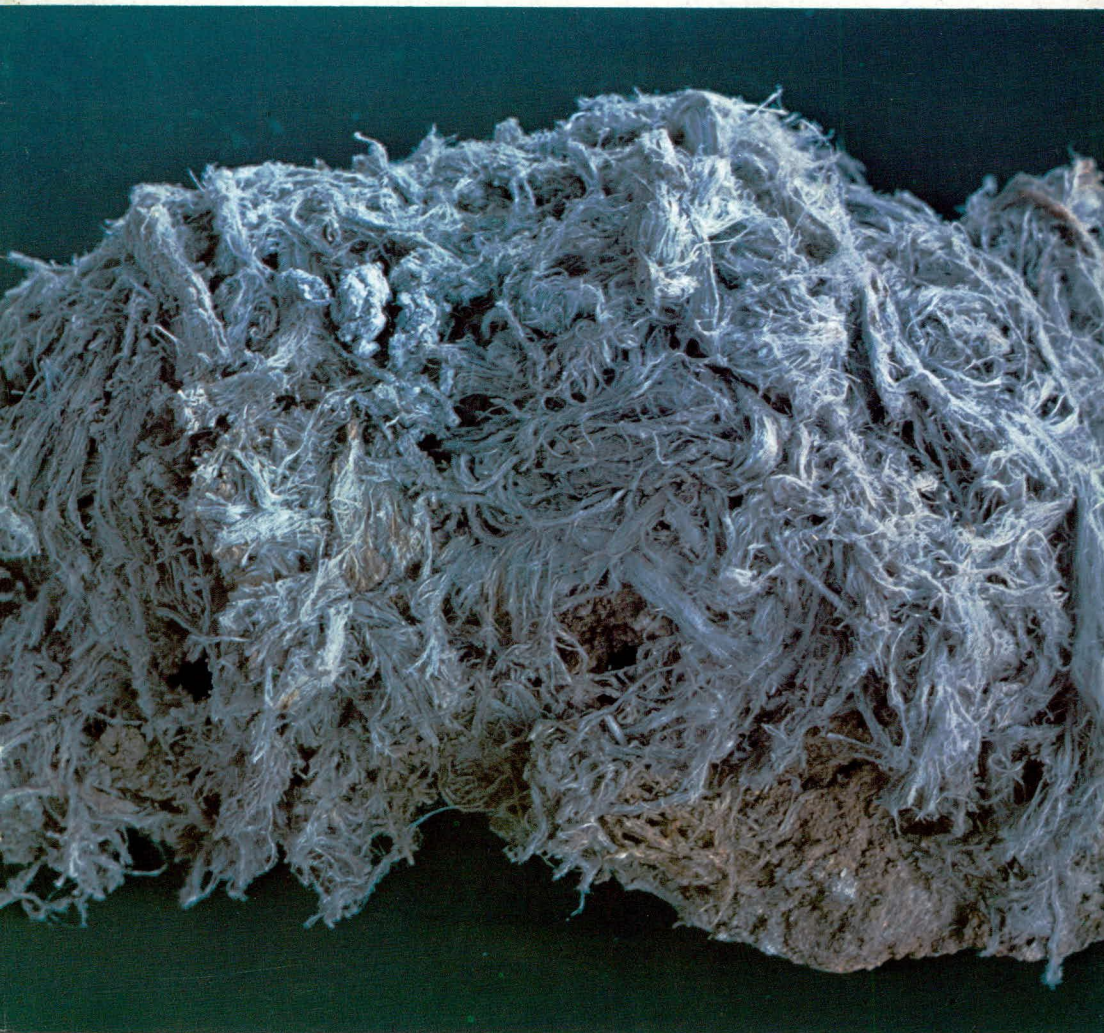




MINOR INDUSTRIAL MINERALS OF SOUTH AUSTRALIA



MINERAL INFORMATION SERIES

INTRODUCTION

Industrial and non-metallic minerals, though generally lacking the glamour of precious and base metals, are nevertheless of great importance and locally rank second only to iron ore in total value of production. They include barite, clay, gypsum, limestone, salt and talc.

This brochure deals with less common South Australian industrial minerals:

asbestos
beryl
corundum
diatomite
dolomite
feldspar
fluorite
graphite
magnesite
mica
sillimanite, andalusite and kyanite
strontium

ASBESTOS

The minerals classified as asbestos are white, grey, green-grey or blue-grey, flexible fibrous varieties of

amphibole: tremolite-actinolite, crocidolite, amosite and anthophyllite

(formula $A_{2-3}B_5(Si, Al_4)O_{11}(OH)_2$ where

(A may be Mg, Fe^{2+} , Ca or Na)

(B may be Mg, Fe^{2+} , Fe^{3+} or Al)

serpentine: chrysotile

(formula $Mg_3Si_2O_5(OH)_4$)

Uses

Long fibrous varieties have many commercial uses, owing to their resistance to heat and chemical attack. One of the main uses is in fibro-cement sheeting for building purposes. Other uses include brake linings, clutch facings, insulation, pipes, gaskets, putty, welding rods, floor tiles, filters and catalyst carriers.

Production

The earliest recorded production was from the Robertstown area in 1894. Between 1915 and 1950 approximately 1 000 tonnes were won from the Robertstown-Truro-Lyndoch district, 50 to 120 km northeast of Adelaide. Since 1935, there has been small but continuous production (2 500 tonnes total) of a talc-vermiculite-chrysotile rock from an open pit near Lyndoch; this is used locally as "asbestine" in the manufacture of paint.

Occurrence

Crocidolite, tremolite and chrysotile asbestos are found in shear and crush zones within serpentinous dolomites and altered magnesian limestones of Cambrian and Precambrian age in the Mount Lofty and Flinders Ranges. Although these minerals are generally considered to be of metasomatic origin, there are no outcrops of igneous rocks near these deposits.

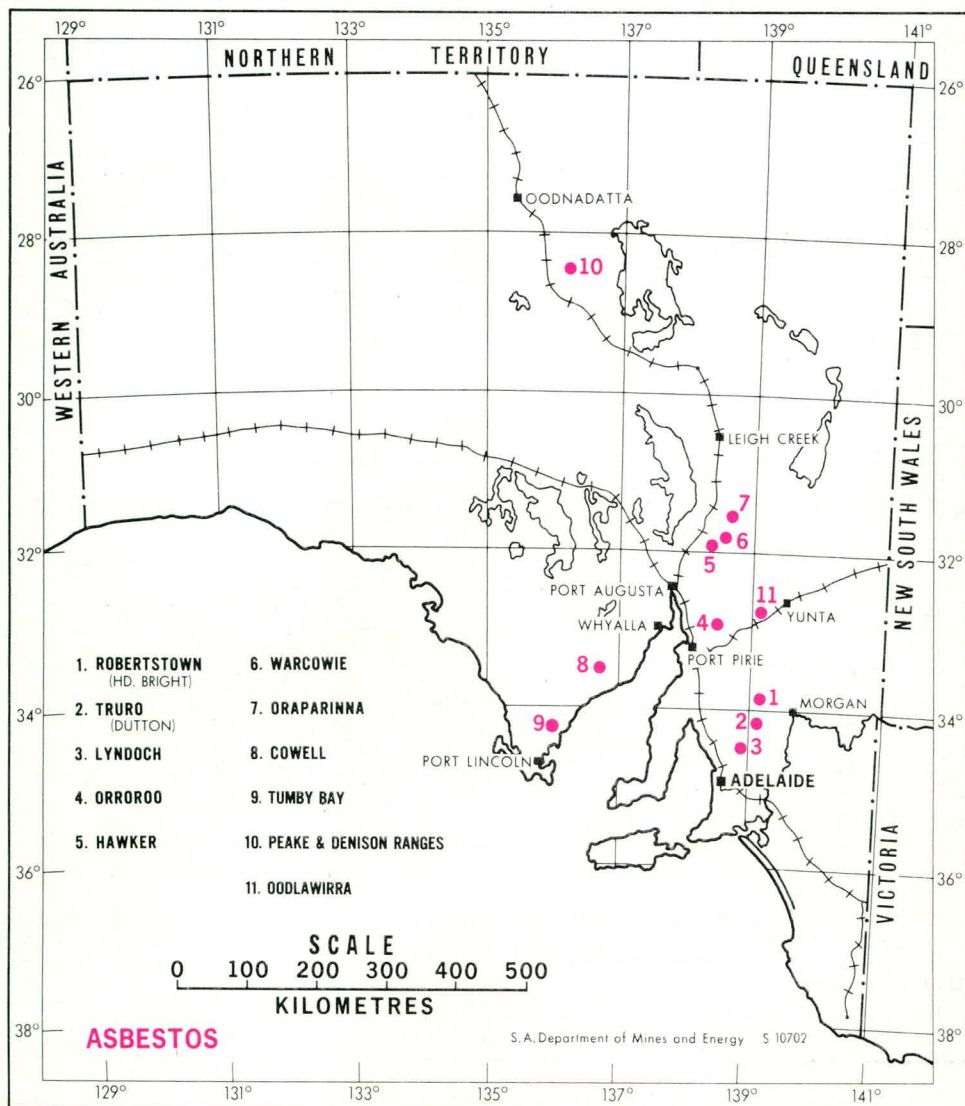
In the Flinders Ranges and in the Robertstown-Truro area, blue crocidolite occurrences lie in or adjacent to diapiric structures.

