Explanatory Notes on the Brunette Downs Geological Sheet

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The Brunette Downs Sheet area is in the central-western part of the Barkly Tableland in the Northern Territory of Australia; it lies between longitudes 135°E and 136°30'E, and between latitudes 18°S and 19°S. Its south-western corner is about 80 miles north-east of Tennant Creek.

The area is covered by two sets of vertical air-photographs; one set was taken by the Royal Australian Air Force in 1947, and is at a scale of 1:46,500; the other by Adastra in 1963, at 1:80,000. In 1960 the Division of National Mapping, Department of National Development, published a planimetric sheet at a scale of 1:250,000; the map was based on the 1947 photography supplemented by spot photography and ground control, both of which were carried out in 1958. Photomosaic compilations of the separate one-mile areas are available from the Division of National Mapping, and these show all cultural information to 1958. At present no map based on the 1963 photography is available. However, during the 1962 geological survey (Randal & Nichols, 1963), on which these notes and map are based, bores, tracks, and fences constructed since 1958 were mapped, and these are shown on the geological Sheet.

The Anthony Lagoon Road, which was constructed in 1961-63, roughly bisects the area from south to north, and provides access from the Barkly Highway via Alroy Downs in the adjoining Alroy Sheet area. The graded and formed Barkly Stock Route bisects the area from south-east to north-west, and joins the Stuart Highway at Elliott to the north-west, and the Barkly Highway near Camooqueal to the south-east, via Alexandria Homestead in the adjoining Ranken Sheet area. Other main roads connect Brunette Downs homestead to Rockhampton Downs in the south-west and to Creswell Downs homestead 5 miles north of the area in the adjoining Wallhallow Sheet area. Another main road connects Anthony Lagoon homestead, which is 1 mile north of the area, to the Barkly Highway 22 miles west of Frewena in the Alroy Sheet area via Rockhampton Downs homestead. A frequently used road connects Brunette Downs to Frewena via Brunette Downs No. 23 bore and Lake Sylvester. All these roads are formed earth and are usually impassable after heavy rain, but in dry weather they provide access to an extensive network of bore and fence tracks which are generally maintained in excellent condition.
The area contains parts of the Brunette Downs, Rockhampton Downs, Creswell Downs, Anthony Lagoon, and Alexandria cattle stations, and the homesteads for the first two. Airfields are situated at Brunette Downs, Brunette Downs Racecourse, Rockhampton Downs, and, within the sheet area, south of Anthony Lagoon. On Brunette Downs Station most of the water-borees have small strips suitable for light aircraft. All settlements within the area are included in the Alice Springs radio network of the Royal Flying Doctor Service of Australia. A police station is located 1½ miles north of the area near Anthony Lagoon homestead.

The climate is monsoonal; the wet season lasts normally from December to March. The lowest temperatures and humidities are recorded during the dry season, which is influenced by consistent south-easterly winds. Towards the end of the dry season the temperature and humidity rise and cloudy days are frequent: wind directions become variable, and ultimately winds from the north-west predominate, and usher in the wet season. The annual rainfall in the period 1952-60 ranged from about 13 inches at Rockhampton Downs to 19½ inches at Anthony Lagoon.

Previous Investigations

No systematic geological mapping had been done in this Sheet area until 1962, although the Barkly Tableland had been traversed previously by explorers and geologists engaged in reconnaissance mapping.

Cambrian fossils were discovered on the Barkly Tableland in the Ranken Sheet area by Brown (1895), and in the Alroy Sheet area by A. L. Merrotsy (Etheridge, 1919). The history of these finds is described in Randal (1966a, b).

Woolnough (1912) and Jensen (1914) passed through this area, and referred to the Cambrian limestones and the groundwater of the Barkly Tableland. Jensen subsequently (1923, 1944) referred to the Cambrian rocks as the Barkly Tableland Series. Ward (1926) visited the area during an investigation of the groundwater resources of the Northern Territory.

