DEPARTMENT OF MINES
SOUTH AUSTRALIA

TIVER'S QUARTZITE QUARRY

Sections 3324, 3325, Hd. Munno Para, Co. Adelaide

_ District Council of Munno Para _

by

W.S. McCALLUM
GEOLOGIST
EXTRACTIVE MINERALS SECTION

Rept.Bk.No.75/44
G.S. No. 5581
DM. No. 542/75

23rd July, 1975

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ABSTRACT

Mapping of the disused Tiver's Quarry in the Hills Face Zone near Gawler township has revealed folded quartzite and sandstone with interbedded shale. Potential reserves within the existing quarry area have been estimated. The quartzite and hard sandstone will be suitable for sub-base course, but the considerable amount of shale will have to be removed as waste.

The quarry should be rehabilitated and a development plan should be proposed to facilitate this.

INTRODUCTION

Tiver's Quarry is located in sections 3324, 3325, Hd. Munno Para in the Hills Face Zone several kilometres southeast of Gawler township. Between 1955 and 1963 Quarry Industries Ltd. extracted quartzite from a number of benches and recorded production amounts to 531 000 tonnes. Prior to 1955 the quarry was operated by S.J. Tiver but no production has been recorded. The quarry has been disused since 1963.

The District Council of Munno Para has applied to the Extractive Industries Committee to reopen the quarry to extract sub-base material for rural roads. In a letter dated 16th August, 1974, the Council requested the Department of Mines for assistance in determining quality and quantity of reserves. The nearby land is being subdivided and it is necessary to rehabilitate the quarry workings to improve the amenity of the area.

On the 28th and 29th of August, 1974, the author prepared a geological map of the area, and on 18th September, 1974, the heights of benches were determined by plane table. The accompanying plan (Figure 1) shows the position of benches, geology, form lines and spot heights on the benches. The plane table survey was not tied in with any Lands Department bench mark, and form lines are drawn to an arbitrary base level, setting the lowest point within the quarry at 100 metres. Cross sections A to E (Figure 2) were drawn perpendicular to the fold axis to illustrate topography and fold shapes.

Calculation of reserves indicates a total of 199 000 cubic metres of rock available within the quarry area, 55 000 cubic metres of which is waste and the remainder suitable for pavement material.

GEOLOGY

The area investigated lies on the Gawler 1:63 360 sheet and the ADELAIDE 1:250 000 geological map sheet (Thomson, 1969).

The quarry lies at the extreme western edge of the Mt. Lofty Range which is here underlain by Adelaidean sediments of the Undalya quartzite (Stonyfell quartzite equivalents). The Para Fault lies along the western boundary of the ranges. To the west of the fault is the St. Vincent Basin, underlain by Tertiary and Quaternary sediments.

The Undalya Quartzite at this quarry site consists of white massive quartzite and hard sandstone with well sorted and rounded, fine to medium grained quartz and lesser amounts of feldspar grains. Heavy mineral laminations, sometimes wavy or cross bedded, are seen in places. Interbeds, typically 10 to 20 cm thick, of weathered grey shale occur within the quartzite. These show more evidence of micro folding than the sandstone and quartzite. Cleavage is well developed in the shale unit. The sandstone is often arkosic and friable for approximately a metre where it overlies shale.

This feature is most pronounced above the southerly dipping shale at the north of the southern quarry workings where the sandstone is poorly sorted with abundant feldspar, heavy mineral laminations and contorted bedding.

The ADELAIDE 1:250 000 geological map sheet shows unnamed shale units within the Undalya Quartzite. Three thick interbeds of fine grained grey or brown weathered shale were seen within the quarry area and were used as marker beds to outline the structure. These are identical to the thin shale interbeds within the quartzite described above. They are finely laminated and break parallel to the bedding. Cleavage is developed in places, especially in the nose of folds, and the shales have been more highly deformed than the quartzites during folding. Where shale overlies sandstone in the southeast of the quarry, the transition is marked by a sequence of interbedded shales and arkoses resting on sandstones, grading up into shales with minor arkoses as the arkose interbeds thin out. The total transition sequence is about 75 m thick.

