DEPARTMENT OF MINES
SOUTH AUSTRALIA

MINERAL RESOURCES, EXTRACTIVE INDUSTRIES POTENTIAL OF THE MIDNORTH OF SOUTH AUSTRALIA

Client: State Planning Office

by

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CONTENTS

PLANS

Plan No.	Title	Scale
69-204	Geological plan of Mid-North showing mineral and rock deposits (State Planning Office)	1:250,000

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INTRODUCTION, DEFINITION OF AREA

To assist The State Planning Office "examine and assess the future development of a defined area in the Mid-North of the State in anticipation of the area being declared a planning area under the provisions of the Plannin and Development Act, 1966-1967" a summary of past, present and potential usage of minerals and rock products is made hereunder. The area under consideration comprises the district council areas of Port Germein, Orroroo, Peterborough, Hallett, Spalding, Jamestown, Laura, Gladstone, Georgetown, Redhill, Crystal Brook, Pirie, Snowtown, Blyth, Clare, Burra Burra, Robertstown, Eudunda, Saddleworth, Upper Wakefield, Riverton, Owen, Balaklava and Port Wakefield; the corporate towns of Peterborough, Jamestown, Burra and Clare and the City of Port Pirie.

The accompanying plan (69-204) is a generalised geological map of the study area which depicts selected formations, potential extractive industry raw materials resources, quarries, pits and mines and is based on collation of published and unpublished data available within the Department of Mines records and files and principally on the mapping of Binks (1968) and Mirams (1964).

GEOLOGICAL SETTING

Geomorphologically, the Mid North straddles the southern Flinders Ranges and the northern Mount Lofty Ranges and is fault-bound along its eastern and western margins. Eastwards the ranges of hills give way to plains of the Murray Basin. On its western aspect the ranges are terminated generally more abruptly by the sunklands which comprise the Pirie - Torrens Basin and the northern Adelaide Plain marginal to Spencer Gulf and Gulf St. Vincent, respectively. A separate line of low hills extending northerly

from Port Wakefield constitute the Hummocks; on the extended line of this range are several low discrete hillocks including Mts. Fergusson and Mambray. Relief within the elevated tract is generally subdued and comprises essentially rounded hills and ranges separated by broad, elongate, alluviated valleys.

The oldest rocks which comprise shales, siltstones, sandstones and dolomite of the (upper Proterozoic) River Wakefield Group are exposed in the cores of anticlinal fold structures generally in sequence but occasionally (e.g. Spalding - Bundaleer Reservoir and Paratoo localities) in complex crush zones and intruded by basic plugs. They are succeeded by a normal conformable Adelaide System succession to the A.B.C. Range Quartzite. Argillaceous rocks make up the bulk of this sequence with prominent quartzites and dolomites; the extent of the various quartzites and dolomites are indicated on the accompanying plan. These sedimentary strata have been folded as a result of east-west directed compression to derive a system of regularly spaced elongate meridional folds which bifrucate in the northeastern sector as part of the Olary Arc. The predominantly sandy beds of the Hummocks and its northern extension represent a little-disturbed shelf facies equivalent of the Tent Hill Formation. More or less meridional lines of hills resulting from differential erosion within the horst reflect the geological structure with resistant quartzite and tillites comprising ridges and the more easily eroded argillaceous rocks underlying the elongate, often alluviated, valleys.

Portions of several intermontane basins are included in the area under review, viz. the Willochra and Walloway Basins, partially filled by Tertiary sands and silts that provide aquifers for useful sub-artesian waters (O'Driscoll, 1956; Sprigg, 1950; Millwood 1964).

The down-faulted coastal sector comprises part of the Pirie - Torrens Basin which is underlain by Quaternary and Tertiary sediments that provide aquifers for the supply of pressure waters of variable quality (Chebotarev, 1958).

The southwestern sector of the area is underlain by Tertiary lignites, limestones, sands and clays which occupy a down-faulted wedge which comprises the northern extremity of the Adelaide Plains and the St. Vincent Basin wherein the dominantly marine sequence has a basal, lacustrine unit

including local accumulation and preservation of lignite.

