

Model 24b Mafic extrusive VAMS Cu-Zn-Ag-Au-Co	
Alternative Model Name	Besshi style VAMS
Commodities	Cu, Zn, Co, Ag, Au
% Global Production	Minor: 10 th quantile has > 157 950 tonnes Cu-Zn-Au-Ag (1998)
% Australian Production	nil
World Class Deposit Size	>30 Mt @ 2.5% Cu; Zn, Ag and Au are generally minor; Co can be economically significant
World Class Deposit Examples	Windy Craggy, Besshi, Kizil-Dere
Geological Setting	Back-arc basins, rifted continental margins, intracontinental rifts, fore-arcs and sedimented spreading ridges proximal to continents. Mixed mafic volcanic and clastic sedimentary host sequences.
Age	Late Palaeozoic to Cretaceous
Components:	
<i>Source</i>	Leaching of ophiolite suites within sub-seafloor hydrothermal cells.
<i>Transport/Pathway</i>	Syn-volcanic faults; convection in porous medium driven by anomalous heat flow along rifts
<i>Trap</i>	Interaction with seawater at or just below the seawater-rock interface
<i>Other</i>	Water depth > 2000 m. Rapid burial after mineralisation
Critical Elements	<ul style="list-style-type: none"> • Occurrence in medial valleys of spreading ridges in the various environments; this provides maximum heat (1) • Association with basaltic volcanism principally tholeiitic, rare alkaline or calc-alkaline (3) • Extensional structures that allow fluid circulation (1) • Interaction with seawater at or just below ocean floor (1) • Deep water depth > 2000 m (2) • Rapid burial to allow preservation (2)
Other Comments	There is one extremely large deposit: Windy Craggy, which contains 297.4 Mt @ 1.38% Cu with Au, Ag and Co credits (Zn is minor, with grades of less than 0.5%; this deposit is now tied up in a World Heritage area and likely will not be mined). The Besshi deposits are distinguished from Cyprus deposits by the presence of significant clastic sedimentary rocks, generally lack footwall stringer zones, and generally have higher Cu/Zn ratios. Cobalt contents of some deposits are 0.1%.
Key References	Franklin, J.M., Sangster, D.M. & Lydon, J.W., 1981. Volcanic-associated massive sulfide deposits. <i>Economic Geology</i> 75 th Anniversary Volume, 485-627. Fox, J.S., 1984. Besshi-type volcanogenic sulphide deposits – a review. <i>CIM Bulletin</i> , April, 57-68 Peter, J.M. & Scott, S.D., 1999. Windy Craggy, northwestern British Columbia: the world's largest Besshi deposit. <i>Reviews in Economic Geology</i> 8, 261-295.

