2007 Fall Meeting
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HR: 13:40h
AN: **V33F-01 INVITED**
TI: Sulfur and Copper in Magmatic Arcs: Sources and Linkages
AU: ***Hattori, K H**
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AF: *University of Ottawa, Department of Earth Sciences, Ottawa, ON K1N 6N5, Canada*
AB: Economic metal mineralization, principally porphyry and related hydrothermal deposits, occurs in the shallow crust of volcanic arcs, in association with felsic rocks. However, the processes that lead to the formation of giant deposits take place at much deeper levels in the subarc mantle. Sulfur is a critical component because it is the most anomalous element in deposits in terms of enrichment factor. Sulfur isotopes and other information from giant deposits indicate that S was introduced to the host felsic rocks by a primitive mafic melt. The mafic melt was oxidized, allowing the transport of a large quantity of S from the mantle to the shallow crust. An oxidized melt also allows the transfer of chalcophile metals from the mantle, thus avoiding the metals being scavenged by dense sulfide liquid. Formation of an oxidized primitive melt requires an oxidized subarc mantle because of the minimal change in fO2 during partial melting. A substantial range in the fO2 of subarc mantle is most likely caused by the nature of subducted sediments, because the compositions of oceanic lithosphere have been comparable over 2 Ga. The subarc mantle is depleted in chalcophile elements because they are mildly to highly incompatible during partial melting, as shown by inverse correlations between Cu and compatible elements in residual peridotites. However, Cu concentrations in primitive arc magmas have a wide range, from very low to high values, > 300 ppm, in contrast to the MORB values of about 70 ppm. Furthermore, there are broad spatial variations, with high concentrations in some arcs such as Izu. The wide variation in both Cu contents and the ratios of Cu to immobile elements in primitive arc magmas suggest that Cu is introduced to the subarc mantle by aqueous fluids from slabs. In a given subduction zone, the Cu concentration in primitive arc magmas does not correlate with Ni, Mg, alkalis, alkali-earths, and other fluid-mobile or chalcophile elements, such as Pb. Rather, Cu concentration correlates positively with V, which is a fluid-immobile lithophile element. The evidence suggests that Cu and possibly other chalcophile elements may not be hosted by sulfides in the magma source region in subarc mantle. Vanadium valence is sensitive to fO2 and oxidized species are not compatible with mantle minerals. Therefore, the positive correlation between Cu and V confirms an oxidized mantle source for the generation of fertile Cu-rich arc magmas that can lead to mineralized systems at shallow depths.

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DE: 3613 Subduction zone processes (1031, 3060, 8170, 8413)
DE: 3665 Mineral occurrences and deposits
SC: Volcanology, Geochemistry, Petrology [V]
MN: 2007 Fall Meeting

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