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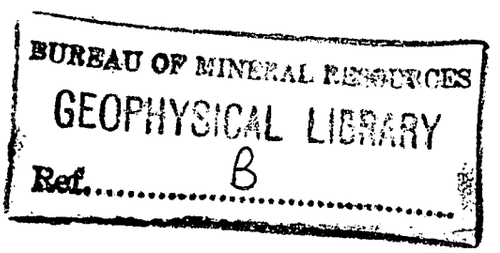

UNDERGROUND WATER SUPPLY AT BIRRINDUDU AND INVERWAY PASTORAL LEASES, NORTHERN TERRITORY.

by

J. Hays

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SUMMARY

Twenty-two bore sites have been selected on Inverway and four have been examined on Birrindudu. Because of the absence of geological data, most of the holes have been recommended to be drilled to 500 feet. There is some risk of salt water in the Nongra Lake area but this cannot be confirmed until water analyses are available.

UNDERGROUND WATER SUPPLY AT BIRRINDUDU AND INVERWAY PASTORAL LEASES, NORTHERN TERRITORY.

INTRODUCTION

Inverway and Birrindudu Pastoral Leases occupy part of the Limbunya (S.F. 52/7) and Birrindudu (S.F.52/11) 4-mile map areas, near the West Australian border. Access is by the Stuart Highway for 220 miles south of Darwin to Katherine, and thence by all-weather gravel road for 450 miles south and west through Willeroo, Top Springs and Wave Hill. The area was visited at the request of the Director, Water Resources Branch, Northern Territory Administration, between the 17th September and the 26th September and again between the 9th October and the 21st October, 1962. The purpose of the visits was to advise upon boresites being drilled and to select other sites as requested by the lessees of Inverway and Birrindudu. The only geological map available for the area is a 16-mile reconnaissance map compiled by Traves (1955). The scale of this map makes it unsuitable for use in the field for siting bores. Full photo cover was available and 1-mile photomosaics were available for most of the area. Although 23 bores, 8 of them dry, have been drilled in the area, complete logs have not been kept and most of the available data are unreliable. The accompanying 4-mile map (plate 1) is based on traverses made during the investigation supplemented by some photo interpretation.

Climate

The area has a long dry winter lasting from March-April to October-November, during which the maximum daily temperature may be as low as 70°F. The minimum daily temperature drops to below 50°F in June and July. At the beginning and end of the dry season and throughout the wet season and throughout the wet season maxima of more than 110° and minima of more then 70° are common. The hot wet summer lasts from November to March but most of the rain falls in December and January. The area is in the 15 inch to 20 inch average annual rainfall belt but figures of less than 15 inches have been recorded for many wet seasons. Average annual free surface evaporation is at least 100 inches.

Vegetation and Soil

The area is mostly one of open savannah alternating with savannah woodland. The open savannah soils are alluvial loams on which there is a prolific growth of mitchell, flinders and feathertop grasses. The savannah woodland soils are skeletal types found on sandstone, laterite and ferricrete. They support spinifex grass and a variety of trees and scrub, including coolibah, snappy and white gum, lancewood, turpentine and tea-tree. On the north-west and east of Inverway are low lying areas of high relief with skeletal and alluvial soils derived from basalt and laterite. These soils support all the grasses and trees common on the savannah areas.

GEOMORPHOLOGY

The main land surface in the area is a lateritized surface that has been warped upwards in the north and upon which the endoreic* Sturt Creek and Hooker Creek drainage systems have developed. A post-laterite surface, about 100 feet below the main surface, is encroaching from the Wave Hill area to the

* Endoreic drainage - drainage into an interior basin

east and is in turn being dissected by the Victoria River. Relics of the lower surface can be seen in the Stirling River basin north and north-west of Inverway, where modern dissection has removed most of the lower surface and is now encroaching upon the main (lateritized) surface.

GEOLOGY

The oldest rocks in the area are sediments thought to belong to the Upper Proterozoic Victoria River Group. These are overlain, with marked unconformity, by the Antrim Plateau Volcanics of Lower Cambrian age, upon which a thin sequence of very fine-grained siliceous sediments possibly rests. All the sediments and the volcanics have been lateritized and a classic laterite profile has been imposed upon the volcanics. Post-laterite deposits include ferricrete, calcrete (deposited in post-laterite valleys on the main surface), and post-calcrete alluvium.

Victoria River Group.

The Upper Proterozoic Victoria Group extneds as a continuous body from its type area in the Victoria River area to the north-east of Inverway. It consists of several major sandstone members separated by calcareous shale and siltstone, and limestone. One of the sandstone members crops out north-east of Inverway homestead near the main Wave Hill road, where it is very highly silicified and well jointed. Outcrops of a similar sandstone are abundant in low ridges in the central and western parts of Inverway and in the south of Birrindudu. Bore data show that these outcrops are sandstone caps on the ridges and that the sandstone is underlain by calcareous rocks similar to those of the Victoria River Group. Dips appear to be gently undulating or horizontal and this is confirmed by air photographs.

