DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 87/113
GLADSTONE SANDSTONE QUARRIES
SEC. 31, 33, 328, 329,
HD. YANGYA, CO. VICTORIA

GEOLOGICAL SURVEY

by

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and

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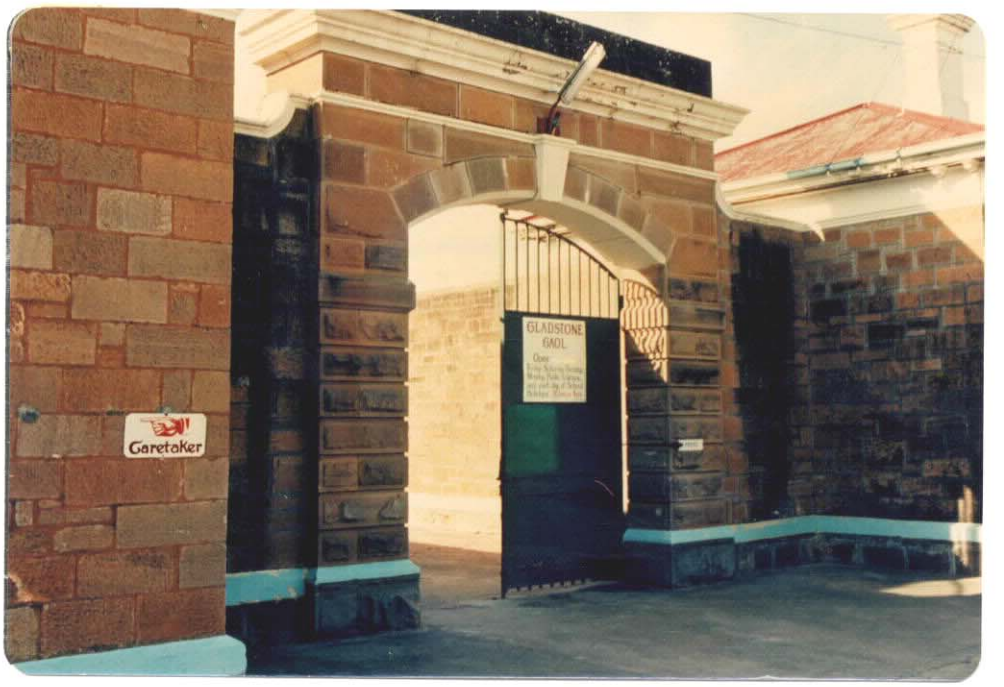
MINERAL RESOURCES

SEPTEMBER, 1987 DME.295/84



FRONTISPIECE ENTRANCE TO GLADSTONE GAOL, 1879-1881

Gladstone sandstone used in various hand dressed finishes. January 1984. Slide No. 36002

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DEPARTMENT OF MINES AND ENERGY
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GLADSTONE SANDSTONE QUARRIES, SEC. 31, 33, 328, 329 HD. YANGYA CO VICTORIA

ABSTRACT

From 1872 to 1949, an estimated 60 000 tonnes of brown durable feldspathic sandstone (freestone) were quarried from Emeroo SubGroup sediments of late Adelaidean age in four quarries east of Gladstone in the Mid North.

Most production was during last century when most major buildings and many houses were built in Gladstone and nearby towns.

Quarry 3 (Ballantyne) was reopened in 1985 to supply 21 tonnes of stone to repair the Bishop's House in Gladstone.

INTRODUCTION

Despite being an important source of building stone in the Mid North, there is no reference to the four Gladstone quarries in previous Departmental reports on building stones such as Jack (1923).

The middle two building stone quarries on the southeastern outskirts of the township of Gladstone were mapped by stadia survey on 21 and 22 February 1984 by the authors assisted by A.M. Pain (Principal Geologist) and P.P. Crettenden (Field Assistant) as part of a program of appraisal of quarries near Gladstone.

On 3 and 4 March 1987, the other two quarries were inspected by J.G. Olliver during a geological reconnaissance of the township environs for other workings.

LOCATION, ACCESS AND TOPOGRAPHY

The four quarries extend in an arc from the eastern edge of the township to 2.2 km south east of the railway station about 210 km north of Adelaide in the following sections, hundred Yangya, county Victoria in the District Council of Gladstone part of the Mid North Planning Area (Fig. 1 and 2).

Quarry	Section
1.	31
2.	33
3. Ballantyne	328
4.	329

Map sheets are Gladstone 1:50 000 6531-II part of BURRA 1:250 000 Sl 54-5

Access is:

1. west for 50 m from the southern end of Charles Street.
2&3 at the southern end of Port Street at the southeastern corner of town proceed east for 1 km along the northern boundary of section 328.
4. turn off the sealed Adelaide road 1.8 km southeast of the Port Pirie railway crossing and proceed 0.6 km east to the farmhouse and then 0.5 km north.

Sections 31, 33, 328 and 329 are cleared of vegetation and used for cereal crops and grazing. Quarry 3 is used for waste disposal particularly by Mr Frank Landers (landowner and local veterinary) for disposal of animal carcases.

Terrain is gently undulating drained by ephemeral streams. Quarries 2 and 3 are on a north - westerly trending ridge which rises to RL 264 m.

MINERAL TENURE

No tenement was required to quarry stone under the repealed Mining Act.

However, when the current Mining Act was proclaimed in 1971, extractive minerals became vested in the Crown.

Accordingly, when building stone was required for repair of the Bishop's House in Gladstone, a mineral claim was pegged and on 5.10.83, Mineral Claim (MC) 1760 was registered for the Synod of the Church of England in the Diocese of Willochra Inc.

On 19.3.85, Extractive Mineral Lease (EML) 5263 was granted to the Synod for seven years.

EML 5263 covers 0.2 ha of the north - western part of Quarry 3 (Fig. 2).

HISTORY

Despite proximity to the township little is recorded of quarrying activities by the Gladstone Centenary Committee (1980) as summarised below with dates of erection of major buildings.

1846 . Herbert Bristow and Bristow Herbert Hughes occupy Booyoolie Station - homestead is build in stages up to 1880's.

1872 . John Luke Batten built first stone house in hundred Yangya.

1873 . Booyoolie Hotel.

