Geophysical Research Abstracts
Vol. 12, EGU2010-15614, 2010
EGU General Assembly 2010

200 million years of komatiite evolution in the Barberton Greenstone Belt, South Africa

Robin Christoph (1), Nick Arndt (1), Gary Byerly (2), Igor Puchtel (3), Janne Blichert-Toft (4), and Allan Wilson (5)

(1) LGCA, Universite de Grenoble, 1381 rue de la Piscine, Grenoble, 38400, France (arndt@ujf-grenoble.fr), (2) Dept. of Geologyand Geophysics, Louisiana State Univ, Baton Rouge, LA 70803, USA, (3) College Park, MD 20742, USA, (4) Lyon, 69364, France, (5) Johannesburg, South Africa

Komatiites with complex and contrasting chemical compositions erupted throughout the 200 m.y. history of the Barberton greenstone belt in South Africa. The oldest well-preserved examples, from the ca. 3.5 Ga Komati Formation, display a range of volcanic structures, from thin differentiated spinifex-textured flows to much thicker flows or sills composed mainly of massive olivine cumulate. Pyroxene spinifex layers that cap the latter units indicate crystallization from komatiitic basaltic liquids. Although some rare, unusually coarse, vesicular, completely serpentinized units may have contained a small fraction of water, most of the flows are essentially anhydrous. Two geochemical types are present in the Komati Fm; Al-depleted komatiites with moderately enriched LREE and depleted HREE, and Al-undepleted komatiites with near-chondritic REE ratios. Komatiites from the 3.2 Ga Mendon and Weltevreden Fm display two patterns –Al-undepleted with near-chondritic REE ratios and Al-enriched with extremely low REE concentrations and marked depletion of LREE. In many units, both geochemical types are present. The Al- and HREE-depletion of Komati Fm magmas indicates that residual garnet was retained in the mantle source and their high MgO contents require that melting was at great depth. Up to 30% batch melting at 300 km depth is indicated; the high percentage of batch melting is possible because melt is neutrally buoyant at these depths. The Al-undepleted to enrichedmagmas formed by up to 50% cumulative fractional melting that terminated at shallower depth. The. presence of both types inseveral units points to complex dynamics in the mantle plumes that yielded these magmas. Epsilon Nd in all Barbertonkomatiites ranges from 0 to +2; epsilon Hf from +2 to +7; gamma Os from 0 to +3.7. The combination of fractionated REE, positive epsilon Nd and Hf, and near-chondritic Os in certain komatiites is attributed to differentiation of the komatiite sourcevery early in Earth history followed by fractionation during komatiite formation.