

Copper porphyries: from source rocks to reservoirs

CIN-TY LEE¹ AND JACKSON BORCHARDT²

¹Rice University

²United States Geological Survey

Presenting Author: cintylee@gmail.com

How copper porphyry systems form continues to be a highly productive, though highly debated field of study. In short, Cu-porphyries tend to be associated with thick volcanic arcs, either in continental arcs or mature island arcs, but exactly what controls these associations of Cu-porphyries is unclear. The fundamental problem centers on how Cu from large volumes of otherwise diluted source rock is mobilized and then concentrated into Cu-rich reservoirs. The problem is complicated by the fact that these processes can operate anywhere between the mantle and the surface, and it is likely that there are multiple mechanisms by which a Cu-porphyry can be generated while still satisfying the observed geologic associations. Rather than focus on a particular hypothesis for the origin of Cu-porphyries, this talk will review different physical processes of mobilization and enrichment, focusing on their efficiencies and the conditions that favor them. We will review the effects of mantle metasomatism, redox conditions (from oxidized sources to auto-oxidation), sulfide stability (and segregation), silicate differentiation, and magmatic recharge on scavenging or concentrating Cu in the deep crust. We will also discuss how and when water and halogens might mobilize Cu and other metals during magmatic differentiation. We will end with a discussion on how these different mechanisms can conspire to lead to make a Cu-porphyry.