1875 . Gladstone Hotel.
. Primary School.

1876 . St Alban's Anglican Church.
. Start of local government with hundred Yangya proclaimed District of Yangya.

1878 . Commercial Hotel started.

1879 . Commercial Hotel completed.
. District of Yangya renamed District of Gladstone.
. Seven masons living and working in town.

. Gaol started by Sara and Dunstan with Richard Peters as stone mason on first his job in Australia. - 9 500 superficial yards of walling stone to be obtained from Quarry 2 (Frontispiece and Plate 6) and 19 000 superficial feet of paving slate from Mintaro.

1880 . Mr R. Tilley's shop extended using stone from same quarry used for Gaol.

1881 . Gaol completed.

1884 . St Peters Catholic Church.

1919 . New chapel of Wesleyan Church built from stone from Ballantyne Quarry.

1920 . E.A. Gale & Sons erected many freestone houses in town and district with stone work by Fred E. Delsar.
. J.P. Madigan & Sons other builder.

1921 . H.A. (Bert) Klemm rebuilt his house, 5 km southwest of Gladstone with freestone from the quarry on Brown's property 4 km south on Rocky River.

1922 . Methodist Church.

1923 . Bishop's House first stage - stone from Quarry 3.
. Ben Blesing and eldest son Karl built freestone and brick house, 10 km from Gladstone using stone from high ridge 3 km east of the building stone quarries.

1932-33 . Ben Shetlat and Ted Clark quarried stone from Ballantyne Quarry to build present day Primary School.

1939 . Bishop's House second stage - stone from Quarry 3.

Based on the above information, quarrying of building stone is assumed to have started in 1872 - 73 However, there is no record of the names of operators nor production before 1924.

On 26 May, 1987, Mr. Peter Ballantyne advised that

- his father Mr. R.S. (Syd) Ballantyne operated Quarry 3 from about 1914 to closure in 1949.
- the Mutter brothers owned the land before 1914 and had been involved in quarrying.
- stone was transported by horse and dray to the railway cutting between Quarry 3 and 4 for loading onto rail trucks.
- considerable quantities of stone were used in other towns in the region and as far south as Kadina and even Adelaide. One order was for slabs 2.1 m long for a 'War Memorial'.

Gladstone freestone is durable feldspathic sandstone which produced a pleasing brown appearance after exposure and shows little deterioration after more than 100 years (Frontispiece and Plate 6).

PRODUCTION

The following four quarries are scattered for 2 km along a south east to south southeast arc (Fig. 2).

Quarry 1. 80 m long, up to 30 m wide partly backfilled and to 5 m maximum depth.

Quarry 2. 95 m long, up to 35 m wide and to 8 m deep (Plates 1 and 2). Entrance is from the northwest and the southwestern face is partly obscured by waste.

Quarry 3. Ballantyne - 145 m long, 17 m to 27 m wide and to 7 m deep (Plate 3 & 4). Entrance is from the southeast. Much of the quarry floor is obscured by debris.
The mining proposal for EML 5263 is to remove 150 m^3 of stone from the northwestern face.

Quarry 4. Two pits 12 m apart.
northern - 70 m long up to 7 m wide and backfilled to about 1 m deep.
southern - 50 m long, up to 8 m wide, partly backfilled with maximum depth of 2.5 m.

Based on the above dimensions, at least 48 000 m^3 of material have been removed from the four quarries. Assuming specific gravity of 2.5 for sandstone, this volume is equivalent ot 120 000 tonnes. As 50% is expected to have been unsuitable for walling purposes, overall yield of building stone is estimated to have been 60 000 tonnes.

This tonnage is confirmed by allocating the average thickness of building stone in each quarry as in Table 1.

TABLE 1

ESTIMATE OF PRODUCTION

Quarry	Dimensions (m)	Rock Unit	Thickness (m)	Tonnes
1	80 x 30	3	1	
		6	1	12 000
2	95 x 35	1	1	25 000
		3	2	
3	145 x 20	1	1	22 000
		3	2	
4	70 x 7	3	1	2 000
	50 x 8			
			TOTAL	61 000

The overall estimate of 60 000 tonnes is conservative as the Gladstone Gaol above used 9 500 superficial yards equivalent to almost 11 000 tonnes in 1879 -1881.

Production recorded by SADME from 1924 to 1945 totalled 2 972 tonnes as detailed in Table 2. Operator was recorded variously as

- Ballantyne Bros.
- Ballantyne
- R.S. Ballantyne

TABLE 2

PRODUCTION, GLADSTONE BUILDING STONE

Year	Tonnes
1924	nil
1925	149
1926-27	nil
1928	899
1929	284
1930-33	nil
1934	152
1935	234
1936	188
1937	183
1938	152
1939	254
1940	132
1941	65
1942	51
1943	nil
1944	46
1945	12
1946	nil
1947	16
1948	122
1949	16
1950-84	nil
1985	21
TOTAL	2 972

SUMMARY

1872 - 1923	57 000
1924 - 1986	3 000
TOTAL	60 000

GEOLOGICAL SETTING

The regional geology on figure 1 has been modified from Mirams (1964), Preiss (1983) and figure 1 in Dugmore and Pain (1984a and 1984b).

The quarries are sited on poorly outcropping Emeroo Subgroup feldspathic sandstone with black heavy mineral laminations in places part of the Burra Group sediments of Adelaidean age. Overlying Woolshed Flat Shale is mainly laminated grey siltstone and Undalya Quartzite which is quarried for:

- road rubble - 4 km northeast of Gladstone (Dugmore & Pain, 1984a)
- rail ballast - 3 km south of Gladstone (Dugmore & Pain, 1984b).

Undalya Quartzite is overlain by grey green calcareous siltstone of Saddleworth Formation.

The building stone quarries are about 100 m east of the top of the Emeroo Subgroup which is placed at a narrow prominent bed of grey fine grained quartzite exposed in the railway cutting between Quarry 3 and 4. Top of Woolshed Flat Shale is deeply weathered wavy bedded siltstone.

SITE GEOLOGY

The following seven feldspathic sandstone units within Emeroo Subgroup are exposed in the quarries from oldest to youngest.

Units 1-4 are exposed in Quarry 2 and 3, Units 3-7 in Quarry 1 and Units 3-4 in Quarry 4.

