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Sulfide saturation and dissolution in mid-crustal magma chambers: insights from the Colorado Mineral Belt

JESSICA BERRY, DAVID HOLWELL, DANIEL J SMITH AND ANDREW J MILES

University Of Leicester

Presenting Author: jb772@leicester.ac.uk

Syn- and post-subduction processes are responsible for some of the greatest concentrations of Cu, Au, and Te on Earth [1]. Subduction-related Au-Te-(Cu) enrichment of the sub-continental lithosphere is thought to be a necessary precursor for the formation of upper crustal deposits during later episodes of post-subduction magmatism [2]. Pyroxene-rich xenoliths in a shallow andesite sill from the northern San Juan Volcanic Field (Colorado, USA), offer new insights into the behaviour of sulfide melt in post-subduction magmas: including transport, trapping, and partial resorption of chalcophile and siderophile elements at mid-crustal levels. The San Juan xenoliths contain rounded sulfide inclusions (pentlandite, pyrrhotite, minor chalcopyrite), and formed at ~15 km depth during extensional magmatism. Comparable sulfide-bearing inclusions have been reported in pyroxene-rich xenoliths from the Last Chance porphyry copper stock at Bingham Canyon (Utah, USA), which also formed in a post-subduction (extensional) setting [3]. However, the Last Chance Stock xenoliths host bornite and chalcopyrite as primary sulfide phases, with no co-existing pyrrhotite, and are thought to have formed from a Cu-rich source, leading to the creation of the giant porphyry copper deposit at Bingham [4]. The more varied sulfide mineralogy in the San Juan xenoliths could mean that (a) the source of the sulfides in the San Juan mid-crustal enclaves is from a Cu-poor source, (b) the source of the sulfides is from a Cu-rich source that failed to mobilise Au-Te-(Cu), or (c) the source of the sulfides is from a Cu-rich source that *did* mobilise Au-Te-(Cu), but failed to trap these at a mid-crustal level. This study offers a new understanding of the differences between Cu-rich sulfide melt in a porphyry copper forming magma (e.g. Bingham), and the relatively Cu-poor sulfide melt in the 'barren' magmas from the San Juan Volcanic Field, at mid-crustal levels.

[1] Richards, J.P (2009), *Geology* 37(3), 247-249.

[2] Davidson et al. (2007), *Geology* 35(9), 787-790.

[3] Pettke, T (2010), *Earth and Planetary Science Letters* 296, 267-277.

[4] Core et al. (2006), *Geology* 34(1), 41-44.