THE DISTRIBUTION, MINERALOGY AND PARAGENESIS OF THE HELLYER BARITIC AND SILICEOUS CAPS

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A thesis submitted in partial fulfilment
of the requirements for the degree of
Bachelor of Science with Honours

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University of Tasmania
November, 1991

life is earnest, life is real,

life is but an empty dream,

for the soul is dead that slumbers,

and things are not what they seem.

W. Shakespeare (A Midsummer Nights Dream)

Abstract

Baritic and siliceous caps are a feature of many volcanic-hosted massive sulphide deposits. Their distribution, mineralogy and geochemistry are important to the understanding of the genesis of these deposits.

The baritic and siliceous caps overlying the Hellyer volcanic-hosted massive sulphide deposit, western Tasmania, show a spatial affinity to the centres of hydrothermal activity, identified previously from copper contents of the ore. Mineralogical and textural investigations identified barite as a precursor to formation of the siliceous cap. In both caps intricate sulphide textures, including pristine collofom pyrites, are present. Mineralogical and spatial relationships suggest an interdigitation of the baritic and siliceous caps.

Sulphur isotope studies of barite (with $\delta^{34}S$ values between +38 and +50 per mil) and pyrite (with $\delta^{34}S$ values between +6 and +18 per mil) revealed a duality in the source of sulphur during formation of the caps; incompletely reduced seawater sulphur, and magmatic sulphur. The wide range of $\delta^{34}S$ values are thought to be the result of fluctuating contributions from these two sulphur sources.

Metal zonation and mineral geochemical studies show that base and precious metal contents of both caps are enriched proximal to underlying massive sulphides. In such zones, textural evidence supports hydrothermal overprinting and porosity infill by paragenetically late sulphides.

Formation of the barite cap at or above the seawater interface is interpreted to be the result of oxygenated seawater mixing with spent hydrothermal fluids enriched in barium, during periods of low hydrothermal flux, at temperatures between 230 and 250°C. By contrast, silica cap precipitation requires the local dominance of H_2S and a combination of conductive cooling and mixing. This is evidenced by the presence of arsenopyrite, and the absence of hematite.

The interdigitating spatial affinity combined with mineralogical and textural evidence suggests that formation of the baritic and siliceous caps at Hellyer was an integral part of orebody formation. Thus these facies evolved with the growing sulphide mound, in a manner consistent with the zone refining model proposed by Eldridge et al. (1983), for the growth of seafloor sulphide deposits.

Acknowledgements

I would like to thank Aberfoyle Resources Limited for providing logistic support. Particular thanks are extended to; Gary McArthur who organised the project, Richard Downs for helpful advice and preliminary reading of the manuscript, Steve Richardson, Henry Kurth, Graham Howard, Dave Adams, Bevan McWilliams and Andrew Wilson for their help and friendship.

I thank my supervisors Bruce Gemmell and Ross Large for advice and preliminary reading of the manuscript .

For her support and indeterminable patience, I am indebted to Kim Hein. In addition, for constructive discussions and preliminary reading of various parts of the manuscript, I am grateful to Gary Davidson, Anthea Hill, Dave Huston and Khin Zaw.

For advice and guidance during analytical work thanks are extended to; Mike Power Sen. and Christine, Wis Jabolinski and Phil Robinson.

I thank all of my fellow Honours students for making the year an enjoyable one. A special thanks must also go to Micheal Blake.

In conclusion, the loving support provided by my father, Stan, who provides his daughter with a place to call home no matter how far she may stray; the endless words of wisdom of my brother, Ian, and the patience and guidance of Annie McEntee; I cannot thank them enough.

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