DEPARTMENT OF ~~NATIONAL RESOURCES~~ NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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MURRAY BASIN HYDROGEOLOGICAL PROJECT

PROGRESS REPORT, DECEMBER QUARTER 1979

compiled by W.J. Perry

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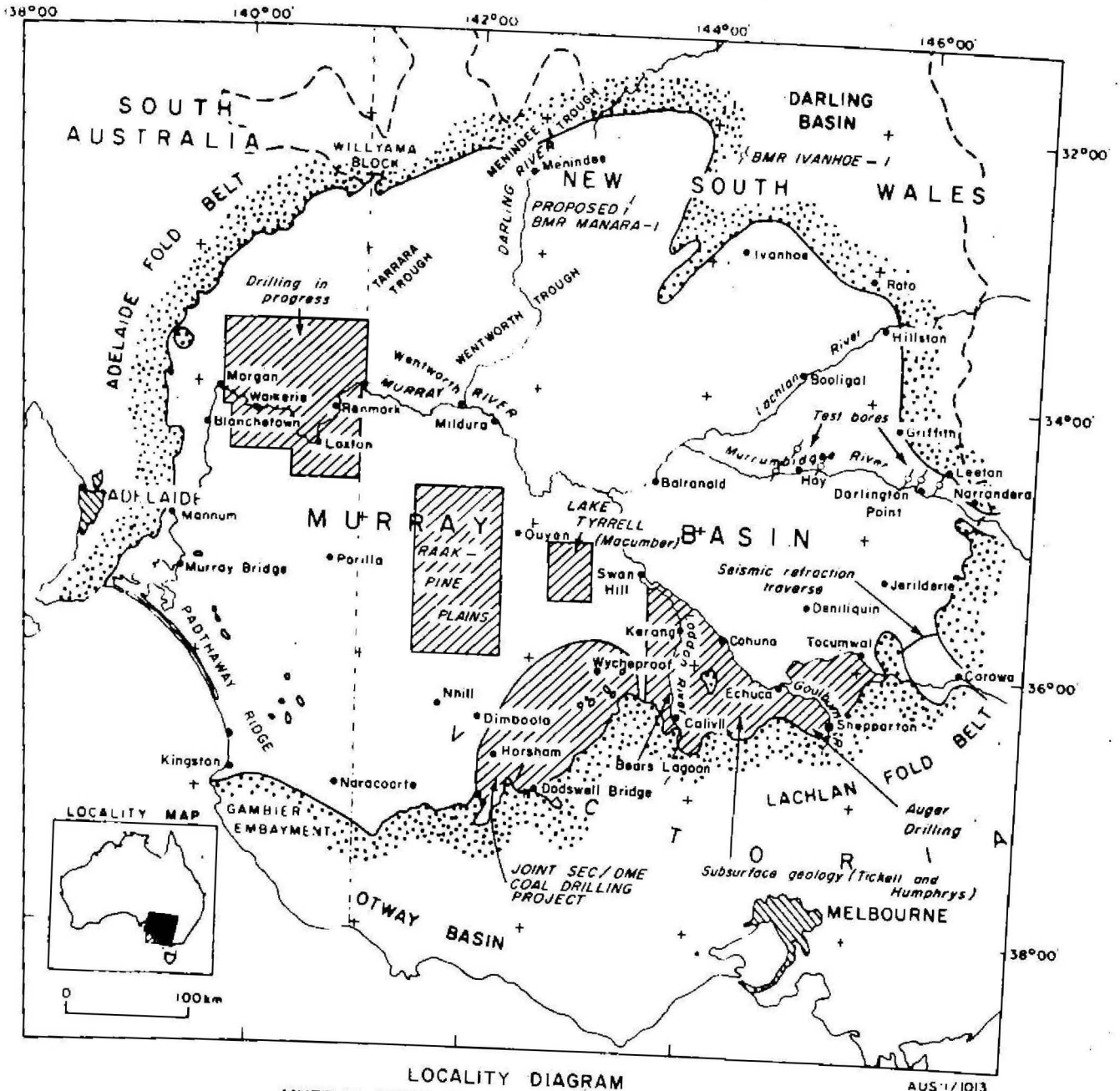