Unit 1 - basal sandstone, 1.8 - 2.0 m thick, some building stone - pale brown thickly bedded, feldspathic, laminated and cross - bedded. Yellow sandy ochre 0.25 m thick at base. Discontinuous fine grained yellow orcheous sandstone (Sample 6531 RS 29) 0.15 m thick at top (Plate 5).

Unit 2 - flaggy sandstone, about 1 m thick - Sample 6531 RS 30 - pale brown, feldspathic, with thin to flaggy bedding, laminated with slightly darker bands and distinctive irregular crossbedding. Silty sandstone interbeds up to 0.1 m thick throughout.

Unit 3 building stone - sandstone 1-3 m thick, sample 6531 RS 31. Pale grey to brown, fine to medium grained, feldspathic, cross - bedded. Very thickly bedded to massive with individual beds 0.2 - 2 m thick (Plate 5). Basal contact with Unit 2 is graduational. Induration variable particularly in Quarry 1 where stone ranges from friable sandstone to quartzite. Jointing produces rectangular blocks.

Unit 4 - Ochreous sandstone, 0.6 - 4 m thick - some building stone. Pale grey and pale brown banded, fine to medium grained, feldspathic. Thinly bedded to flaggy with yellow ochreous bands (Sample 6531 RS 32). Lens of moderately bedded, laminated sandstone with 5 mm pyrite cubes altered to limonite (Sample 6531 RS 33) extends for about 8 m along the top of the south - western face of Quarry 3.
Thickness of Unit 4 is 0.6 m in Quarry 1 but 3.5 - 4 m in Quarry 2 and 3.

Unit 5 - friable sandstone, 0.3 - 0.8 m thick.
Pale brown massive friable, feldspathic coarse grained and lenticular.

Unit 6 - building stone, 1.2 m thick.
Pale brown, thickly bedded fine to medium, feldspathic Rectangular joint blocks in places.

Unit 7 - Weathered rubbly sandstone, 0.8 m thick.

In Quarry 1, dip is 20-26° south with strike varying from 95° to 115°. Irregular quartz veins striking 315° dipping 60° northeast are common in Unit 4.

In Quarry 2 and 3, bedding is relatively uniform with strike of 135° and dip of 18-20° southwest, although there is local crenulations near the northern end of Quarry 2 (Plate 2).

In Quarry 4, strike is 155° with dip of 22° west. Quartz veins up to 0.3 m wide have intruded along crosscutting fractures striking 270° dipping 70° north. Similar irregular veins are exposed in the railway cutting to the north.

RECENT QUARRYING ACTIVITY AND RESERVES

Mining of the steep northern terminal face at Quarry 3 (Plate 5) was proposed by the Synod of the Church of England in the Diocese of Willochra Inc. to obtain up to 150 tonnes of stone for repair of the Bishop's House in Gladstone.

During 1985, volunteers quarried 16 tonnes early in the year and a further 5 tonnes later.

As the northern boundary of EML 5263 is only 3 m from the northern terminal face, Unit 3 is expected to provide 30 m^3 of building stone based on a yield of 50% with small amounts ofstone from Unit 1 - perhaps a total of 60 m^3.

Substantial quantities of similar stone are expected to be available by extending Quarry 3 northwards for 180 m to Quarry 2.

CONCLUSIONS

At Gladstone in the Mid North, four quarries have been worked for building stone since the town was established in 1872-73.

An estimated 60 000 tonnes of building stone have been produced from 1872 to 1949.

The favourable bed of rectangular jointed pale-grey to brown feldspathic sandstone is part of Emeroo Sub-Group sediments of late Adelaidean age which extends in an arc around a major north south syncline. The brown durable freestone has been used for all important buildings in the town and district including Gladstone Gaol, 1879-1881.

An estimated 21 tonnes were mined from Quarry 3 - Ballantyne in 1985 for repairs to the Bishop's House in Gladstone. Adequate reserves of similar stone exist along strike north of the northern face should further stone be required.

J.G. OLLIVER

for M.A. DUGMORE

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APPENDIX

Petrographic Descriptions from AMDEL report GS 6502/84

by

Frank Radke

Sample: 6531 RS 29; TSC41895

Rock Name:
Arkose

Hand Specimen:
A massive, pale tan coloured rock with a finely granular, weakly friable texture.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	50
Feldspar	30
Argillaceous matrix	15
Tourmaline	trace-1
Muscovite	trace
Carbonate	trace
Opaques and semi-opaques	3

This is a fine-grained rock comprised mainly of angular to subangular detrital quartz grains intergrown with detrital feldspar grains and an argillaceous matrix. Most of the detrital quartz grains are between 0.1 and 0.2 mm in size although some larger quartz up to 1 mm in size are present. Most of the larger detrital quartz grains have rounded to subrounded shapes.

The detrital feldspar consists of potash feldspar in the form of grid-iron twinned microcline and untwinned orthoclase and polysynthetically twinned plagioclase. Most of the detrital feldspar grains are below 0.5 mm in size and have angular to subangular shapes. The feldspar is generally quite fresh although some feldspar shows incipient alteration to finely divided sericite/clay. Much of the feldspar also has a slightly turbid character produced by very finely divided inclusions.

The argillaceous matrix consists mainly of weakly birefringent clay intergrown with smaller amounts of fibrous sericitic phyllosilicates. In general the matrix occurs interstitially between the felsic mineral grains. Some clays are also present as rounded detrital-appearing clasts.

Traces of tourmaline form detrital grains up to 0.2 mm in size which generally have a pleochroic green or brown colour. Traces of muscovite form well developed flakes up to 0.4 mm in length which are most likely of detrital origin. Small detrital zircon grains up to 0.1 mm in size were also noted. A small number of detrital quartz grains contain very small carbonate inclusions below 0.1 mm in size. Opaque to translucent iron oxides form finely divided intergrowths with the argillaceous matrix imparting a translucent, reddish-brown colour within localized areas. Minor opaques also form anhedral disseminated grains and aggregates.

This is a fine-grained, detrital sedimentary rock comprised mainly of detrital quartz and feldspar grains cemented by a matrix rich in weakly birefringent clay.