Chrysotile asbestos is found in serpentinous dolomites of the Cleve Metamorphics in the Cowell and Tumby Bay localities.

The Blue Hole deposits north of Robertstown are enclosed by folded dolomitic marbles that are equated with Burra Group, Skillogee and Auburn Dolomites.

In Hundred of Bright, section 19, lavender-coloured crocidolite prisms average 6 mm in length in a marble bed. In the Truro district, crocidolite occurs in shear zones up to 1 m wide in magnesian limestones equivalent to the Cambrian Hawker Group.

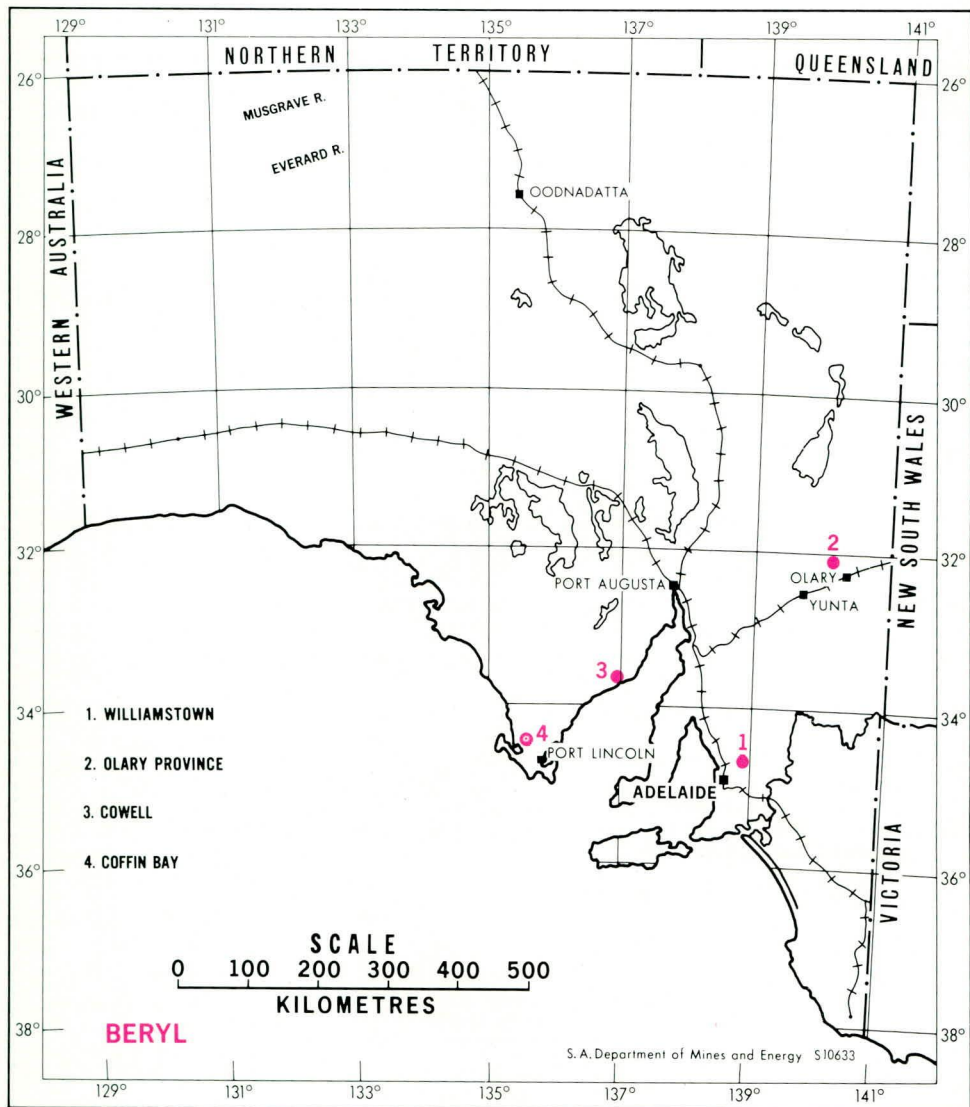
Crocidolite is associated with a zone of albitisation 1 km south of the town of Dutton. Minor occurrences are known in Adelaidean dolomites near Orroroo.



BERYL

Beryl is a bluish-green, light-yellow, pink, white or green transparent to translucent beryllium aluminium silicate, (formula $\text{Be}_3\text{Al}_2(\text{Si}_6\text{O}_{18})$).

Colour distinguishes the gem varieties of beryl. Aquamarine is pale greenish blue, morganite (rose beryl) is pale pink to rose red, emerald is deep green, and heliodor or golden beryl is the clear golden-yellow variety.



Uses

Coloured transparent crystals are used as gemstones, with emerald ranking as one of the most precious.

Beryl is the major source of the metal beryllium which is used as an alloying element in copper, as a source of neutrons in atomic energy operations, and in guidance mechanisms for aircraft and missiles.

Occurrence

Beryl is most commonly found in granitic rocks either in cavities within granite or in pegmatite veins. It also is found in some mica schists, quartz-cassiterite veins, and, in Colombia, in a bituminous limestone.

Williamstown Area: Approximately 3 km southeast of Williamstown, beryl has been mined in small quantities from a pegmatite which is part of a swarm between Williamstown and Gumeracha.

Olary Region: Almost all beryl production (132 tonnes up to 1974) has been from this northeast province in conjunction with feldspar mining. These pegmatites rarely contain more than 1 percent beryl, and where coarse crystals exist, a hand-picked by-product is recovered. The two main centres of pegmatite mining are a few km south of Bimbowrie homestead and at Old Boolcoomata homestead.

North West Province: The Musgrave and Everard Ranges contain numerous pegmatites. Beryl crystals up to 8 cm have been found but deposits are too remote to have attracted commercial interest.

Eyre Peninsula: No production has been recorded.