LOCALITY DIAGRAM
MURRAY BASIN HYDROGEOLOGICAL PROJECT
QUARTERLY REPORT, DECEMBER 1979

MURRAY BASIN HYDROGEOLOGICAL PROJECT
PROGRESS REPORT

December Quarter, 1979

INTRODUCTION

This is the second quarterly report on the progress of the Murray Basin Hydrogeological Project. In this report an outline map of the basin is included to indicate where activities have taken place during the quarter, and the general statement describing the Project forms the appendix. We plan to retain these items in future reports. Participating organisations are the Geological Survey of New South Wales, the Water Resources Commission of New South Wales, the Geological Survey of Victoria, the State Rivers and Water Supply Commission of Victoria, the Department of Mines and Energy of South Australia, and the Bureau of Mineral Resources.

PROGRESS REPORTS

GEOLOGICAL SURVEY OF VICTORIA

by A.C.M. Laing

1. Auger drilling of the shallow sand aquifers at Shepparton continued with soil samples for salinity being taken at 0.5 intervals.

2. The Shepparton Office (Tickell & Humphrys) prepared an unpublished report (UR 1979/135) on the basic geology of the study area; it included isopach and structure maps of all stratigraphic units, and some revisions to the stratigraphy.

3. Drilling and pump testing continued at Lake Tyrrell (Macumber). It has been found that the groundwater under the lake is of very high salinity, and of much lower salinity around the lake. Corrections to the potentiometric map because of the different density of the saline water make a significant difference. Instead of Lake Tyrrell being a definitely closed basin, it is apparent that subsurface groundwater flow can take place out of the lake westwards if there is only a small increase in water-level in the lake.

4. Pump testing started at Bears Lagoon (Macumber), to measure vertical permeabilities between the deep leads (Calivil Formation) and the overlying Parilla Sand and Shepparton Formation. At Bears Lagoon groundwater discharge is taking place as a result of increases in the pressures in the deep leads over the past few years. Macumber has demonstrated that groundwater pressures in the deep leads have increased over the past seventy years.

5. About six shallow investigation holes were drilled in the Dadswell Bridge-Wycheproof area as part of joint State Electricity Commission of Victoria/Department of Minerals and Energy investigation for brown coal.

DEPARTMENT OF MINES & ENERGY, SOUTH AUSTRALIA

by R.G. Sheperd

Early in 1980 a drilling program will start in the Morgan-Renmark area and is expected to continue for about 2 years.

The two main aims of the drilling program are as follows:

1. To confirm the hydrogeology, as now postulated, in areas near the River Murray. A better understanding of the relation between groundwater and the river will be provided by the investigation.

2. In the area north of the river, drilling will establish the relation between the confined and unconfined aquifer systems.

Six areas are considered for investigation, and proposals are as follows:

1. Waikerie-Morgan-Bungunia area

Thirteen wells will be drilled in order to establish groundwater gradients towards the river. Eight of them will be sited roughly along a north-south line midway between Morgan and Waikerie. The other

five wells will be drilled north of the river from Morgan to Waikerie.

In this area the Murray Group sediments form an unconfined aquifer and the overlying Loxton Sands are dry.

2. Waikerie-Overland Corner area

South of the river current data indicate that mound in the groundwater-table occurs within the unconfined Murray Group aquifer. Little is known of the hydrogeology of this area, and nine holes are proposed in order to provide more data.

3. Loxton-Moorook area

This is possibly a discharge zone for groundwater of the Murray Group, which is here confined beneath Bookpurnong beds. The unconfined aquifer of this area is the Parilla-Loxton sands.

Twelve holes are proposed, of which four are expected to enter the unconfined Murray Group aquifer in the western part of this zone. Farther east, five holes will be drilled into the confined Murray Group aquifer to determine potentiometric gradients and characteristics of the confining bed. The three other holes will be completed in the Loxton Sands to monitor behaviour of the unconfined aquifer.

