Insight into arc magma genesis from the Higashi-akaishi Peridotite, Japan

C. B. TILL[1]*, T. L. GROVE[2], R. W. CARLSON[3], S. WALLIS[4] AND T. MIZUKAMI[5]

[1]SESE, Arizona State Univ, Tempe, AZ 85287
(*correspondence: christy.till@asu.edu)
[2]EAPS, MIT, Cambridge, MA 02139
[3]DTM, Carnegie Inst. Wash., Washington D.C. 20015
[4]Earth & Planetary Sci., Nagoya Univ., Japan 464-8602
[5]Earth Science Course, Kanazawa Univ., Japan 920-1192

Located in the Sanbagawa subduction-type metamorphic belt in SW Japan on the island of Shikoku, the Higashi-akaishi peridotite body is composed of dunite, lherzolite and garnet clinopyroxenite, interfingered in one locality with quartz-rich eclogite. Previous work indicates the P-T history of the peridotite includes rapid prograde metamorphism with peak temperatures of 700-810°C and pressures of 2.9-3.8 GPa [1] at ~110-120 Ma [2,3]. Major and trace element and isotopic data from samples within the Higashi-akaishi peridotite presented here and in another recent study [4] provide a record of subduction zone melting processes in a paleo-mantle wedge. Ultramafic samples range from 40-52 wt.% SiO_2, 1-11 wt.% Al_2O_3 and 21-45 wt.% MgO with olivine and clinopyroxene Mg#s as high as 0.93. The quartz-rich eclogite contains 62 wt.% SiO_2, 6 wt.% MgO and 13 wt.% Al_2O_3 and has trace element concentrations that are enriched relative to the ultramafic samples. $^{87}Sr/^{86}Sr$ (.703237-.704288), $^{143}Nd/^{144}Nd$ (ϵ_{Nd}=+2 to +6) and Pb isotopic compositions are within the range of Japanese arc rocks. We interpret the pyroxenites as shallowly crystallized cumulates with varying amounts of trapped hydrous melt and the harzburgites as residues of melting. The peak P-T conditions of these rocks are similar to the solidus conditions of H_2O-saturated fertile mantle near the base of the mantle wedge [5,6]. The presence of garnet porphyroblasts that enclose primary euhedral chlorite together with the chemical evidence, suggest these samples are associated with mantle melting in the presence of H_2O. Therefore the Higashi-aikashi rock suite provides a record of the beginnings of hydrous melting and the mechanisms of metasomatism in the mantle wedge through element transfer from the underlying subducted lithosphere.

[1] Enami *et al* (2004) *J. Meta. Geol.* **22**, 1-15. [2] Okamoto *et al* (2004) *Terra Nova* **16**, 81-89. [3] Isozaki *et al* (1990) J. *Meta. Geol.* **8**, 401-411. [4] Hattori *et al* (2010) *Island Arc* **19**, 192-207. [5] Grove *et al* (2006) *Earth Planet. Sci. Lett.* **249**, 74-89. [6] Till *et al* (2012) *Cont. Min. Petrol.* **163**, 669-688.