



THE GEOLOGY OF THE
ANGUS MINE AREA
OF THE
BARRIER RANGES,
NEW SOUTH WALES.

by

J.B. McManus, B.Sc. (Hons).
Department of Economic Geology,
University of Adelaide.

St. Louis

This thesis does not contain any material previously submitted for a degree in any University by me, or by any other person, except where due reference is made in the text of the thesis.

J. B. McMANUS
31st December, 1963

S U M M A R Y

The "aprites" and concordant pegmatites in the Angus area are considered to be altered sediments; the "aprites" would have been felspathic sands, or arenites with minor clay material; the concordant pegmatites are considered to be similar sediments, with greater amounts of clay material. Major soda metasomatism is not invoked to explain the sodic rich nature of the rocks, which are thought to have been sodic rich sediments. Transgressive sodium rich and potassium rich pegmatites have been derived partly by pneumatolytic processes and partly by migration of ions from metasediments into joints and fractures.

The amphibolites are interpreted as having a sedimentary origin, and to have been calcareous-chloritic-siliceous-ferruginous sediments, with minor clays and sericitic material. Iron, aluminium, and magnesium metasomatism is not invoked, and the constituents of the amphibolites were originally present in the sediments. The amphibolites could also have been acidic tuffs.

All rock types have been described in detail, and the genesis of each rock type has been given.

The stratigraphic sequence and sedimentary environment could be explained by regressions and transgressions

of the sea in unstable areas where uplift and subsidence occurred.

The overall structure is a limb structure, with minor folding on the limb. The beds dip steeply in a westerly direction. The overall plunge is northerly.

Metallic minerals in the area have been deposited in a calcic environment within fine-grained sediments, now gneisses, schists, calcic-plagioclase quartzites, quartz-epidote rocks, and in places, amphibolites. The mineralisation has concentrated in small folds within the calcic bearing zones. Potassic feldspar associated with the mineralisation is considered to have developed partly as the result of potassium ions being relatively mobile during metamorphism and migrating to areas of lower stress, and partly by potassium ions being "repelled" from calcic environments under metamorphic conditions. A sedimentary origin is favoured for the Broken Hill type mineralisation in the area.

Vegetation-rock type associations and their possible significance have been outlined.

The results of geophysical studies have been applied to the geology.

Economic considerations have been put forward. Surface indications of base metal mineralisation are such

that further geophysical (electrical) studies should be carried out before drilling is considered. Consideration could possibly be given to drilling at the Angus mine without further geophysical studies.

Minor beryl occurrences in some of the transgressive pegmatites within an "aplite" zone require investigation by using a Beryllium Detector (berylometer).

TABLE OF CONTENTS

	Page
LIST OF TABLES	1
LIST OF PLATES AND PLANS ...	ii
CHAPTER I	
INTRODUCTION ...	1
Aim of Work ...	1
Previous Investigations ...	2
Survey and Mapping Methods ...	4
Accessibility ...	6
PHYSIOGRAPHY ...	6
Topography ...	6
Drainage ...	6
Climate ...	7
Vegetation ...	8
Water ...	9
GEOMORPHOLOGY ...	11
CHAPTER II	
GEOLOGY ...	13
Rock Types ...	13
Pegmatites ...	13
(1) Concordant pegmatites .	14
Mineralogy ..	16
Genesis ...	21

Table of Contents (Continued) - Page 2

	Page
(2) Transgressive pegmatites	30
Mineralogy	35
Genesis	41
(3) Pegmatites with green felspar..	47
Albite-Soda Oligoclase-quartz Rocks ("Aplites")	51
Mineralogy	54
Genesis	60
Tourmaline Rock Interbedded with "Aplites"	65
Amphibolites..	68
Mineralogy	70
Genesis ..	97
Schists and Gneisses	125
Gneisses	126
(1) Gneisses with calcic plagioclase	126
Mineralogy ..	126a
Genesis	131
(2) Gneisses with porphyroblastic garnets and calcic plagioclase	132
Mineralogy...	133
Genesis	137
(3) Schistose gneisses	139
Mineralogy	141
Genesis	144
(4) Pegmatitic and granodioritic gneisses..	145
Mineralogy ..	146
Genesis	148
(5) Gneisses with abundant potassic felspar	149
Mineralogy ..	149
Genesis	151

<u>Table of Contents (Continued) - Page 3</u>					Page
Schists ... ..	...	...	...	...	152
(1) The well foliated schists	...	...	...	...	152
Mineralogy...	...	...	...	...	154
Genesis ... ..	...	...	...	...	160
(2) Schists with abundant quartz...	...	...	...	...	160
Mineralogy...	...	...	...	...	162
Genesis ... ..	...	...	...	...	166
Quartz, epidote rocks	...	...	...	...	166
Mineralogy	...	...	...	...	167
Genesis	...	...	...	...	170
Felspathic quartzites with garnet	...	...	...	...	171
Mineralogy	...	...	...	...	172
Genesis	...	...	...	...	175
Quartz, magnetic rocks	...	...	...	...	177
Mineralogy	...	...	...	...	177
Genesis	...	...	...	...	178
Siliceous laterite - "Grey Billy" ..	...	...	...	...	179
Mineralogy of the "Grey-Billy" rocks	...	...	...	...	180
STRATIGRAPHY AND SEDIMENTATION	...	...	...	...	181
METAMORPHISM ... ..	...	...	...	...	188
(1) Pelitic and quartzo-felspathic assemblages	...	...	...	...	188
(2) Calcareous and magnesian assemblages	...	...	...	...	190
(3) Basic assemblages	...	...	...	...	191
METASOMATISM ... ..	...	...	...	...	194
Structure	...	...	...	...	196
Folding ..	...	...	...	...	196
Petrofabric study	...	...	...	...	202
Foliation (bedding cleavage or bedding schistosity)	...	...	...	...	206