Upper Tertiary sands and gravels mark the sites of former water-courses and lakes in the elevated block but the outcrops have been dissected by subsequent erosion. Quaternary cover includes a variety of strata - gravels, grits and mottled clays, nodular and sheet kunkar, dune sands, gypseous sands and silts, scree and alluvium.

MINERAL RESOURCES

Copper

Burra Burra Mines

The rich secondarily enriched orebody consisted of a large cigar-shaped mass of copper carbonate minerals in limestone and shales; its maximum dimensions were 800ft. long x 250ft. wide x 300ft. deep. The deepest shaft, Morphett's engine shaft was vertical and 600ft. deep. An extensive system of underground workings was developed. In 1869 open cutting was begun for recovery of lower grade ore in and around the old workings and the mine closed in 1877 after all the profitable carbonate ores had been fairly completely extracted. Tributors recovered small parcels of ore periodically to 1913.

The total yield of dressed ore from the mine amounted to 234,648 tons averaging 22% copper and the total quantity of rock raised from the workings exceeded 700,000 tons.

Below the 30-fathom level, which may be regarded as the lower limit of secondary enrichment, the oxidised ore graded into primary sulphides (Dickinson, 1942).

Exploration and development work at depth and along the projected extensions of the lode have failed to reveal further useful sources of ore in the sulphide zone. Several millions tons of +1.0% remnant oxidized ore have been outlined by drilling adjacent to the open cut and metallurgical work is being undertaken to determine whether the contained metal can be economically recovered.

Princess Royal Mine

The several lodes were emplaced along fracture cleavage, minor

shears and small breccia zones as narrow low grade copper-bearing veins. Redistribution of copper minerals through weathering resulted in small irregular high grade pods and disseminations of secondary copper carbonates.

The mine was worked from 1845 to 1851, and during the years 1867-1868, and it is evident that the development work which consists of 11 shafts, ranging from 10ft. to 180ft. in depth, and numerous pits was disappointing. The most persistent lode is traceable for a length of about 2,000ft. on the surface by means of pits, trenches and outcrops (Reyner and Pitman, 1955).

Exploration undertaken during the period 1964-1966 included diamond drilling of two holes (aggregate 1290ft.) without disclosing copper mineralisation that could be economically recovered.

Karkulto Mine

The Royal Mining Co. produced 855 tons of iron ore for the Burra smelter from four shafts and several open cuts on the lode during the period 1851 to 1861. Little copper was present.

From an adjoining property the South Australian Mining Association produced 7,500 tons of iron ore for flux at the Burra during the period 1850 to 1866. Recorded copper production amounted to 70 tons of ore (Reyner and Pitman, op.cit.). Development included 6 shafts, the deepest being 240ft.), and some 1,600ft. of driving undertaken on five levels which were connected by winzes and stopes. The value of these deposits depended on their contained ironstone which was in short supply at the Burra smelters.

St. Elmo (Carn Brae) Mine

Some 20 tons of copper ore were recovered from several shafts and limited underground workings, including a tunnel after discovery prior to 1890 and sporadic attempts to mine since 1933 (Reyner and Pitman op.cit.).

Apoinga Mine.

During the years 1857 to 1871 six shafts, up to over 80ft. in depth, and numerous pits were sunk to disclose only traces of copper in very small quartz stringers (Reyner and Pitman op.cit.).

Edelweiss Mine

The first record of work was in 1901 when a shaft was sunk to 170ft. By 1906 several more shafts with cross cuts and drives at the 115ft. level of the main shaft had been developed when the mine was abandoned.

No ore was shipped and only very small disseminations of copper accompanied by vanadium were reported in a series of narrow quartz veins. This marked the first discovery of vanadium in the State and accounts for the sustained effort (Reyner and Pitman, op.cit.).

Bon Accord

The Bon Accord shaft, 300ft. deep, was until recently the source of the Burra township water supply. A considerable amount of driving was performed but no mineable lodes were intersected (Reyner and Pitman, op.cit.).

