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**RECORDS.**

1961/65



## REVISIONS TO STRATIGRAPHY OF HAY RIVER, HUCKITTA AND TOBERMORY 4-MILE SHEETS, NORTHERN TERRITORY.

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## SUMMARY

This report outlines corrections and additions to previous mapping on the Huckitta, Hay River and Tobermory Four-mile Sheets, Northern Territory, and presents all available data on water bores drilled in those areas.

On the Hay River Sheet, Upper Cambrian and Lower Ordovician sediments on the western limb of the Toko Syncline are faulted against Upper Proterozoic sediments along a complex north-west trending fault zone named the Toomba Structure. The maximum throw of the main fault exceeds 2,000 feet, and there are smaller, parallel strike faults which affect Middle Ordovician sediments. A section of 460 feet was measured in a ? Ordovician sandstone sequence which overlies the Middle Ordovician Mithaka Beds. Samples obtained from several water bores along the Field River show the presence of a locally non-outcropping sequence, probably the Tarlton Formation, overlying the Upper Proterozoic Field River Beds.

On the Tobermory Four-mile Sheet, the effects of lateritisation on the mixed lithologies of the Upper Cambrian and Lower Ordovician units were unravelled, and it was shown that the change from the Tomahawk Beds of the Huckitta area to the Ninmaroo and Kelly Creek Formations of the Toko Range is a facies variation. A small disconformity was established between the Nora Formation and the Carlo Sandstone in the Tarlton Range. Numerous measurements in the Tarlton Range show that during the deposition of the Carlo Sandstone currents came from the south-east. Further plant fossils were collected from the Tarlton Formation; they indicate a probable Triassic or early Jurassic age.

On the Huckitta Four-mile Sheet, two sections of about 750 feet were measured in the predominantly dolomitic Arthur Creek Beds, in the area west and south-west of Huckitta homestead; in one section, trilobites and brachiopods were discovered 85 feet, stratigraphically, above archaeocyathids in the top of the Lower Cambrian Mount Baldwin Formation. Three new fossiliferous horizons were found in the Upper Cambrian Arrinthrunga Formation; one is near the base and contains trilobites of lower Upper Cambrian age; the other two horizons are near the top of the formation and contain trilobites and brachiopods. Revised structural mapping and measurement of new sections shows that the Arrinthrunga Formation is about 3,200 feet thick. The Middle Ordovician Nora Formation, which occurs only in the southern foothills of the Dulcie Range, has been mapped as a separate unit from the Tomahawk Beds, which formerly included it. Additional samples of Devonian fish were collected from a new locality in the Point Spring area.

## INTRODUCTION

During the 1960 field season, a party from the Geological Branch of the Bureau of Mineral Resources, tried to solve various stratigraphical problems arising from the mapping carried out from 1957 to 1959 when the same party covered the Huckitta, Tobermory and Hay River four-mile sheets in the Northern Territory; these are part of the western Georgina Basin, in which lower Palaeozoic sediments were deposited.

The field party consisted of K.G. Smith, R.R. Vine, P.J. Jones and E.N. Milligan; M.A. Condon visited the party between 13/6/60 and 1/7/60. About ten weeks were spent in the field in 1960 and some new information has been gained, both from field mapping and from new water bores. Amendments have been made to map compilation sheets and a regional map at a scale of 10 miles to one inch, has been produced; (Plate 1).

## GEOLOGY.

### 1. HAY RIVER FOUR-MILE SHEET

The sedimentary sequence in the north-eastern part of this sheet was re-examined to delineate further the Palaeozoic formations and to obtain information on the Toomba Structure (named by Smith and Vine, 1960, unpublished. It is the most easterly of three parallel, north-west trending structural zones on the western side of the Toko Syncline.). In this area, the sedimentary sequence is as follows:-

| | | Thickness |
|---|---|---|
| Mesozoic | Undifferentiated | |
| Unconformity | | |
| ? Ordovician | Undifferentiated quartz sandstone | 460' + |
| Middle Ordovician | (Mithaka Beds | |
| | (Carlo Sandstone | 285'+ |
| | (Nora Formation | ?400' |
| | (Coolibah Formation | 20'-40' |
| Lower Ordovician to Upper Cambrian) | Kelly Creek Formation Ninmaroo Formation) | ?1200' |
| Upper Cambrian | Arrinthrunga Formation | 1400' |
| Middle Cambrian | Marqua Beds (not present in outcrop) | ?600' |
| Unconformity and Fault | | |
| Upper Proterozoic | Field River Beds | ?2000' |

The Palaeozoic sediments form part of the steeply-dipping western limb of the Toko Syncline, where Carlo Sandstone forms a prominent strike ridge known as the Toomba Range; the formations above and below the Carlo Sandstone crop out poorly.

