GEOLOGICAL PROSPECTS AT PAPUNYA

NATIVE SETLEMENT, N.T.

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SUMMARY

INTRODUCTION

GEOLOGY

HYDROLOGY

Bedrock configuration and distribution of aquifers

Discharge & groundwater movement

Storage

CONCLUSIONS

RECOMMENDATIONS

REFERENCES

Fig. 1  Locality Plan

Plate 1  Geological sketch map of area surrounding Pagure Settlement
SUMMARY

Kamala Bluff Settlement is about 150 miles west of Alice Springs and additional supplies of ground-water are required for domestic and irrigation usage. Groundwater is available from sandy aquifers within Tertiary sediments which overly a Proterozoic metapelitic basement. A programme of investigation drilling having 13 holes of half mile spacing on two lines at right angles is proposed; depth of the holes will range from 150 to 250 feet approximately. The programme is designed to assess the possibility of increasing the withdrawal of groundwater from Tertiary aquifers in the vicinity of the settlement.

INTRODUCTION

This report has been prepared at the request of the Officer-in-Charge, Water Resources Branch, N.T. Administration, Alice Springs. Papunya Native Settlement is located about 150 miles west of Alice Springs. Water supplies for the settlement are provided from four bores, and yields have been falling during the past few years, partly as a result of falling water levels. A small drilling programme to investigate the groundwater situation, has been proposed.
GEOLOGY

The main rock outcrops in the area are Precambrian metamorphic; they are covered by varying (largely unknown) thicknesses of superficial sediments. These sediments are probably of Tertiary age, except for a thin surface veneer of Quaternary deposits.

Precambrian

Precambrian rocks cropping out in the area shown on Plate 1 are gneiss, schist and quartzite. Gneiss is dominant and is generally of granite composition. Mica schist and quartzite are interbedded with the gneiss. The regional trend of the rocks is east-west, with a general dip to the north at a high angle, (Figure 156). There are two very distinct major joint directions, one strikes west-northwest, the other strikes east-northeast.

The Precambrian rocks form the bedrock to the superficial sediments. Prospects of obtaining useful supplies of ground water from these are negligible, and they will not be considered further here.

Tertiary

One area of outcrop of piedmont conglomerate, thought to be of Tertiary age (Wells, Roxman and Runford 1962) occurs to the south of Papunya (see Plate 1). The conglomerate is poorly sorted and unconsolidated, composed dominantly of clasts of silicified sandstone and quartzite. Maximum known exposed thickness of the deposits is fifty feet.

Only drillers logs are available from holes drilled at Papunya and it is therefore difficult to be sure what type of sediments were intersected. However, it is thought probable that a large proportion of the sediments drilled were of Tertiary age, and from the log of the No. 4 Bore (P52/16-23) it seems that Quaternary deposits extend to about 100 feet below surface at most. As the pamastric surface in the area is much deeper than this, it is likely that all aquifers will be of Tertiary age.

The maximum depth attained by bores in the sediments is about 190 feet, but bedrock was not reached. The sequence appears to consist of yellow and brown clay and white fine to coarse sand. Sand beds up to about 20 feet thick have been penetrated.

Quaternary

Very little is known about the Quaternary deposits, but they are thought to be entirely above the pamastric surface.
HYDROLOGY

Bedrock configuration and distribution of aquifers

It appears likely that the Tertiary drainage system was controlled by the major west-north-west joint system in the basement rocks, and if this was the case then the bedrock lows will trend west-north-west, and aquifers in this Tertiary sequence will have a similar general trend. The only control on the bedrock surface configuration that is available is the present outcrop pattern, together with information from one bore (F52/16-15), as shown on Plate 1. This bore intersected gravel at 162 feet, and a buried bedrock high to the east of Papunya is therefore suspected. It is not known whether this high is continuous with the outcrop 12 miles to the east, but this is not considered to be very likely. Two small outcrops three miles west of Papunya (Plate 1) limit to some extent the location of any bedrock lows. If the bedrock valleys trend west-north-west, there could be one through Papunya and it would be of the order of 1 - 12 miles across.

Information on distribution of aquifers interpreted from drillers logs is summarised below in Table 1.