Utica (New Burra, Dutton) Mine

Purchased in the late 1840's the mine was developed by a number of shallow pits and five shafts varying in depth from 15ft. to 103ft. and limited underground workings. Recorded production relates to 1854 when 50 tons of ore were sold. Several attempts were made to reopen the mines until 1920 (Reyner and Pitman op.cit.).

West Burra Mine

Production of 26 tons of 29% copper ore were achieved in the period 1913 to 1916 from the main shaft, 157ft. deep, and underground development on three levels (Warne, 1967).

Rhynie Mine.

When inspected in 1867 this was described as a "copper mine having rich indications" (Brown, 1908, p. 123) but these hopes were apparently not realised.

Stanley (Pompurne) Mine

Two separate mining companies raised 150 tons of 17% copper ore during the years 1858 and 1875 from a number of trenches, pits and 14 shafts,

drives and adits. Shafts ranged in depth from 10ft. to 110ft. (Warne, 1968).

Emu Flat

Little work was done at this prospect situated in Section 1995, Hd. Clare southwest of the township of Clare (Brown, 1908, p. 51).

Paratoo Mine

Copper carbonates were recovered in the early 1900's from several shafts ranging to 70ft. in depth. Exploration since 1966, including drilling, defined the limits of mineralisation and several hundred tons of hand picked ore are reported to have been marketed since the report of Nixon (1967).

Burnt Pussy

No details have been recorded (Brown, 1908, p. 159).

Robertson Mine

Small production has been reported from five shafts, ranging to depths of 220ft., and connecting trenches and stopes on a lode 1 to 2ft. in width over a length of 400ft. The copper ore carried some gold (Brown, 1908, p. 100).

Wheal Bassett

During the years 1890 and 1908 small production was achieved from shafts, the deepest being 160ft. (Brown, 1908, p. 147).

Barroota Nob Mine

Copper with a little gold was recovered from a shaft and shallow open cut in the period 1895 to 1907 (Brown, 1908, p. 27).

Melrose Mine

Small production was reported after discovery in 1845 (Brown, 1908, p. 80).

Mt. Remarkable Mine

Recorded production amounts to 60 tons raised during the years 1846 to 1911 from workings which consisted of a tunnel, a number of pits and a 100ft. shaft (Matthews, 1911).

Charlton Mine

Several shafts were sunk prior to 1858 (Wade, 1953).

Whyte Park Mine

Prospecting in shafts, winzes and drives in the "Forest Reserve, Wirrabara" revealed only poor grade ore. There was no production (Brown, 1908, p. 151).

Spring Creek Mine

Workings are quite extensive and comprise an open cut, shafts (to 132ft. depth), cross cuts, stoping and an adit. The mine was worked between 1860 and 1874 and again in the early 1900's. A crushing plant and smelter were erected indicating that "a fair amount of ore" was mined from a near-surface zone of secondary enrichment though recorded production amounts to only 90 tons.

Water is pumped from the mine to provide the Wilmington township supply (Summers, 1955).

Cartapo Mine

This copper prospect is reported to be in "Hd. Ayers" (Brown, 1908, p. 160).

Broughton Prospect

Prior to 1863 the prospect was explored in three shafts (the deepest being 120 feet) and several trenches. There was little or no production of copper ore (Blissett, 1968).

Wheal Sarah (Bundaleer or Belalie)

Following discovery in 1858 two lodes have been explored under-

ground but ore was apparently extracted only from the south lode. The richest part of this 2ft. 6ins. wide orebody was probably stoped out at the 36ft. and 133ft. levels (Blissett, 1968).

Penn Mine

In 1902 two shafts were sunk to a depth of 157ft. and connected by a drive at that level. A winze extended a further 70ft. Small production was reported from several thin copper-bearing veins (Jones, 1916). The mine was re-opened 1915-1916.