Green beryl occurs in a coarsely crystalline pegmatite 1 km south of Mount Geharty near Cowell and as pale green crystals, in pegmatites which intrude granite gneisses about 2 km south of The Frenchman, a hill on the eastern coast of Coffin Bay.

CORUNDUM

Corundum or aluminium oxide (Al_2O_3) is the second hardest known mineral and varies in colour between white, grey, green, red and blue. Sapphire (blue or yellow) and ruby (red) are gem varieties. Emery is a black granular corundum intimately mixed with magnetite, hematite or hercynite.

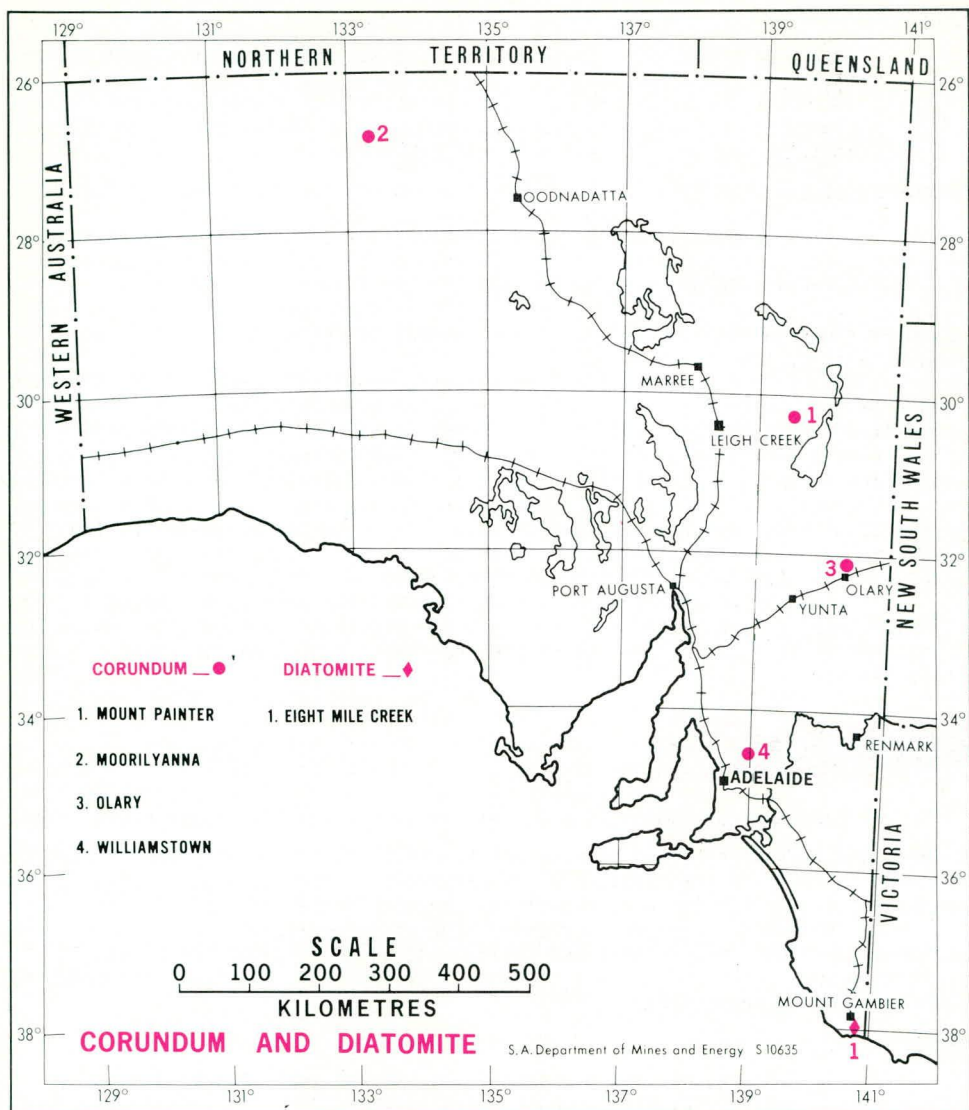
Corundum is a common accessory mineral in metamorphic rocks, e.g. crystalline limestone, mica-schist and gneiss, and as an original constituent of certain igneous rocks which are deficient in silica, e.g. syenites and nepheline syenites, and in pegmatites.

Uses

Deep red ruby and blue and yellow sapphires are valuable gemstones. Stones of gem quality are also used as watch jewels and as bearings in scientific instruments. Because of its hardness, corundum is used as an abrasive, either ground or in its impure form as emery, e.g. grinding wheels, sandpaper. Artificial abrasives such as silicon carbide have now largely replaced natural corundum as an abrasive.

Production

There has been no commercial production of corundum in South Australia. Small quantities of blue and green sapphires and rubies have been found in the Mount Painter Province. Unsuccessful attempts were made about 1910 to exploit the main deposit in shallow workings at the Corundum Mine but high freight costs were a major handicap to their development.



Occurrence

Mount Painter Province: The most extensive deposits were discovered in 1906 by W.B. Greenwood, about 6 km west of Mount Painter in the northern Flinders Ranges, 100 km east-northeast of Leigh Creek. The corundum is sporadically distributed over a width of about 800 m in the Corundum Creek Schist Member of the Lower Proterozoic Mount Painter Complex.

Musgrave Block: Massive blue-grey corundum has been recorded within ultrabasic bodies surrounded by gneiss in the Lower Proterozoic Musgrave Block in two localities south of Moorilyanna Dam. They are on Tarcoonyinna Creek, 24 km northwest of the Indulkana Creek crossing on the Stuart Highway, 110 km south of the Northern Territory border.

Olary Province: Porphyroblasts of corundum have been noted in gneiss and schist within the Willyama Complex near the Woman-in-White mine, and near Ameroo Hill.

Williamstown: Fragments of detrital corundum have been recovered from Tertiary sands and gravels near Williamstown.

DIATOMITE

Diatomaceous ooze comprises soft siliceous accumulations on the bottom of the "deep" sea and in freshwater lakes and consists largely of the shells of diatoms which are microscopic, single-celled plants that exist in marine or fresh water. On consolidation, the ooze forms diatomaceous earth, a whitish, lightweight, friable earthy deposit composed of almost pure silica, and consisting essentially of frustules of the microscopic diatoms. Very thick deposits of diatomaceous earth are known in the United States and elsewhere.

Uses

Diatomaceous earth in a powder form is used in the manufacture of dynamite, as a pottery glaze, filtering agent, as an inert filter, and in pozzolanic cement.

Production

No production has been recorded in South Australia.

Occurrence

Diatomite has been recorded from the Eight Mile Creek Swamp, 6 km east of Port MacDonnell in the lower South-East, as a bed of sub-Holocene to Holocene age, only 20 cm in thickness.

DOLOMITE

Dolomite is a pink, white, grey, green, brown or black carbonate of calcium and magnesium ($\text{Ca Mg}(\text{CO}_3)_2$). It has a hardness $3\frac{1}{2}$ -4 and may be transparent or translucent.

