DEPARTMENT OF MINES
SOUTH AUSTRALIA

TALC RESOURCES OF SOUTH AUSTRALIA

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ABSTRACT

Properties, uses and specifications, world and Australian consumption, of industrial grades of talc are summarised. In the past the principal demand in Australia has been for high quality cosmetic grade talc but a market survey indicates that national consumer trends have changed in recent times and previously unexploited deposits may now have some potential for production. Talc deposits in South Australia are reviewed in terms of geological setting and physical properties of the talc. Systematic laboratory evaluation of representative samples, in terms of consumer specifications, is recommended.

INTRODUCTION

For many years South Australia has been the leading producer of talc in Australia but recently the State production has been eclipsed by the Three Springs deposit in Western Australia. (Appendix 3).

Past development of local deposits has been influenced by the high Australian demand for cosmetic grade talc. South Australian deposits were previously reviewed by Dickinson et.al. (1951) but because of changing consumer requirements and export enquiries this report has been prepared to provide up to date basic data for marketing studies.

Talc has many useful physical properties and as a consequence is used for a variety of industrial purposes. These are discussed in this report only to the extent of providing the necessary background. For further details the reader is referred to the several standard text books listed in the general references.

Only the broader geological features of local deposits are discussed in this report and emphasis has been placed on production potential and limitations of the deposits.

Data used in the compilation of the report came from detailed reports listed in the South Australian references, from Departmental records, tabulated in Appendix 1 and from discussion with local mining and milling companies.

The principal milling and marketing firms in Australia were circularised to prepare the 1966-1967 consumption data shown in Table 5, and the ready response by these companies is acknowledged.

PROPERTIES, USES & SPECIFICATIONS

Talc is a soft pale coloured mineral with a characteristic greasy feel and pearly lustre. It has the formula $3MgO\ 4SiO_2\ H_2O$ and occurs in commercial deposits as a mono mineralic rock with variable amounts of impurities.

In Australia industrial talc is composed entirely of the mineral talc, but overseas, particularly in the United States, commercial grade talc may comprise any of several calcium-magnesium silicate minerals. Bates (1960) quotes compositions of several talcs from the Gouverneur District of New York State, the principal producer of commercial talc in the U.S. (Table 1).

TABLE 1

Mineral Composition of Talcs from the Gouverneur District, New York. (From Bates 1960).

Mineral	Specimen Number 1	2	3	4	5	6	7
Tremolite	17	78	38	29	15	38.0	47.6
Anthophyllite	20			45	78	7.0	38.4
Talc	63	4			7	24.0	5.4
Serpentine		18	54	26		12.0	4.1
Quartz						3.6	3.5
Carbonates		trace	4			14.4	3.0
Fe and Mn oxides, mica, diopside, pyrite			4			0.5	trace
	100	100	100	100	100	99.5	102.0

1. Pale grey to white fibrous talc, Talcville, N.Y.
2. Serpentinous tremolite, "10A ore," Talcville, N.T.
3. Serpentinous tremolite, "regular ore," Talcville, N.Y.
4. Gray fibrous to bladed tremolitic talc, Ontario mine, Fowler, N.Y.
5. "Arnold fiber", Arnold mine, Fowler, N.Y.
6. Average composition of the talc unit on the fifth level of the Woodcock talc mine near Balmut, N.Y.
7. Layer of commercial talc, Woodcock mine, near Balmut, N.Y.

Tremolitic and talcose rocks combine to provide commercial talc in California, the second largest U.S. producer.

The hydrous aluminium silicate pyrophyllite has similar properties to talc and is used industrially, sometimes in preference to talc.

Australian production consists mainly of the mineral talc, or in some specified cases pyrophyllite, and in this report 'talc' and 'soapstone' (as defined in a later section) are used in reference to Australian usage of material consisting predominantly of the mineral talc and 'commercial talc' refers to U.S. usage.

The theoretical composition of the minerals comprising commercial talc is shown in Table 2, after

TABLE 2

Composition of Minerals in Industrial Talc. Adapted from Engel and Wright 1960 p.836.

Mineral	CaO	MgO	Al_2O_3	SiO_2	CO_2	H_2O
Talc		32		63		5
Diopside	26	18		56		
Tremolite	13	28		57		1.5-2.3
Anthophyllite	2	30		58		1.5-2.2
Chlorite		36	18	33		5 -14
Serpentine		43		44		8 -13
Pyrophyllite			28	67		5

The principal industrial uses of commercial talc are in ceramics, paints and fillers - these commodities comprising 80% of world consumption It also has a wide variety of minor uses including cosmetics, textiles, foundry facings, polishing compounds and marking crayons. Its usefulness is related to a number of physical properties including extreme softness and smoothness, good lustre, extreme whiteness, high degree of slip, high fusion point, oil absorption properties, low electrical and heat conductivity, low firing shrinkage, chemical inertness. Specifications for commercial talc refer mainly to the physical state of samples, chemical composition being of importance only in its effect on the physical properties.

Commercial talc is almost always used in powder form, the degree of fineness varying from industry to industry.

The significant features of the various industrial uses of commercial talc are summarised below.

In ceramics talc is used to advantage in wall tiles and dinner ware because its drying shrinkage and thermal contraction are low and match that of many glazes, thus reducing the tendency for crazing of the finished surface. For ceramic ware of this type white firing (low iron) talc is traditionally used although pale coloured bodies of equal quality can be prepared using talc higher in iron. The main requirement of ceramic grade talc is constancy of fired colour and thermal properties. Mixing, blending and stockpiling at the pit are commonly practiced to ensure uniformity of composition over extended periods.

At higher temperatures many talcs possess valuable chemical and electrical properties and talc of this grade is used for the manufacture of high performance electrical, chemical and refractory articles. Fired colour is not important for this purpose and in the United States the specification allows up to 1.5% iron oxide, 1.5% calcium oxide and 4% alumina. Originally most of these articles were made by dressing and machining block talc to the required shape but today this is achieved more effectively by pressing powdered talc with a bonding material. For ceramic work talc is usually ground to pass 200 mesh screen.