Summary

In general none of the lodes in these mines is of sufficient size and grade to be considered a good copper prospect as mineralisation is weak, wall-rock alteration is slight and the lodes consist of narrow low grade siliceous veins emplaced along small faults, shear zones and cleavage fractures. Leaching and redeposition of the copper minerals has in some cases produced small pockets and lenses of high grade copper ore but these are considered to be too small and scattered to be of economic importance. Nevertheless, exploration is continuing in the knowledge that copper mineralisation is widespread and the deposits of Burra Burra and Kapunda (a short distance to the south and in the same province) were of great economic importance.

Gold

Mount Grainger

The main period of production from the Mt. Grainger field (including the Mount Grainger mine and several small producers - the Medora, Golden Junction, Ironclad, Heather Bell, Aureous Mine, Golden Morn and the Dustholes) dated from discovery in 1894 to 1916 when some 3,600 ozs. of gold averaging 9.9 dwts/ton were recovered. The Mt. Grainger mine produced 2,400 ozs. from numerous shafts and drives from two main levels off the main shaft, 333ft. in depth. In recent times a new head frame has been erected over the main

shaft and mining of a desultory character confined to the 220ft. level where two diamond drill holes were sited in 1964. Leases are at present held by Grainger Gold Pty. Ltd. A recent comprehensive study of the mine was made by Fairburn and Nixon (1968) when further exploration was recommended.

Mongolata

Gold was discovered in quartz - limonite veins which heal fractures in sandstone at this locality in 1930 and, when actual mining ceased in 1944, some 7,517 tons of ore had been treated at the Government battery and cyanide plant at the site for the recovery of about 11,000 ozs. of gold bullion, then valued at about £40,000. The workings (including Byles Mongolat Baldina Mongolata, Golden Harp, Block 8, Eastview, Terry's, North Star, Curlew, Wildildie, Takati, The Battler, Mount Blanche and Northern Hope), comprises shafts, drives, adits and trenches which extended over a strike length of two miles and to a depth of over 260ft. in one section. A list of references is given by Mansfield (1946) while a generalised map of the field was prepared by Segnit (1939). Prospecting for occurrence of alluvial gold apparently has not been seriously attempted. Mansfield concluded that "the Mongolata field is a gouger's proposition only, and will no doubt continue to attract this type of miner and more rich pockets will probably be unearthed"

Pitcairn Range

Workings which include shallow shafts, adits and stopes and comprising the Altitude and Altimeter Mines extend for a distance of almost one half mile and are based on thin parallel quartz veins. Mining during the period 1932-1936 is reported to have proved unprofitable (Hillwood, 1965).

Ulooloo (White Lead, Twigham)

Gold was discovered in this locality in 1870-1 in gravels. The output has not been recorded but £18,000 worth were recovered to August, 1886. The gold was erratically distributed and mostly very fine but some coarse gold was recovered from "older" and "younger" gravels to a depth of about 20ft. below the surface. In 1915 it was reported that veins of quartz and iron formation containing a little gold were being explored. Sub-

sequently these were probed in a number of shafts up to 40ft. in depth with a "considerable amount" of driving and cross-cutting without disclosing a reef worth developing. Inspectors of Mines reports appear in Mining Review Nos. 22, 50, 51, 52, 56, 57, 59 and 60; the last report is that of Cornelius (1935) when a small puddling plant was erected.

Mintaro alluvial diggings

Waterworn gold with nuggets up to 6 ounces in weight have been recovered from shallow gravels on two distinct alluvial leads in the locality of sections 2153 and 2157 Hd. Stanley (Brown, 1908, p. 248). Interest was renewed in the area in 1931 when shafts were sunk to locate source gold-bearing veins but the field was again abandoned in 1932 (Cornelius, 1931, 1935b).

Orroroo (Norman Claim) prospect

Gold was first discovered 4½ miles southwest of Orroroo in 1914. Small production is reported from several shallow cuttings but occurrence of gold was erratic (Pearson, 1931, 1932).