Sample: 6531 RS 30; TSC41896

Rock Name:
Fine-grained arkose

Hand Specimen:
A fine-grained, weakly friable rock with a pale tan colour and a weakly banding character produced by variations in grain size between some bands as well as fine lamellar bands with a slightly darker colour.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	55
Feldspar	25
Sericite/clay	15
Tourmaline	trace-1
Muscovite	trace
Opaques and semi-opaques	3

This rock consists mainly of detrital quartz and feldspar grains between 0.15 and 0.4 mm in size cemented by an interstitial, argillaceous matrix. The detrital quartz and feldspar grains generally have angular to subangular shapes although some larger detrital quartz grains up to 1 mm in size have rounded to subrounded shapes. The original shapes of the quartz grains have been slightly modified by recrystallization producing localized sutured grain margins and undulose, strained extinction.

The feldspar consists of polysynthetically twinned plagioclase and potash feldspar including gridiron twinned microcline and untwinned orthoclase. Most of the detrital feldspar grains have angular to subangular shapes. The feldspar generally has a very fresh character although some of the plagioclase shows incipient alteration to finely divided sericite/clay. Traces of tourmaline form disseminated, rounded detrital grains up to 0.3 mm in size which have a pleochroic green or brown colour.

The interstitial matrix is comprised mainly of weakly birefringent clay intergrown with minor fibrous sericite. Some clay also forms rounded appearing clasts which are thought to be of detrital origin and it is possible that some of the interstitial clay could represent deformed, argillaceous clasts. Traces of muscovite form small flakes up to 0.3 mm in length which are believed to be of detrital origin.

The translucent, reddish-brown iron oxides are intergrown with some of the argillaceous matrix imparting a dark reddish-brown colour to it. The rock also contains some disseminated opaque grains up to 0.4 mm in size with euhedral to subhedral shapes. The shapes of these grains are typical of pyrite and they are believed to represent limonite pseudomorphs after pyrite.

This is a fine-grained, immature detrital rock with a slightly recrystallized character. The rock also contains some limonite pseudomorphs after pyrite.

Sample: .6531 RS 31; TS41897

Rock Name:
Fine-grained, argillaceous arkose

Hand Specimen:
A fine to medium-grained rock with a weakly friable character and a pale grey to tan colour. A fine banding on a scale of one to several millimetres is evident in the rock and is produced mainly by slight variations in grain size and colour between different bands.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	55
Clay	25
Feldspar	20
Tourmaline	trace
Muscovite	trace
Carbonate	trace
Opaques and semi-opaques	1

This rock consists mainly of detrital quartz and feldspar grains up to 0.8 mm in size intergrown with argillaceous clasts and interstitial argillaceous material. Most of the detrital quartz grains have sub-angular shapes but some larger quartz grains up to 1 mm in size have rounded to subrounded shapes. Many of the quartz grains also exhibit fine overgrowths.

The detrital feldspar grains generally have angular to subangular shapes and consist of potash feldspar and plagioclase. Some of the detrital potash feldspar grains have authigenic overgrowths. Most of the feldspar has a slightly turbid colour produced by micron-sized inclusions but otherwise is very fresh with only some of the plagioclase showing incipient alteration to secondary phyllosilicates.

The rock contains rounded to subrounded clasts comprised mainly of weakly birefringent clay. Some clay also occurs as an interstitial matrix between the detrital mineral grains.

Traces of tourmaline form small detrital grains up to 0.2 mm in size which have a pleochroic green to brown colour. A small proportion of the tourmaline forms weakly prismatic-shaped crystals intergrown with the argillaceous matrix and could be of authigenic origin. Traces of muscovite form flakes up to 0.2 mm in length which are believed to be of detrital origin. Carbonate occurs as very small inclusions within some detrital quartz grains. Opaque to translucent iron oxides form small disseminated grains and aggregates up to 0.1 mm in size.

This is an immature detrital sediment comprised mainly of quartz with smaller amounts of feldspar and clay clasts.

Sample; 6531 RS 32; TSC41898

Rock Name:
Fine-grained, argillaceous arkose

Hand Specimen:
A fine-grained, weakly friable rock with an undulose banding produced by alternating pale grey and pale tan coloured bands. Locally the rock contains well developed limonite cubes up to approximately 3 mm in size which are pseudomorphic after pyrite.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	50
Clay	25
Feldspar	20
Tourmaline	trace-1
Muscovite	trace
Zircon	trace
Carbonate	trace
Opaques and semi-opaques	3

This rock consists mainly of fine-grained, detrital quartz intergrown with detrital feldspar and minor amounts of weakly birefringent clay. Most of the detrital quartz grains have subangular to subrounded detrital shapes which have been modified by recrystallization and the development of minor quartz overgrowths. The detrital feldspar consists of potash feldspar including gridiron twinned microcline and untwinned orthoclase along with smaller amounts of polysynthetically twinned plagioclase. Most of the feldspar is very fresh showing only localized incipient alteration to finely divided phyllosilicates. The detrital feldspar grains generally have angular to subangular shapes.

Most of the clay in this rock forms weakly birefringent, flaky aggregates with rounded to subrounded shapes believed to represent small, clay-rich clasts. Minor clay also occurs interstitially between the detrital, felsic mineral grains and at least some of this matrix clay could represent deformed clasts.

Traces of tourmaline form disseminated, detrital grains up to 0.2 mm in size which have pleochroic green to brown colours. Traces of zircon also form small detrital grains up to 0.1 mm in size. A small number of relatively large muscovite flakes up to 0.3 mm in size are disseminated through the rock and are thought to be of detrital origin. Traces of carbonate form very small inclusions within some detrital quartz grains.

The rock contains some euhedral limonite pseudomorphs after original pyrite crystals. Opaque to translucent iron oxides also form small disseminated grains and aggregates which are usually intergrown with the clay minerals. At least locally minor opaque to translucent iron oxides also form discontinuous vein-like structures.

This is an immature, fine-grained detrital rock quite similar to sample 6531 RS 31.

Sample: 6531 RS 33; TSC41899

Rock Name:
Fine-grained, argillaceous arkose

Hand Specimen:
A fine-grained, moderately well indurated rock with a pale tan colour. The rock contains disseminated, cubic limonite pseudomorphs after pyrite. The rock also has a very weakly laminated character.