STRUCTURE

The sequence of quartzites and shales is folded into a syncline in the south and an anticline in the north, with fold axis dipping shallowly to the southeast and axial planes dipping steeply to the northeast.

The three major shale beds outline the character of the folding. The highest (southern) shale unit is folded into a syncline with smaller scale W shaped folding in the nose of the syncline. The thickness of this unit was not determined due to lack of outcrop to the southeast. The middle shale unit is only about three metres thick and outcrops in the northern limb of the syncline and across the anticline. In the northern limb of the anticline two shale beds, each several metres thick and separated by 8 metres of quartzite, are in approximately this same stratigraphic position. The lowest shale member, visible only in the anticline, is 5 metres thick on the southern limb and 10 metres on the northern limb. The general shape of the folding is shown in cross sections A to E.

RESERVES

Calculations of reserves were based on the following parameters.

1. That the depth of the quarry will not be extended below its present maximum depth.
2. That the quarry will not be extended beyond the present limits of workings, and or beyond the existing cleared area (see figure 2).
3. That a ridge would be left along the west of the quarry to shield the workings from view. To be effective this ridge would be 15 metres above the quarry floor.
4. The final workings will comprise benches of approximately 12 metres height with a 60^{o} batter, and benches 10 metres wide. This work could all be carried out by extending the existing benches.

Reserves were calculated from cross sections B, C and D (see appendix A) which gave a total reserve of 199 000 cubic metres of stone. Of this total 55 000 cubic metres is shale overburden, and the remaining 144 000 cubic metres is quartzite or sandstone suitable for pavement. (Testing would confirm this). The stone would not be suitable for sealing aggregate. As the shale contains thin quartzite lenses and interbeds it could not be used for brick shale or other purposes.

ENVIRONMENT AND REHABILITATION

Tiver's Quarry lies in the Hills Face Zone, southeast of Gawler township, and is visible from the west over a large area. However, at the moment much of the quarry is hidden from view by a natural ridge left to the west of the main workings. If this ridge is left untouched and the quarry workings are not extended beyond their present limits, the reserves outlined above are available without altering the appearance of the quarry from the west.

The quarry should be worked to a prepared development plan so that it will be an asset to the Munno Para District Council. The quarry area could be used as a picnic, recreation or camping ground etc. At present the quarry is untidy and unsafe with haphazard development of benches, and unstable high bench faces. With new subdivisions to the northeast of the quarry the area will be a hazard to children in its present state. Controlled workings should reduce the safety hazard by creating more stable bench faces and provide a pleasant area for public use.

SUMMARY

The District Council of Munno Para has proposed reopening the disused Tiver's Quarry to supply sub-base course material for rural roads. The sandstone and quartzite available from the quarry is suitable for the purpose and 144 000 cubic metres of stone are estimated to be available. However, 55 000 cubic metres of shale overburden which is not suitable for road use would have to be removed.

As rehabilitation is a prime consideration, the protective ridge to the west should be retained. The quarry should be worked to a development plan aimed at preparing the quarry for an appropriate after use.

W A Mc Callum

W.S. McCALLUM
GEOLOGIST
EXTRACTIVE MINERALS SECTION

WSMcC:FdeA
23/7/75

REFERENCE

Thomson, B.P., 1969. ADELAIDE map sheet. Geological Atlas of South Australia,1:250 000 series, Geol. Surv. S. Aust.

APPENDIX A

CALCULATION OF RESERVES

The volume of rock between cross sections A and B equals $\frac{A+B}{2}$ x (distance between A and B) x (Scale factor)^3

However the distance between cross sections A and B is large, and the above calculation would be inaccurate. This inaccuracy can be reduced by creating cross sections between each of the four existing cross sections, thus creating eight new sub areas (eg. AB is new cross section between A and B).

Therefore volume between A and AB equals

$\frac{A+AB}{4}$ x (distance between A and B) x (Scale factor)^3

Cross section AB is estimated, or let AB equal A and estimate the division factor x.