The contact between Upper Proterozoic and Palaeozoic rocks is concealed beneath a soil-covered plain, but to the west and north-west a regional unconformity separates the Field River and Marqua Beds. However, in the north-eastern part of the Hay River sheet, the Marqua Beds are not exposed and the oldest sediments are steeply-dipping beds of the Arrinthrunga Formation; but the Marqua Beds and the basal beds of the

Arrinthrunga Formation are exposed along strike to the south-east on the Mount Whelan four-mile sheet, Queensland. In some localities the Arrinthrunga Formation is missing and the Ninmaroo Formation is in near contact with the Proterozoic. The Arrinthrunga, Ninmaroo and Kelly Creek Formations dip vertically or steeply to the east-north-east, but in some places the beds are overturned to the west.

Along the western side of the Toomba Range the overall structural pattern is a fault zone between Precambrian and Palaeozoic sediments. This fault zone trends north-west, and has some subsidiary faults which trend east-north-east. The throw of the major fault cannot be estimated because of complications caused by a regional unconformity between the Field River Beds and the Marqua Beds. The Proterozoic sediments near the contact are stratigraphically low in the Field River Beds and a thickness of about 3000 feet is missing from these Beds in this vicinity. But their full sequence is preserved only in a fault block to the west of the Field River and much of the diminution in the Toomba Range may be due to erosion before deposition of the Marqua Beds. Therefore the maximum stratigraphic throw on the fault is of the order of 2000 feet (from the Marqua Beds and the Arrinthrunga Formation) plus an unknown factor, which could be 3000 feet, for the Field River Beds.

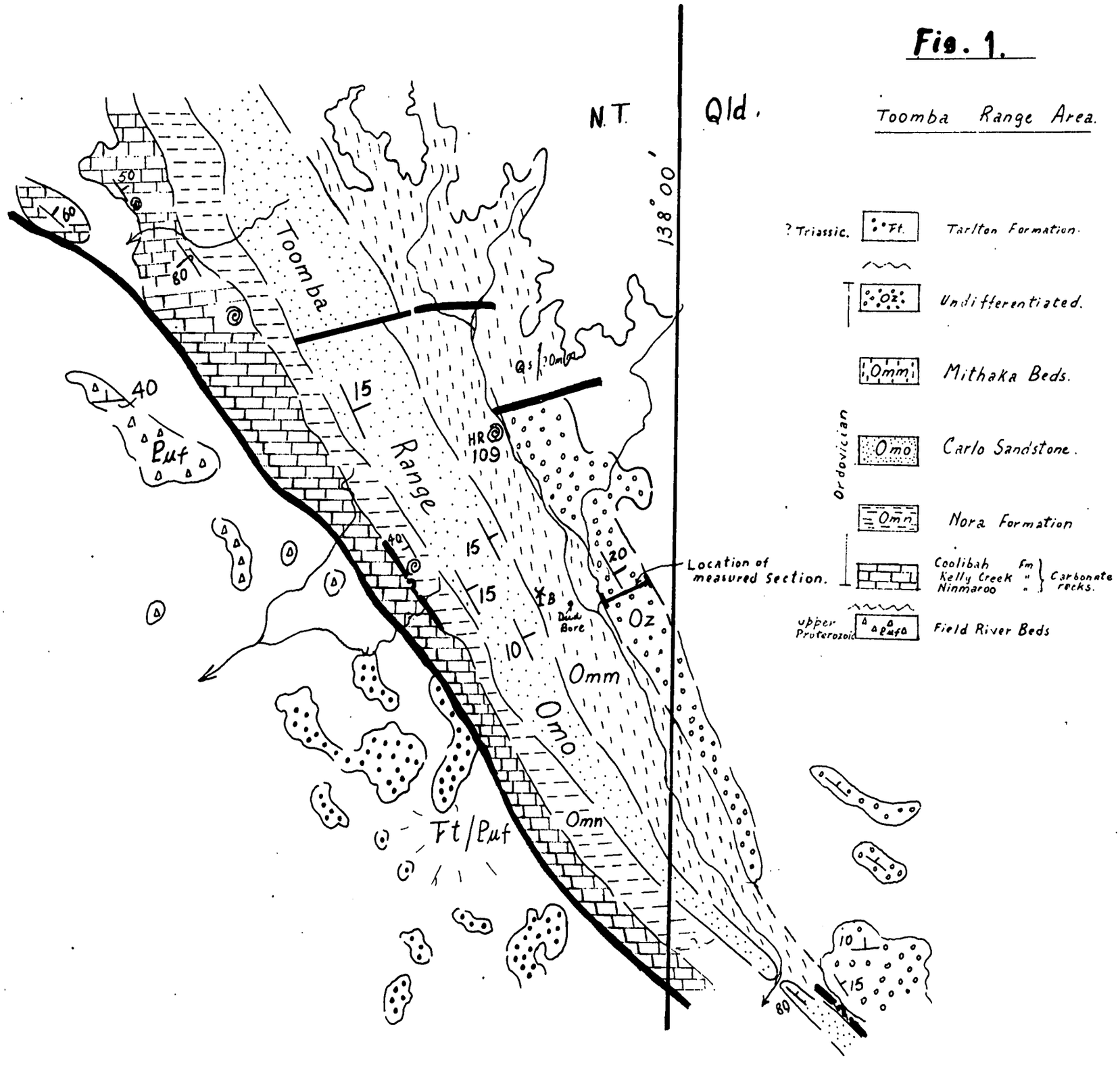
Poor outcrops and changing dips (in places overturned) make it difficult to estimate the thickness of the Arrinthrunga Formation; only in the south-east (on the Mount Whelan sheet) were exposures good enough to estimate a thickness of 1400 feet. The Arrinthrunga Formation in the Toomba Range area is composed of dolomite and limestone, with few thin sandstone interbeds.