In 1947 and 1948 Noakes & Traves (1954) visited the area during a CSIRO investigation of the Barkly Region. Many of their original observations are recorded in files of the Bureau of Mineral Resources. They referred to the Cambrian rocks as the Barkly Group. Ōpik's (1965a, b) geological observations and fossil collections on the Barkly Tableland were made in adjoining areas, but have some bearing on the Cambrian stratigraphy of this Sheet area; the mapping on the adjoining Sheet areas of Tennant Creek (Ivanac, 1954), Wallhallow (Plumb & Rhodes, 1964), and Ranken and Alroy (Randall, 1966a, b) is also relevant.

In 1963 Adastria Hunting Geophysics Pty Ltd completed an aeromagnetic survey of the Brunette Downs and the eastern part of Helen Springs Sheet areas for Mines Administration Pty Ltd as supervisor for the Papuan-Apinaipi Petroleum Co. Ltd (Howe & Faessler, 1963), and from October to December 1964 Sedco Exploration (Aust.) Pty Ltd drilled Brunette Downs No. 1 Stratigraphic Well to 2040 feet for the same company.
PHYSIOGRAPHY

The entire Sheet area is within the Barkly Internal Drainage Basin: Stewart (1954a) used the term Barkly Basin, but the former name is preferred to avoid confusion with the geological concept of the Barkly Basin (BMR, 1960). The divide separating this Basin from the Georgina River Basin lies to the east in the Ranken Sheet area (Randal, 1966a), and the divide separating it from the Gulf Fall lies to the north and east in the Wallhallow (Plumb & Rhodes, 1964), Mount Drummond (Smith & Roberts, 1963), and Ranken (Randal, op. cit.) Sheet areas.

The Internal Drainage Basin is not a single entity: it consists of several swamps or lakes which are themselves internal drainage centres (Fig. 1). The largest is Lake Sylvester (including Lake De Burgh—these two lakes join together in the Altroy area to the south) in the central south; this drainage centre receives water from the central-eastern part of the region and beyond via Brunette, Mittlebah, and Fish Hole Creeks. Other centres are Tarrabool Lake in the north-west, fed by Creswell Creek, and Corella Lake in the centre, fed by Corella and Edwards Creeks. The lakes contain water only during the wet season and for a short time after; however, the streams enter the lakes in
strongly developed distributaries most of which contain long-lasting or permanent waterholes.

Besides the internal drainage systems, physiographic features are delineated by the division of the landforms into timbered areas—locally termed 'desert country'—and the widespread grassy downs characteristic of the Barkly Tableland.

A large timbered area extends from about Lake De Burgh to Corella Lake, thence westwards to south of Tarrabool Lake, which it adjoins. It broadly corresponds to the Drylake Land System within the Tertiary Lake Alluvia unit of Stewart (1954a, b). The vegetation is mainly coolibah with some Acacia spp. and bluebush; the main grasses are bluegrass and Mitchell and Flinders grasses. The topography is generally subdued, but the soils are broken and traversed by well-defined runnels. The area is occasionally flooded, but usually the water accumulates in the lakes on its margins.

Areas of moderate timber cover occur between Edwards Creek and Corella Creek, and between Edwards Creek, Anthony Lagoon Aerodrome, and Tarrabool Lake. Snappy gum and acacias predominate, with some coolibah trees and Mitchell grass. The areas are associated with heavily lateritized or leached rocks probably in the more sandy and silty parts of the Cambrian sequence.

Along the upper reaches of Creswell Creek, outcrops of Upper Proterozoic sandstone and the sandy plains surrounding them are moderately timbered with snappy gum, silver box, and bloodwood. Bluegrass predominates over various species of Mitchell grass.

The downs forming the rest of the Sheet area are essentially grasslands developed on clayey black soils, with various types of Mitchell grass dominant over the Flinders and couch grasses. The topography is gently undulating, with low gravelly rises supporting various species of eucalypts and acacias. The drainage is well developed and partly dendritic, but the major streams are widely spaced. The downs are generally developed on Cambrian and Tertiary carbonate rocks.

