Mantle compositional gradients in a hot subduction setting, the Garibaldi Volcanic Belt, northern Cascade Arc

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Hot subduction zones challenge the dehydration melting model for primary arc basalt generation, as hot slabs may liberate water at depths too shallow to trigger mantle melting. The Garibaldi Volcanic Belt (GVB), the northernmost segment of the Cascade Arc, extends from Glacier Peak in the south to Bridge River Cones in the north and is one of the hottest subduction zones globally [1, 2]. The age of the subducting plate decreases from ~10 Ma in the south to ~5 Ma in the north at the trench [3], resulting in a northerly increase in slab temperature beneath the arc axis [1]. Together with a decrease in magmatic productivity, basalts grade progressively from typical calc-alkaline arc basalts in the south to alkalic basalts in the north, reflecting reduced melt fractions due to low slab input [4]. Both basalt varieties occur at Mt. Garibaldi. Gradual northerly decreases in La/Nb, $^{87}Sr/^{86}Sr$ (0.70318 to 0.70298) and Pb isotope ratios are consistent with the hypothesis of decreasing slab input. In addition, decoupling of ε_{Hf} from ε_{Nd} indicates sediment input as a fluid. The most alkaline basalts record minimal slab input, with Pb isotope ratios lower than in other Cascade Arc basalts and similar to Explorer MORB. However, Zr/Nb, $^{208}Pb^{*}/^{206}Pb^{*}$, ε_{Nd} (+8.9 to +7.1) and ε_{Hf} (+13.3 to +8.5) decrease to the north, indicating an arc-parallel gradient in mantle source enrichment that is unrelated to slab input. The alkaline basalts tap a mantle source more incompatible element enriched and isotopically distinct from the depleted mantle that produces calc-alkaline basalts. The enriched mantle is also hotter (~1500°C) than the sub-arc mantle wedge (max ~1350°C) [2], consistent with upwelling asthenosphere, possibly at the slab edge [5]. Arc-parallel mantle flow may draw the upwelling mantle into the arc, generating a compositional gradient upon which slab input is superimposed. The influx of this upwelling mantle may have far-reaching effects, as the $^{208}Pb^{*}/^{206}Pb^{*}$ trend begins as far south as Mt. Adams and continues to the end of the GVB.

[1] Harry & Green (1999) *Chem. Geol.* 160, 309-333. [2] Syracuse *et al.* (2010) *Phys. Earth Planet. Interiors* 183, 73-90. [3] Wilson (2002) *USGS Open-File* 02-328. [4] Green (2006) *Lithos* 87, 23-49. [5] Long & Silver (2008) *Science* 319, 315-318.

Multiple sulphur isotope analyses of sulphate deposits from the Sargur Group, Dharwar Craton, India.

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Sulphides from sedimentary rocks older than 2.45 Gyr old define a positive $\delta^{34}S$-$\Delta^{33}S$ correlation called the "Archean Array". In contrast, Archean sulphates were deposited during short periods of times between 3.5 and 3.2 Gyr ago and define a narrow isotopic range that is not correlated with the Archaean Array. Sulphide associated with the sulphate deposits form a specific isotopic domains characterized by ^{34}S-depleted values with both positive and negative $\Delta^{33}S$. These sulphides were interpreted to reflect a combination of UV-photochemical processes in optically-thick volcanic plumes combined with terrestrial processes of biologic and/or non biologic origin. Here we present S isotope systematics of the 3.2 Ga sulfate deposit of the Sargur Group near Ghattihosahalli (Dharwar Craton, India).

The rocks investigated consist of a meter-scale layer of barite interbedded within different types of quartzites and micaschists grading towards the west into Cr-micaschists, ultramafic volcanics and felsic gneiss. Bulk and in situ S-isotope analyses were measured with IRMS in dual-inlet mode at IPGP and ims 1280 HR2 at CRPG, respectively, both with a reproductibility better than 0.2 ‰ (2σ) in $\delta^{34}S$ and 0.1 ‰ in $\Delta^{33}S$.

S-isotope compositions of barites ($\delta^{34}S$ = 3.19 to 4.35 ‰ and $\Delta^{33}S$ = -0.49 to -0.47 ‰) fall within the range of other Archaean sulphates. Pyrites in sulphates and other rock types show a narrow range of $\Delta^{33}S$ values between -0.70 and +0.37 ‰ but a larger range of $\delta^{34}S$ values between -12.21 and +0.27 ‰ in barite, -4.12 and +0.63 ‰ in micashists and quartzites, -6.96 and -2.43 ‰ in Cr-micaschists, and 1.83 and 5.99 ‰ in surrounding gneisses. These results are consistent with previous data obtained in other Archaean sulphate deposits from the Pilbara Craton and Barberton Greenstone Belt, thus arguing for a common origin. Different from other deposits, however, is the relative small range of both $\delta^{34}S$ and $\Delta^{33}S$ values, which suggests that the isotopic imprint inherited from atmospheric and microbial/hydrothermal processes have been reequilibrated in part during greenschist/amphibolite facies metamorphism and pervasive ductile deformation.

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DOI:10.1180/minmag.2013.077.5.13