Uses

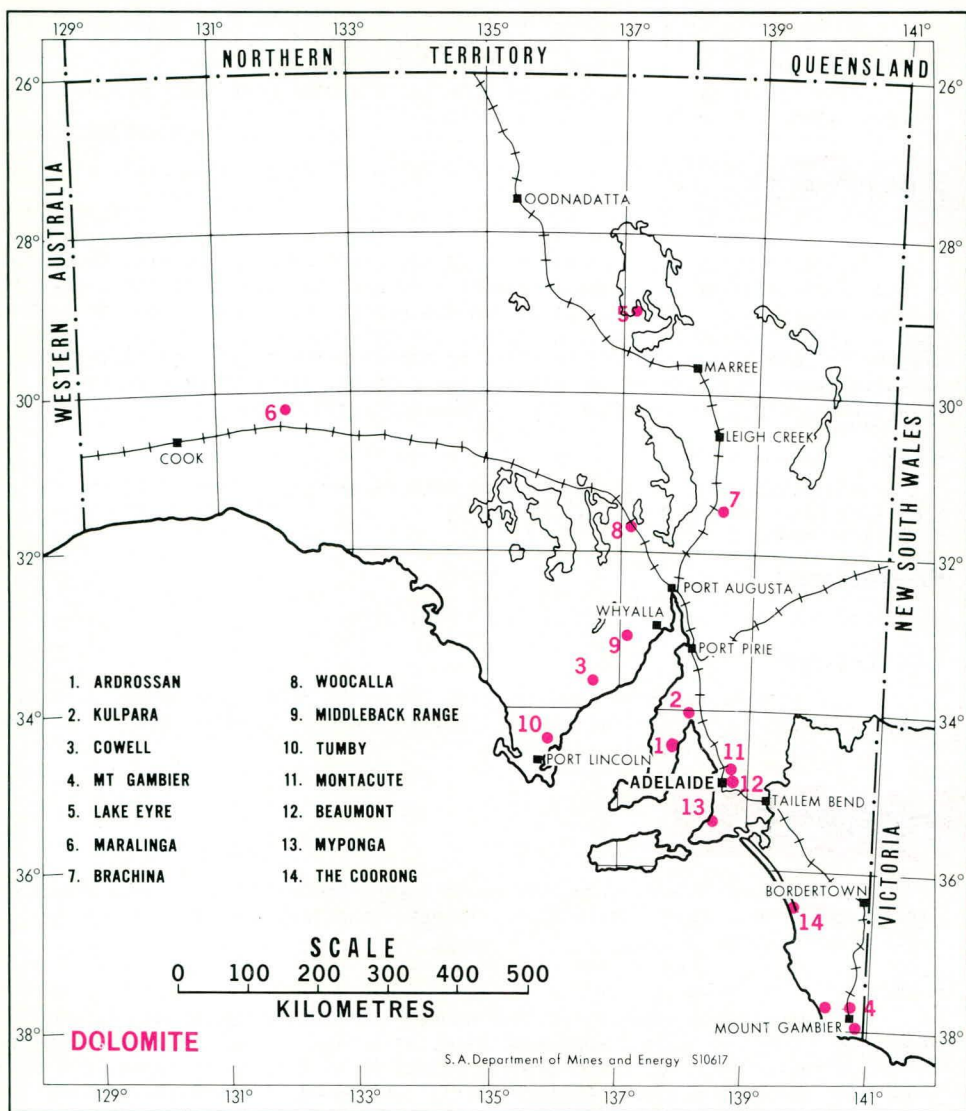
Dolomite, a potential future source of metallic magnesium, is used widely as a building stone, road aggregate, as a flux in basic oxygen steel-making and in refractories. Most of the local output is used as an aggregate and building stone with minor uses as a fettling material in the manufacture of iron and steel, and for manufacture of plate glass.

Production

Production to June 1978 exceeded 2 142 000 tonnes, valued at \$4 301 000.

Occurrence

Dolomites are either sedimentary in origin, or are formed by replacement of calcium by magnesium in limestone beds. More rarely, it is found as a gangue mineral associated with lead and zinc veins.



South Australian dolomites are subdivided stratigraphically below- Lower Proterozoic

Discontinuous beds of dolomitic marble occur at several stratigraphic levels within the Cleve Metamorphics on Eyre Peninsula. The Middleback North Dolomite has the composition: CaCO_3 , 50%; MgCO_3 , 35%; SiO_2 , 3%; R_2O_3 , 6%; MnO, 5%. The deposits of the Cowell area, associated with the nephrite jade deposits, are more extensive and too siliceous for metallurgical use. Their average composition is CaCO_3 , 52%; MgCO_3 , 40%; insolubles, 8%.

Adelaidean

In the Adelaide region, the Beaumont Dolomite, the Montacute Dolomite and upper unit of the Brighton Limestone are highly siliceous with silica content being generally greater than 5%. The Skillogee Dolomite is the principal formation in the northern Mount Lofty Ranges and Flinders Ranges while other dolomites are prominent throughout the Adelaidean sequence. Available analyses indicate that silica content of all these formations is seldom less than 5%. The Woocalla Dolomite on average contains 50% CaCO_3 ; 40% MgCO_3 and 5% SiO_2 .

Cambrian

Carbonate rocks outcrop almost continuously along the coast between Normanville northerly to beyond Sellick Hill; some formations are dolomitic but silica content generally exceeds 2 percent.

The Kulpara Limestone is a conspicuous formation that outcrops at intervals between Kulpara and Ardrossan and includes thick sequences of uniformly high-grade dolomite. Reserves are considerable and quarry sites in a gently folded formation are readily available.

A typical analysis from the Ardrossan area is as follows: CaCO_3 , 55.1%; MgCO_3 , 43.1%; SiO_2 , 2.5%; Fe_2O_3 , 0.7%; Al_2O_3 , 0.7%; P_2O_5 , 0.02%.

Dolomite at Ardrossan has been quarried since 1950 for refractory use in the B.H.P. company steelworks. The dolomite is fine-grained, dense and buff coloured.

Sampling of the Ajax Limestone along the western front of the Flinders Ranges has revealed that the lower part of the formation is dolomitic. The dolomite is fine grained, fawn to grey colour, with a composition: CaCO_3 , 54.3%; MgCO_3 , 41.9%; SiO_2 , 1.6%.

Cainozoic

Metasomatic replacement deposits

Dolomites have been derived in the lower South-East of the State by metasomatic replacement of bryozoal limestones along major fault zones. They are usually pink and of variable hardness and texture. Dolomitisation is irregular and unpredictable and dolomites pass vertically and laterally into normal white highly calcareous bryozoal limestone abruptly, or - less often - gradually.

At Up-and-Down Rocks, near Tantanoola, reserves of 1.6 million tonnes of high-grade dolomite have been outlined in an irregularly dolomitised zone adjacent to the Tartwaup Fault. The rock, used in the manufacture of plate glass, is of fairly uniform composition as follows: CaCO_3 , 60%; MgCO_3 , 30%; SiO_2 , 0.3%; Fe_2O_3 , 0.3%.

Dolomites of similar type occur near Mount Gambier, at Blue Lake, and between Burnda and Compton. A number of irregular discontinuous lenses of dolomite, arranged *en echelon* within bryozoal limestone, mark the trace of 2 km of the Nelson Fault 30 km southeast of Mount Gambier.

Lacustrine deposits

Dolomites, dolomitic mudstones and intraformational dolomite - clay breccias accumulated in shallow brackish water lagoons which covered large areas in the northern part of the State during the Cainozoic. Etadunna Formation equivalents in the Lake Eyre Basin exceed 45 m in thickness in the floor of Lake Eyre and show little variation in composition from the following: CaCO_3 , 40%; MgCO_3 , 36% with silica from 3 to 20%.

Deposits elsewhere in the interior are lithologically similar but have little commercial interest because of remote location and low grade.

Carbonate sedimentation is occurring in the shallow water lagoons at the closed shallow end of the Coorong. Calcite and dolomite are present in most localities; dolomite is often the dominant carbonate mineral and magnesite has accumulated in at least one lagoon near the Coorong.



BERYL FROM THE ADELAIDE HILLS.

VARIETIES OF SOUTH AUSTRALIAN
DOLOMITE.



MASSIVE FELDSPAR WITH QUARTZ STRINGERS
FROM KANGAROO ISLAND -
FUSED FELDSPAR ON TILE.