Relief is generally low: the ridges in the north-east have an altitude of about 880 feet—some 80 feet above the adjoining grassy downs. The lowest area is Lake Sylvester, which is about 630 to 660 feet above sea level. The regional slope of the Sheet area is westward, but to the west of the lakes it appears to be gently eastward.

**STRATIGRAPHY**

Stratigraphic information is difficult to obtain because of the paucity of outcrop and the lack of exposed contacts. The area is covered by extensive superficial deposits with loose blocks of carbonate rocks and sandstone, and pebbles of chert and pisolithic ironstone. The drillers' logs of the water-bores are too vague to be useful, and the bores logged by geologists are too few and too far apart to permit accurate correlation or interpolation. Consequently formal nomenclature has been avoided.
PRECAMBRIAN

In the section on the map, unnamed Precambrian rocks are shown under the Cambrian sequence. The Precambrian rocks do not crop out, and very little is known about them. The Cambrian succession may be underlain by the Lower Proterozoic Warramunga Group and the Upper Proterozoic Ashburton Sandstone (Noakes & Traves, 1954; Ivanac, 1954) in the west, and by the Upper Proterozoic Mittiebah Sandstone in the north and east. The Lower Proterozoic Hatches Creek Group (Smith, Stewart, & Smith, 1961) crops out in the Davenport and Murchison Ranges about 100 miles to the south-south-west, and may extend northward as far as this Sheet area. From the magnetic data, Howe & Faessler (1963) have inferred that the basement changes from Upper Proterozoic rocks in the north to Lower Proterozoic rocks in the centre and south.

Magnetic basement ranges from 840 feet above sea level in the north-east to 1000 feet below in the south-west near Rockhampton Downs. Magnetic basement may be within the Mittiebah Sandstone in the north-east, but efforts to check this theory in the Ranken Sheet area to the south-east were unsuccessful: no definite conclusions could be made from the results of an aeromagnetic traverse over outcrops of the Mittiebah Sandstone south of Alexandria or over Alexandria water-bore No. 1 where the sandstone is about 1750 feet below the surface.

The Upper Proterozoic Mittiebah Sandstone crops out north of Creswell Creek in the north-east. It is continuous with a line of outcrops in the north-western part of the Mount Drummond Sheet area (Smith & Roberts, 1963). The rocks, which consist of ferruginous quartz sandstone, with minor lenses of pebble and boulder conglomerates, dip to the south-south-west beneath the Cambrian rocks, but no contacts have been observed. Its subsurface extent is unknown as it is not reported in any of the drillers' logs of the water-bore. However, Papuan-Apinaipi Petroleum Brunette Downs No. 1 Well, near Brunette Downs Racecourse, penetrated about 1050 feet of carbonate rocks overlying 360 feet of quartz sandstone to about 1410 feet; the underlying rocks to the total depth of 2040 feet consisted of micaceous and gauconitic shale and siltstone (Mines Administration, 1965).

H. G. Roberts (BMR, pers. comm.) considers that the sandstone-siltstone sequence represents the Mittiebah Sandstone and the underlying Mullera Formation, which crop out in the Mount Drummond Sheet area to the east (Smith & Roberts, 1963). P. R. Evans (BMR, pers. comm.) reports unicellular organic bodies of unknown origin from Cores 7 (1550-1559 feet) and 11 (2030-2040 feet) of this well; they are identical with specimens which he found in samples of the Mullera Formation but they have no age significance. In the south of the Mount Drummond area the Sandstone is 9000 feet thick, but thins to about 1000 feet in the north and apparently to 350 feet to the west in Brunette Downs No. 1 well.
CAMBRIAN

Scattered outcrops of carbonate rocks, sandstone, and chert occur in the centre and west, extending northwards into the Wallhallow Sheet area, where they have been named the Anthony Lagoon Beds by Plumb & Rhodes (1964).