Antrim Plateau Volcanics

Basalt flows of the Lower Cambrian Antrim Plateau Volcanics crop out extensively on the north-west and eastern part of Inverway and less extensively on Birrindudu and the southern part of Inverway. The presence of basalt above Victoria River Group sediments in some of the wide shallow valleys in the central and western part of Inverway has been proved by drilling, and its absence in other valleys has also been proved. Traves (op. cit.) has described valleys eroded from Victoria River Group sediments and filled by Antrim Plateau Volcanics. The valleys on Inverway that contain basalt are thought to be similar. The central part of Inverway appears to have been a ridge dissected by wide shallow valleys at the time of extrusion of the basalts. The basalt overlapped onto the ridge from the north and east and perhaps from the south. The early flows filled the valleys and perhaps later flows buried the ridge which has since been partly exhumed.

Small inliers of Victoria River Group sediments have been observed near the Victoria River, confirming that the sub-basalt surface was one of moderate to high local relief.

Post-Basalt, Pre-Laterite Sediments.

At several places on Inverway and at Mosquito Creek on Birrindudu, the basalts are overlain by what appear to be extremely fine-grained, somewhat siliceous, sediments. These range in thickness from a few inches to about 30 feet and appear to fill hollows on an irregular basalt surface. The sediments are restricted to the top of the mottled zone of lateritization and the texture has been almost obliterated except where preserved by local silicification. W.C. Smith (B.H.P. Co.Ltd. personal communication) has suggested that lateritized loess-like deposits may occur in the Ord-Victoria Region. This is a reasonable explanation for the deposits observed on Inverway and Birrindudu. Traves (op. cit.) has noted the abnormally high silica content of the laterite in the Ord-Victoria region, ranging from 26% to 70%. This may confirm the existence of siliceous sediments above the basalt.

Laterite

Classic laterite profiles to a maximum depth of 120 feet have been formed on the Antrim Plateau Volcanics. The profile at Mosquito Creek consists of 40 feet of laterite (pisolitic, nodular and vermicular) grading downwards into about 50 feet of red and white mottled zone of lateritization. A complete pallid zone has not been observed, probably because of the scree at the base of the cliffs in which the profile is exposed; fresh basalt crops out in the creek bed 120 feet below the top of the laterite. Control of weathering by joints was indicated by regular spheroidal mottling in the mottled zone.

Post-Laterite Deposits

The lateritized surface has been dissected by the endoreic drainage systems and broad shallow valleys have been etched upon it by erosion. These valleys have been filled by calcareous deposits, including spongy limestone in which occur bands of opalescent quartz. In places the basal and marginal beds consist of reworked laterite, and fragments of laterite have been observed within the limestone. The deposits are thus younger than the laterite and not coeval with it as suggested by Traves (op. cit.). At some places the limestone is massive, but porous and spongy varieties have been seen and a well sunk near Killowie bore has penetrated material which appears to have been calcified after deposition.

All the streams in the endoreic systems are underfit and in some valleys the drainage has been reversed. The calcareous deposits are not the result of aggradation by the modern streams; aggradation by the Sturt, south of Birrindudu, has buried the calcareous deposits beneath recent alluvial fans.

Structure

Several photo lineaments are thought to be faults but few have been identified positively in the field and most have been omitted from the map

The endoreic drainage pattern is thought to be the result of upwarping in the north but the axis of the upwarp has not been located.

GROUNDWATER SUPPLIES

The superficial calcareous deposits are potential aquifers of considerable importance but the yield at any given site cannot be forecast; it may range from less than 200 gallons an hour to 2,000 gallons an hour. The range in possible yield is postulated because the deposits are calcified alluvium containing bands and lenses of material of greatly different characteristics.

The sediments of the Victoria River Group contain aquifers but no detailed information is available. Until more drilling data is obtained all that can be said is that a thickness of between 300 feet and 500 feet of sediments must be drilled to obtain supplies of water in excess of 1,000 gallons an hour. Drilling on Victoria River Downs indicates that permeability depends largely on the extent to which the arenaceous sediments are jointed or fractured and that the other rocks are not good aquifers.

The Antrim Plateau Volcanics are, in general, poor to moderate aquifers and supplies tend to be restricted to below the base of the sequence, in the underlying Victoria River Group although more abundant supplied are expected, by analogy with the Victoria River Downs area, in fault zones.

More than twenty provisional bore sites were selected in Inverway and four were examined in Birrindudu. The sites were selected as far as possible in areas of superficial sediments. In every case, the selected site was on the projection of a photo lineament into an area of superficial sediments or directly on the lineament in the hope that if the yield at shallow depths was inadequate, good supplies would be obtained from fractures in the underlying rock.

Salt Water

Several holes have been recorded as brackish and two salt bores have been recorded but analyses are not available One of the salt bores was drilled 15 miles south-west of Birrindudu and potable water was obtained at the second attempt in the area. Coolibah bore, on Inverway, near Nongra Lake is reputedly unfit for stock because of the high iron content. Mr. Underwood, lessee of Inverway, has been advised to pump the bore for several hours then to collect a sample of the water for analysis. The nature of the dissolved salts may be significant in relation to drainage into Nongra Lake.