$\frac{A+A}{x}$ x (distance between A and B) x (Scale factor)^3

Therefore total volume

$= \left(\left(\frac{A+A}{4} + \frac{B+A}{4}\right) + \left(\frac{B+B}{3} + \frac{C+C}{4}\right) + \left(\frac{C+C}{8} + \frac{D+D}{4}\right) + \left(\frac{D+O}{6} + O\right)\right)$

x (distance between A and B) x (Scale factor)^3

Cross section on A = 0.0 sq.cm.
B = 1.94 sq.cm.
C = 2.65 sq.cm.
D = 0.31 sq.cm.
E = 0.0 sq.cm.

distance between A and B = 1.56 cm

Scale. 1 cm represents 31.68 metres.

Therefore, total volume of Reserves

$= \left(\frac{11B}{12} + \frac{3C}{4} + \frac{2D}{3}\right)$ x 1.56 x $(31.68)^3$

= 199 200 cubic metres of sandstone, quartzite and shale.

Volume of Shale

Cross section of shale on B = 0.33 sq.cm.
C = 0.57 sq.cm.
D = 0.12 sq.cm.

Cross section of shale on BC = 1.98 sq.cm. (measured from the total value of shale on C, including shale projected upwards from ground level as strata is dipping to the southeast).

Substituting into the previous equation

Volume of shale = $(B/4 + (B + BC)/3 + (BC + C)/3 + (C + C)/8 + (D+D)/8 + D/6)$ x 1.56 x $(31.68)^3$ cu.m.

$= \frac{(7B + 8BC + 7C + 5D)}{12}$ x 1.56 x $(31.68)^3$ cu.m.

$= \frac{13.2}{12}$ x 1.56 x $(31.68)^3$ cu.m.

= 54,600 cu.m.

Therefore the volume of usable sandstone and quartzite is 144 600 cu.m.

PLATE 1. Tivers Quarry, from the road to the northwest.

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PLATE 2. Tivers Quarry. Southern cutting, looking south.

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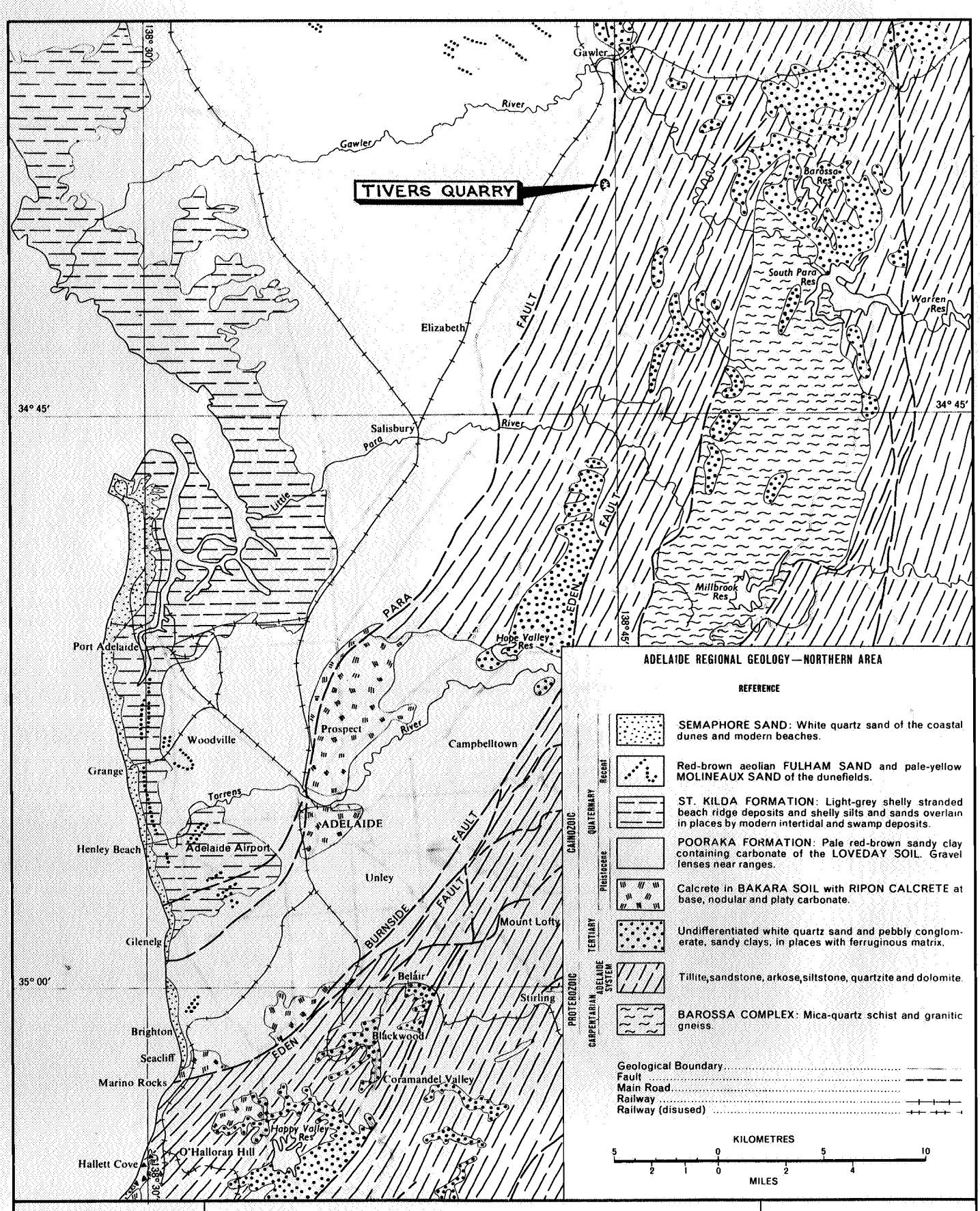
PLATE 3. Tivers Quarry. Northern face of southern cutting. Quartzite overlying shale.