In the Brunette Downs Sheet area the Anthony Lagoon Beds consist of flaggy and blocky dolomite, dolomitic sponge and algal limestone, dolomitic calcarenites and calcilutites, and quartz sandstone and siltstone. The bulk of the sequence appears from surface exposures to consist of carbonate rocks; but, although the drillers' logs of water-bores indicate mainly carbonates at depth, they also indicate a greater proportion of sandstone and siltstone than is visible in outcrop. Rock chips from numerous bore drains include micaceous silty carbonates. P.A.P. Brunette Downs No. 1 Well penetrated 1060 feet of limestone, calcilutite, dolomitic limestone, and some shale interbeds.

Occasional nodules and bands of chert are present in the carbonates; the abundant chert rubble is apparently derived from silicified carbonate rocks. The sandstone is flaggy and ripple-marked, and is fine to medium-grained. Some of the sandstones are very porous and appear to be the remnants of leached carbonate rocks which contained considerable amounts of quartz; similar rocks have been noted in the Barkly Tablelands by Condon (1961) and Randal & Brown (1962a, b). The petrology of the Anthony Lagoon Beds has been discussed by Nichols (1963), who has also described some saucer-shaped structures of unknown origin which occur in the unit on the eastern side of Tarabool Lake (locality BT326).

No identifiable fossils have been found in the Anthony Lagoon Beds. Algal and sponge remains occur in dolomitic limestone south-south-west of Anthony Lagoon homestead (BT330) and west of Brunette Downs homestead (BT316): fragments of trilobites and eocrinoderms (?) have been seen in thin sections, and trilobite cross-sections are visible in hand specimens from near Boundary Bore on the Barkly Stock Route. Core No. 2 (1009-1019 feet) from P.A.P. Brunette Downs No. 1 Well contains fragments of brachiopods, but the core has not yet been examined in detail. Nevertheless, since the Anthony Lagoon Beds appear to form part of the widespread carbonate rocks of the Barkly Tableland (Randal & Nichols, 1963), which in adjoining areas contain early Middle Cambrian fossils, this unit is provisionally assigned to the Middle Cambrian.

Water-bore logs indicate that the Anthony Lagoon Beds are at least 700 feet thick in the central part of the Sheet area, and P.A.P. Brunette Downs No. 1 in the east penetrated 1050 feet of carbonate rocks referred to them.

The scattered chert rubble, white crystalline and pelletal dolomite with plentiful chert nodules and bands, and some sandstone lenses in the east (and in the accompanying section) are shown as 'undifferentiated Cambrian'. The subsurface information comes from drillers' logs of several bores and the examination of rock chips. These rocks are unlike the exposed Anthony Lagoon Beds farther west, but they may represent rocks either within or beneath the Beds.
MESOZOIC

Unnamed Mesozoic rocks crop out as scattered blocks and boulders along the Brunette Downs/Creswell Downs road in the extreme north. They consist of fine-grained silicified quartz sandstone with abundant plant remains. Brunnswieker (1950) has identified *Ptilophyllum, Cycadites*, and *Elatocladus planus* in a collection from this locality by Noakes & Traves (1954), and assigned the beds to the Lower Cretaceous. This age has been confirmed by M. E. White (pers. comm.) who examined a collection made in 1962 by Skwarko (1965) and Randal (Randal & Nichols, 1963); her determinations were *Ptilophyllum pecten, Pterophyllum fissum, Thinnfeldia pinnata, Otozamites beechii, Otozamites bengalensis*, and *Taeniopteris spatulata*.

CENOZOIC

Noakes & Traves (1954) used the name *Brunette Limestone* to describe the white nodular limestone which crops out near Brunette Downs, Alroy Downs, and Rockhampton Downs homesteads. The Brunette Limestone consists of white to brown fine-grained to coarsely crystalline limestone and minor dolomite; the rock contains chert and opaline nodules. It crops out as scattered boulders along Brunette, Mittiebah, and Boree Creeks in the eastern part of the Sheet area; it occurs extensively in the west between Rockhampton Downs and Tarrabool Lake, and as isolated outcrops around the lower part of Corella Creek.