Silver-lead

Robertstown - Bright prospect

In 1886 discovery of silver-lead ore was reported from thin lodes enclosed in dolomites "7 miles from Robertstown" (Brown, 1908, pp. 187-188). A number of shafts were sunk, the deepest being 210ft., and at least 30 tons of ore were raised; one parcel of 10 tons contained 36% lead, 29% zinc and 2 ozs. silver/ton (Jones, 1915).

Peters Hill Mile

Silver-lead and minor copper ores were worked from several shafts in this locality, 5 miles east of Riverton, in 1849 (Brown, 1908, p. 166, p. 187). Nixon (1967) reported that "it may prove to be a profitable venture for a small syndicate".

Manganese

Ketchowla deposits

Manganese deposits which have been worked over a length of 300ft. by means of three open cuts to depths ranging up to 24 feet and up to 12 feet in width appear to be exhausted with little prospect of extensions at depth (Armstrong, 1941).

Ironstone

Ironstone flux has been mined at several localities for fluxing lead ore from Broken Hill at the Port Pirie Smelters during the period 1897 to 1915 before the Iron Knob deposits were brought into production.

Oodlawirra flux quarries

The deposits situated 4 miles north-northeast of Oodlawirra consist predominantly of limonite with minor haematite that were recovered from open cuts and pits. Some 18,000 tons of +51% iron ore were extracted and reserves of some 40,000 tons of similar grade rock remain. A tramway formerly connected the quarries with the Broken Hill - Port Pirie railway (Binks, 1968b).

Pekina deposits

Small limonite deposits cap hilltops south of Pekina township. Jack (1922) records that several thousand tons of variable grade ironstone flux were sent to Port Pirie from a deposit situated 3 miles south of Pekina.

Hicks Quarry, Gladstone

A quarry, situated 3 miles from Gladstone, was worked during the period 1897 - 1902 by B.H.P. Co. Ltd. for use in smelting operations at Port Pirie. Over 70,000 tons were recovered from the quarry, which is reported to have been 90 feet deep (Mansfield, 1946).

Magnesite

Thin beds of sedimentary magnesite occur within the Skillogalee Dolomite in a number of areas but though they are generally thin-bedded

units of variable purity they have potential for development. The occurrence and usage of carbonate rocks throughout the State have been summarised by Johns (1963).

Port Germein Gorge

Testing of these deposits by diamond drilling was undertaken by the B.H.P. Co. Ltd., and, during the period 1940-1956, some 1,200 tons were recovered from surface workings and shallow underground workings comprising an adit which connected with an inclined shaft and stoping. The magnesite was used in the steel industry as a refractory furnace lining. Sampling has shown that the mineral is of fairly high grade with the chief contaminant being silica.

The formation extends beyond this locality (King, 1956) and during the years 1915-1919 the B.H.P. Co. Ltd. held leases and produced 37 tons from a deposit situated in Section 184, Hd. Howe, 3/4 mile northeast of Beetaloo H.S.

Clare

Magnesite occurs in dolomite near the Emu Flat copper mine and in 1929 production from Sections 1995 and 1976, Hd. Clare amounted to 95 tons.

Saddleworth

Rather impure, in part earthy and iron-stained magnesite has been quarried in Section 420, Hd. Saddleworth. Production of 80 tons has been recorded but the reserves are limited.

Robertstown

Magnesite beds extend from two miles north of Robertstown a distance of ten miles to the northwest. In the period 1916 to 1953 production amounted to 5,250 tons. Although some of the rock is of reasonably high grade much of it has high lime and iron contents.

Paratoo

Magnesite has been recovered from a number of shallow pits, located

3½ miles northwest of Paratoo, during the years 1921 to 1945 and recorded production amounts to 700 tons.

Asbestos

The occurrence of blue asbestos (crocidolite) north of Robertstown has been detailed by King (1957). Numerous small deposits in dolomites, in Sections 2, 2A and 3A, Hd. Bright, 9 miles northeast of Robertstown, were important producers in the past, having yielded over 600 tons of crude crocidolite of a good grade of mostly slip fibre suitable for heat insulation and as a filler. The asbestos occurs as small and sporadic veinlets and pockets in association with pyritic albite - mica schist in fault zones and fissures in dolomite. The individual occurrences are of very limited size and the surface showings are now practically exhausted.

