THE GEOLOGY AND HYDROGEOLOGY
OF THE AYRES ROCK AREA
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INTRODUCTION.

This report is intended to summarize present knowledge of the geology of the Ayers Rock area to provide a generalized picture of the hydrogeology which can be used as a guide for future exploration.

GENERAL.

The area has very limited outcrop and the geology must be inferred largely from borehole information.

At the present stage of knowledge many interpretations of the 'solid' geology are possible. The one offered here seems the most reasonable interpretation on present knowledge, but will doubtless have to be modified to fit future drilling results.

PREVIOUS WORK.

A number of reports have been written on water supply investigations. These have generally been non-geological. Read (3) reported on the geology of the Ayers Rock Water Supply Investigation. This report was written to accompany Eggington & Kingwell (2), and is mainly concerned with the Dune Plains aquifer.

Jolly (5) presented an interpretation of the regional geology which is unsatisfactory in a number of respects.

GEOLOGY.

The main structural features of the area are as follows:

(a) The low angle thrust fault south of Mount Olga from 398864 to 349867.
(b) The two faults from 385843 to 398859 and 388842 to 409849.
(c) The syncline of which Ayers Rock is the northern limb and which has been displaced by the two faults above.

The synclinal axes shown passing through 400842 and 397850 are reasonably well established.

That shown passing through 384850 is conjectural.

General geological opinion is that the Petermann Orogeny, which led to the deposition of the Mount Currie Conglomerate was the last period of major movement in this area.

Since the thrust fault (a) involves the Mount Currie Conglomerate it is in contradiction with this and needs to be justified.

RN 1052 passed through Finyima Beds into a crush zone with brecciated chert and finished in Mount Currie Conglomerate.
THE MOUNT CURRIE CONGLOMERATE.

The Mount Currie Conglomerate is known from the prominent outcrops at Mount Olga, and from several bores.

The arkose at Ayers Rock is considered to be the lateral equivalent of the Mount Currie Conglomerate.

Drilling has shown the arkose to be overlain by a felspathic greywacke. The latter is similar to the outcropping arkose, and is probably a later stage deposit from the same source. I consider it to be part of the Mount Currie Conglomerate deposited at a later stage with lower current velocities.

Bores RN 6281, RN 6286 and RN 6276 to the north west of Ayers Rock have penetrated Mount Currie Conglomerate. Here it appears to be a pebble conglomerate, coarser than the arkose at Ayers Rock but finer than that outcropping at Mount Olga.

The exposed thickness of arkose is about 3000m. Above this the syncline must contain an additional 1000 to 2000m of sediments. This may be of more poorly-sorted arkose and greywacke belonging to the Mount Currie Conglomerate though there is a possibility of other formations including potential aquifers occurring in the centre of the syncline.

Palaearctic.

No Palaearctic rocks younger than the Mount Currie Conglomerate outcrop in the vicinity of Ayers Rock. However, there is a possibility that they exist north of Ayers Rock in the cores of synclines. Since rocks of this age include good aquifers in other parts of the Amadeus Basin this possibility should be considered if other attempts to obtain sufficient water fail.

Cenozoic.

Poorly consolidated Tertiary sands supply most of the water extracted at present. Tertiary sands are still probably the best targets in this area.

Future work.

Egginton (1976) states "Development of the Dune-Plains" groundwater reservoir will exhaust the potential for groundwater development within 100km of the proposed Ayers Rock Village. This is an unduly pessimistic view, for while it is true that the Dune Plains and South East aquifers occur in special situations it is by no means true that all the areas in which such aquifers might occur have been tested.

Jolly (1978) has outlined other possible areas of investigation.

This approach is sound. Jolly's area 2 seems particularly worthy of investigation. RN 10385 proved the existence of a Tertiary aquifer in this area, and although the water was saline it is possible that better quality water exists to the west. The entire strip between Areas 2 and 3 has reasonable potential.
EN 10619 penetrated a similar crush zone.

The probability of a more or less randomly located bore intersecting a high angle fault is quite low, and the fact the fault zone has been intersected twice suggests that the fault is dipping at a low angle.

Further the irregular traces of the fault as outlined by drilling in the Dune Plains area could not be satisfactorily explained by a single high angle fault.

The thrust has been interpreted as the continuation of the fault inferred by the B.M.R. (1).

The outcrop of folded sandstone (Winnall Beds?) at 380854 presents some problems in interpretation, since EN 10385 and EN 184 to the south and south east of it both intersected Mount Currie Conglomerate.

Three explanations are possible:

a. At least two minor concealed faults.

b. The outcrop represents the top of a mountain in the surface on which the Mount Currie Conglomerate was deposited.

c. The outcrop is on the upper plate of the thrust, and has been preserved by an irregularity in the thrust surface.

The last of these possibilities is the most probable.

PRECAMBRIAN BASEMENT.

This has no potential for groundwater on the scale required.

DEAN QUARTZITE.

This has no potential for groundwater on the scale required.

PINYNNA BEDS.

Carbonate beds in the Pinynna Beds form aquifers in both Dune Plains and South East of Ayers Rock. A porous sandstone aquifer has also been intersected in the South East area.

Reasonable supplies are available from these aquifers, but the quality is often poor. Gypsum has been observed in the Pinynna Beds and is responsible for the generally high sulphate contents.

INDIA AND WINNALL BEDS.

The sandstone in both these units yield small supplies of saline water.
On a broader scale the following targets should be considered.

1. Surface evidence suggests a buried river channel passing northeast through 383 863 over Pinyinna Beds. This is worth investigation.

2. South west and south east of Mount Currie may have some potential. This area might be underlain by thick Tertiary deposits and Pinyinna Beds. There is some surface runoff from Mount Currie which might provide recharge.

3. The sandstone outcrops near Armstrong Creek have never been adequately tested, and although this is 80km from the proposed Ayers Rock Tourist Village it would be worth testing in preference to the George Gill and Levi Syncline. (AMC 675 215)

4. The area to the north of Ayers Rock in the region of 400 870 could be tested by a geophysical traverse and drilling since there is a possibility of Palaeozoic aquifers occurring in this area. Waters in this area would almost certainly be non-potable but quality might be similar to some of the marginal parts of the Dune Plains aquifer.

METHODS OF EXPLORATION

The following comments may seem obvious and unnecessary. Since they should have been equally obvious a decade ago when they were largely disregarded I will state them again.

1. All holes should have a definite objective.

2. The results of each hole should be appraised as drilling progresses and the drilling programme modified if necessary.

3. Holes should be spaced well apart, not clustered, except perhaps for the final evaluation of an aquifer.

4. Holes should be geologically and geophysically logged as soon as possible.

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September 1978.
REFERENCES

1. Geological Map "Amadeus Basin (West)" compiled by Wells et al of the B.M.R.


3. "Geology of the Ayers Rock Water Supply Investigation" Read, 1974. (Included as an appendix with (2) above.)


Fault

Syndinal arc

Geological boundary

Generalized limit of basement inferred from aeromagnetic map