The lithology and stratigraphical position of the Brunette Limestone are similar to the Austral Downs Limestone (Noakes, 1951; Noakes & Traves, 1954) which crops out in the Avon Downs Sheet area (Randal, 1966c) and farther south: both were laid down on older carbonate rocks, presumably when the old rocks were being lateritized and leached during the Tertiary. Leaching of lime and silica from the older rocks apparently provided material for the younger siliceous limestone.

The Brunette Limestone was previously regarded as a lacustrine deposit, but fossils found at locality BT169 near Bore 18 Rockhampton Downs (Randal & Nichols, 1963) indicate some marine influence. The outcrop consists of conglomeratic shelly limestone boulders together with boulders of the more common siliceous limestone of the Brunette Limestone. The two are probably in sequence, but this has not been proved. Lloyd (1965a, b) found specimens of the foraminifera *Ammonia beccarii* and an ostracod in the shelly limestone, and McMichael (1965) found three species of freshwater gastropods and one species of a freshwater pelecypod in the same rock. Lloyd considers that the foraminifer indicates a marine incursion during the Miocene which produced lagoonal or estuarine conditions.

The thickness of the Brunette Limestone is unknown, but in a sinkhole along Mittiebah Creek about 60 feet is exposed.

Isolated outcrops of travertine occur in the vicinity of Tarrabool Lake and Lake Sylvester. The travertine is in part opaline and siliceous like the Brunette
Limestone; but it contains more detrital quartz and is not so cohesive. The thickness of the deposit is unknown but exceeds 10 feet.

Unconsolidated deposits are widespread; they consist of sand and sandy soils, residual gravelly rises of pisolithic ironstone and chert, black and grey clayey soils, and alluvium and river gravels.

Sand and sandy soils occur in the western and north-eastern parts of the Sheet area. Quartz sand, though subordinate, gives the soil a sandy texture which is distinct from the clayey texture of the black and grey pedocalic soils.

The rises of pisolithic ironstone rubble are presumably the remnants of lateritized Cambrian rocks: most are in situ, but some appear to have been transported and redeposited. The residual chert gravels are defined from the chert bands and nodules in the underlying carbonate rocks, or the silicified carbonate rocks.

The grassy downs are underlain by black and grey pedocalic soils; they are moderately to weakly leached and contain carbonate and gypsum horizons. Stewart (1954b) considers that the areas not occupied by these soils were swamps during the Tertiary lateritic cycle. The soils overlie the carbonate rocks of the Cambrian sequence and the Tertiary Brunette Limestone. They are of mixed origin, partly residual on the carbonate material and partly derived from material deposited in the Tertiary swamp.

Stream alluvium consists of transported gravels and reworked clayey and sandy soils. The fine-textured alluvium in the swamps of the internal drainage centres is also derived from clayey black soils.

**STRUCTURE**

Structure is difficult to assess because of the poor outcrop and the lack of exposed contacts. Very few outcrops have well-defined dip and strike directions; some dip directions have been determined by photo-interpretation, but most cannot be verified on the ground. Low, elongated rubble-covered ridges with one slope much steeper than the other may be remnants of original dip slopes in the Cambrian sequence. East of Tarrabool Lake and immediately north of Corella Lake these ridges strike east-west, which is also the trend of the divide between Creswell Creek and the streams entering Lakes Corella and Sylvester. North-east of Lake Corella the ridges strike south-west, which is also the direction of flow of Corella Creek, Brunette Creek, the lower reaches of Creswell Creek, and the upper reaches of Edwards Creek. The ridges frequently occur as parallel pairs sloping towards each other.

The regional structure should be considered in relation to the adjoining areas. The Upper Proterozoic rocks in the north of the sheet dip south-westwards and in the Mount Drummond Sheet area dip westward; and in some parts they form the basement to the Cambrian sequence. On the Tennant Creek and Helen Springs Sheet areas, Middle Cambrian sediments dip eastward off the Precambrian Ashburton Sandstone and Warramunga Group. It appears that
the Cambrian rocks have been deposited in depressions in the Precambrian land surface.

