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NOTES ON THE GEOLOGY OF THE ANGAS-BREMER IRRIGATION AREA

-Proposed Quarterly Note-

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SOUTH AUSTRALIA

GEOLOGICAL SURVEY
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by

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Rept.Bk. No. 78/29
G.S. No. 6003
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D.M. No. 734/74

PLANS

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PHOTOGRAPH

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1	Elevated Tertiary outcrop on weathered Cambrian bedrock near Strathalbyn.	13705

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LOCALITIES
10 — LANGHORNE CREEK
14 — MILANG
18 — LAKE ALEXANDRINA
22
26
30
34 — 39 LICENCE AREA

HUNDRED: BREMER
SECTIONS: 40 43 47 51 55

HUNDRED: STRATHALBYN
SECTIONS: 59 62 66 70 74

KEYWORDS
MAJOR KEYWORD: REGIONAL ~~HYDRO~~GEOLOGY
SURFICIAL GEOLOGY
~~WATER RESOURCES~~
TERTIARY
CAINOZOIC
STRAT. CORREL.
CROSS-SECTION
ARTESIAN AQUIFER
KARST
& LIMESTONE
DRILLING
ISOPACH
& CONTOUR MAPS
HYDROLOGY
FLOOD PLAIN
SURFICIAL DEPOSITS

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A study of the hydrogeology of the Angas-Bremer irrigation area (Figure 1) has been in progress since 1968. A total of 87 wells have been drilled to depths as great as 150 metres to provide subsurface geological information. (Williams, 1978; Waterhouse, et al., 1978).

The irrigation area straddles the floodplains of the Angas and Bremer Rivers, between the Mount Lofty Ranges and Lake Alexandrina, at the western extremity of the Murray Basin. Tertiary limestones form a confined aquifer from which most water used locally is withdrawn; overlying Pleistocene lacustrine and floodplain deposits form a complex unconfined aquifer, which is generally saline.

In the Angas-Bremer area the basement to the Murray Basin is generally 100-120 metres below ground except in the north-west, where an inferred fault (Williams, 1978) marks the limit of subsurface Tertiary limestone. A generalised north-south section is presented in Figure 2. Limestone outcrops in the nearby Mount Lofty Ranges are common (e.g. Lindsay and Williams, 1977, and Plate 1) as far as 25 km up the Bremer Valley. They are isolated from the subsurface occurrences of limestone, and do not contribute to aquifer

recharge. It has been generally assumed that Post-Miocene faulting is responsible for their elevation. Twidale and Bourne (1975) presented an alternative viewpoint: they argued that elevated outcrops could be Morgan Limestone, and that subsurface material could be the older, but similar Mannum Formation. Those formations can be indistinguishable in hand specimen without palaeontological evidence, and sometimes even then cannot be identified.

In a recent publication (Lindsay and Williams, 1977) it was shown that elevated outcrops in the area recorded the Oligocene marine transgression and that the Tertiary Limestones were partly the Ettrick Formation, which underlies the Mannum Formation.

The vertical separation between the highest known Mount Lofty Range outcrop in the Bremer Valley near Monarto and the base of subsurface Mannum Formation (at least 200 metres) is greater than the combined thickness of the Morgan Limestone and the Mannum Formation (Firman, 1973, p. 13). It is considered therefore that uplift is mainly responsible for the separation between limestone in the basin and the ranges.

The eroded surface of the Tertiary Limestone is characterized by a north-south, irregular valley corresponding with the position of the modern Angas River, with a closed depression inferring internal (karstic) drainage (Figure 3). A similar depression exists beneath Langhorne Creek township in a north-easterly trending tributary valley. Solution cavities in the limestone have been reported by drillers. This karst probably predates the overlying Blanchetown Clay, and may have formed before the deposition of the Pliocene sand sequence.

This interpretation is reinforced by exposures in quarries at Naracoorte which show Parilla Sand equivalent infilling solution cavities in Miocene limestone.

A variable sequence predominantly of non-marine fluviatile and lacustrine sediments overlies the Tertiary Limestones. They are equivalent to units such as Pliocene Parilla Sand and Norwest Bend Formation, and Pleistocene Blanchetown Clay, (Firman, 1965; 1966). A detailed geological section is shown on Figure 5.

