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

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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 colloform 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.
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## Contents

### Chapter 1: Introduction
- 1.1 Aims ....................................................... 1
- 1.2 Previous Research ....................................... 2
- 1.3 Terminology and Definitions ......................... 3
- 1.4 The Hellyer Deposit ..................................... 4
- 1.5 Study Outline ........................................... 6.5

### Chapter 2: Spatial Distribution of the Baritic and Siliceous Caps
- 2.1 Stratigraphic Position .................................. 7
- 2.2 Lateral Distribution of the Caps..................... 13
  - 2.2.1 The Barite Cap ...................................... 13
  - 2.2.2 The GSP .............................................. 13
  - 2.2.3 The Hellyer Stringer System .................. 13
- 2.3 Thickness ............................................... 17
- 2.4 Faulting ................................................ 17
- 2.5 Conclusions ............................................ 17

### Chapter 3: Mineral and Textural Paragenesis
- 3.1 Introduction .......................................... 21
- 3.2 Barite ..................................................... 21
- 3.3 Quartz .................................................... 23
  - 3.3.1 Microcrystalline Quartz ......................... 25
  - 3.3.2 Magma quartz ....................................... 25
  - 3.3.3 Silica Pseudomorphs .......................... 27
- 3.4 Pyrite ..................................................... 27
  - 3.4.1 Pyritic Textures in the GSP .................. 27
  - 3.4.2 Pyrite Textures of Barite .................... 35
- 3.5 Sphalerite ............................................. 35
- 3.6 Arsenopyrite ........................................... 36
- 3.7 Galena .................................................. 36
- 3.8 Tetrahedrite-Tennantite ............................. 36
- 3.8 Chalcopyrite ........................................... 36
- 3.9 Electrum ............................................... 38
- 3.10 Carbonate ............................................. 38
- 3.11 Sericite and Chlorite ............................... 38
- 3.12 Paragenesis .......................................... 38
  - 3.12.1 Stage 1: Primary Textures .................. 38
  - 3.12.2 Stage 2: Main Sulphide Deposition Phase .. 40
  - 3.12.3 Hydrothermal Alteration and fill of Open Space 40
- 3.13 Conclusion ............................................ 41

### Chapter Four: Mineral and Whole Rock Geochemistry
- 4.1 Introduction ............................................ 43
- 4.2 XRF Sample Preparation ............................ 43
- 4.3 Analytical Techniques ............................... 43
- 4.4 The Composition of the Barite Cap ................ 44
  - 4.4.1 Whole Rock Geochemistry of Barite Samples 44
  - 4.4.2 Barium and Strontium Concentrations in Barite 45
  - 4.4.3 Hangingwall Datium Alteration .................. 47
- 4.5 GSP - A Classification ............................. 47
  - 4.5.1 Whole Rock Analyses of GSP ................ 47
- 4.6 Carbonates ............................................ 49
- 4.7 Iron Content of Sphalerite ......................... 49
- 4.8 Mineralogical Residence of Arsenic ............... 49
Appendices:
1.1 Logging Codes Employed at Hellyer
2.1 Catalogue
2.2b Coordinates used in the construction of the plan projection of the Hellyer Barite Cap
2.2b Coordinates used in the construction of the plan projection of the Hellyer GSP
3.1 Whole Rock XRF Results
3.2 Microprobe Barite analyses
3.3 Microprobe Carbonate Analysis
3.4 Microprobe Sphalerite Analysis
3.5 Microprobe Pyrite Analysis
3.6 Microprobe Arsenopyrite Analysis
3.7 Microprobe Galena Analysis
3.8 Microprobe Tetrahedrite Analysis
3.9 Microprobe Electrum Analysis
4.1 Barite Cap - Sulphur Isotope sample descriptions, sample locations and d34S values
4.2 Siliceous Cap - Sulphur Isotope sample descriptions, sample locations and d34S values

List of Figures

1.1 Location of the Hellyer deposit........................................2
1.2 Surface geology and stratigraphy of the Hellyer deposit................2

2.1a Stratigraphy of HL414, HL413 and HL417........................10
2.1b Stratigraphy of HL326, HL329 and HL313......................11
2.2a Section 10630N..................................................12
2.2b Section 10790N..................................................12
2.3 Plan Projection of a) the barite cap, and b) the siliceous cap........14
2.4 Plan Projection of the barite and siliceous caps..................15
2.5 Pre-Jack Fault reconstruction of the stringer zone...............16
2.6 Contour plan projection of thickness............................18
2.7 Main faults intersecting the cap zones..........................19

3.1 The relative paragenetic sequence in the cap zones..............42
4.1 The abundances of major oxides and trace elements; Barite cap......44
4.2 Relation of Ba and Sr in barite..................................45
4.3 Ba/Sr results for a traverse along a barite grain................46
4.4a Spidergram of the major oxides in GSP..........................48
4.4b Spidergram of the tetsukieki and Nova nda cherts..............48
4.5 Al - Fe - Mn plot of GSP samples................................48
4.6 Electrum grain size distribution.................................53
4.7 Electrum fineness distribution.................................53
4.8 Core-Rim Analytical traverse across electrum grain 1............54
4.9 Core-Rim Analytical traverse across electrum grains 11 and 13......55

5.1 Barium zonation within the barite cap and GSP..................61
5.2 Iron zonation within the barite cap and GSP....................61
5.3 Lead zonation within the barite cap and GSP....................62
5.4 Zinc zonation within the barite cap and GSP....................62