Talc for paint preparation is generally required to pass a 300 or 325 mesh screen but some talc in micron size ranges is now being used. In paint it acts both as a filler and a pigment and is used extensively in exterior oil based paints and in cold water preparations. Specifications relate to colour (whiteness), particle size and shape, oil absorption, water soluble content, and specific gravity. Coloured minerals and the sulphates, gypsum and anhydrite, are particularly undesirable. Many overseas commercial talcs contain a considerable proportion of fibrous tremolite which is used to advantage as 'asbestine' in the paint industry.

Only the highest grade of white talc free of gritty impurities is used for cosmetics; some cheaper preparations utilize talc of inferior colour. Many talcs which are coloured in nature grind to a satisfactory whiteness for cosmetic use. Cosmetic grade talc is usually ground to pass 200 mesh sieve but much fine sizing is required for some special preparations. Generally the finer sizes are avoided because of the danger of inhalation.

Talc may be used instead of clay as a filler for paper, the deciding factor usually being the relative prices of available materials. Talc for this purpose must be of good colour and free of grit.

Lower grades of talc are used as a carrier for insecticides and in the rubber industry, and coarser grained material is suitable for the manufacture of waterproof and fireproof materials and papers. No particular specifications exist for talc of this type, the principal requirement being cheapness.

Pyrophyllite is used extensively in ceramics and is preferred for some insecticides.

Talc, soapstone and pyrophyllite can be substituted in many cases by other industrial minerals if price differentials exist at the place of consumption. The talc minerals suffer competition from kaolin, fullers earth, limestone and other non-metallic fillers and from felspar in ceramics. Mica, gypsum, kyanite, quartz and wollastonite may also compete where performance is of lesser consequence than price.

NOMENCLATURE

Most industrial minerals have several trade names in use which do not always convey the same meaning. Those most commonly used for commercial talc in the literature are defined below.

Talc - apart from its use as a mineral group name, talc is applied generally to the higher grades of commercial talc used in powdered form in the ceramic, paint and filler industries. It grades imperceptibly into soapstone.

Soapstone - originally described talc which could be sawn into blocks but today is used principally as a rock name for the lower grades of commercial talc. In the U.S.A. it describes rocks composed of 50-80% of the mineral talc with varying proportions of chlorite, amphibole and pyroxene.

Steatite - formerly described a massive variety of talc free of grain and visible impurity but the term now refers specifically to a grade of talc suitable for high quality electrical porcelain.

Block talc is massive talc or soapstone from which shaped articles can be machined.

Block steatite talc is used in U.S.A. to describe block talc of steatite grade.

Steatite ceramics are shaped bodies composed of powdered talc (of steatite grade) bonded with a suitable binder.

Lava ware refers to fired block talc and is applied principally to chemically and electrically inert slabs used for laboratory bench tops and electrical switch boards.

Asbestine was originally a trade name for fibrous and tremolitic talc used specifically to retard the settling rate of paints. The name is now often applied to talc used in paints for other purposes as well as a retarder. Other synonomous names in use in U.S.A. are loomite and tremoline.

PRODUCTION AND CONSUMPTION

Total world production of commercial talc in 1966 was estimated to be 3.44 million tons (Gourlay 1968) of which approximately 1 million tons, mainly pyrophyllite, were won in Japan. Of the remainder, the U.S.A. produced 0.8 million tons and the U.S.S.R. 0.35 million tons.

Substantial tonnages were won in France, India, China, Italy, Norway and Austria. Other producers, not listed by Gourlay (op.cit.) include West Germany 0.03 million tons, South Korea 0.1 million tons, and Canada 0.06 million tons (Anonymous, 1968).

Production data for the Australian industry are shown in Appendix 3. Of significance is the steady growth in production and consumption, the spectaculai rise in Western Australian production and the corresponding fall in tonnage from South Australia. In 1967, 8,650 tons of talc were exported and of this approximately 6,000 tons are estimated to have come from the Three Springs Deposit in Western Australia. Imports in the same year amounted to 2,164 tons, the principal sources being mainland China (1393 tons) with some from India, U.S.A. and South Africa. A large proportion of the imports is reported to be block steatite of a variety not available in Australia.

Consumption of talc and soapstone in the U.S.A. is shown in table 3

TABLE 3

Consumption of talc and soapstone in U.S.A. by industries

	1958 %	1967 %
Ceramics	35	29
Paint	19	21.5
Insecticides	7	6
Roofing	10	10
Rubber	4	4
Asphalt filler	4	N.R.
Paper	2	6.5
Toilet preparations	N.R.	4
Textiles	1	1
Foundry	N.R.	0.5
Miscellaneous	18	17.5

N.R. not recorded and included in miscellaneous.

Source: 1958 Johnstone and Johnstone (1961)
1967 Industrial Minerals No.11, August 1968

A breakdown of U.S. consumption patterns over the years 1959-1963 is given by Wells (1965) and shown in Table 4.

TABLE 4

Uses of Talc, Soapstone and Pyrophyllite in U.S.A. - average 1959-1963. Source: Wells (1965) p. 923.

	Talc (%)	Soapstone (%)	Pyrophyllite (%)
Ceramics	38	3	27
Paints	21	2	1
Rubber	5	4	5
Insecticides	4	36	24
Paper	4	-	-
Roofing	7	23	<1
Toilet preparations	2	-	<1
Textiles	2	-	-
Asphalt filler	2	20	11
Foundary facings	<1	4	-
Refractories	<1	-	18
Rice polishing	<1	<1	-
Crayons	<1	<1	-
Other	15	8	14
TOTAL:	100	100	100

Australian industrial consumption for the years 1943 and 1966-1967 is shown in Table 5.

The figures for 1943 represent an estimate of usage under war time conditions. Data for 1966-1967 were obtained from a questionnaire submitted to the major milling and marketting firms and represent 93% of talc consumed from Australian raw material sources. The 2,000 odd tons of imported talc are not included in the table.