FLUORITE - PURPLE VARIETY FROM
OLARY PROVINCE.
- CRYSTAL VARIETY FROM
PERNATTY LAGOON.



GRAPHITE - CEYLON VARIETY COMPARED
WITH THE IMPURE VARIETY
FROM ULEY.

MAGNESITE FROM BALCANOONA, TUMBY BAY
AND COPLEY.



KYANITE, SILLIMANITE AND TWO SPECIMENS
OF ANDALUSITE
(CHIASTOLITE, A VARIETY OF ANDALUSITE,
IN THE CENTRE).

STRONTIUM (CELESTITE) FROM FOSSIL
CREEK.



FELDSPAR

Feldspars are silicates of aluminium with potassium, sodium, calcium, and, rarely, barium. A solid solution series exists from pure albite, $\text{Na Al Si}_3\text{O}_8$, to pure anorthite, $\text{Ca Al}_2\text{Si}_2\text{O}_8$. The plagioclase feldspars are named according to the relative amount of albite and anorthite present.

Name of Feldspar	% Albite	% Anorthite
Albite	100 - 90	0 - 10
Oligoclase	90 - 70	10 - 30
Andesine	70 - 50	30 - 50
Labradorite	50 - 30	50 - 70
Bytownite	30 - 10	70 - 90
Anorthite	10 - 0	90 - 100

Orthoclase, and microcline, KAlSi_3O_8 , are also common rock constituents, particularly in granites.

Each particular species varies in physical properties with change in composition, with hardness approximately 6 and specific gravity ranging from 2.55 to 2.76.

Uses

Feldspar is used in the manufacture of mild abrasives in household cleansers, e.g. Solvol, Ajax. Potassium and sodium feldspars are used in porcelain and in the formation of glazes. Large amounts were previously used in the manufacture of glass to contribute alumina to the batch, but feldspar has been largely replaced in this process by imported nepheline syenite. Some varieties, e.g. labradorite, amazonite, show opalescence and are also used as ornamental stones.

Production

The total recorded production in South Australia to June 1978 was 75 000 tonnes. Most has been derived from a deposit near Gumeracha while 18 000 tonnes have been produced from 15 separate deposits in the Olary region since 1932, initially as a by-product from beryl mining.

Occurrence

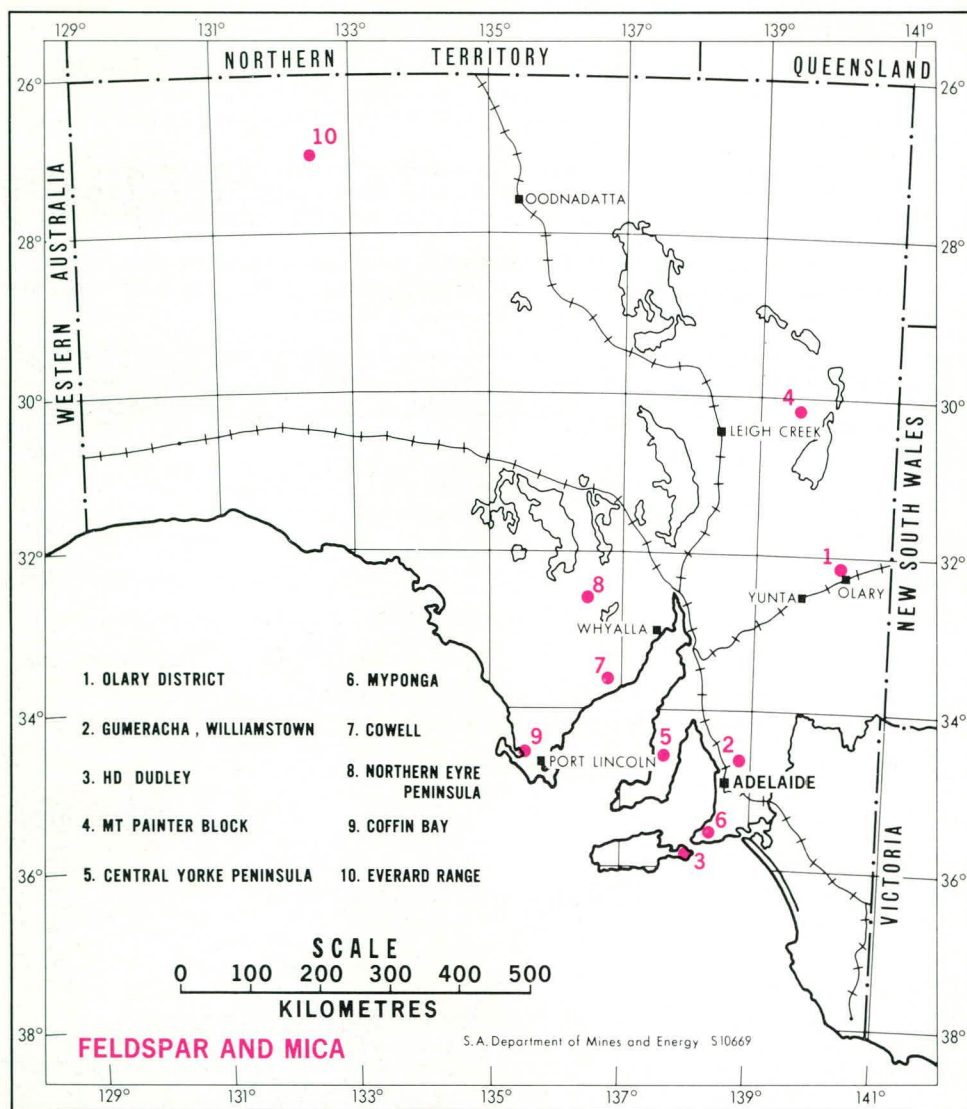
Feldspar is a common mineral as a primary constituent of igneous rocks e.g. granites and pegmatites. It is also common in sedimentary and metamorphic rocks.

Pegmatites containing feldspar are found in the Precambrian and Lower Palaeozoic bedrock blocks.

Recent developments in feldspar exploration have been centred on large, quartz-free, igneous masses where feldspar composition is uniform.

Olary Province: Pegmatites are abundant in metasediments of the Willyama Complex which flank the granite of Boolcoomata Hill. Many of the pegmatites are zoned with a central quartz core, an intermediate zone of perthitic potash feldspar and an outer zone of relatively fine-grained quartz, feldspar and muscovite. One of the largest, at Wiperaminga Hill, is approximately 75 m long and 30 m wide.

Mount Lofty Ranges: Zoned pegmatites with segregations of feldspar and mica are associated with lower Palaeozoic granites which intrude Adelaidean and Kanmantoo Group rocks. Mixed quartz, potash and soda feldspar have been produced from Gumeracha. Poorly outcropping and zoned pegmatites occur in the Gumeracha-Lyndoch district and in the Myponga area. Albite is associated with talc at Gumeracha and Lyndoch.



FLUORITE (FLUORSPAR)

Fluorite (formula CaF_2) varies widely in colour in shades of green, yellow, purple, white, red, blue and brown. Massive samples are often banded. It is usually found in veins associated with other minerals.

Uses

The principal use of fluorite is as a flux in the steel industry; it is also used in opalescent glass, enamelling cooking utensils, preparation of hydrofluoric acid for use in the uranium enrichment process, in ornamentation of vases and dishes, cement, abrasives and electrodes.

