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Title: THE SPECTRUM OF VOLCANIC-HOSTED MASSIVE SULFIDE (VHMS) DEPOSITS: THE AUSTRALIAN PERSPECTIVE

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Author 1 (CONTACT AUTHOR)
Name: J. Bruce Gemmell
Org: CODES, University of Tasmania
Country: Australia

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Abstract: In Australia there is a spectrum of VHMS deposits in submarine volcanic arc successions, including mound, lens and sheet-style Zn-rich polymetallic, massive and disseminated pyritic Cu-Au, and disseminated stratabound Au-only deposits. Mound, lens and sheet-style polymetallic Zn-rich deposits such as Rosebery, Hellyer, Que River, and Thalanga are considered to have formed in relatively deep water environments. These deposits probably formed either on the seafloor (e.g. Hellyer, Que River), or by replacement of porous volcaniclastic units directly below the seafloor (e.g. Rosebery, Gossan Hill). The footwall alteration associated with these polymetallic VHMS deposits was controlled by host rock permeability and porosity, which are in turn related to volcanic facies type, degree of fracturing and syn-volcanic structural architecture. Focusing of hydrothermal fluids along syn-volcanic structures has resulted in well-zoned chlorite-sericite footwall alteration pipes within footwall lavas at Hellyer. On the other hand, diffuse fluid flow through very thick pumice breccia at Rosebery and Hercules has resulted in stratabound, sericite-dominated footwall alteration zones parallel to the paleo-seafloor and the ore lenses.

Massive and disseminated, pyritic Cu-Au deposits, such as those in the Mt Lyell field and at Highway-Reward, formed by sub-seafloor replacement and are associated with only minor zinc-lead massive sulfide ore. These deposits formed from higher temperature fluids, in which copper transport is enhanced, and are commonly located in felsic volcanic centers dominated by shallow porphyritic intrusions (e.g. Highway-Reward). The Cu-Au ore lenses may be stratabound (e.g. Mt Lyell) or cross-cutting pipes (e.g. Highway-Reward) depending on the structure and permeability characteristics of the felsic volcanic host rocks. The presence of high sulfidation alteration minerals (e.g. pyrophyllite, zunyite) in some Cu-Au deposits (e.g. Mt Lyell field) indicates that fluids were relatively acidic and that magmatic fluid input into the hydrothermal system may have been significant. Alteration zonation associated with the Cu-Au VHMS deposits is more symmetrical than that of the Zn-rich deposits, with sericite-rich alteration extending into the hanging wall, in-keeping with the subsurface replacement origin of these deposits.