The concept of a ‘Barkly Basin’ forming a link between the Georgina and Daly River Basins, has been put forward (BMR, 1960), but has not been proved.

GEOLOGICAL HISTORY

During the Proterozoic extensive sedimentation occurred around the area, with the deposition of the Hatchets Creek and Warramunga Groups, the Ashburton Sandstone, and the rocks of the Limmen Geosyncline (Dunn, Smith, & Roberts, in prep.). Presumably some of these sediments extended into the Brunette Downs area, but most of the rocks are now completely covered. The folded Proterozoic rocks, which form the irregular basement to the Cambrian sequence, were transgressed by an early Middle Cambrian sea. Probable Lower Cambrian volcanics are known to the south-west of the area (Ivanac, 1954) below the Middle Cambrian, but so far they have not been recorded in the Brunette Downs Sheet area either in outcrop or in boresholes.

Little is known of the geological history of the area between the deposition of the marine Cambrian sediments and the deposition of Lower Cretaceous sediments in a freshwater environment. Gentle folding and warping during the late Mesozoic and Tertiary produced a series of freshwater lakes between the higher divides. Probably in the late Tertiary lateritization proceeded on the higher ground and silica and lime leached from the older rocks were deposited in the lakes along with other alluvial material. A brief marine transgression occurred to the north during the Miocene and may have extended into this area. The pre-laterite landform is still reflected in the present-day landform of the area, though it has been modified by the deposition of detrital laterite and the other Cainozoic sediments. Slight rejuvenation of the streams has produced the present cycle of erosion.

ECONOMIC GEOLOGY

Petroleum

No reliable assessment of the petroleum prospects can be made until adequate subsurface investigations have been carried out.

Fossiliferous marine Cambrian rocks are known in the area and may provide source rocks for petroleum. The carbonate rocks could form reservoirs for oil or gas; the large quantity of subartesian water produced from them is proof of their permeability. None of the numerous bores in the area have reported hydrocarbons, but few have penetrated more than half of the probable Cambrian section. Fine-grained and compact carbonates are known in outcrop and have been reported in drillers’ logs; these could act as cap rocks for potential reservoir rocks. However, the structure and lithological sequence of the potential source, reservoir, and cap rocks are not well known.
Surface water resources are inadequate for the present cattle population. The rainfall is adequate to provide plenty of good-quality grasses, but none of the watercourses are perennial, and few of the waterholes are permanent because of the low rainfall, the shallow valley profiles, and the high evaporation. Consequently the cattle industry is mainly dependent on groundwater. A series of overshot dams have been built on Brunette Creek at Brunette Downs homestead, and Dingo Waterhole also on Brunette Creek, and Wire Yard Waterhole on Creswell Creek have been deepened.

Over 180 water-bores have been drilled and about 150 of these are currently in use. Eight of the disused bores were abandoned for reasons unknown; five more because of inadequate supply and seven because of poor quality; and the remainder because of mechanical defects or because they were no longer required.

The groundwater is obtained from an aquifer system ranging in depth from 95 to 700 feet, corresponding to a range in elevation of from 580 feet to 15 feet above sea level. Many bore logs record two or more aquifers. Drillers' logs of bores in the eastern part of the area clearly indicate that the depth to good supplies is controlled by the incidence and size of cavities and fissures in an essentially carbonate sequence. However, interpretation of the logs of bores in the west suggests that the water occurs in porous rocks—but porous because of cavities as well as texture—overlain by non-porous rocks.