TABLE 5

Consumption of talc in Australia by Industries

Source: 1943 Dickinson et.al. (1951)
1966-1967 Dept. of Mines Survey of Industry. Hiern and Adam (1969).

	1943 %	1966-1967 %
Ceramics	-	2
Paint	10	28
Insecticides	-	7
Roofing	3	-
Rubber	17	9
Asphalt filler	-	1.5

Table 5 (cont.)

	1943 %	1966-1967 %
Paper	-	-
Toilet preparations	54	37
Textiles	-	-
Foundry	10	0.5
Adhesives, putty	-	3
Pipe enamel	-	7
Auto filler	-	1
Miscellaneous	6	4
TOTAL	100	100

It is reported that the use of talc for ceramic purposes has fallen considerably in recent years because of competition from cheaper alternative materials (mainly whiting).

GEOLOGY OF TALC DEPOSITS

Talc is a metamorphic mineral resulting from alteration of magnesium-rich rocks. World deposits fall into two characteristic environments where the mineral is associated either with magnesian carbonate sediments or with ultra-basic igneous rocks. In all deposits talc formation has been accomplished by hydrothermal activity which usually also introduced the necessary silica. In some cases the silica was provided locally from arenaceous rocks.

The higher quality commercial talc deposits have invariably originated from carbonate rocks. Most talc bodies associated with carbonate rocks occur in fault zones which are often located on the margin of the carbonate bed. The principal role played by the fault zone is in providing a channelway for the mineralising solutions.

SOUTH AUSTRALIAN TALC DEPOSITS

The South Australian deposits are almost all associated with magnesium carbonate rocks, the principal deposits being at Mt.Fitton and Tumby Bay. In the

Gumeracha-Lobethal-Lyndoch area talc bodies occur in a sequence of metasedimentary schists and quartzites and the magnesium is believed to have been derived from micaceous minerals in the schists. This type of mineralisation is believed to be unique (Dickinson et.al. 1951).

Numerous other occurrences are known, some of which have been exploited to a small degree, but, as stated earlier, past talc mining has been oriented largely towards winning of cosmetic grade material.

Northern Flinders Range

Talc bodies are associated with Adelaide System dolomites as described below.

Mt.Fitton

Located 80 miles east of Lyndhurst, a siding on the Marree-Pt.Augusta standard guage railway, 170 miles north of Pt.Augusta. The deposit was discovered in 1944 and has been described by Dickinson (1949), Sprigg (1951) and Nixon (1961).

Mineral rights are reserved to the Crown but all significant talc bodies are held under mineral lease. In addition, the operating company holds a Special Mining Lease over all potentially productive ground in the area.

The talc bodies occur in a massive recrystallised dolomite which was probably originally a carbonate reef. Stratigraphically it overlies the Sturtian tillite and in the most recent mapping is assigned to the Balcanoona Formation (Coats and Blissett in press). Talc bodies are developed along shear zones in the dolomite and the largest known bodies are located on the margins of the dolomite (stratigraphically at the top and the bottom of the bed). Recent detailed prospecting over the main mass of dolomite has revealed a large number of new talc occurrences which are currently being assessed.

Regional mapping has shown the host dolomite to be lenticular along strike within at least 25 miles of Mt.Fitton and that there is no further development. Although faulting within the dolomite exercises local control over the talc bodies, it is considered that the metamorphic aureole of the Mt.Painter granitic intrusions controls the broader regional distribution of talc mineralisation.

Assessed reserves in 1960 amounted to 200,000 tons in No.5 Deposit, the largest orebody (Nixon op.cit.). Of this, 20% was estimated to be first grade and the remainder 2nd and 3rd grade talc. Nixon (op.cit.) quoted total rock mined in the No.5 deposit up to 1959 as 93,000 tons of which 39,000 tons (49%) was talc. Of this 44% was first grade - the remainder second and third grade. A breakdown of production from the Mt.Fitton mines over the past 5 years shows 54% first grade talc, 29% second grade and 17% third grade. The chief impurity in the lower grades of talc is green chlorite.

No.4 ore body has been exploited by means of an open cut and underground workings and appears to be almost exhausted. Present operations are centred in ore bodies nos. 5, 8 and 22. Substantial additional reserves have been proved during recent exploration activities and there are large stockpiles of second and third grade material at grass in the area.

Mt.Fitton talc is reported to be suitable for all uses including block steatite. However, the operators are primarily mineral earth millers and past mine production has been geared specifically to supply their milling demands. Three grades are produced at the mine; grade 1 for cosmetics, grade 2 for paint and some low grade cosmetics and grade

3 for ceramics. Grade 3 material is of far better quality than talc normally used in insecticides and rubber manufacture. In recent laboratory work at the Australian Mineral Development Laboratories (AMDEL) the fired colour of second grade Mt.Fitton talc was slightly inferior to that of Tumby Bay talc.

Tremolite is associated with the talc bodies but it is not known whether this is available in quantity or whether it is comparable to the U.S. tremolite commercial talc.

Mt.Fitton is capable of producing large tonnages of the higher grades of industrial talc and the chief disadvantage appears to be in location and, in particular, in transport costs from the mine to the railhead at Lyndhurst.

The Balcanoona Formation is further developed around the Arkaroola Syncline, south-west of Arkaroola Station and 40 miles south south-west of Mt.Fitton. Like the occurrence at Mt.Fitton it has a lenticular habit. Magnesite, a common associate of the Mt.Fitton talc bodies is developed in a large body of hydrothermal origin on the southern limb of the Arkaroola Syncline (Nixon 1959). The presence of talc was also recorded.

Departmental records show an occurrence of low grade steatite with magnesite and dolomite at 'Illawartina Well', in the Balcanoona area. This probably refers to Illinawortina Well located 10 miles west of Mt.Warren Hastings Trig and 3½ miles north of "Yadaminna" on the northern limb of the Arkaroola Syncline.

