altered considerably during an important metamorphic event ca.1000 Ma. Subsequent metamorphism is recorded at 530 Ma. The new results give clear evidence of a Grenvillian event, strongly suggesting that the Grenvillian belt branches into the Pinjarra Orogen.

Acknowledgment: This work is supported by National Natural Science Foundation of China (No.40272081 and 49702033). The Chinese Arctic and Antarctic Administration for logistics support>