Diamond drilling has indicated the limited nature of the Blue Hole crocidolite deposit (Johns 1960c) situated in Section 295, Hd. Apoinga. A quarry 70ft. x 50ft. x 12ft. deep has exposed albite - biotite - tourmaline rock in whichramifying veinlets of cross fibre blue asbestos fill joints and fractures varying from a fraction of an inch to 3 inches in width. The recoverable yield of asbestos concentrate proved to be small (Thomson, 1960).

Other deposits are known in Hd. Bright, Sections 19, 17W and 30 (Hallelujah Hills) and in Hd. Apoinga, Sections 294 and 316 but they are small and unlikely to be exploited.

Gypsum

Diamond Lake

Seed gypsum, mantled by kopi, which has accumulated along the eastern shore of Diamond Lake has been utilised in the manufacture of cement at Angaston and to date some 30,000 tons have been removed. Drilling has indicated that the deposits are irregular and of variable thickness (Shepherd, 1959) and that no exploitable reserves exist under the floor of the lake (Johns, 1960b).

Lake Bumbunga

Low-grade flour and seed gypsum which comprises low dunes on the eastern margin of Lake Bumbunga have been recovered for agricultural use. Approximately 1,300 tons were marketed, mostly in the period 1921-1928. Reserves of about 1 million tons remain but beneficiation would be required to upgrade these (King, 1951).

Hds. Baldina and King

Dunes of flour gypsum over seed gypsum which have accumulated about the eastern margin of a swamp 20 miles southeast of Burra comprise material of 60% grade, unsuitable for commercial use (Willington, 1956).

Salt

A considerable number of lakes occur in the Snowtown - Port Wakefield district, all more or less salt encrusted, but all are comparatively small with the exception of Lake Bumbunga which has a total area of 3,530 acres.

The main salt producer is Australian Salt Co. Ltd. based on Lake Bumbunga near Lochiel, where average seasonal production fluctuates generally between 5,000 and 30,000 tons.

Rain provides water to flush cyclic salt from the surrounding country into the lake and also to dissolve salt from the lake bed thus productivity is dependent upon a wet winter to dissolve salt sufficient for the accumulation of a thick crust on evaporation in the crystallizer pans during the following summer. The thickness of the salt crust varies from 3/4 inch to 1½ inches in a very good year. After harvest the salt is stacked at the lake edge and refined (Betheras, 1951).

Minor production is derived from a number of smaller lakes in the region located as follows: sections 283S, 282, 286E, 285, 289, Hd. Barunga, Snowtown Lake and section 536, Hd. Cameron (Jack, 1921).

Phosphate rock

Phosphate rock has been mined at several localities, near Orroroo, Tarcowie and Pekina and at Fairview, 18 miles southeast of Burra (Jack, 1919). The phosphate beds are thin, irregular and of low grade and further

exploitation is unlikely.

Brown Coal

The largest deposit of brown coal in the State is that of the Alma - Inkerman - Balaklava area where some 400 million tons of coal in one seam, 20 to 40ft. in thickness, have been outlined by drilling. The presence of large supplies of groundwater and thick cover of overburden (average about 240ft. thick) have inhibited development (Hillwood,1961).

At Whitwarta the coal seams attain a maximum known thickness of 33ft. but it thins rapidly in all directions (Parkin, 1952; Johnson 1960).

The coal deposits are of low grade and it is unlikely that they will be exploited now that natural gas and uranium constitute alternative energy sources.

Rock Products

Construction aggregate, ballast

Crushed rock for use as civil construction aggregate, for road-building, rail ballast etc. is derived from a variety of materials in proximity to centres of utilisation. The major quartzite formations which are widely developed within the upper Proterozoic sedimentary sequence are quarried at numerous centres, crushed and sized for base courses and bituminous surface treatment of roads within township boundaries and for highway construction. Easily rippable materials for base courses and construction of secondary roads comprise a variety of rocks - kunkar, siltstone, slate, sandstone, quartzite, dolomite, etc. and pits operated by the various District Councils abound.