Reference

TRAVES, D.M., 1955 - The geology of the Ord-Victoria Region, Northern Australia. Bur.Miner.Resour. Aust. Bull. 27.

APPENDIX

BORES SITED ON INVERWAY

All sites were selected in the presence of Mr. Underwood and are marked by a steel picket.

NUMBER	PHOTO	REMARKS
JH 1	L9/5056 (i.e. Limbunyah 4-mile area, Run 9, Photo 5056).	On Kurrkimbie Creek - basalt - on photo lineament - maximum depth doubtful - 400 feet?
JH 2	L10/5106	North of Swan Creek - basalt - on photo lineament - maximum depth 500 feet.
JH 3	L11/5138	Near Kurrkimbie Road - basalt - on photo lineament - maximum depth 500 feet.
JH 4	L11/5139	1 mile west of Swan Creek Road - basalt under calcrete - on photo lineament - maximum depth 500 feet.
JH 5	L12/5189	3 miles from N-S boundary along E fence to 3 Mile bore - calcrete over Victoria River Group - maximum depth 400 feet.
JH 6	L12/5186	Calcrete on basalt - on photo lineament - maximum depth 500 feet.
JH 7	L12/5185	Calcrete on basalt - on photo lineament - maximum depth 500 feet.
JH 8	L13/5222	On Laura Creek - calcrete on Victoria River Group - faint photo lineament - maximum depth 400 feet.
JH 9	L14/5022	Near Nutwood well - calcrete on basalt - on photo lineament - maximum depth 500 feet.
JH10	L14/5015	Victoria River - basalt - on photo lineament - maximum depth 500 feet, probably less - no reliable data.
JH11	L14/5013	3 Miles west of Revolver Creek - on basalt - on photo lineament - maximum depth 500 feet - see JH10.
JH12	L14/5007	On Hut Creek 5 miles from Victoria River -basalt - well defined photo lineament - maximum depth 500 feet - see JH10.

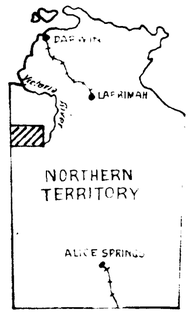
NUMBER	PHOTO	REMARKS
JH13	B1/5034 (Birrindudu 4-mile area).	N.E. edge of Maud Plain - west of Kinslick bore -calcrete on Victoria River Group - maximum depth 500 feet.
JH14	L15A/5064	Calcrete on basalt on Victoria River Group - maximum depth 500 feet.
JH15	B1A/5050	Head of Hooker Creek - on basalt - intersection of photo lineaments - maximum depth 500 feet.
JH16	B1A/5057	Calcrete on basalt - 9 miles east of Killowie -maximum depth 500 feet.
JH17	B1/5029	W. of Three Ways - basalt - photo lineament and shearing in basalt - maximum depth 500 feet- may be less.
JH18	B1/5023	Alternate for Three Ways if deepening fails - calcrete on basalt - maximum depth 500 feet.
JH19	B2/5058	Calcrete on basalt near Sturt Creek - maximum depth 500 feet - good chance of water before 150 feet.
JH20	B2/5061	Calcrete on basalt - maximum depth 500 feet.
JH21	B2/5072	Calcrete on basalt - maximum depth 500 feet.
JH22	B2/5064	Calcrete on ferricrete on basalt - maximum depth 500 feet.

BORE SITES INSPECTED ON BIRRINDUDU

NUMBER	REMARKS
3	Selected by M. Vogel and marked by steel picket. On fresh basalt with thin layer of overburden Approved - maximum depth may be 500 feet.
4	Initial site selected by M. Vogel. Rejected because of inconvenient locality. New site selected but new boundary is within 1 mile of this site. Final selection depends on testing of Coolibah Bore in Inverway. The salt content of this bore may indicate that the area around Nongra Lake is not suitable for drilling.
5	Selected by M. Vogel and marked by steel picket. Probably ferricrete on laterite on basalt. Approved - maximum depth may be 500 feet.
6	Selected by M. Vogel and marked by steel picket. Calcrete with thin ferricrete or alluvium cover, on basalt. Good prospects of water at 120 feet or less, but may have to go to 500 feet.

LIMBUNYA 4 MILE SHEET
BIRRINDUDU 4-MILE SHEET

LOCALITY PLAN



REFERENCE

- Q — Post laterite younger alluvium
- TT — " older "
- FF — Ferruginous deposits including laterite
- oo — Laterite positively identified

CAMBRIAN
- Ea — Antrim Plateau volcanics

UPPER PROTEROZOIC
- VR — Sediments of Victoria River Group

- Dry well or bore
- Producing well or bore with windpump
- ⊙11 — Selected bore site
- Road or track
- Fault
- Geological boundary
- Station boundary (approx)

GEOLOGICAL SKETCH MAP
INVERWAY AND BIRRINDUDU STATIONS
SCALE 0 5 10 15 MILES

RESIDENT GEOLOGIST'S OFFICE, BUREAU OF MINERAL RESOURCES, DARWIN, N.T. JANUARY 63

To Accompany Record 1963/54