Slide 11665

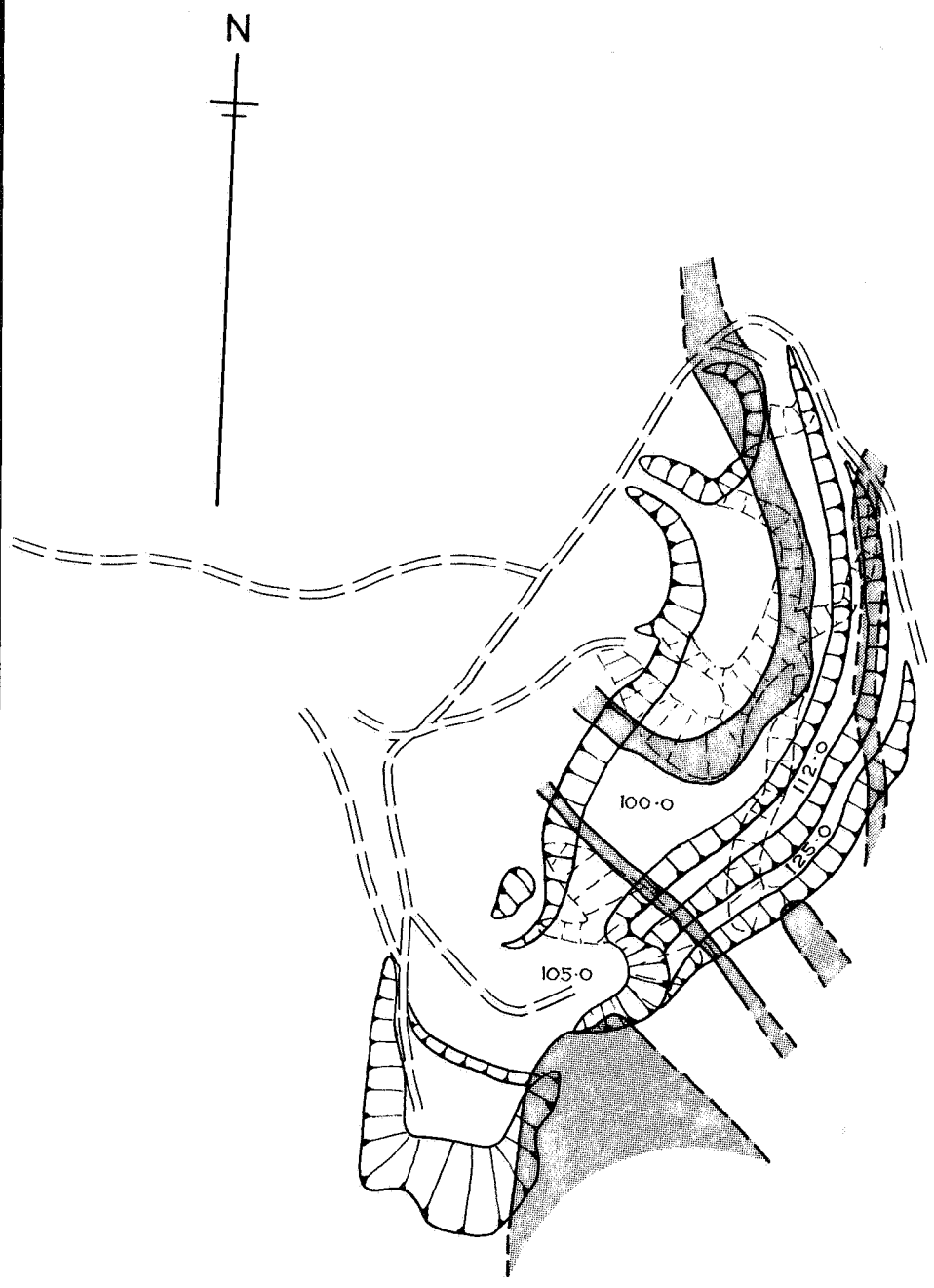
PLATE 4. Tivers Quarry. Quartzite in the eastern cutting.