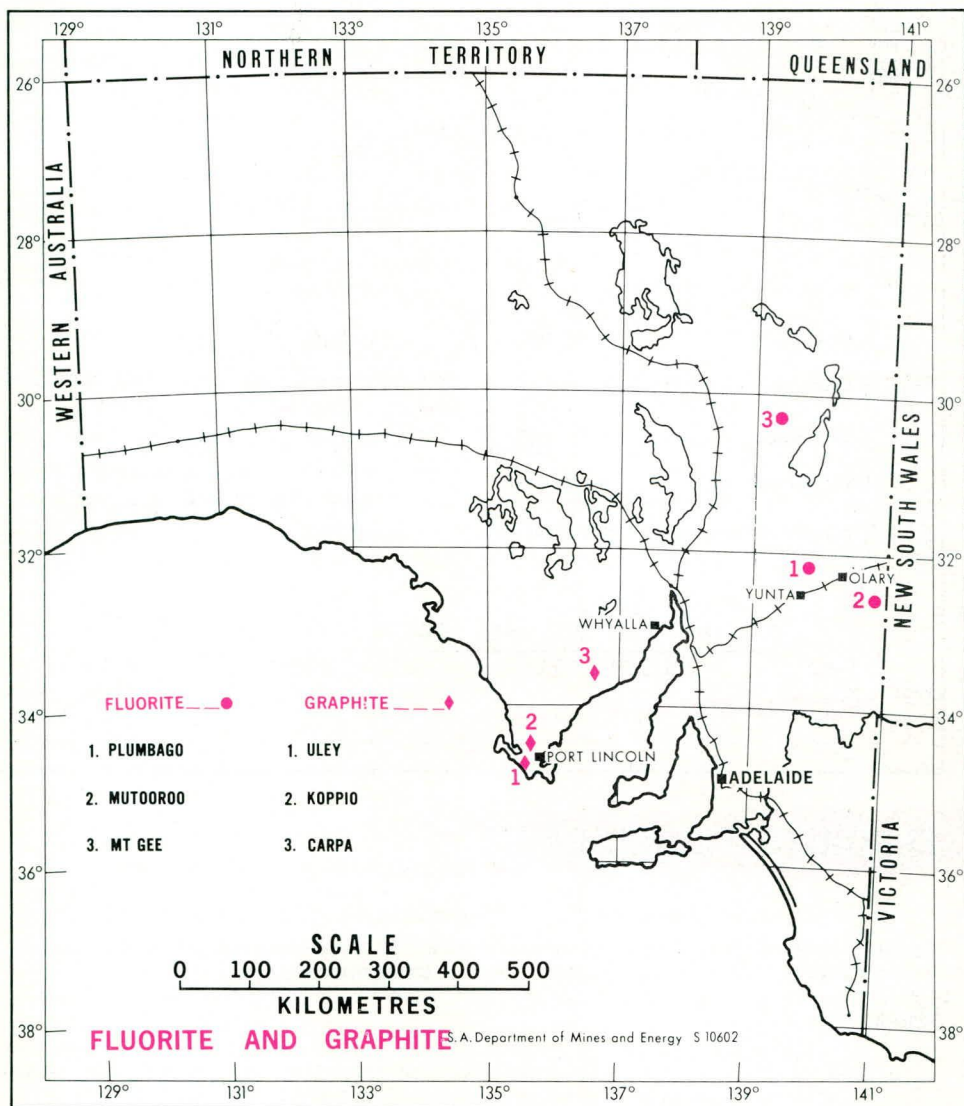
Production

Sporadic production from the Olary region has totalled little more than 700 tonnes.

Occurrence

A number of small deposits have been recorded. The principal ones occur in Precambrian granites and Proterozoic metasediments in the Olary Province. Veins of quartz and purple fluorite have been worked at Plumbago, 56 km north of Mannahill.

At Mutooroo, 50 km south of Cockburn, a swarm of veins containing quartz, fluorite, calcite, and barite with copper occur in schists of Adelaidean age.



Fluorite has also been recorded at Old Boolcoomata, Ameroo Hill, Walparuta, Mount Victoria, Outalpa Springs, Crocker Well East, Tietz Dam, Curramulka, Mount Painter, Mount Monster, Pernatty Lagoon, and the Moonta-Wallaroo area.

GRAPHITE

Graphite is elemental carbon usually with impurities of iron oxide and clay. Hardness is 1 - 2 on the Mohs' scale; colour is black to steel grey with a black streak.

It most commonly occurs in metamorphic rocks, as large crystalline plates or disseminated in small flakes.

Uses

Graphite is used in refractory crucibles, batteries, electrodes, electroplating, protective paint for structural iron and steel, mixed with fine clay to form the "lead" of pencils, and in lubricants.

Production

Total production in South Australia is less than 800 tonnes of concentrate recovered principally from the Uley deposit on Eyre Peninsula. All current Australian requirements of graphite are imported.

Occurrence

The Uley graphite mine, 22 km southwest of Port Lincoln, is located on a bed of graphite schist up to 10 m thick and enclosed by graphite-quartz-feldspar gneiss. The mine has not been worked since about 1951.

The Koppio mine, 45 km north of Port Lincoln was opened on a bed of graphite schist 13 m thick.

In the Cleve Uplands fine-grained graphite schists have been disclosed at a number of localities but reserves are undetermined. A deposit near Carpa was drilled recently. However, the flake size of sampled material is too small for most uses.

MAGNESITE

Magnesite is a compact cryptocrystalline carbonate of magnesium with a hardness $3\frac{1}{2}$ -5. It is known in a variety of colours but is usually white, grey, yellow or brown.

Uses

The main use is as a refractory in steel furnaces, magnesium chemicals, and fertilizers. Magnesite is also used as a filler in PVC pipe manufacture.

Occurrence

Magnesite in South Australia can be subdivided according to mode of formation.

Residual Deposits: Magnesite is often intimately associated with the graphite deposits on Eyre Peninsula and was particularly common in the Koppio graphite mine. Weathering of these deposits has resulted in the re-aggregation of magnesite into high-grade, dense cryptocrystalline masses containing up to 99.9% MgCO_3 . In one deposit near Tumby Bay, elongate lenses, more than 1 m wide and 12 m long, outcrop over a distance of 400 m. Small tonnages were mined from shallow trenches and shafts.

Sedimentary Deposits: The Skillogalee Dolomite, a persistent formation throughout the Adelaide Geosyncline, commonly includes beds of sedimentary magnesite. These have been formed by chemical precipitation in marginal lagoons subjected to periodic advance and retreat of the sea and the addition of alkaline continental waters.

In the Torrens Gorge, within 15 km of Adelaide, thin highly siliceous magnesites (72% MgCO_3 ; 21.6% SiO_2 ; 6.5% CaCO_3) grade into intraformational breccias and conglomerates. There has been small production from similar deposits in the northern Mount Lofty Ranges at Emu Flat, Saddleworth and Robertstown, but content of lime, silica and iron is too high for chemical use.

The Broken Hill Pty Co. Ltd cut costeans and undertook diamond drilling prior to production of 2 000 tonnes for trial refractory use from deposits at Port Germein Gorge during 1947-50. The best-grade material is confined to a bed of massive pale grey brecciolitic magnesite 1 m thick and separated from a similar bed 0.3 to 0.6 m thick by 0.3 m of impure magnesite and chert. The mineral was produced from shallow open-cut work and shallow underground workings. Samples cut from the magnesite beds exposed in underground workings showed the following compositional variations: MgCO_3 , 86 to 98%; CaCO_3 , 0.1 to 4%; SiO_2 , 1 to 6%.

Magnesite beds are particularly well exposed in the Copley and Witchelina areas. From near Copley they extend continuously with little change in thickness or facies for 30 km. A costean across the deposits exposed 30 beds varying in thickness from several centimetres to 1 m showing the following range in composition: MgCO_3 , 63 to 94%, CaCO_3 , 2 to 12%; SiO_2 , 5 to 20%. As in other deposits, there is a tendency for the superficially weathered material to be slightly purer owing to preferential leaching of calcium. Three prominent beds, one of which is 3 m thick, outcrop in a basinal structure south of Witchelina.