The chemical characteristics of the waters suggest some interconnexion between the shallower and the deeper aquifers, not only in the east but also in the west (Randal, in prep.). The cavernous nature of the sequence has been responsible for lost circulation problems in virtually every stratigraphic well drilled on the Barkly Tableland. Despite the partial lithological control on the depth of aquifers in some areas the shallower aquifers contain unconfined groundwater: the two principal areas are from Kennedy Creek north-eastwards to the upper reaches of Boree Creek, thence along Nittiebah Creek to Brunette Downs homestead, thence northwards to Creswell Creek; and from between Lakes De Burgh and Sylvester in a thin band northwards to Edwards Creek. However, the shallower aquifers seldom provide an adequate supply, and deeper aquifers are sought; the standing water levels for the deeper aquifers are usually the same as for the shallower ones—that is, the deeper water is confined.

The piezometric surface—obtained by contouring the standing water levels—ranges from about 520 to 640 feet above sea level, but the contouring has produced a somewhat confused and complicated pattern. This is mainly due to the lack of surveyed heights (most heights have been obtained by barometer traverses) in an area of subdued topography and apparently low hydraulic gradients. Further confusion may have been introduced by regarding the numerous water levels as being on a single piezometric surface when actually two or more surfaces may be involved. However, other information tends to discount this possibility for most of the area (Randall, in prep.). Despite the complicated pattern some general trends are apparent.
In the east groundwater flow is westward and in the central parts eastward, thus forming a trough in the piezometric surface which trends generally northward from Kennedy Creek in the south to west of Creswell Downs homestead in the Wallhallow Sheet area to the north. The trend is offset near Brunette Downs homestead and is complicated by sweeping westward lobes in the trough about Lake Sylvester and Corella Creek. Another lobe is directed north-eastward from Tarrabool Lake along Creswell Creek and joins the main trough between Anthony Lagoon homestead and Creswell Downs homestead. In the trough area salinity values are exceptionally high, and the bore waters are characterized by the dominance of chloride and sulphate ions. South of Tarrabool Lake groundwater flow is westward, and the salinity increases in the same direction. Higher areas in the piezometric surface occur north of Rockhampton Downs Homestead, about Tarrabool Lake, between Lake De Burgh and Corella Lake, near Edwards Creek, and north-east of Brunette Downs homestead. In these areas the salinity of the groundwater is appreciably lower than in the trough areas (Fig. 2).
The quality of the groundwater is extremely variable. Most of the groundwater is fit for stock, but very little is fit for human consumption: only the centre and north-west and small areas in the north-east and south-east contain groundwater with less than 2000 ppm of total dissolved solids; and less than 10 percent of the area contains groundwater with less than 250 ppm of sulphate ion, and less than 2 ppm of fluoride.

The supplies are excellent in most parts, being greater than 1500 gph, and in two-thirds of the area greater than 2000 gph.

The hydraulics and geochemistry of groundwater in this area have been examined in relation to the entire groundwater province of the Barkly Tableland, and are discussed further in a report by Randal (in prep.), from which these notes have been taken.

Construction materials
Flaggy carbonate rocks and altered sandstones have been used for minor building purposes—pathways around homesteads, mounting bore-equipment, as foundations for cattle troughs, and in overshot dams.

Gravel supplies are scattered over wide areas, but are thin and sparse. In the downs country the gravels are mainly chert with minor silicified ironstone, but in the timbered areas ironstone forms the greater part. In a sinkhole along the Anthony Lagoon road north of Edwards Creek at least 10 feet of detrital laterite is exposed, but much of this has been recemented, and would be difficult to scrape.

There are no occurrences of good quartz sand; the ferruginous and often silty sand of the 'desert' areas is of doubtful value for building purposes: but it has been used mixed with a high proportion of cement for paved floors. Most of the streams contain gravel and reworked black soil rather than sand.

The heavy clayey soils of the downs country make excellent earth tanks for the storage of bore water. These soils become plastic and impervious when wet, and if maintained in moist and vegetated conditions make a virtually waterproof container (turkey nest). They are however considerably weakened by admixed sand, and the use of iron tanks is the only permanent solution against leaking turkey nests in the sandy areas.
REFERENCES


ÓPIK, A. A., 1956b—Cambrian geology of the Northern Territory. Ibid., 25-54.