4. South of Loxton

Thirteen wells are proposed for this area in the following categories: five holes into the confined aquifer of the Murray Group; two holes into a probably unconfined part of the Murray Group aquifer; and six holes into unconfined Loxton Sands.

South of the river near Loxton, the (unconfined) water-table probably varies from the Loxton Sands through the Bookpurnong beds (confining bed) to the Murray Group. The proposed drilling will indicate whether this is so.

5. Barmera-Loxton-Renmark area

Ten wells are proposed for this area in order to obtain a better understanding of the hydrogeology, particularly of the confined Murray Group aquifer.

Only one shallow well is proposed in order to better define groundwater in the unconfined Loxton Sands aquifer.

6. North of the river

No investigation has been carried out in this area; all previous assessments were based on results of privately drilled wells. Sixteen investigation wells are proposed, extending up to 75 km north of the river.

All wells in the drilling program will be completed for longterm observation purposes.

Mr Murray Lindsay plans to start a biostratigraphic study of recent Departmental drilling in the upper Murray region in mid-1980.

WATER RESOURCES COMMISSION OF NEW SOUTH WALES

by D.R. Woolley

Murrumbidgee River: Darlington Point area

Bores were sunk at three locations, but were not continued to bedrock. These are part of a series of bores being established to augment the water-level observation network in the vicinity of large-scale groundwater withdrawals in this area. Separate holes were constructed at each site so that the water-levels in each of the Olney, Calivil, and Shepparton Formations could be measured independently. Some progress has been made towards preparing water-level contours for pumping/non-pumping conditions for each aquifer.

Murray River: Corowa-Mulwala area

Four exploration bores were sunk to bedrock, extending the known area of occurrence of probable Lachlan Formation gravels to the north of previous drilling. Maximum depth to (Permian) bedrock in this area, which is within the Ovens Graben, is about 120 m; thick quartz gravels are common at depths greater than about 90 m. Each site drilled is being equipped with multiple water-level observation tubes. One private production bore was constructed in the Hopfield area near the margin of the main alluvial deposits; it penetrated a relatively thin gravel sequence which yielded about 25 l/s.

Seismic refraction traversing continued, and the planned work for this area is nearly complete. The crew will shortly move to an area west of Tocumwal.

Water sampling

Water samples for chemical analysis, are being collected from new bores as they are drilled and from the observation bore network periodically. A small portion from each sample is being separated for deuterium/hydrogen analysis by AAEC. Thirty such samples are ready for analysis.

GEOLOGICAL SURVEY OF NEW SOUTH WALES

by J.N. Cramsie

The Geological Survey of New South Wales did not undertake any work directly related to the project during the December quarter. However, a number of activities were proposed which could contribute considerable information to the geology of the NSW area of the basin.

A program of drilling has been proposed by the Coal Strategy Division of the Department of Mineral Resources and Development to test infrabasins for Permian coal. Six holes totalling 2500mhave been proposed for an area north of the current area of coal exploration in the Oaklands Basin. These holes were recommended by D. Palmer in his report entitled 'Interpretation of two seismic reflection traverses in

the Oaklands Basin north of Jerilderie'. A further two wildcat holes have been suggested to test the Ivanhoe Trough and an area south of Hay. If this drilling is approved it would certainly provide a considerable amount of stratigraphic information for the basin in areas where available information is relatively sparse.

Comserv Pty Ltd have been granted six petroleum exploration licences covering areas of the basin where available geological information suggests that infrabasins might occur. The areas covered by these licences include the Tararra, Menindee, and Wentworth Troughs, and an area between Balranald and Roto.

BUREAU OF MINERAL RESOURCES

by C.M. Brown

After discussions with counterpart geologists in Sydney, Shepparton, Melbourne, and Adelaide during the previous quarter, consideration was given to the format in which the available data should be arranged so as to best achieve the objectives of the Murray Basin Project, and to accommodate the individual interests of intending contributors. Phase 1 of the project has been divided into a number of subprojects which will be presented for discussion at the February meeting of the Project Steering Committee meeting to be held in Melbourne on February 7.