The isopach map of the Quaternary sediments (Figure 4) shows a generally simple pattern, with thinning to the southeast, This suggests a source area to the northwest, a situation similar to the modern Angas and Bremer floodplain. The modern rivers are not perpendicular to the isopachs, inferring that minor north-south tilting may have occurred subsequent to deposition.

A phase of deposition of massive, ~~fine, red~~ quartz sand (calcreted ?) in scour structures in the top of calcretized (?) Blanchetown Clay can be observed in places in the banks of the River Angas. The sections exposed in the river show clearly a recent phase of deposition of up to 3 metres of fine grey-brown silt in several phases (buried soil horizons are regarded as the best interpretation of conspicuous dark layers within the silt). This silt forms the natural levees associated with the rivers. Large wood fragments (up to 2 metres) are common in the silt, and appear to have been deposited with it. The wood has been carbon-dated at 3540 years B.P. ±-230 (Dury, 1964). There is a well preserved, abandoned river channel to the west of the area, entering Lake Alexandrina near Milang. It is a similar size to the River Angas, and may have been a former

channel, perhaps abandoned 3500 years ago during a major run-off event dated by the tree fragments in the levee deposits. Since that event, the rivers have eroded down to their modern base levels.

The authors are unable to devote more time to the geological interpretation of the area, but feel there may be much to be gained by a more detailed study of the data collected by the hydrogeological investigations.

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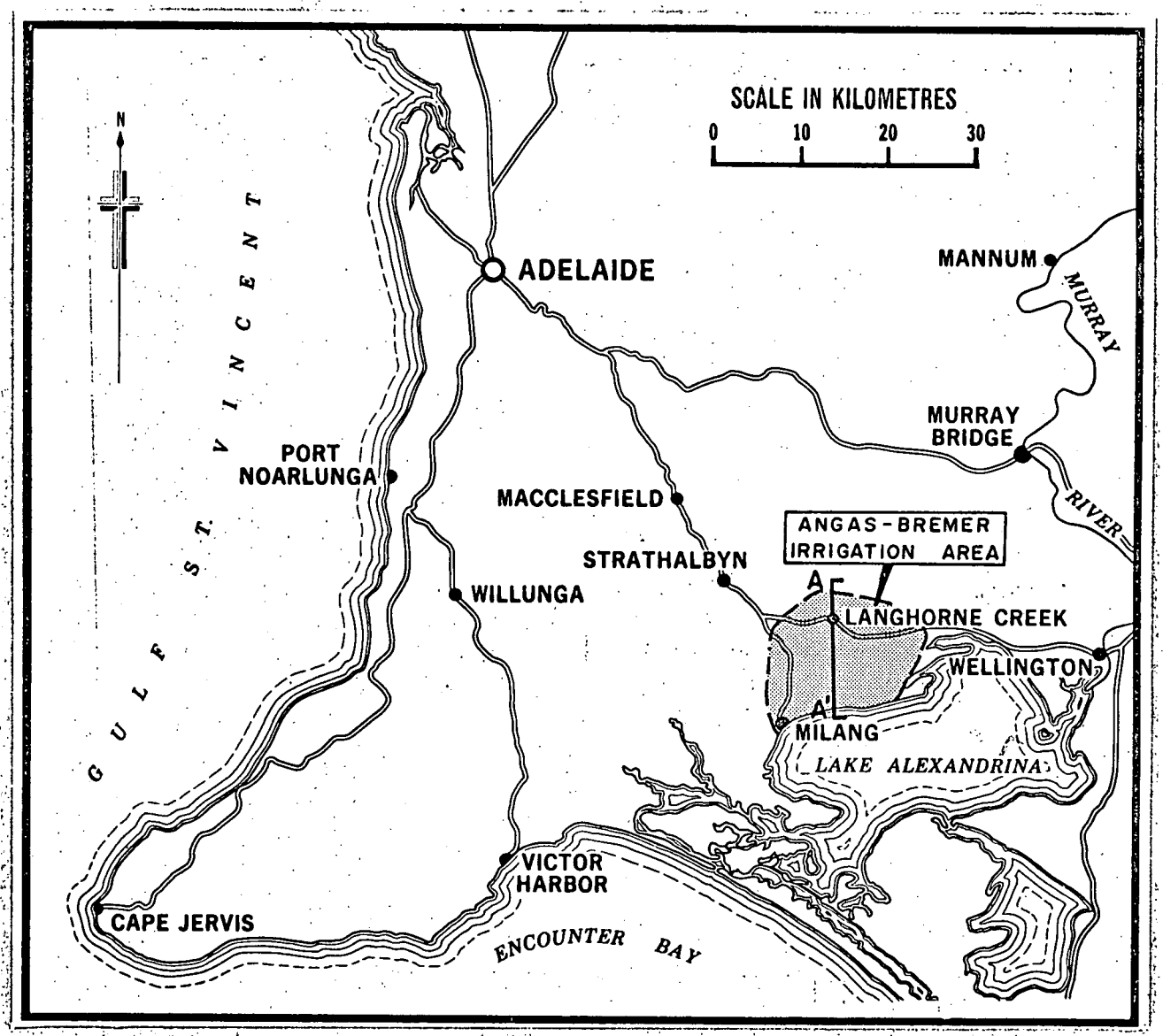