Table of Contents (Continued) - Page 4 Page

Fracture Cleavage	...	...	...	207
Joints	...	...	...	208
Faults and shears	...	...	...	209
(1) Shear zone	...	...	...	210
(2) Hillston Fault	...	...	...	211
(3) Mundi-Mundi scarp	..	...	...	211
(4) Fault parallel to Angus-Kintore zone of mineralisation	...	...	...	212
(5) Minor faults and shears	...	...	...	213

CHAPTER III

MINERALISATION	...	...	...	214
(1) Broken Hill type mineralisation	..	...	...	215
(a) The lower zone of mineralisation	...	...	...	215
(b) The middle (Angus-Kintore) zone of mineralisation	...	...	...	216
(i) The Angus Mine	..	...	...	217
(ii) Tonnages removed from the Angus Mine	...	...	...	219
(c) The upper zone of mineralisation	...	...	...	220
(d) Mineralisation within the zone of amphibolite with associated spotted gneiss, which resembles Potosi Gneiss	...	...	...	222
Mineralogy of the Broken Hill type mineralisation	...	...	...	222
Genesis of the Broken Hill type mineralisation	...	...	...	241
(a) Genesis of the garnet granulite ("garnet sandstone")	...	...	...	241
(b) Genesis of the mineralisation	...	...	...	245

<u>Table of Contents (Continued) - Page 5</u>		Page
(2) Thackaringa type mineralisation ..	...	254
(3) Copper staining in shears	...	255
(4) Other mineralisation	...	256
Sequence of events	...	256

CHAPTER IV

SOME VEGETATION-ROCK TYPE RELATIONSHIPS	...	258
(1) <u>Pittosporum phillyreoides</u>	...	258
(2) <u>Sida virgata</u>	...	260
(3) <u>Atriplex vesicaria, Kochia sedifolia</u> and <u>Kochia pyramidata</u>	...	262
(4) Triodia...	...	262

CHAPTER V

GEOPHYSICAL STUDIES	...	264
---------------------	-----	-----

CHAPTER VI

ECONOMIC CONSIDERATIONS..	...	267
(1) Further search in the Angus area .	...	268
(a) Sulphide mineralisation	...	268
(b) Beryl mineralisation	...	270
(2) Further search in the Broken Hill district		270

Table of Contents (Continued) - Page 6 Page

ACKNOWLEDGEMENTS 273

REFERENCES 275

APPENDIX 280

 List of specimens collected for
 Petrological and Mineragraphic Studies ... 280

LIST OF TABLES

		Page
TABLE 1	The An Content of Plagioclases in the Amphibolites	74
TABLE 2	Partial Analyses of Amphibolites and a Gneiss	98
TABLE 3	Average Assays: Basalts and Amphibolites	117
TABLE 4	Strontium Analyses of Metadolerites, Amphibolites and Para-amphibolites ..	119
TABLE 5	The An Content of Calcic Plagioclases in Gneisses	127
TABLE 6	Manganese Assays of Gneisses, Schists and Garnets	129
TABLE 7	The An Content of the Gneisses (with Calcic Plagioclase) which resemble Potosi Gneiss	135
TABLE 8	Amounts of Sodic Plagioclase and Potassic Felspar in the well Foliated Schists	153
TABLE 9	Lead and Zinc Assays of various Rock Types	223-4
TABLE 10	Partial Assays of Rocks and Minerals ..	226-7
TABLE 11	Plant Assays	259
TABLE 12	Plant and Rock Assays	262

* * * * *

LIST OF PLATES AND PLANS

	Page
PLATE 1	1A
Figures 1 & 3	Locality maps
Figure 2	Plan showing origin of ZC-NEHC district Coordinate system
 PLATE 2	
Figures 1 & 2	Narrow calcic plagioclase bands in amphibolite (up to 3 inches wide)
Figures 3 & 4	Broad calcic plagioclase bands in amphibolite (up to 8 feet wide)
 PLATE 3	 203A
PLAN No.X27/739	Surface geological plan Angus Mine area Scale 1 inch rep. 20 feet
	(In Folder)
PLAN No.X27/746	Level Plans, Angus Mine Scale 1 inch rep. 20 feet
	(In Folder)
PLAN No.X27/747	Cross Sections, Angus Mine area. Scale 1 inch rep. 20 feet
	(In Folder)
PLAN No.X27/750	Longitudinal Section, Angus Mine. Scale 1 inch rep. 20 feet
	(In Folder)
PLAN No.X27/751	Composite Plan, Angus Mine. Scale 1 inch rep. 20 feet
	(In Folder)
ISOMETRIC BLOCK DIAGRAM, Angus Mine	(In Folder)

List of Plates and Plans (Continued)

		Page
PLAN No.X27/762	Geological Plan, Angus area, Sheet 1. Scale 1 inch rep. 400 feet	(In separate container) <i>CYLINDER</i>
PLAN No.X27/763	Geological Plan, Angus area, Sheet 2. Scale 1 inch rep. 400 feet	(In separate container) <i>CYLINDER</i>
PLAN No.X27/780	Angus area, Interpretation of Geology. Scale 1 inch rep. 400 feet	(In separate container) <i>CYLINDER</i>
PLAN No.X27/781	Angus area, Interpretation of Geology. Scale 1 inch rep. 400 feet	(In separate container) <i>CYLINDER</i>
PLAN No.X27/782	Angus area, Cross-Section A-B-C. Scale 1 inch rep. 400 feet	(In Folder)
PLAN No.X27/780 & X27/781	Angus area, Interpretation of Geology. Scale 1 inch rep. 800 feet	(In Folder)

* * * * *