Dolomite rocks with some associated talc occur in the Wywyana Formation lower in the Adelaide System sequence which is developed around the western and southern margins of the Mt.Painter Block. Coats (pers.comm.) reports a large body of talc located near Humanity Seat Trig, 2½ miles south east of Mt.Painter, lying along the faulted contact of a carbonate bed and an overlying quartzite. There is some visible hematite but no samples have been taken for testing.

Talc schists are developed locally in shear zones in actinolitic marble of the Wywyana Formation at the Black Queen mine, ¾ mile south east of Yudnamutana Bore. (Blissett 1964). The shear zones, in which hematite, limonite, quartz and secondary copper occur, are reported to be about 5 feet wide but no samples have been tested.

Hd. Adams

Asbestos and talc are exposed in the bed of a creek located 20 miles east of Hawker (Crawford 1958). Good quality talc, with some clay impurity, immediately underlies a bed of dolomitic limestone which strikes at right angles across the creek. The talc band, which is poorly exposed, is estimated to be 25 feet wide. The asbestos is exposed a further 200 feet upstream from the talc deposit.

Stratigraphically the talc band lies near the base of the Umberatana Group.

Mt. Lofty Ranges

Gumeracha

Many deposits of pale green foliated talc occur in the Hundred of Talunga, near Gumeracha, 20 - 25 miles east of Adelaide. On most of the land mineral rights are privately owned but some of the deposits lie on properties with minerals reserved to the Crown.

Mapping by Whittle (Dickinson and Whittle 1951) disclosed that talc bodies occur in the vicinity of a marker quartzite horizon and extending over a distance of about 6 miles. These bodies, which contain in part a considerable proportion of albite both as large blocks and in small gritty particles, represent replacement of mica schist in zones of structural deformation. Well developed pyritohedra of pyrite, up to 4" across, occur in the deeper mines and limonite pseudomorphs are found in the upper levels. Both albite and talc are considered to have been derived from the enclosing schists by metasomatic action (Stillwell and Edwards 1951).

The deposits, which are the first to have been worked in the State, are currently being mined, mainly from underground workings. Several open cuts exist and are worked sporadically. Production for the years 1957-1967 is shown in Appendix 3 and has been fairly steady at 2500-3000 tons per year since 1964.

Four grades of talc are produced by hand selection. Grade 1, which is reported to be about equivalent to Grade 2 Mt.Fitton, is used for lower quality cosmetics and for paint. It is free of iron staining and albite grains. Grade 2 is also used for some paints but grade 2 to 4 are low quality stained talc suitable mainly for insecticides, dusting powders, waterproof paints etc.

Gumeracha talc contains iron impurity both as visible pyrite and limonite grains and iron staining and also chemically combined in stain free material. Iron in this latter form amounts to over 2% and gives a brownish tinge to fired products. While this is not detrimental to lava ware and steatite articles, the talc is unacceptable for wall tiles by present day standards.

All grades are reported to be difficult to grind, although the powdered products have a good white colour. The accompanying albite contributes to grittiness.

The deposits, because of their proximity to industrial centres in Adelaide, could be an important source for expanding markets of lower grade talc.

In the open cuts large tonnages of talc containing inclusions of schistose and quartzitic country rock are available. Research into uses for this material is recommended.

Lyndoch

Talc bodies in a similar environment to those at Gumeracha occur along the west limb of a regional syncline, 2 miles east-south-east of Lyndoch and 14 miles north of Gumeracha (Whittle 1951b). Mineral rights in the area, which lies in the Hundred of Barossa, are privately owned.

A deposit located in Section 3133, Hd. of Barossa and known as the Karawirra Orebody is described in detail by Olliver (1967b) who recommended diamond drilling or underground development to define the limits of the orebody. More than 25,000 cubic yards of talc, of similar quality to Gumeracha, were considered to be present. The proportion of marketable talc in this volume could not be assessed from existing exposures at the mine.

Lyndoch talc is reported to be even more difficult to grind than Gumeracha material. A sample recently submitted by a private prospector to Japanese interests was rejected on account of high iron content (maximum permitted 0.5%).

Mapping by Whittle (op.cit.) shows the Karawirra deposit to be far from the largest in the area and a considerable tonnage of talc, similar to Gumeracha, exists in the area. Both Whittle (op.cit.) and Olliver (op.cit.) refer to the rugged terrain in which the talc bodies occur.

Ward (1937) recorded the presence of talc schists at an asbestos deposit located in Section 585, Hd. of Barossa, 2 miles north east of Lyndoch.

Williamstown

A small talc body, from which 56 tons of soapstone were produced in 1944, is located in Section 1180, 1181, Hd. of Barossa, 1 mile E.N.E. of Williamstown. (Whittle 1951c).

Although associated with carbonate rocks, Whittle (op.cit.) regards the origin of this deposit to be similar to those at Gumeracha and Lyndoch.

Reserves are small and the talc of poor quality.

Lobethal

A deposit, described by Whittle (1951a) as talcose pegmatite, has been worked in Section 5083, Hd. of Onkaparinga, for both felspar and soapstone. Exposures are poor but the deposit is considered to be of the same type as Gumeracha, i.e. an albitised metasediment, developed under special conditions which allowed growth of large albite crystals. A considerable reserve of both felspar and soapstone are reported to exist. Production of soapstone amounted to 4,733 tons during the period 1932-1963.

Talc deposits in the Gumeracha-Lyndoch-Lobethal area could provide a source of the lower grades of commercial talc and several of the bodies, if developed, might be suitable for open cut mining. Their location near Adelaide is an advantage in minimising haulage costs. Increased production by open cut methods would eventually remove the surface stained zone and would result in a greater proportion of the higher grade material becoming available.

Truro District

Three talc deposits, associated with Cambrian magnesian marble, are known to exist in the area north of Truro. This area is covered by the Truro 1:63,360 map sheet (Coats 1959). Topography is mature and outcrop poor so that deposits of soft talcose rock could exist undiscovered.