Thin Section:
An optical estimate of the constituents gives the following:

	%
Quartz	60
Feldspar	20
Clay	15
Tourmaline	1
Zircon	trace
Carbonate	trace
Opaques and semi-opaques	3

This rock consists mainly of a finely granular quartz and feldspar mosaic with a grain size between 0.1 and 0.3 mm. The quartz generally exhibits a modified detrital-appearing texture produced by recrystallization. Most of the quartz exhibits slightly sutured grain margins and some has very fine overgrowths. The detrital feldspar generally forms angular to subangular grains and consists of plagioclase and potash feldspar including gridiron twinned microcline and untwinned orthoclase. Most of the clay occurs as irregular, interstitial fillings between the felsic mineral grains. Minor clay forms small granular-appearing aggregates which could be of detrital origin. Most of the clay has a weakly birefringent character although some fibrous sericite is intergrown with it.

Accessory tourmaline forms detrital grains up to 0.2 mm in size which have rounded to subrounded shapes. Most of the tourmaline has a pleochroic green or pleochroic brown colour. Traces of zircon form small detrital grains up to 0.1 mm in size. Traces of carbonate were noted as very small inclusions within some quartz grains.

Opaque to translucent iron oxides form disseminated aggregates up to 0.2 mm in size which are generally intergrown with the argillaceous material. Some large limonite pseuodmorphs after pyrite are also disseminated through the rock.

This a fine-grained, immature detrital sediment with a weakly recrystallized texture.

SUMMARY

Five rocks submitted by the South Australian Department of Mines and Energy (M. Dugmore) for petrographic examination were given the following rock names:

6531 RS 29 Arkose
TSC41895

6531 RS 30 Fine-grained arkose
TSC41896

6531 RS 31 Fine-grained, argillaceous arkose
TSC41897

6531 RS 32 Fine-grained, argillaceous arkose
TSC41898

6531 RS 33 Fine-grained, argillaceous arkose
TSC 41899

All of these samples are immature detrital sedimentary rocks comprised mainly of detrital quartz and feldspar grains. Some samples also contain detrital lithic clasts or rounded clasts of weakly birefringent clay which are believed to represent argillaceous clasts. Some samples also have an argillaceous matrix, at least some of which could represent deformed argillaceous clasts. Accessory detrital tourmaline is present in all of the samples and many also contain traces of detrital zircon.

The samples show varying degrees of induration and recrystallisation. All of the thin sections described in this report have been stained with an alizarin red-S solution to distinguish calcite from other carbonates by staining it pink. In the petrographic descriptions calcite is used only for stained carbonate but most of the carbonate forms very small inclusions within quartz which may not be stained even though it is calcite.

PLATE 1. NO. 2 QUARRY - VIEW NORTH WEST
Face at left to 8 m high, partly obscured by rubbish. Floor overgrown. Gladstone township in background. No. 1 Quarry not visible but in front of houses and behind tree at mid centre right. February 1984.
Slide No. 36003

PLATE 2. NO. 2 QUARRY - VIEW SOUTH EAST
Thickly bedded building stone Unit 3, 1-2 m thick in middle of face underlain by flaggy sandstone Unit 2 and overlain by ochreous sandstone Unit 4. Bedding is crenulated at top of Unit 3 at right centre. February 1984.
Slide No. 36004

PLATE 3. NO. 3 QUARRY - VIEW SOUTH EAST
Thickly bedded building stone Unit 3, 3 m thick in centre of face at right. Floor overgrown. Quarry 4 obscured in cropped paddock left rear in front of trees and farmhouse. February 1984
Slide No. 36005

PLATE 4. NO. 3 QUARRY - VIEW NORTH WEST
Basal sandstone Unit 1 at right overlain by flaggy sandstone Unit 2 about 1 m thick, thickly bedded building stone Unit 3, 1-2.5 m thick, and ochreous flaggy sandstone Unit 4, 0-1.5 m thick.
Gladstone township in background. February 1984.
Slide No. 36006

PLATE 5. NO. 3 QUARRY - TERMINAL FACE
Thickly bedded basal sandstone Unit 1 to 2 m thick at right suitable for building stone. Top marked at left by yellow-white lens of fine-grained ochreous sandstone, 0.15 m thick. Some building stone is available from the overlying flaggy sandstone Unit 2.
February 1984.
Slide No. 36007

PLATE 6. GLADSTONE GAOL, 1879-1881 - INTERNAL WALLS
January 1984.
Slide No. 36008

PLATE 7. GLADSTONE GAOL - CUBES OF BROWN LIMONITE AFTER PYRITE IN WALL.
Closeup of graded bedding in sandstone and random cubes of pyrite altered to red brown limonite.
January 1984.
Slide No. 36009