The Copley area provides the greatest reserve of magnesite beds because of their continuity, number, and width. As with the Mundallio and Port Germein deposits no estimate of reserves has been made but from surface outcrop and limited mining and drilling, reserves of >90% MgCO_3 are considerable. However, the comparative thinness of the beds and the need for some degree of selectivity in mining to obtain the highest-grade material are factors not conducive to cheap mining.

Replacement Deposits: Irregular bodies of coarsely crystalline magnesite occur as metasomatic replacement deposits in the Balcanoona Formation at Balcanoona and near Mount Fitton.

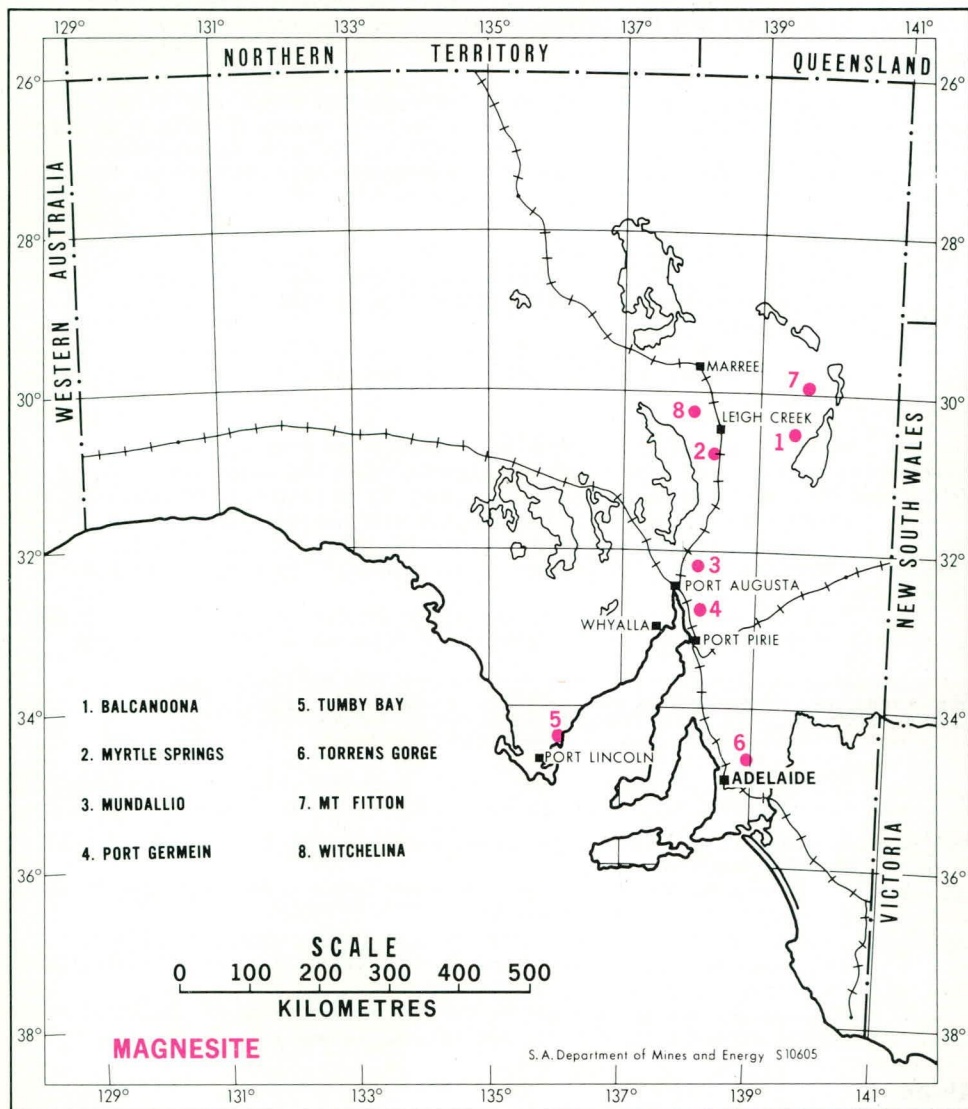
The Balcanoona deposit has been tested in three adits by the Broken Hill Pty Co. Ltd. A bulk sample of 650 tonnes contained 95.7% MgCO_3 ; 0.7% CaCO_3 ; 0.8% SiO_2 ; 1.8% Fe_2O_3 ; and 0.5% Al_2O_3 .

White coarsely-crystalline magnesite occurs in a number of irregular pods, the largest of which outcrops in the bed of Balcanoona Creek where it averages 100 m in width, is 450 m long, and is dissected to a depth of 60 m. The enclosing fine-grained dolomite dips northerly at 80° and the foot-wall contact is more or less conformable; elsewhere the boundaries between magnesite and dolomite are highly irregular in plan but are sharply defined. Several thin unreplaced beds of dolomite extend from the surface to at least the level of the adits. Reserves of several million tonnes of magnesite are available in the main mass above the level of Balcanoona Creek.

The Balcanoona dolomite is the host not only to talc but also to irregular replacements of light green, grey or honey-coloured magnesite in the Mount Fitton locality and at Mount Livingston. Numerous small irregular masses are localised in three principal localities near the base of the formation. Samples show the following ranges of composition: MgCO_3 , 93 to 96%; CO_3 , 0.4 to 1%; SiO_2 , 0.5 to 3.5%; Fe_2O_3 , 1.5 to 3%; Al_2O_3 , 1 to 3%. Reserves of several million tonnes have been indicated.

Production

Total recorded production of magnesite in South Australia to the end of 1977 was 25 242 tonnes. 173 tonnes were mined for the year 1977/78.



MICA

This large mineral group consists of phyllosilicates with sheet-like structures. the general chemical formula for the group is $(K, Na, Ca)(Mg, Fe, Li, Al)_{2-3}(Al, Si)_4O_{10}(OH, F)_2$ and includes biotite, lepidolite, muscovite, and phlogopite being the most common with rarer varieties paragonite, roscoelite, damourite, gilbertite, margarite, zinnwaldite and lepidomelane.

Uses

Mica is used as an insulating material in electrical apparatus; coatings or fillings in roofing materials, plastic, paints and rubbers; and as a constituent of joint-cements, lubricants, drilling muds, welding rod coatings, wall papers and decorative sprays.

Production

The production of mica in South Australia has never been of any importance. In general, the mica is usually herring-boned and badly crumpled, or spotted and stained. One exception in South Australia is damourite, mined from the Williamstown area, where 20 600 tonnes have been won up to June 1978.

Occurrence

Mica is a very common mineral found in numerous rock types.

- as a constituent of deep-seated siliceous igneous rocks, e.g. granites.
- often as large crystals, up to 2 m, in pegmatite veins.
- in metamorphic rocks, schists, and gneisses, as a constituent mineral.

Mount Lofty Ranges: Damourite is associated with kaolin and sillimanite in a zone of high alumina metasomatism at the Australian Industrial Minerals NL mine, near Williamstown, 40 km northeast of Adelaide.

Other lesser deposits of mica in the Williamstown, Barossa and Myponga areas are associated with small pegmatite veins, up to 2 m wide. Minerals often found with mica include beryl, feldspar, rutile, quartz and tourmaline.

Mica has been recorded from the Olary and Eyre Peninsula area in small quantities, from pegmatites as a by-product of feldspar or beryl production.

SILLIMANITE, ANDALUSITE & KYANITE

Sillimanite, andalusite, and kyanite have the same chemical composition (Al_2SiO_5) but have distinctive crystal structure and physical properties.