Slide 11666



ENGINEERING GEOLOGY SECTION	**DEPARTMENT OF MINES—SOUTH AUSTRALIA**	Scale: 1:250 000
Compiled: W.McC	TIVERS QUARRY — GAWLER SECTIONS 3324, 3325 HD MUNO PARA	Date: Jan 1975
Drn. A.F. | Ckd.		Drg. No.
Geology from Adelaide and Barker 1:250 000 Geological Atlas Series	LOCATION AND REGIONAL GEOLOGY	S11351

PF No S9992 GH



Existing quarry face

Proposed new quarry face

112·0 Proposed bench height

0 100 200 METRES

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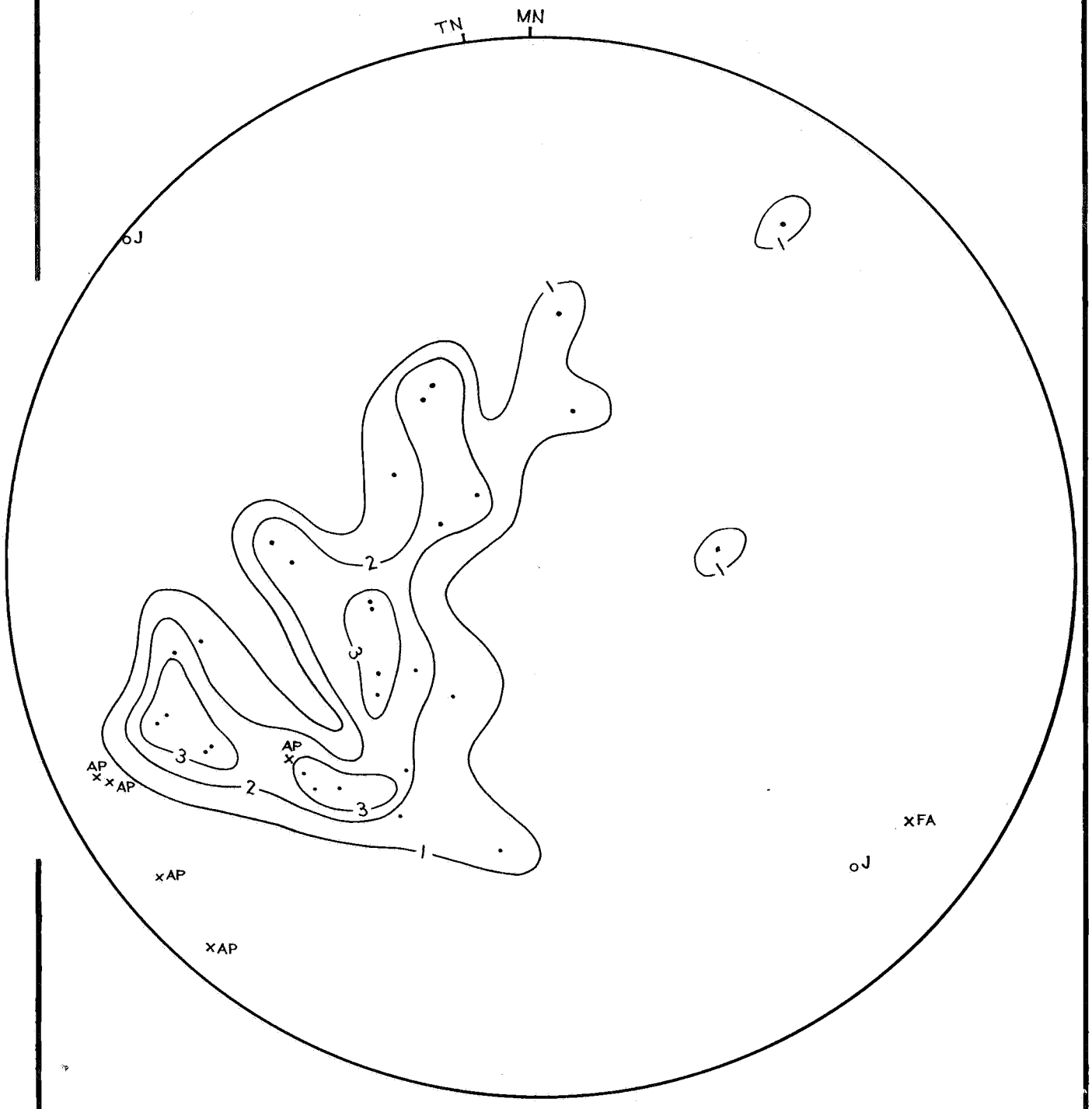
EXTRACTIVE MINERALS SECTION	Drn. W.Mc Tcd. A.F. Ckd. Exd.	TIVERS QUARRY GAWLER SEC. 3324 3325 HD MUNO PARA POSSIBLE LIMITS OF PROPOSED WORKINGS	SCALE: 1:3168 S11159 DATE: JANUARY 1975