In BMR, work continued on the following:

(i) Compilation of a 1:1 000 000-scale geological map. Transparent copies of the available 1:250 000 and 1:500 000-scale geological maps were photoreduced to 1:1 000 000 scale. Details of Cainozoic, Cretaceous, Permian and Devonian units were retained while the geology of the surrounding 'basement' was generalised. Some sheet boundary problems, reflecting different philosophies of mapping between State surveys, remain to be resolved.

(ii) Plotting of borehole localities. Borehole localities and downhole stratigraphic details were plotted on 1:250 000-scale data base maps in preparation for reduction to 1:1 000 000 scale for compiling structure

contour and isopach maps depicting the Cainozoic geology. Plotting of most relevant borehole localities in Victoria was largely completed, and plotting of data from South Australia commenced. Borehole locations in the eastern part of the basin in NSW were plotted, but stratigraphic information is not yet available.

(iii) Compilation of geophysical data. Most of the required geophysical data have been assembled, but problems of integration and interpretation of some company data have emerged. Advice from the appropriate geophysical section within BMR is to be sought during the March quarter.

(iv) Compilation of existing hydrocarbon exploration data. Petroleum well locations have been plotted on the 1:250 000 data base sheets and on a 1:1 000 000 base map. Stratigraphic logs, lithologic logs, and availability of geophysical logs, core material, and palaeontological data are to be summarised in tabular form.

(v) Murray Basin bibliography. Compilation of the computerised bibliography comprising about one thousand references was completed during the quarter. Considerable time was spent in standarising journal titles, abbreviations, and keywords, and, where possible, in expanding the data base to incorporate additional information on geographic localities, structural/tectonic features, and 1:250 000 and 1:100 000 sheet localities.

Associated Activities. The following are projects which BMR is undertaking as part of its normal overall Australian-wide program, and are not specifically directed to the Murray Basin joint project. They may however be of interest as they have relevance and perhaps application to the overall study of the Murray Basin.

1. ESCAP Project. During the December quarter C.M. Brown completed the compilation and drafting of an atlas sheet contribution on the Murray Basin for the atlas of stratigraphy being compiled by ESCAP (UN Economic and Social Commission for Asia and the Pacific). This project aims to produce an atlas of stratigraphic columns and brief explanatory notes to be used for correlation in and between the sedimentary basins

of the ESCAP region. Objectives of the project are to determine the nature, structure, age, thickness, and facies of sedimentary sequences within the region in order to advance the knowledge of the distribution of economic minerals.

2. Darling Basin source rock study - drilling of BMR Ivanhoe No. 1. The presence of the recently constructed Moomba to Sydney gas pipeline has stimulated renewed interest in the hydrocarbon potential of the Devonian rocks of the western Darling Basin beneath the northern Murray Basin. Evans (1977) has suggested that hydrocarbons may occur in regressive lower Devonian sand bodies of shallow marine or deltaic facies and may have originated in and be sealed by possible marine Lower Devonian shale preserved in grabens of the western Darling Basin. The objectives of the BMR source rock study are to review the available source rock data, to obtain laboratory analyses on core and cutting material held by BMR, and to locate possible drill sites where fresh samples of Lower Devonian potential source rocks may be sampled at shallow depths.

Only three wells have previously penetrated the Lower Devonian, and only one (Berangabah No. 1) encountered shale which was reported to contain some organic matter. After fieldwork in June 1979 by C.M. Brown and K. Lockwood, two drill sites were selected. The first of these, BMR Ivanhoe No. 1, was located close to the original Berangabah No. 1 well site, (see locality diagram) and was drilled to a total depth of 305 m between 3 and 29 November 1979. The lower three-quarters of the hole was continuously cored, and the well site geologist, V.L. Passmore, reported an alternating sequence of thinly bedded Lower Devonian marine siltstone and shale with a higher shale content than was recorded in cores and cuttings from the Barangabah No. 1 well. In late December a complete suite of geophysical logs was run, and the hole temporarily left open to allow heat-flow measurements to be obtained over the next few months. Core samples have been selected for palynological, macrofossil, source potential, and maturation studies.