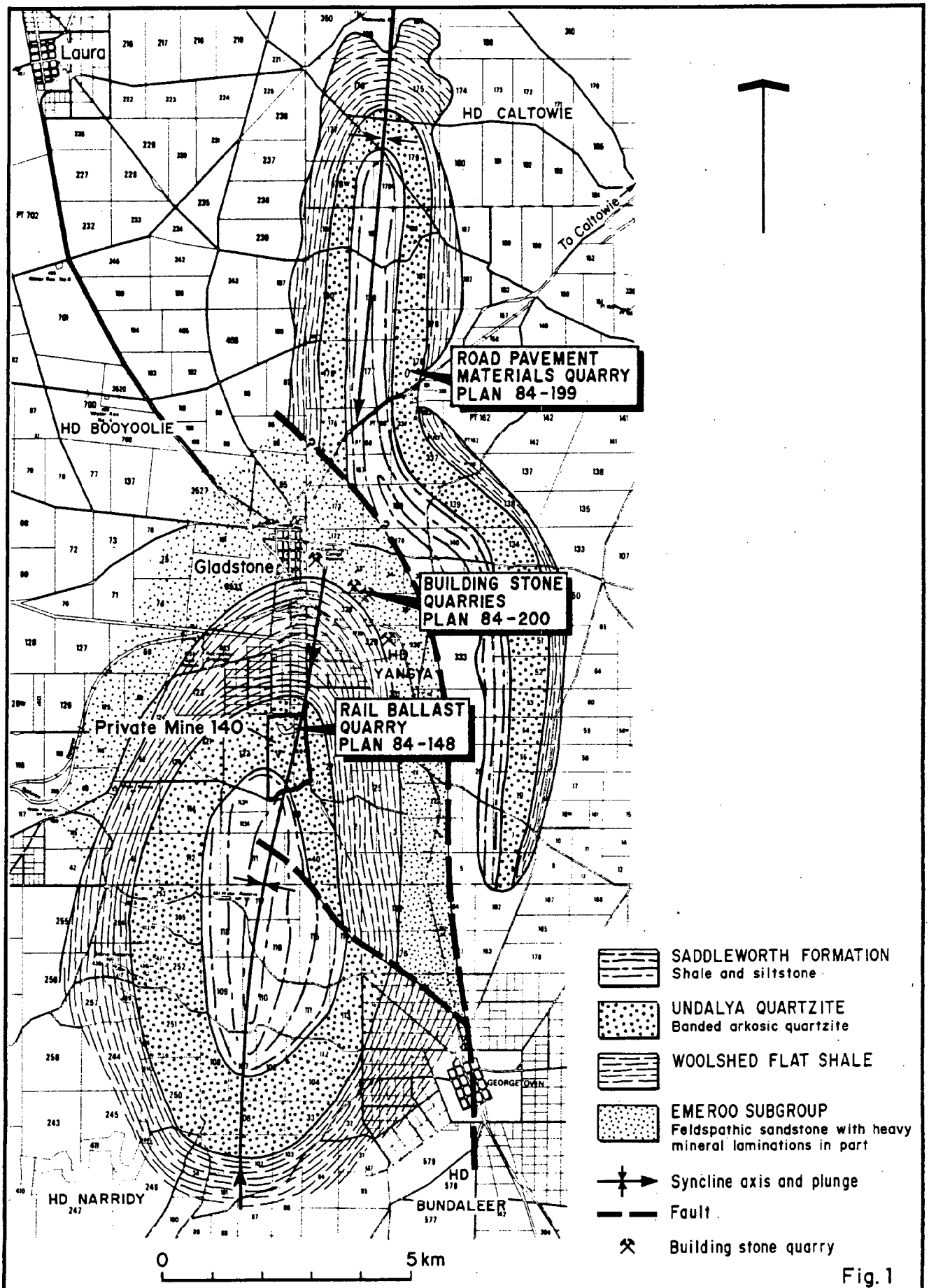


Fig. 1

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

GLADSTONE QUARTZITE DEPOSITS
LOCATION AND REGIONAL GEOLOGY

COMPILED A.M.P.	11-12-84
DRAWN A.F.	SCALE 1:100 000
DATE 27-8-84	PLAN No. S17499

3546

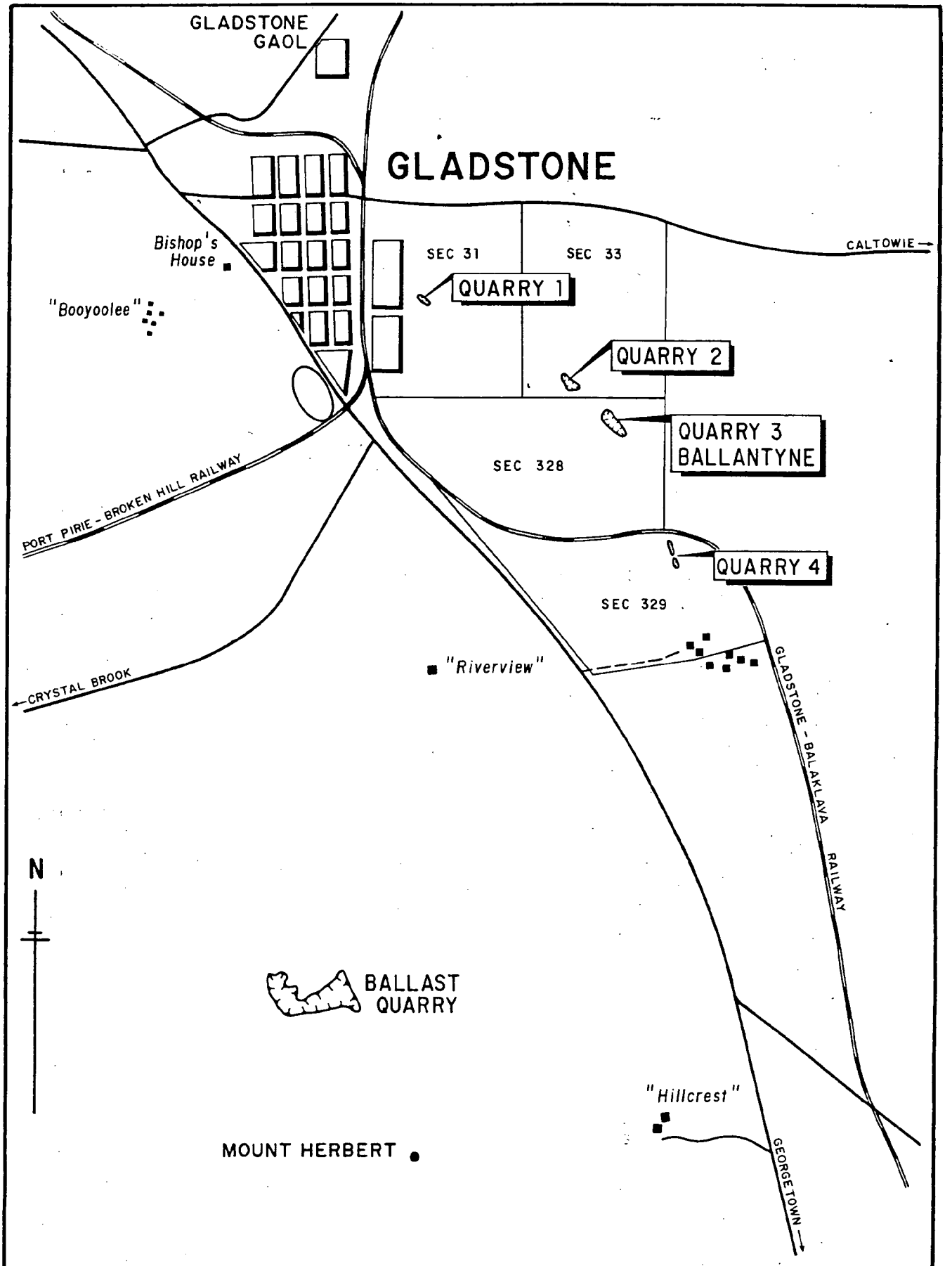


Fig. 2

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED A.M.P.
CDO
DATE

DRAWN M.B.
SCALE 1 : 25000

DATE June '87
PLAN NUMBER

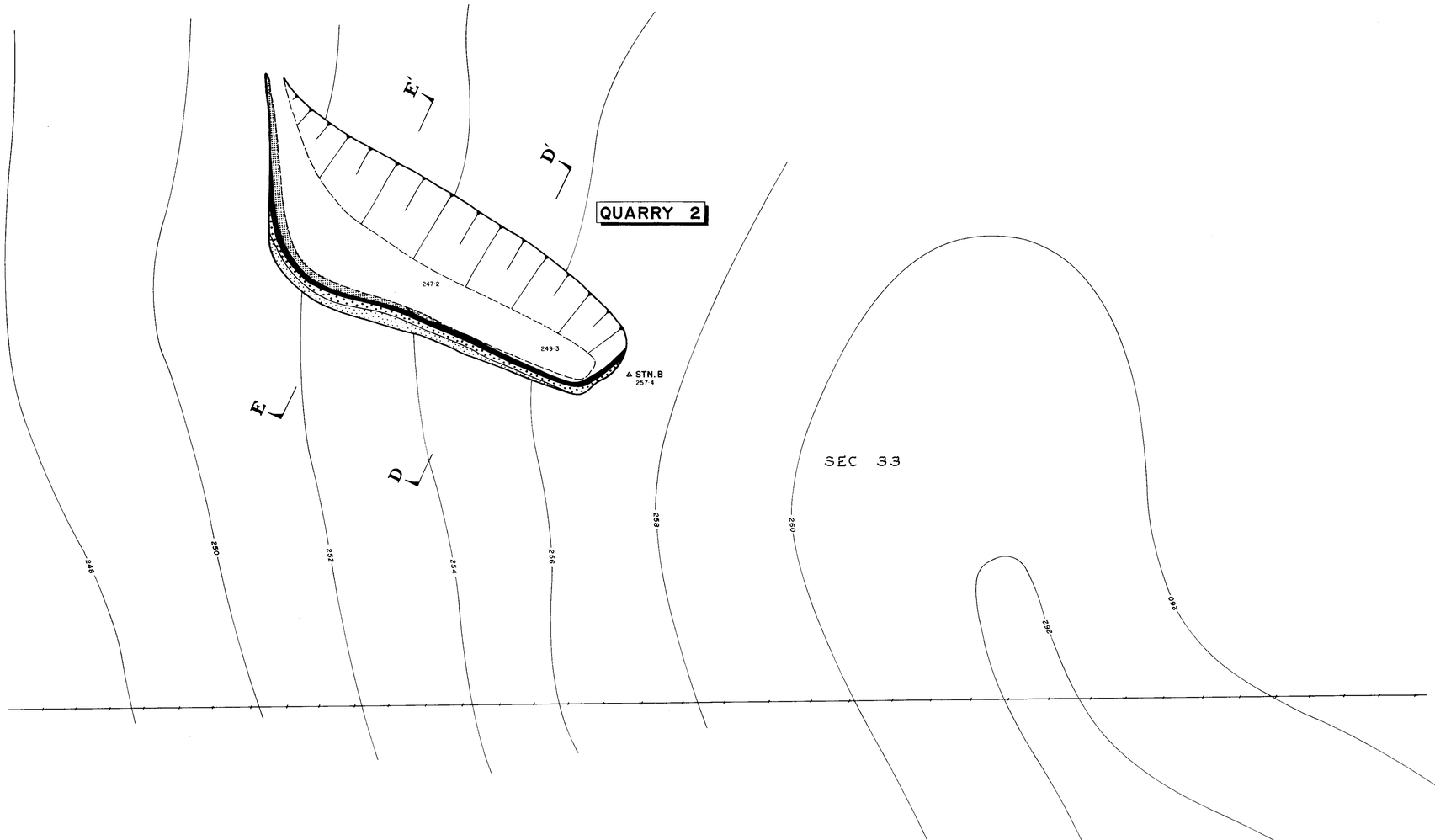
CHECKED

S19284

GLADSTONE BUILDING STONE QUARRIES

LOCALITY PLAN

3546



SCREE

OVERBURDEN

UNIT 4 — SANDSTONE : Fine to medium grained feldspathic. Thinly bedded to flaggy with yellow ochreous bands. A lens of moderately bedded, laminated sandstone with pyrite cubes to 5mm, is exposed in south western quarry face.

UNIT 3 — SANDSTONE : Fine to medium grained feldspathic. Very thickly bedded to massive. Beds 20–200 cm thick. Crossbedded. Contact with Unit 2 is gradational. Main source of building stone.

UNIT 2 — SANDSTONE : Fine to medium grained feldspathic. Thin to flaggy bedding. Laminated and showing distinctive irregular crossbedding, thin silty sandstone interbeds to 10cm thick occur throughout unit.

UNIT 1 — SANDSTONE : Thickly bedded, feldspathic. Laminated and cross bedded. Base marked by a yellow sandy ochreous bed approx. 25cm thick. Top marked by discontinuous fine grained yellow ochreous sandstone approx. 15cm thick.