FIG. 1

	DEPARTMENT OF MINES—SOUTH AUSTRALIA	Scale: 1:800 000
Compiled: JDW	ANGAS-BREMER IRRIGATION AREA	Date: 19.1.77
Drn. / Ckd.	LOCALITY PLAN	Drg. No. S12542

500—6.76 G6584 O

NATURAL SCALE SECTION

A NORTH — A' SOUTH

SEA LEVEL

SEDIMENT

BASEMENT

MOUNT LOFTY RANGES

DM 23 639006205

DM 25 639006702

DM 4 360355504

DM 9 360357401

DM 1 360360603

ELEVATION (METRES)

50 40 30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120

MEAN SEA LEVEL

26m

40m

122m

82m

146m

QUATERNARY CLAYS, SILTS AND SANDS

LAKE ALEXANDRINA

PARILLA SAND

NORWEST BEND FM

INFERRED POSITION OF FAULTED MARGIN

DOMINANTLY TERTIARY LIMESTONE

CAMBRIAN BASEMENT

LEGEND

	AGE	FORMATION	LITHOLOGY
	RECENT	Un-named	Sandy silt-clay, mostly dark grey, with root remains and large wood fragments. Not shown on section.
	QUATERNARY	BLANCHETOWN CLAY EQUIVALENT	Unfossiliferous interbedded mottled sand, silt and clay containing calcrete nodules, often fining upward, cyclic repeating in parts because of river meandering. Overall pale olive grey, brown and brownish red. Gravel beds near the margin of the basin mostly at the sequence base often containing ferromagnesian minerals and maghemite.
	UPPER PLIOCENE	PARILLA SAND EQUIVALENT	Fine yellow quartz sand with thin bands of pale olive grey, brown clay and silt.
		NORWEST BEND FORMATION EQUIVALENT	Calcareous quartz sand, yellow to clear, contains bryozoal remains and foramifera.
	LOWER MIOCENE	MANNUM FORMATION	Calcarenitic sandy limestone, well to moderately cemented, mainly yellow. Fossil fragments consisting of bryozoa, foraminifera, mollusca, echinoids (spines), marly in part.
	CAMBRIAN	KANMANTOO GROUP	Weathered phyllite, siltstone and greywacke, mostly pale green grey.