Truro Talc Mine

Off-white gritty talc is exposed in a small open cut in Section 228 Hd. of Jellicoe where mineral rights are privately owned. A total of 465 tons of third grade talc were won during the years 1961-1964.

The talc is associated with Cambrian marble beds but outcrop at the deposit is poor and the extent of the talc body is unknown (Johns 1962).

Preliminary ceramic investigation showed the talc to be suitable for earthenware bodies but not for whiteware. Mineralogical analysis disclosed 68% talc, 28% quartz and 4% kaolin.

Joe's Hill Talc Deposit

Auger drilling on Sections 321, Hd. of Belvidere and 87, Hd. of Dutton has outlined a large body containing possibly ½ million tons of clayey talc (Olliver 1967a). Firing tests of a sample from a shallow shaft showed the material to be suitable for ceramic use.

Further testing is considered to be necessary before a workable deposit can be assured at Joe's Hill. The exploratory work should take the form of extensive trenching and laboratory testing of representative samples.

A similar deposit has been reported to occur nearby but its location is unknown. Talcose rock containing up to 80% talc has been recorded from Section 331, Hd. of Belvidere, 1 mile south west of the Joe's Hill Deposit (See Appendix 1).

Mineral rights throughout the district are privately owned.

Eyre Peninsula

One of the principal talc deposits in the State occurs in the Hundred of Yaranyacka, near Tumby Bay. Talc and soapstone are associated with Precambrian dolomites and serpentinous marbles in the area north and west of Cowell.

Tumby Bay

Lenticular bodies of high grade talc occur in a band of talcose schist flanking both sides of a dolomite lens in Precambrian metasediments 8 miles north of Tumby Bay. The deposit was first worked in 1910 and produced high quality cosmetic grade talc continuously until 1956. Mining was by underground methods and approximately 12,000 tons of talc were produced from a series of narrow lenticular bodies which extended along both margins of the dolomite bed for a length of almost 3 miles.

The workings are now abandoned but the principal group are still held under a mineral lease while at the time of writing the area is included in a Special Mining Lease for non-metallic minerals. The line of lode extends through Section 412, 413, 46 and A^{S}, Hd. of Yaranyacka, where mineral rights are reserved to the Crown, and through Sections 24, 33 and 42 where minerals are privately owned.

Broadhurst (1951) described the deposit in detail and more recently Hiern (in press) discussed aspects of reopening the field.

Stained talc suitable for ceramic purposes is reported to occupy the upper 20ft. of the talc bodies and little of this was extracted during the previous mining operations. Although much of this would appear to be available for open cut mining, the old workings are a hazard to safety and would need to be located ahead of mining Alternatively, entirely new bodies or lower grade sections might be found and developed. It is considered that there s a reasonable chance of locating substantial additional reserves in this way.

Throughout the deposit the talc bodies are contaminated by seams and pockets of hard jasper and a satisfactory means of separating this would need to be developed to enable significant production to be achieved.

Recent firing tests of a selected sample of Tumby Bay talc returned satisfactory results, and the fired colour was considered to be better than that of second grade Mt.Fitton talc.

Cowell District

At a deposit located in Section 116, Hd. of Minbrie pale-green massive talc and powdery clayey talc surround a lenticular mass of marble but reserves although not defined, appear to be small (Mason in press).

Substantial reserves of talc are reported to occur in Section 110 (formerly 1B), Hd. of Minbrie, associated with marble and intrusive pegmatites (Miles 1952). The talc is schistose and crushes to an off-white colour. An analysis shows 3% iron oxide and the material would be unsuitable for most ceramic purposes.

Mid and Upper North

Several, as yet mainly undefined, talc deposits occur in Adelaide System rocks in the mid and upper north of the State.

Yongala

Impure gritty talc associated with dolomitic limestone is exposed in a cutting for the standard guage Pt.Pirie-Broken Hill railway in Section 159, Hd. of Mannanarie, 2 miles south west of Yongala.

Preliminary firing tests indicated the talc to be suitable for earthenware.

Locally, the limestone is intensely folded in a disturbed zone several square miles in area adjacent to a major regional fault. Impure talc was recorded in fence post holes in Block 483, Hd. of Whyte, 8 miles to the south east of the railway cutting exposure, associated with the same limestone bed.

Topography in the area is mature with widespread soil cover and concealed talc bodies of considerable dimensions could exist in this area.

Yatina

Talcose kaolinitic clay occurs in a 20ft. wide band which is thought to represent a shear zone in Adelaide System rocks. The exposure sampled is in a creek bed in Section 209B, Hd. Black Rock Plain and is overlain by several feet of gravel overburden.

Preliminary firing tests showed the talcose clay to be suitable for ceramic whiteware.

Mineral rights are reserved to the Crown. The deposit has been pegged by a local syndicate but the claim lapsed several years ago. The deposit may be the same as that formerly held by the Bismark China Clay Co. and referred to in a note in Mining Review No.12 (1910).

Hallett

White clay and talcose clay are exposed in a railway cutting in Section 489, Hd. of Hallett (Hiern - in press). Preliminary firing tests showed the material to be suitable for ceramic whiteware. Ironstained talc occurs in surface soil a few hundred yards to the west and this may pass to talc of better colour and quality at depth.

Mineral rights are privately owned.

The deposit requires subsurface exploration before its value can be assessed.

Spalding

In describing the Spalding Willouran Inlier, a diapiric structure within Adelaide System sediments, Forbes and Johnson (1966) report talc to be "fairly abundant in the metamorphosed Skillogalee Dolomite south west of Spalding".

Blissett (1969) records the presence of talc in Willouran dolomite located on the eastern margin of the inlier. The deposit is associated with a fault zone.

No other details of these occurrences are available.

Hundred of Bright

Talc schist and talc have been identified from the Fairview Phosphate workings in Sections 2^A and 225, Hd. of Bright.