Geological mapping of selected deposits has been undertaken by the Geological Survey on behalf of the Highways and Local Government Department to assess reserves of rock suitable for road construction and for the S.A. Railways Department to provide ballast sources for use in railway construction between Cockburn and Port Pirie. Diamond drilling has been utilised to provide samples for laboratory testing, to determine extent of formations, geological structure, overburden thickness etc.

Clays, shales

A variety of clays and weathered shales have been quarried throughout the region but exhaustive testing to outline the limits of the various occurrences has not been undertaken. References to reports on individual deposits are appended.

Slate

The slate deposits of Mintaro owned by the Mintaro and Flagstone Co. Ltd. has been a producer of high quality flagstones since 1891 and the "reserves of unworked stone are enormous" (Jack, 1923, Mansfield, 1960).

SUMMARY

Copper was discovered in the Burra district at the Princess Royal in 1843 but the Princess Royal Company failed to locate a good profitable lode and abandoned the workings in 1851 after producing 588 tons of ore dressed to a 25 - 30% grade for shipment to England. The more important Burra orebody was discovered shortly after the Princess Royal and during its producing life to 1872 the total yield of dressed ore amounted to 234,648 tons of approximate grade 22% Cu, valued then at £4,749,224 which ranks second in value to that of the Wallaroo - Moonta field. Some 25 other named copper mines and prospects are located in the area but, though production from these is generally not known, output was obviously small. Exploration for extensions to known deposits and for new ones is currently being undertaken.

Gold from structurally controlled vein-type deposits has been mined at Mount Grainger, Mongolata and the Pitcairn Range and from alluvials at Ulooloo etc. with total production being in excess of 15,000 ozs. There is little current interest in gold mining in the area.

A variety of non-metallic and industrial minerals occur but current production is limited to salt and past production has been generally limited. The known gypsum, asbestos and phosphate rock deposits are small, of low grade and are unlikely to contribute significantly to the mineral industry but magnesite in the Port Germein Gorge locality has potential for development.

Though the lignite deposits of the Inkerman - Balaklava area comprise the largest in South Australia, it is unlikely that they will be developed commercially as a fuel source.

Natural rock materials which are being utilised include quartzite for aggregate, ballast etc. with lesser usage of dolomite and diorite; slates for paving etc; weathered shales for manufacture of heavy-clayware products, bricks etc; alluvial clays for brickmaking; and sand for fine concrete aggregate. Though the availability of shales for specialised requirements is limited, stone suitable for construction aggregate and ballast is readily available throughout the region.

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DEPARTMENT OF MINES — SOUTH AUSTRALIA

MINERAL RESOURCES DIVISION

Director of Mines

SUP. GEOLOGIST

GEOLOGIST

Exd. | Ckd. L.V.W. | Trd. R.H. | Drn. R.K.J.

DATE: / May /1969 | SCALE: 1:250000 | 69-204 | FG

LEGEND

POTENTIAL USAGE AS CONSTRUCTION AGGREGATE ; BALLAST.

- Sandstone
- Quartzite
- Dolomite
- Dolerite, diorite
- Quarries, pits, ; road making materials.
- Sand
- Mintaro Slate
- Bricks, whiteware, refractories

MINERAL OCCURRENCES

- Asb Asbestos
- Cu Copper
- Au Gold
- Pb Lead
- Fe Iron
- Mn Manganese
- Mg Magnesite
- P Phosphate
- Gy Gypsum
- Coal

- Alluvium, outwash gravels, calcrete, sand etc.
- Anticline
- Syncline
- Approximate limit of outcrop
- Salt lakes, lagoons.
- Main roads
- Railways
- Council boundary

SCALE

MILES 2 1 0 2 4 6 8 10 12 14 16 18 20 MILES

KILOMETRES 5 0 5 10 15 20 25 30 35 KILOMETRES