Geophysical Research Abstracts
Vol. 17, EGU2015-3589-1, 2015
EGU General Assembly 2015
© Author(s) 2015. CC Attribution 3.0 License.

The giant Pan-African Hook Batholith, Central Zambia: A-type magmatism in a syn-collisional setting

Lorenzo Milani (1), Jérémie Lehmann (1), Kalin V. Naydenov (1,2), Kerstin Saalmann (1,3), Judith A. Kinnaird (1), J. Stephen Daly (4), Dirk Frei (5), and Alberto Lobo-Guerrero Sanz (6)

(1) University of the Witwatersrand, Geosciences, Johannesburg, South Africa (lorenzo.milani@inwind.it), (2) BAS: Geological Institute; Bulgarian Academy of Sciences; Acad. G. Bonchev str., bl. 24, 1113 Sofia, Bulgaria, (3) Norges geologiske undersøkelse (NGU), Postboks 6315 Sluppen, 7491 Trondheim, Norway., (4) UCD School of Geological Sciences and UCD Earth Institute, University College Dublin, Belfield, Dublin 4, Ireland., (5) Department of Earth Sciences, Stellenbosch University, Private Bag X1, 7602 Matieland, South Africa., (6) LOGEMIN S.A., Calle 127 A. No. 43A-28, off. 309, Bogotá, Colombia.

The Pan-African Hook Batholith formed during the assembly of the Gondwana supercontinent between 570 and 520 Ma (U-Pb on zircon) as a result of syn-collisional stage interaction between the Congo and Kalahari Cratons1. The extension of the batholith, exposed and undercover, is estimated to be between 25,000 and 30,000 km2. The bimodal magmatism (mafic to predominantly felsic) is characterized by both an alkali-calcic and an alkalic suite, with the felsic rocks featuring a typical A-type, metaluminous, high Fe/Mg and K/Na geochemical signature. The scattered outcrops of gabbroic rocks, both tholeiitic and alkaline, suggest periodic input of mantle material, which, in some cases, interacted with metasomatizing fluids. Fractional crystallization is invoked for the most differentiated products, while Sr-Nd isotopes rule out any significant contribution from crustal assimilation. Exceptionally highly radiogenic Pb isotopes have been measured on both unaltered and hydrothermally altered rocks, and attest to the radiogenic character of the batholith. The Pb isotopes indicate that the anomalous signature was acquired during, or soon after, magma emplacement, and was likely enhanced by metasomatizing fluids. An enrichment in Th and U, affecting large portions of the crust along the southern margin of the Congo Craton, is suggested by comparable anomalous Pb isotopes measured in basement gneisses in the Domes Region, Zambian Copperbelt. Geochemical and isotopic evidence support interaction between mantle components and portions of the deep crust at pressures of < 10 kbar, while decompression melting of rising asthenospheric mantle ponding at the base of the crust heated, and ultimately melted, crustal material. Low-pressure mineral phases in metasedimentary wall rocks along the eastern margin of the pluton indicate that the magma was subsequently emplaced at shallow crustal depths. A crucial contribution to the crustal melting was likely provided by internal radiogenic heat production of the thickened crust, and is in agreement with the high radioactivity of the pluton. A tectono-thermal model where crustal accretion is accompanied by slab retreat and lithospheric mantle thinning, can reconcile coeval orogenic contraction in the crust and A-type magmatism. The emplacement of the Hook Batholith further supports the idea that A-type granites, commonly considered to be restricted to extension-related environments, can also occur in compressional regimes.