Sillimanite: needles of brown, pale green, white; hardness 6-7 on Mohs' scale; S.G. 3.23.

Andalusite: prisms of flesh-red, reddish-brown, olive-green; hardness $7\frac{1}{2}$ on Mohs' scale; S.G. 3.16-3.20.

Kyanite: colour usually blue, white, grey or green, generally bladed; hardness 5 parallel to length of crystals, 7 at right angles to this direction; S.G. 3.55-3.66.

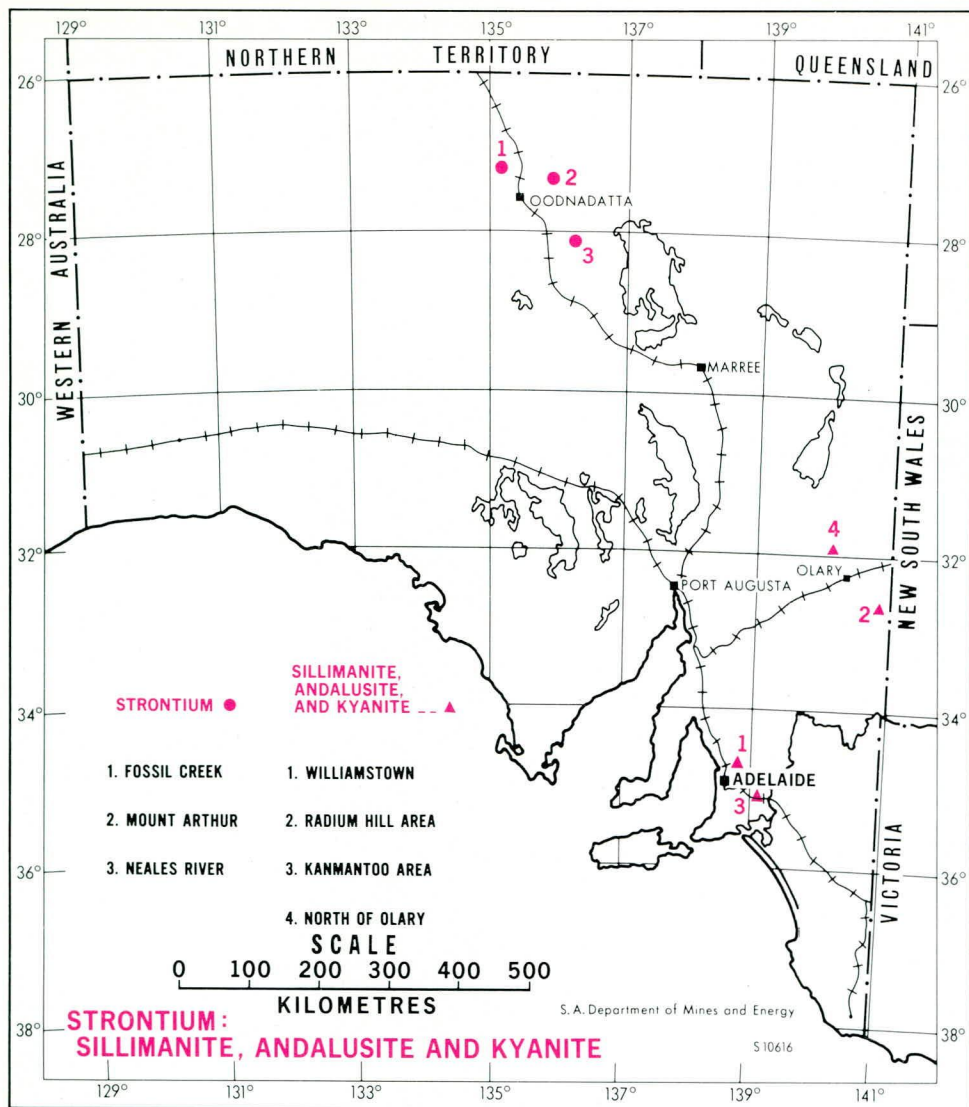
All are derived by regional or contact metamorphism of aluminous shales and slate adjacent to granitic intrusions.

Uses

Sillimanite is the most satisfactory of these three minerals for refractory purposes, e.g. firebricks and crucibles. Andalusite is not now commercially available in Australia and, kyanite required calcining before use because of a high (16%) expansion when heated. Chistolite, a variety of andalusite with distinctive cruciform markings due to crystallographically oriented inclusions, is marketed as a gemstone.

Production

Sillimanite was first produced in South Australia in 1936 from the Olary Province.



Total production to June 1978 amounted to 32 150 tonnes, with 6 750 tonnes being won at Olary and 25 400 tonnes from the Williamstown deposits.

Occurrence

Sillimanite, andalusite, and kyanite are widespread in the Carpentarian metasediments of the Willyama Complex in the Olary Province.

Relatively large, low-grade deposits of disseminated crystals of andalusite, including chiasolite, occur at Mount Howden. Large crystals up to 15 cm are confined to sandy bands whereas the original clayey layers are crowded with small crystals. Reserves and grade are not known.

Six lenticular bodies of kyanite-chlorite or kyanite-mica schist exist within 5 km north and east of Radium Hill. The largest deposit, Sprigg's, contains an estimated 680 000 tonnes of 6.5% kyanite above the base of the hill.

Beneficiation to upgrade the rock to a satisfactory alumina content of 57% Al_2O_3 has been achieved in the laboratory but is uneconomic on a commercial scale.

Other large low-grade deposits occur at Poothlaringa and Alconie Hill.

Small sporadic segregations of relatively pure aluminium silicate have developed adjacent to pegmatites or cross-cutting quartz reefs at Morialpa. Sillimanite is associated with mica, tourmaline, quartz, and feldspar at Ameroo, Tommy Watty, Centralia and Walparuta.

At Williamstown, hard, massive, high-quality sillimanite is enclosed by white refractory clay and is the sole source of sillimanite in the State.

Andalusite-mica schist comprise host rocks to the Kanmantoo copper orebody at Kanmantoo - 51 km east of Adelaide. Rods of andalusite attain 2 cm in length. Beneficiation to remove the deleterious biotite and iron oxide would be required to produce possibly refractory-grade mineral.

Aluminous silicates have also been recorded at Tungkillo, Cambrai, Harrogate, and Jutland.

STRONTIUM

The principal ore mineral of strontium is celestite ($SrSO_4$), colourless white, blue or red tinted mineral with hardness of 3 to 3.5 on Mohs' scale with S.G. 3.95-3.97.

It occurs commonly as disseminations in veins or cavities in limestone or sandstone, in association with calcite, dolomite, gypsum, halite, sulphur or fluorite. It is a common gangue mineral in lead veins.

Uses

Celestite is used in the preparation of strontium nitrate for fireworks and tracer bullets. More recently it has been applied to usage in colour television and in ceramic magnets. Other uses include ceramic glazes, glasses, welding and brazing fluxes, high-temperature greases and in paint.

Production

125 tonnes of celestite were mined from Fossil Creek during the years 1941/2 for munition purposes.

Occurrence

Numerous veins of celestite, up to 0.2 m wide and occurring in irregular patches several metres across, have been exposed in shallow workings at Fossil Creek, 45 km northwest of Oodnadatta. The veins occur in the Early Cretaceous Wooldridge Limestone Member of the flat-lying Oodnadatta Formation.

Celestite is widely distributed in the region of Lake Eyre, as veinlets within the Oodnadatta Formation and as a cement and as nodules within Quaternary sands and clays. These occurrences appear to have no economic significance.

COVER PHOTO: ASBESTOS (CROCIDOLITE)
FROM THE ROBERTSTOWN AREA.

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