Relics of Pristine Paleoarchean Continental Crust: Granitoids from the Bastar Craton, India

A. MALTESE[1]*, K. MEZGER[1] AND D. UPADHYAY[2]

[1]Institut für Geologie, Univ. Bern, Baltzerstrasse 1+3, 3012 Bern, Switzerland (*correspondence: alessandro.maltese@geo.unibe.ch)

[2]Department of Geology and Geophysics, Indian Institute of Technology, 721302 Kharagpur, India

Models for the growth of the continental crust and the concomitant depletion of the mantel are heavily based on isotope and trace element analyses of rocks mostly younger than ca. 3.0 Ga [e.g. 1-3]. Other models that incorporate data from older material are more dependent on crucial assumptions regarding the preservation and assessment of primary geochemical signatures and geochronological information [e.g. 4-5]. Additional data sets with robust age-isotope relationships are therefore required to shed light on Earth's crust-mantle evolution prior to 3.0 Ga.

Zircon U-Pb ages from some granitic domains in the Bastar Craton (BC), Central India range from 3.4 to 3.6 Ga. These segments are surrounded by granites that record uniform ages of ca. 2.5 Ga, possibly indicating the absence of major later overprinting. This creates a firm temporal framework for the old granitoids. In order to critically assess the intactness of the geochemical systems and avoid potential pitfalls [6], we conducted major and trace element as well as isotope analyses on whole rock samples and Pb isotope measurements on feldspar. Similar trace element patterns can be observed for these two rock suites and the combined Pb isotopic signatures of all samples plot on a well-defined correlation line (R^2 = 97 %).

The data record a major addition of juvenile material at 3.5 Ga, which in part, was subsequently reworked at 2.5 Ga. This process most likely did not involve further addition of juvenile material nor major overprinting, as indicated by the trace element patterns and Pb isotopic signatures. The simple petrogenetic evolution makes this crustal segment ideal to better constrain models for the evolution of Earth`s early crust-mantle system. Finally, it underlines the importance of multiple-system geochronology for the identification of intact geochemical packages.

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