King and Knapman (1956) describe an adit driven beneath the southern workings in which impure talc with veins and segregations of chert, ironstained impure talc and partially decomposed dolomite carrying impure talc were observed over a width of 90 feet across the strike of the host rocks.

In recent diamond drilling beneath the adit (Johns 1969) little talc was recorded in bore logs corresponding to the talcose zone mapped in the adit although Johns (pers.comm.) confirms that impure talcose material was present. Cores of this section are available for inspection in the core library.

<u>Miscellaneous Deposits</u>

Tea Tree Gully

A sample from Section 5397, Hundred of Yatala, submitted for firing tests as white clay, was shown on chemical analysis to be an impure talc (Ellerton, 1956). Rocks in the area consist of Adelaide System dolomite and shales.

Weekeroo

One mile north-east of the Walparutta Copper Mine talcose mica schist occupies an 8ft. wide fault zone in Adelaide System quartzites and slatey dolomites (King 1955). This deposit and small magnesite lenses lie near the unconformity with older Precambrian rocks.

A representative sample con tained only 50% talc and much siliceous grit.

Other Deposits

Talc has been recorded from several other localities in the State about which little is known. A list of all recorded talc occurrences is given in Appendix 1. Many of these are probably of mineralogical interest but inspection of some is warranted.

BENEFICIATION OF TALC

A considerable amount of trial beneficiation of South Australian talcs was carried out in the mid 1940's and again during 1963. Because of the high proportion of cosmetic grade talc consumed in Australia the tests were directed entirely towards upgrading of hand-sorted second and third grade material.

Blaskett (1946) investigated upgrading of Gumeracha talc by dry grinding followed by flotation. The chief impurity in the sample tested was albite. Iron oxides in the feed amounted to 0.76% Fe_2O_3 and 1.7% FeO by chemical analysis. Little beneficition resulted from dry grinding and classification but a considerable improvement in colour and reduction of grit was achieved by wet grinding and flotation. However the concentrate still contained over 2% iron oxides.

Metallurgical investigation of Mt.Fitton rock during 1948-1949 was concerned with the dual problem of developing a sorting procedure to eliminate hand-dressing and also to increase the proportion of first grade talc produced (Jackson, 1951). The work was performed on samples which had been selectively mined in the normal manner of the field. Undesirable impurities consisted of red iron stain (confined to near-surface material), lime scale filling cleavage cracks (also a near-surface feature) and chloritic material. Green chlorite is the principal contaminant of second and third grade talc.

Samples containing these impurities were subjected to gravity separation, differential grinding, magnetic separation, electrostatic separation and flotation. The lime scale was found to flake away from the talc lumps with coarse crushing and a satisfactory grade was obtained by screening and rejection of fines.

The chloritic impurity responded to all beneficiation methods to some degree but failed to produce a talc of sufficiently good colour for cosmetics. Flotation gave moderate results but the method was not tested exhaustively because it was stated that the slip characteristics of the talc were adversely effected by wetting.

More recently Moskovits (1964) conducted tests on a sample consisting of white and discoloured (grey-green) lumpy talc. The methods used were high tension and magnetic separation, screening, flotation and photometric sorting. Although the sample was significantly upgraded by flotation, the concentrate was pale-yellow and of unsuitable colour for cosmetics. Leaching with hydrochloric acid produced talc of acceptable colour. No data on slip properties were given by Moskovits.

Separation of white and coloured lumps was accomplished satisfactorily by photometric techniques.

No further work or improving the lower grades of selectively mined talc for cosmetic use appears to be necessary.

Methods of eliminating country rock inclusions and other impurities, such as jasper in Tumby Bay talc, from material won by open cut methods could be investigated to supply demand for paint and lower grades of talc.

SUMMARY AND CONCLUSIONS

Recent statistics indicate an increasing demand for talc in the paint, rubber and other industries at the expense of higher quality cosmetic grade talc and deposits previously regarded as uneconomic should be re-examined in the light of specifications demanded by these industries.

All deposits known in the State have been reviewed in terms of geological setting and chemical and physical properties; this will provide a basis for further development of talc resources.

Data required by present day specifications are not available for many deposits and systematic laboratory evaluation of talc from the larger and more favourably located deposits is recommended.

This work has already been implemented as an AMDEL project through the Geological Survey

MNH:JB
27.8.1969

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SENIOR GEOLOGIST
NON METALLIC SECTION

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APPENDIX I

RECORDED OCCURRENCES OF TALC IN SOUTH AUSTRALIA FROM RECORDS SECTION, DEPARTMENT OF MINES

A = analytical report. P = petrographic report. MR. = Mining Review

Hundred	Section	Remarks	Dept. Reference
Adams	17	Fairly pure talc, some felspar.	P56/200
Apoinga	-	15m from Burra West. Talc identified in dolomite.	A5/153
Apoinga	B	Metamorphosed siliceous dolomite containing talc.	P62/307
Barossa	96	Talc identified in limestone.	A6/247
Barossa	266	Soapstone identified	P65/11
Barossa	3131,3133	Lyndoch Talc Deposit.	M.R.121
Belvidere	321	Joe's Hill Talc Deposit	M.R.121
Belvidere	331	Talcose rocks containing up to 80% talc. 1m. S.W. Joe's Hill	P58/979, 980
Belalie	-	Near Jamestown - identification of French chalk and dolomite.	A3/203
Black Rock Plain	209B	Talc and kaolin identified.	P67/523
Bright	73	Equal quantities of talc and dolomite.	P59/809
Bright	225	Talc schist, traces quartz and rutile. Fairview Phosphate Mine.	P56/69
Bright	1A	Talc and quartzite identified	A Vol.1/101
Dutton	87	Joe's Hill Talc Deposit	M.R.121
Jamieson	-	Impure talc associated with some tremolite and clay minerals.	P56/198
Jellicoe	228	Truro Talc Mine.	M.R.113
Kapunda	-	Talc and quartz identified	A4/201
Kooringa	-	Burra Mine - talc - dolomite rock.	P62/55
Lincoln	147	Borehole G.D.1 - dolomite with talc at 133', 226', 247'.	P63/500, 501
Light	764	Talcose marble containing 35% talc, 37% calcite 3% dolomite.	P59/546
Mann	68	Poonana Mine - claystone and talc identified.	A4/201

cont...