<table>
<thead>
<tr>
<th>Bore No.</th>
<th>Depth to top of main aquifer</th>
<th>Thickness of main aquifer</th>
<th>L.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F52/16-13 (No. 1)</td>
<td>160</td>
<td>12' (no bottom)</td>
<td>172</td>
</tr>
<tr>
<td>F52/16-14 * 2</td>
<td>162</td>
<td>18'</td>
<td>152</td>
</tr>
<tr>
<td>F52/16-15</td>
<td>158</td>
<td>4' (overlies bedrock)</td>
<td>170</td>
</tr>
<tr>
<td>F52/16-22 * 3</td>
<td>170</td>
<td>17'</td>
<td>187</td>
</tr>
<tr>
<td>F52/16-23 * 4</td>
<td>21'</td>
<td></td>
<td>172</td>
</tr>
</tbody>
</table>

While this information is insufficient to draw inferences, it does indicate a trend in a direction through bores No. 2 and 3, and a thickening to the south-west. This is not inconsistent with the idea of a channel sand trending along a west-north-west striking valley.

Anchors and groundwater movement

This presumably occurs along the flood plain areas outlined on Plate 1, and the initial direction of groundwater movement is thought to be to the north. If the main aquifers trend west-north-west, however, groundwater movement will occur in this direction. Existing information is insufficient to determine anything significant about the shape of the piezometric surface or direction of groundwater movement in the area.
The main creek providing recharge to the settlement area has a catchment area of about 50 square miles of rock outcrop. Several other creeks drain the ranges to the south of the settlement, and these all provide recharge to the Tertiary sediments although not to the immediate vicinity of the settlement bores.

A fall in water level of ten feet occurred between 1959 and 1964 at No. 2 Bore, and a further fall is thought to have occurred since then. Water levels are from 150 to 160 feet below surface in the immediate vicinity of Papunya.

Storage

Very little is known about the amount of groundwater storage in the area, but it appears to be considerable. Besides the Settlement Bore, two stock bores produce water from aquifers within the superficial sediments. These are Kerekara Bore, 5 miles east-south-east of Papunya, and Ulumbera Bore 20 miles to the west. Both these produce water of domestic quality. While the sediments penetrated by these bores may not be continuous, it is obvious that water bearing sediments are widely distributed.

Conclusions

Considerable quantities of groundwater are stored in Tertiary sediments in the area near Papunya Settlement, extending to north, west and east for a considerable distance. Aquifers are scarce and end up to at least 20 feet thick. Recharge to them is available from several small to moderate sized creeks which drain the hilly country to the south. Some investigation drilling is needed to assess—

(a) the effect of past pumping
(b) the distribution of aquifers
(c) whether there is sufficient water available for withdrawal to be increased
(d) the best location for additional production bores

Recommendations

Two lines of investigation bores should be drilled, as shown in Plate 1; one east-west line, and one north-south line, intersecting at the No. 2 Bore, with holes at half mile spacing. The bores should be drilled to bedrock, and are expected to vary between 100 and 250 feet in depth. The total number of bores will be about 13. The purpose of the bores is to—
(a) enable bedrock contours to be drawn. This should give an indication of the trend of
cluastic sandy aquifers within the Tertiary sediments, and show whether there are any
significant bedrock highs which would act as groundwater divides.

(b) Enable contours to be drawn on the piezometric
surface. This will indicate the direction of
groundwater movement through the area.

(c) Indicate the distribution of aquifers, and
whether there are any aquifers deeper than
the main one penetrated at about 160 feet
by existing bores.

(d) Either indicate suitable localities for con-
struction of further production holes, or areas
in which further test drilling is necessary
before locating production holes.

REFERENCES

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Nelles, A. Norman, D A
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PLATE I  GEOLOGICAL SKETCH MAP OF AREA SURROUNDING PAPUNYA SETTLEMENT

Geological boundary
Dip and strike of foliation
Boundary of windward area
Stream
Bare, exposed
Prox, small colony
0 Proposed site for investigation bore

Scale (km)

Quaternary supralateral deposits
Tertiary conglomerate
Permian sandstones

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