500-2.69 665 6628 - IV



• Poles to bedding

x AP Poles to axial plane cleavage

oJ Poles to jointing

x FA Fold axis, interpreted. 18° → 133°

—2— Area Density contours around poles to bedding

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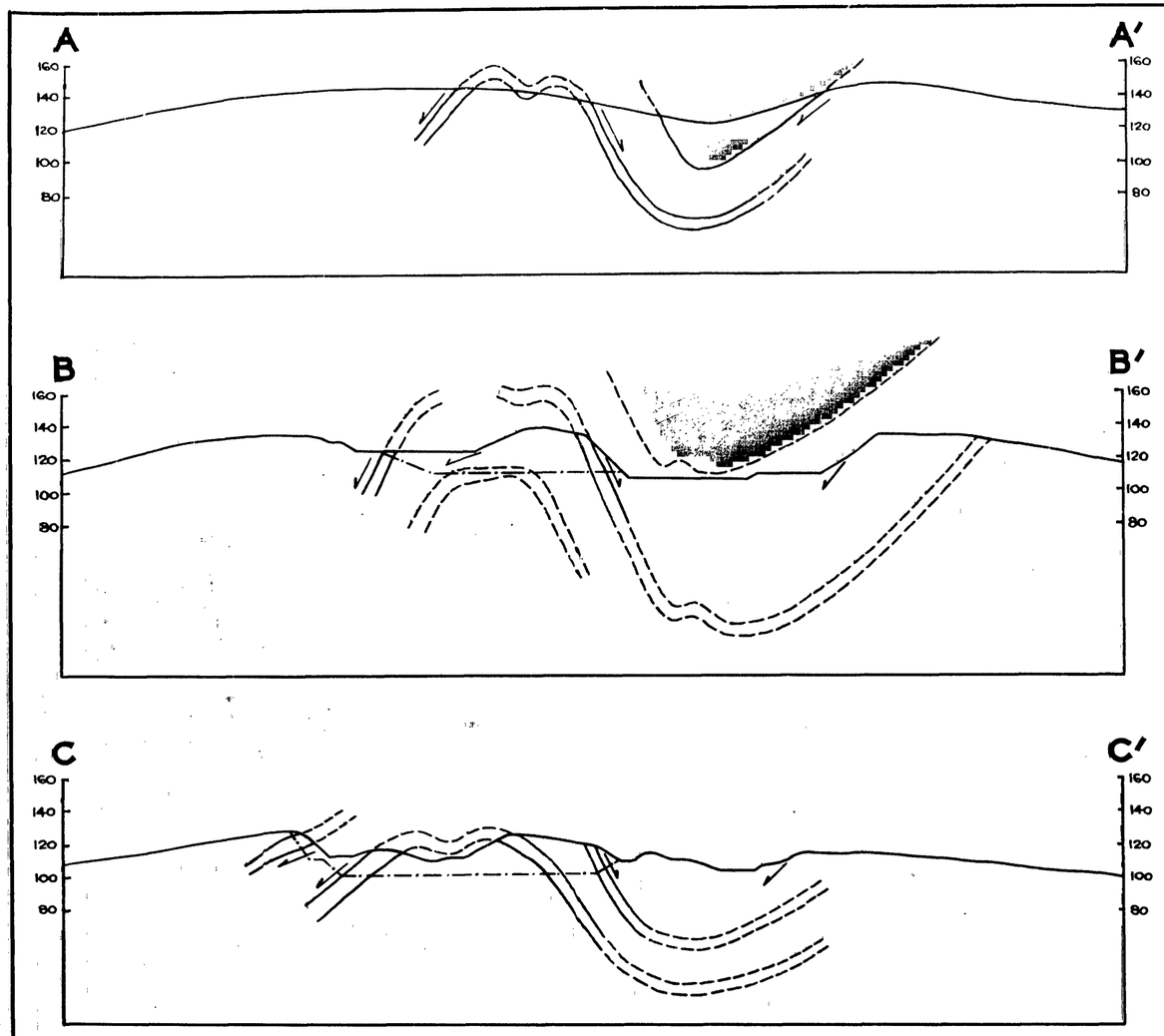
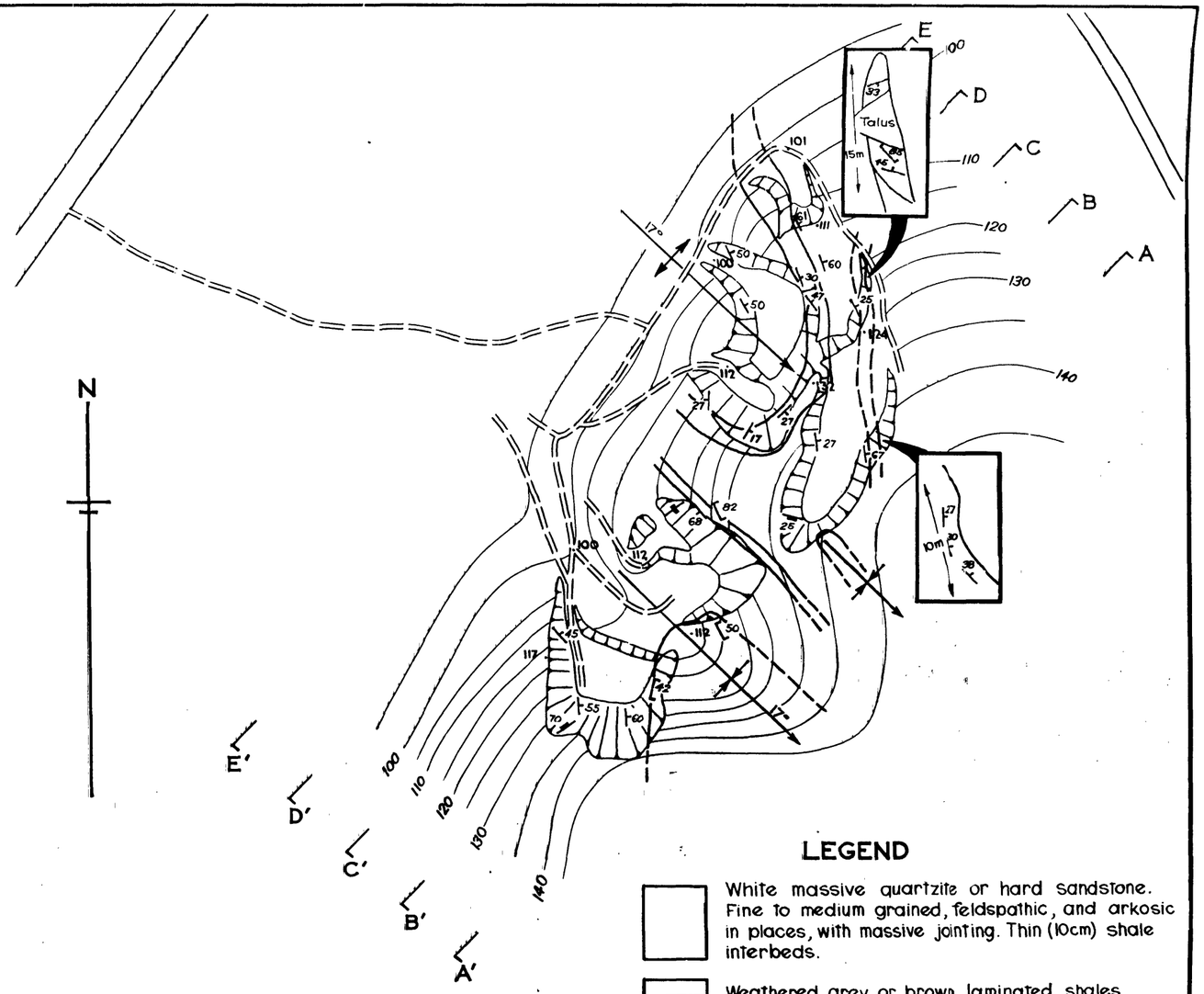
EXTRACTIVE MINERALS SECTION	Drn. W.Mc Tcd. A.F. Ckd. Exd.	TIVERS QUARRY GAWLER SEC. 3324 3325 HD. MUNO PARA STEREOGRAPHIC PROJECTIONS OF ROCK BEDDING CLEAVAGE AND JOINTING	SCALE: S11158 DATE: JANUARY 1975

500—2.69 665

6628—IV





SCALE
1:3168 (1 INCH • 4 CHAINS)
0 100 200 300 METRES

Dip of bedding
Axial plane
Extension of quarry down to deepest present level within the existing cleared area

Elevations are in metres

LEGEND

White massive quartzite or hard sandstone. Fine to medium grained, feldspathic, and arkosic in places, with massive jointing. Thin (10cm) shale interbeds.

Weathered grey or brown laminated shales

- Geological boundary
- Anticline
- Syncline
- Strike and dip of bedding
- Jointing inclined, vertical
- Cleavage
- Road, Track
- Contour in metres, ·100 Spot height
- Quarry face

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TIVERS QUARRY GAWLER
SECTIONS 3324 3325 HD MUNO PARA
GEOLOGICAL PLAN & SECTIONS

EXTRACTIVE MINERALS SECTION	W. Mc Callum GEOLOGIST	Drn. W McC	SCALE: 1:3168 V/H = 1
		Tcd. A.F	75 – 8
Director of Mines		Ckd.	
		Exd.	DATE: JANUARY 1975

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