Hundred	Section	Remarks	Dept. Reference
Miltalie	13	Full analysis.	A.Vol.1/1[a]
Minbrie	110, 1B	Asbestos Workings.	M.R.92
Moorooroo	-	Near Moculta - talc and dolomite identified.	A6/226
Moorooroo	-	Angaston - full analysis impure talc.	A5/176
Myponga	60	Limonite stained, slightly chloritic talc.	P60/539
Nuriootpa	1662	Walton Hill Copper Mine - talc identified.	A4/204
Onkaparinga	approx. 1190	Near Oakbank - quartz, felspar talc rock.	P50/150
Playford	-	Cowell district - impure talc analysis.	A6/1
Playford	-	Pikes Corner - full analysis.	A.Vol.11/41
Saddleworth	125	High quality talc identified Inspection could not locate source.	P55/130
Talunga	many	Gumeracha Talc Deposits	Bulletin 26
Terowie	433	Willow Creek. Talc identified	P65/509
Upper Wakefield	-	Council quarry - talc in quartzite rock.	P56/113
Upper Wakefield	204	Rubble pit - talc schist with minor limonite.	P56/58
Warrow	139	Kaolin rock with gritty quartz and fine flaky talc.	P49/33
Whyte	483	Talc in post holes. 50% talc with kaolinite and minor quartz.	P57/193
Yaranyacka	many	Tumby Bay Talc Deposit.	Bulletin 26
<u>County</u> Hore, Ruthven. West edge of Lake Gilles east of Harris' Bluff.		Montmorillonite clay and steatite.	P53/40
<u>County</u> Taunton Mt. Caernavon 25m E. Edeowie.		Steatite with quartz, muscovite, andesine.	P54/121
<u>OUT OF COUNTIES</u>			
<u>Mt.Fitton</u> Talc Deposit			Bulletin 26

continued...

Out of Counties	Remarks	Dept. Reference
Gammon Ranges near Lockner's Well	Talc identified	A.Vol.6/86
Leigh Creek Coalfield Lobe D.	Talcose silty clay identified.	P57/356
Balcanoona Illawortina Well	Low grade steatite consisting of talc in magnesite and dolomite. Talc 56%, magnesite 34%.	P64/359
Bimbowrie. Alcoonie. Dam 9m. N.W. Bimbowrie H.S.	Talc identified.	P62/165
Boolcoomata. Cathedral Rock.	Talc identified.	P62/1229
Weekeroo 3 miles north of homestead.	Talc - chlorite - carbonate schist described.	P64/359
Mt.Painter - Corumdum Mine.	Flakes of steatite in dolomite.	P57/313