SCALE

0 1 2 3 4 5

KILOMETRES

FIG. 2

DEPARTMENT OF MINES - SOUTH AUSTRALIA

ANGAS – BREMER IRRIGATION AREA

TERTIARY AND QUATERNARY SEDIMENTS

GEOLOGICAL SECTION A-A'

	COMPILED J.D.W.	DRN. R.H.	SCALE 1:25000	PLAN NUMBER 78-47
DIRECTOR OF MINES		C+D	DATE Nov 1977	

N

TO MOUNT BARKER

TO CALLINGTON

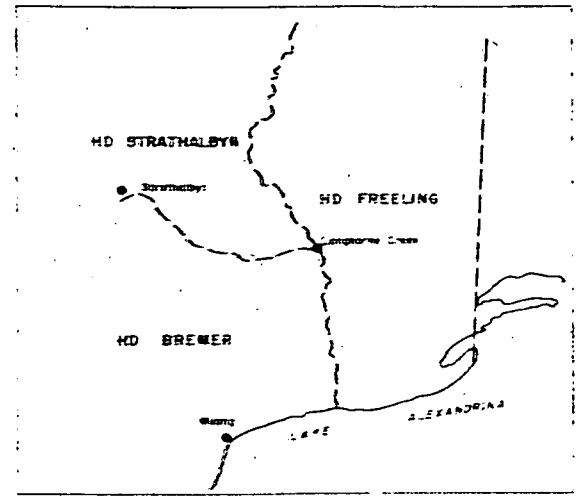
OUTCROP OF BASEMENT ROCKS

TO ADELAIDE

STRATHALBYN

TO MONARTO

INDEX TO HUNDREDS



TERTIARY LIMESTONE

MARGIN OF

FAULTED

BREMER

RIVER

APPROXIMATE

LANGHORNE CREEK

ANGAS

Mosquito

Creek

BOGGY LAKE

TO WELLINGTON

TO FINNISS

MILANG

LAKE

ALEXANDRINA

+5

0

-5

-10

-15

-20

-25

-30

-35

-12.5 Well with elevation of top of limestone (m)

-10 Contour (metres)

Datum: M.S.L. Pt. Adelaide

SCALE

0 1 2 3 4 5 6

KILOMETRES

3

FIG. 19

DEPARTMENT OF MINES - SOUTH AUSTRALIA

ANGAS - BREMER IRRIGATION AREA

TOP OF TERTIARY LIMESTONE

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DIRECTOR OF MINES		CHD	DATE Nov. 1977	

N

TO MOUNT BARKER

TO CALLINGTON

OUTCROP OF BASEMENT ROCKS

TO ADELAIDE

STRATHALBYN

TERTIARY LIMESTONE

BREMER

FAULTED MARGIN OF

BREMER RIVER

LANGHORNE CREEK

ANGAS RIVER

APPROXIMATE

ANGAS

TO MONARTO

TO WELLINGTON

Mosquito Creek

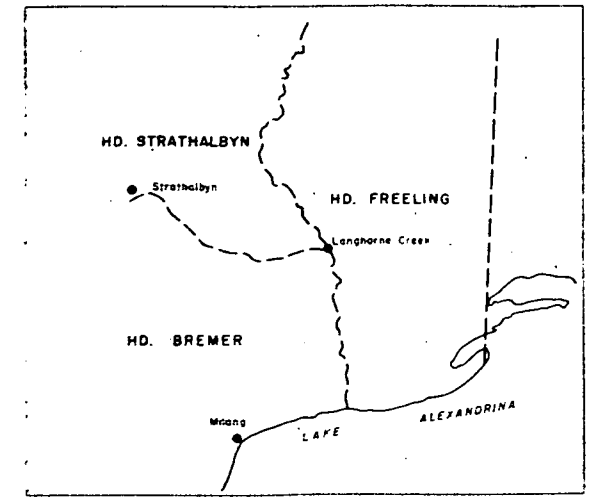
BOGGY LAKE

LAKE ALEXANDRINA

TO FINNISS

MILANG

INDEX TO HUNDREDS



14·3 Well with thickness of Quaternary (metres)

SCALE

0 1 2 3 4 5 6

KILOMETRES

FIG. 4

DEPARTMENT OF MINES - SOUTH AUSTRALIA

ANGAS - BREMER IRRIGATION AREA

QUATERNARY ISOPACH PLAN

ENGINEERING DIVISION	COMPILED J.D.W. & R.Z.G.	DRN	SCALE 1:50 000	PLAN NUMBER
DIRECTOR OF MINES		CKD	DATE Nov. 1977	78-125