65 — Joint, inclined

255·9 — Spot height, elevation in metres, Datum AHD

STN. B — Survey Station

260 — Contour, 2m interval

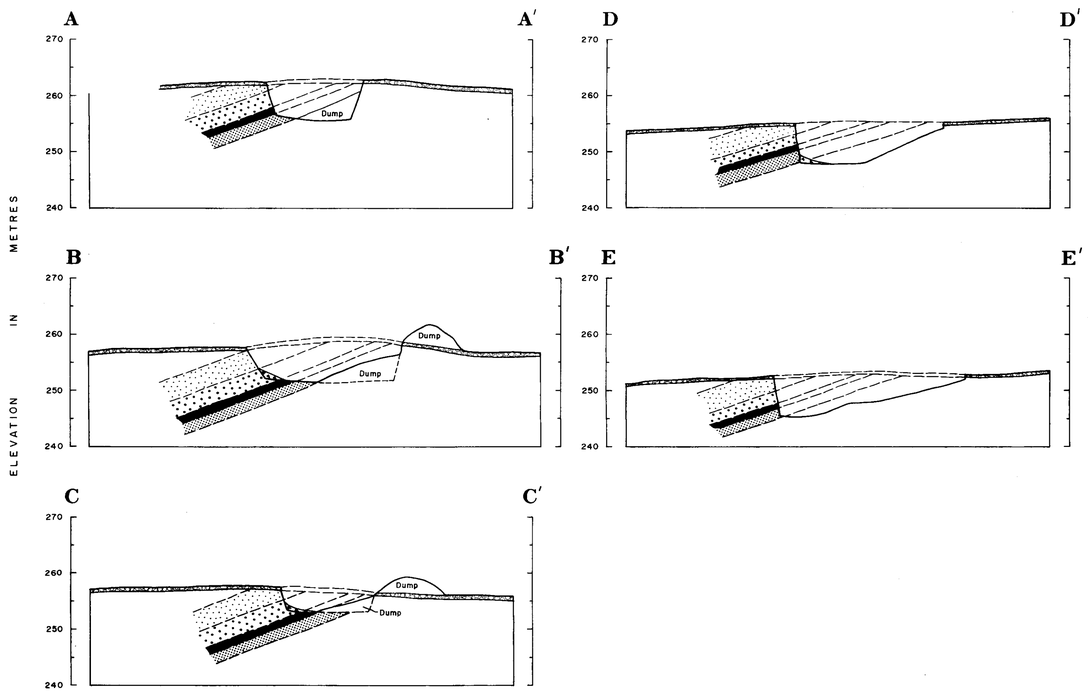
Quarry

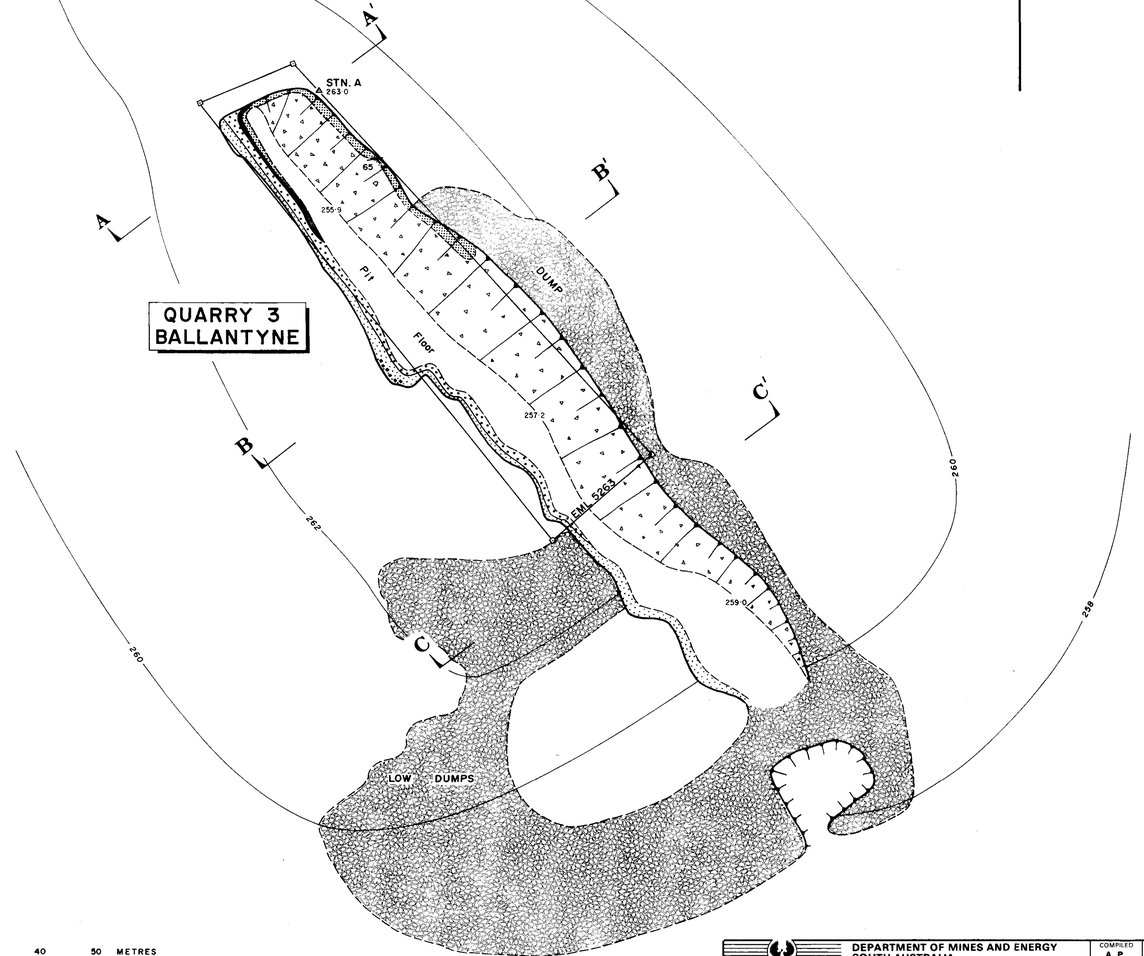
Fence

A A' — Geological Cross section

Corner post, EML 5263

Stadia Survey by P.P. Crettenden, SFB 701 and 702.





SCALE

0 10 20 30 40 50 METRES

Fig. 3

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	COMPILED A. P.	C.D.O.	18 3 86 DATE
GLADSTONE BUILDING STONE QUARRIES	DRAWN M.B.	SCALE 1:500	
SEC 33, 328, HD YANGYA	DATE May '84	PLAN NUMBER 84 – 200	
GEOLOGICAL PLAN AND CROSS SECTIONS	CHECKED		