APPENDIX 2

CHEMICAL ANALYSES OF TALC

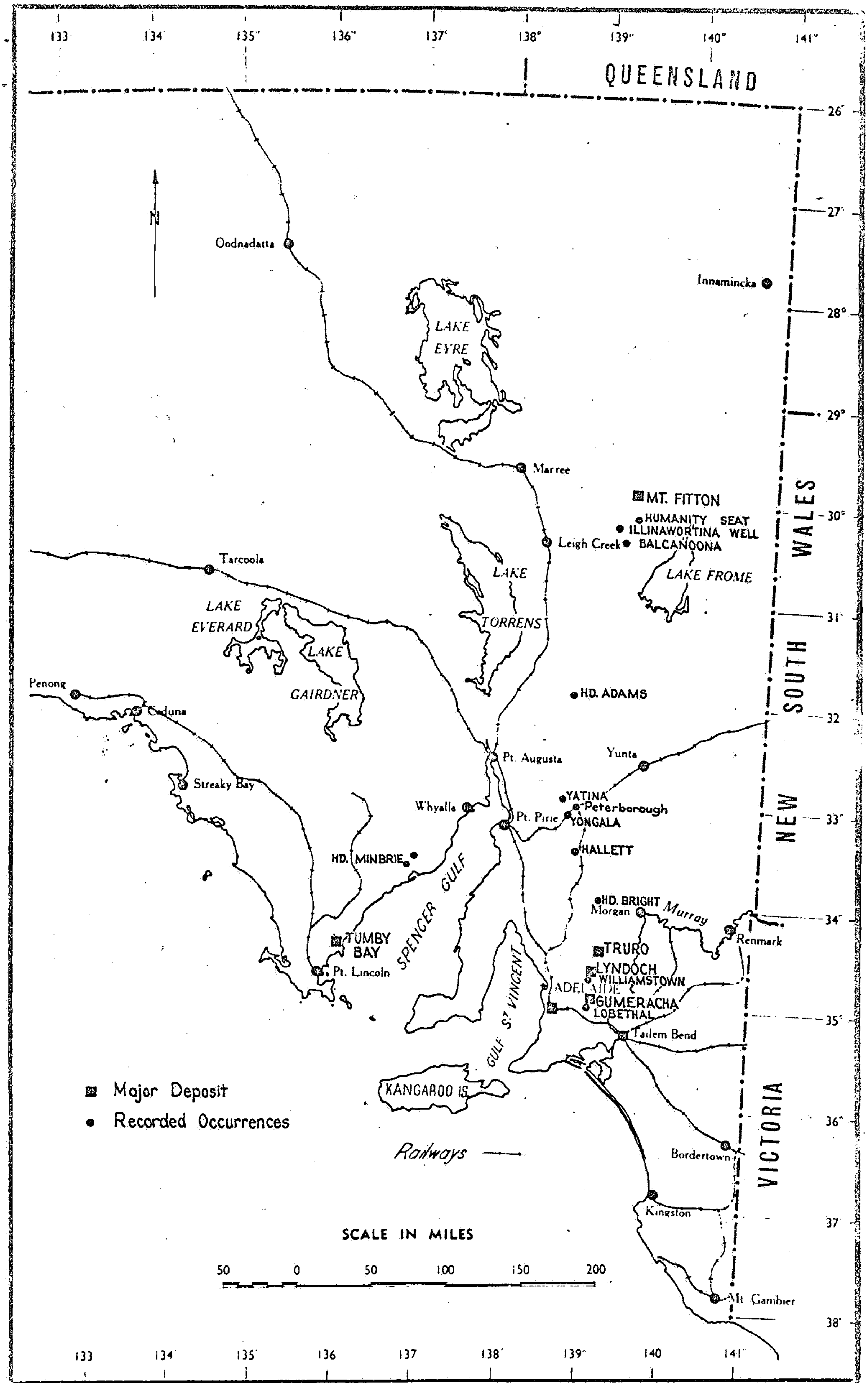
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
S_1O_2	63.5	63.1	62.8	60.3	49.6	64.2	63.4	61.0	63.7	71.7	58.5	52.92	62.08	62.47
Al_2O_3		3.8	4.80	1.50	8.05	0.87	0.66	0.43	6.25	1.68	2.44	5.79	0.46	0.58
MgO	31.7	23.8	22.9	30.9	31.9	29.5	30.1	29.4	20.4	21.7	29.98	28.94	31.33	30.[illegible]
Fe_2O_3		0.22	0.19	<0.01	0.14	0.12	1.08	0.43	0.43	-	0.20	0.58	0.08	0.20
FeO		1.84	1.57	0.47	0.69	0.22	0.12	1.78	1.36	0.50	2.72	3.14	0.77	0.76
CaO		0.14	0.03	0.14	0.34	0.20	0.18	0.21	0.04	0.15	0.22	0.08	0.04	0.07
K_2O		0.03	0.02	<0.01	<0.01	<0.1	<0.1	0.21	0.09	0.01	Nil	0.10	0.01	Nil
Na_2O		2.25	2.40	0.03	0.04	<0.26	0.02	0.05	3.0	0.09	0.06	0.92	0.31	0.08
T_1O_2		0.32	0.57	0.12	0.50	0.07	0.05	0.39	0.28	0.08	Nil	0.14	0.01	0.02
MnO		<0.01	<0.01	<0.01	<0.01	<0.04	<0.04	0.02	0.01	-	-	-	<0.01	<0.01
CO_2		0.25	0.20	0.50	0.60	0.04	0.01	0.10	0.10	0.08	Nil	-	0.06	0.06
SO_3		0.03	<0.01	0.03	0.12	0.04	<0.01	-	-	0.02	-	0.02	Nil	Nil
Cl		<0.01	<0.01	<0.01	<0.01	0.34	<0.01	Nil	Nil	0.09	-	-	Nil	Nil
H_2O^+	4.8	3.90	4.10	5.60	8.00	4.77	4.83	5.10	3.75	3.60	5.55	6.93	4.68	4.80
H_2O^-		0.19	0.19	0.15	0.17	0.61	1.02	0.66	0.52	Nil	0.13	0.14	0.33	0.44
P_2O_5		-	-	-	-	-	-	0.99	0.02	-	-	-	Nil	0.03

1. Theoretical
2. Gumeracha - first grade - Sample A4/69
3. Gumeracha - third grade - Sample A5/69
4. Mt.Fitton - first grade - Sample A6/69
5. Mt. Fitton - third grade - Sample A9/69
6. Tumby Bay - first grade - Sample A 76/69
7. Tumby Bay - stained talc - Sample A 78/69
8. Lyndoch - best green - Olliver 1967b.
9. Lyndoch - good white - " " "
10. Truro - Section 228 - Sample A1429/67
11. Cowell - Hd. Miltalie, Sec. 13.
12. Cowell - Hd. Minbrie, Sec. 110.
13. Three Springs, W.A. - white.
14. Three Springs, W.A. - off white.

APPENDIX 3

TALC PRODUCTION, EXPORTS, IMPORTS
AUSTRALIA 1957-1967

	CALENDAR YEARS										
	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
S.A. PRODUCTION											
Mt.Fitton	4500	5132	6830	5561	4124	4354	3546	5308	7942	3864	4192
Gumeracha	5043	6634	4247	3281	3138	3337	3315	2885	2493	2473	2876
Lyndoch								26			
Tumby Bay						27					
Truro					127	32	127	179			
Lobethal	143		87	97	85	86	67				
Total S.A.	9686	11766	11164	8939	7474	7836	7055	8398	10435	6337	7068
N.S.W.	1020	998	1089	1136	852	720	864	1366	1683	1403	2135
W.A.	3654	2501	4048	5470	5149	4981	4669	6451	7088	13365	10785
QLD	-	-	-	-	-	-	10	-	-	-	-
Total AUST.	14360	15265	16301	15445	13475	13537	12598	16215	19206	21105	19988
IMPORTS	No Record		539	496	1465	2122	2550	2314	2366	2857	2164
Total IN AUST.			16840	15941	14940	15659	15148	18529	21572	23962	22152
EXPORTS	2326	3256	2620	3905	4191	4988	4025	5181	6778	7635	8648
NETT CONSUMPTION	-	-	14220	12036	10749	10671	11123	13348	14794	16327	13504
PYROPHYLLITE N.S.W.	358	267	347	501	1288	1282	837	381	-	262	555
SERPENTINE N.S.W.								604	151	-	-



DEPARTMENT OF MINES — SOUTH AUSTRALIA

	Drn. M.N.H.	LOCALITY PLAN SOUTH AUSTRALIAN TALC - DEPOSITS	SCALE: AS SHOWN
	Tcd. R.A.J.		S 7428 994·2
	Ckd. E.B.T.		
	Exd.		DATE: 25TH. AUG. '69

P.F. No. S 5850 994·2