The interpretation of a seismic section has helped in the siting of a second hole, BMR Manara No. 1 near Albermarle homestead, west of Lake Victoria. Drilling is planned to start in March 1980,

and it is expected that this second hole will penetrate sediments of the Murray Basin sequence before encountering rocks of Lower Devonian age.

3. Lachlan Fold Belt Project. D.H. Tucker, B.W. Wyatt, and A.N. Yeates presented a paper entitled 'The relationships between magnetic anomalies, gravity anomalies and surface geology in the Lachlan Fold Belt of New South Wales' at the Geological Society of Australia Convention in Hobart in January 1980.

The authors have subdivided the Lachlan Fold Belt into four geophysical domains according to gravity trends and magnetic character. They contend that gravity and magnetic profiles beneath the Murray/western Darling Basins geophysical domain lack any indication of the features which characterise the adjacent domains of the Lachlan Fold Belt to the east. In consequence they believe that the basement beneath the Murray/western Darling Basins is unlike that underlying the adjacent geophysical domains to the east, and they now exclude the basement beneath the Murray/Darling Basins in NSW from the Lachlan Fold Belt.

Reference

Evans, P.R., 1977 - Petroleum geology of western New South Wales. APEA Journal, 17, 42-49

APPENDIX

General Statement - Murray Basin Hydrogeological Project

This project is a long-term study which is being undertaken jointly by South Australian, Victorian, and New South Wales geological surveys and water authorities, and by the Commonwealth Bureau of Mineral Resources, Geology and Geophysics. It will be co-ordinated by a steering committee comprising members of those organisations.

The Murray Basin is a geological structure with an areal extent of 300 000 km^2. In each of the three States the basin sediments contain very large groundwater reserves. Where the groundwater has a low salinity it is increasingly being used for irrigation and for town water supply. In much of the basin, the groundwater is suitable only for stock use, and is extensively used for this purpose. In other parts of the basin the groundwater is too saline for any use. There is a complex interaction between groundwater and surface water which may be beneficial, as in recharge areas in some parts of the basin, or harmful, as in areas of saline groundwater discharge to rivers. In recent years, the States involved have stepped up the rate of assessment of the groundwater regime in the basin.

The primary aim of the project is to improve the understanding of the groundwater regime of the basin by examining it as a single entity, unencumbered by State boundaries. Since a knowledge of the geology of an area is basic to the understanding of groundwater occurrence, a geological study of the basin is an essential part of the project, and as a consequence it will also be possible to make an assessment of other mineral resources.

The project is planned initially to last five years and will be organised in five phases:

(1) Geological synthesis, using all available geological and geophysical data.

(2) Hydrogeological assessment from available data.

(3) Documentation of deficiencies in geological and hydrogeological information, and formulation of proposals for appropriate work programs.

(4) Additional work as approved, which might include stratigraphic drilling, aquifer testing, biostratigraphic analysis, and isotope hydrology studies.

(5) Development of numerical model(s), if found to be appropriate in the light of the data then available.

Investigations currently being undertaken by State authorities will continue, and data generated by them will be used for the joint project. Collection, collation, and compilation of data during the first phase, and interpretation and documentation of the second and third phases, will be undertaken by officers of BMR with assistance from officers of the State authorities. Additional work required in phase 4 (e.g., stratigraphic drilling, geophysical investigations) may be conducted by BMR or by appropriate State authorities. The development of a numerical model (phase 5), if found to be feasible, may be undertaken by BMR. The project will depend on the close co-operation of staff from all organisations involved, and some movement of staff between organisations for short periods will be necessary. Throughout the study, individuals and organisations will be encouraged to publish results of various aspects of the work. Results of the overall project will be incorporated into joint publications.