

THE PETROLOGY, GEOCHEMISTRY, AND FLUID HISTORY OF CALC-SILICATE
ROCKS AND ASSOCIATED PRIMARY Cu-Co MINERALIZATION IN THE
ETHIUDNA MINES AREA, OLARY PROVINCE, SOUTH AUSTRALIA.

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TABLE OF CONTENTS

CHAPTER 1	
INTRODUCTION.....	1
1.1. INTRODUCTION.....	1
1.2. HISTORY AND PREVIOUS INVESTIGATIONS.....	1
1.3. AIMS AND METHODS OF STUDY.....	2
CHAPTER 2	
GEOLOGICAL BACKGROUND.....	3
2.1. REGIONAL GEOLOGY AND STRATIGRAPHY OF THE WILLYAMA SUPERGROUP.....	3
2.2. STRATIGRAPHY OF THE ETHIUDNA SUB-BLOCK.....	5
2.2.1. Biotite Microclinolite.....	5
2.2.2. Metapelites.....	6
2.2.3. Ethiudna Adamellite.....	6
2.3. STRUCTURAL GEOLOGY OF THE ETHIUDNA SUB-BLOCK.....	7
2.4. METAMORPHISM OF THE ETHIUDNA SUB-BLOCK.....	8
CHAPTER 3	
PETROLOGY AND FLUID HISTORY OF THE BIMBA SUITE.....	10
3.1. INTRODUCTION.....	10
3.2. PETROGRAPHY OF THE BIMBA SUITE.....	10
3.2.1. The Wollastonite-Diopside Subunit.....	10
3.2.2. The Calc-Silicate Quartzite.....	11
3.2.3. The Footwall Quartzite.....	12
3.3. PETROGENESIS OF THE BIMBA SUITE.....	12
3.3.1 Description of textures.....	12
3.3.2 Interpretation of textures implications for fluid infiltration.....	13
3.4. AQUEOUS ELECTROLYTE COMPOSITIONS OF METASOMATIC FLUIDS.....	16
3.4.1. Fluid inclusion analysis.....	16
3.4.2. Scapolite analysis.....	18
3.4.3. Origin of high metamorphic fluid salinities.....	21
3.5 CARBON-OXYGEN STABLE ISOTOPE GEOCHEMISTRY OF THE BIMBA SUITE.....	21
CHAPTER 4	
SULPHIDE PETROLOGY AND GENESIS.....	25
4.1. THE NATURE AND DISTRIBUTION OF PRIMARY SULPHIDE MINERALIZATION.....	25
4.1.1. Ethiudna mines.....	25
4.1.2. Ethiudna East prospect.....	26
4.1.3. Other sulphide occurrences.....	26
4.2. ORE TEXTURES AND MINERALOGY.....	27

4.3. DISTRIBUTION AND STRUCTURAL CONTROL OF MINERALIZATION	
GENETIC IMPLICATIONS	3 0
4.4. GENESIS OF STRATA-BOUND Cu-Co MINERALIZATION.....	3 1
4.5. EVIDENCE FOR METASOMATIC REMOBILIZATION OF MINERALIZATION	3 3

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REFERENCES

APPENDIX 1: WHOLE ROCK ANALYSES

APPENDIX 2: CARBON-OXYGEN ISOTOPE ANALYSES

APPENDIX 3: MICROPROBE ANALYSES-SCAPOLITE

APPENDIX 4: MICROPROBE ANALYSES-SULPHIDES

APPENDIX 5: FLUID INCLUSION ANALYSES

APPENDIX 6: SULPHUR ISOTOPE ANALYSES

APPENDIX 7: UNIVARIANT REACTIONS AND SLOPES OF UNIVARIANT LINES

LIST OF FIGURES

- Figure 1 Location of the study area.
- Figure 2 Schematic stratigraphy of the Willyama Supergroup metasediments in the study area, and regional correlations.
- Figures 3a and 3b Discriminant diagrams for altered volcanics and volcanoclastics.
- Figure 4 XCO₂-T diagram showing univariant curves for the reaction calcite + quartz => wollastonite + CO₂.
- Figure 5 μ K₂O- μ CO₂ diagram for the system KCASH.
- Figure 6 Histograms of data from microthermometric measurements on fluid inclusions.
- Figure 7 Compositions of Ethiudna scapolites.
- Figure 8 Correlations between scapolite composition and fluid composition.
- Figure 9 Carbon-oxygen isotope profiles.
- Figure 10 Sulphide species proportions: stratigraphic variation.
- Figure 11 T-X diagram for phase relations in the system Fe-S.
- Figure 12 Ternary plot of Ethiudna pyrite compositions.
- Figure 13 Histogram of sulphur isotope analyses.
- Figure 14 Drill hole assay profiles.

LIST OF TABLES

- Table 1 Modal compositions of Ethiudna microclinolites.
- Table 2 Wollastonite Stage assemblages.
- Table 3 Carbon-oxygen isotope analyses.
- Table 4 Mineralogy of sulphide mineralization.
- Table 5 Geochemical characteristics of Ethiudna mineralization.

LIST OF PLATES

- Plates 1-6 Photographs and photomicrographs displaying textural relationships in calc-silicates.
- Plates 7-8 Photomicrographs of fluid inclusions.
- Plates 9-17 Photomicrographs of ore textures.

ABSTRACT

Textures in calc-silicate rocks of the Lower Proterozoic Bimba Suite in the Ethiudna mines area, Olary Province, South Australia, record multiple fluid infiltrational episodes associated with both prograde, amphibolite-facies, and retrograde, greenschist-facies metamorphism. Pervasive infiltration of H₂O-rich fluids ($X_{CO_2} < 0.18$) during prograde metamorphism, was associated with the large-scale development of wollastonite-rich lithologies within the Bimba Suite. Stable oxygen isotope evidence suggests these fluids were equilibrated with a siliciclastic sequence(s) prior to infiltrating the Bimba Suite.

A second, retrograde metamorphic (temperatures $\sim 300^\circ\text{C}$) infiltrational episode was associated with the development of a grossular-quartz assemblage. Fluid flow was channelized during this episode, the H₂O-rich fluids being focussed along structurally-induced zones of high permeability. Large variations in fluid/rock ratios are recorded in the calc-silicates as large variations in the progress of the grossular-quartz producing reaction.

The formation of cross-cutting quartz, calcite, and rare laumontite veins postdates both these infiltrational episodes. Fluid inclusion evidence suggests these veins were deposited by fluids at temperatures of less than 250°C .

Fluid inclusion data and scapolite compositional data indicate fluids associated with all three episodes were highly saline, consistent with conclusions made by earlier workers that the Bimba Suite represents a meta-evaporite sequence.

The microcline-rich rocks of the Quartzofeldspathic Suite, which underlies the Bimba Suite, host stratiform and disseminated Cu-Co sulphide mineralization. Geochemical and petrological evidence suggests this mineralization is of the genetic type known as a red-bed-associated Cu deposit. The distribution, geochemistry, and textural characteristics of sulphides in the Bimba Suite, suggest this mineralization represents a metasomatic remobilization of pre-metamorphic Quartzofeldspathic Suite mineralization. The sulphide-silicate-carbonate textural relationship in the Bimba Suite suggests this remobilization took place during the high temperature, wollastonite-producing infiltrational episode, and that precipitation of ore metals was effected by a pH rise.