The Arrinthrunga Formation is succeeded by a thick but unmeasurable sequence of essentially carbonate rocks which include the Ninmaroo, Kelly Creek and Coolibah Formations. Nautiloids and brachiopods were seen near the base and in the middle of this sequence but they could not be removed undamaged from the beds. At the top of the sequence at HR107 a chert, 20 feet thick, contains fossils typical of the Coolibah Formation (J. Gilbert -Tomlinson pers. comm.), but as this chert was observed in one locality only it is either the product of weathering of a carbonate rock (and so may be represented along strike by unweathered carbonate rock) or, it has been faulted out by a strike fault.

Parts of the sequence may have been faulted out; for example, the sandstone lithology of the Kelly Creek Formation is absent, although it is present to the south-east, on the Mount Whelan sheet and to the north on Tobermory. On the Hay River sheet the sandy facies of the Kelly Creek Formation is probably replaced by carbonate rocks. It is quite possible that undetected strike faults, parallel to the major one to the west, have cut out beds in the Upper Cambrian - Middle Ordovician carbonate sequence. At present, formation boundaries in this sequence are indefinite.

The carbonate sequence is succeeded by the Nora Formation, which crops out poorly and is mainly covered by scree in the western scarp of the Toomba Range. One fossil collection (HR108) was made from a dark-brown coquinite about 125 feet above the bed containing the Coolibah fauna (HR107). The thickness of the formation is unknown but is estimated to be 400 feet. Usually, observed dips in the Nora Formation are steeper than those in both the underlying and overlying sequences.

# Fig. 1.


N.T.
Qld.
138°00'
Toomba Range Area.
Toomba
Range
50
60
60
40
15
15
15
10
20
HR 109
Bore
Pμf
Ft/Pμf
Omm
Omo
Omn
Oz
Qs
Location of measured Section.
? Triassic.
Ft.
Tarlton Formation.
Undifferentiated.
Mithaka Beds.
Ordovician
Carlo Sandstone.
Nora Formation
Coolibah Fm
Kelly Creek "
Ninmaroo "
Carbonate rocks.
upper Proterozoic
Pμfo
Field River Beds
Scale. 1:50,000

This may be due either to relative incompetence of the soft beds of the Nora Formation, or to strike faulting between the Nora Formation and the underlying carbonate rocks.

The strongly-outcropping Carlo Sandstone, 285 feet thick, forms the Toomba Range. This Formation, and two younger ones, have been affected by faults which trend slightly north of east but which have no visible effect on formations older than the Carlo Sandstone. The formation usually dips to the east-north-east at angles ranging from 10° to 25° but the dip steepens rapidly to the south-east, caused presumably by the complex ~~tic~~ faulting in the Toomba Structure.

The Carlo Sandstone contains not only beds of friable, clean quartz sandstone but many beds with abundant mud pellets. In 1960/61, Tobermory Station drilled a water bore through the overlying Mithaka Beds into the Carlo Sandstone, on a site selected by the field party; the drill apparently entered the Carlo Sandstone at 190 feet and a quick drilling rate was maintained to the final depth of 438 feet. A yield of 1400 gallons per hour of good stock water, was obtained between 394 and 398 feet, but no particular aquifer has been observed in outcrop.

The Mithaka Beds crop out poorly; for the most part they underlie a valley between the Carlo Sandstone below and an overlying ?Ordovician sandstone. An unsuccessful water bore in this valley penetrated 275 feet (apparent) of blue-grey shale which is probably Mithaka Beds. In outcrop, the basal beds are silty sandstones with fragments of large trilobites; on the eastern side of the valley, Ordovician fossils (HR109) have been collected from about 50 feet of buff and cream, thin-bedded quartz sandstone. They were determined by Joyce Gilbert-Tomlinson, (pers. comm.) but their position in the Ordovician is not yet clear.

A sequence of predominantly red sandstone succeeds this fossiliferous sandstone of the Mithaka Beds. The age of the red sandstone sequence is Palaeozoic, but no fossils have been found in it and its precise age is unknown. In the Gaphole Creek area (on the Tobermory four-mile sheet, to the north) the ?Ordovician sandstone is not present above the Mithaka Beds to the south-east along the Toomba Range, most of the Mithaka Beds are absent and this may indicate either an unconformity between them and the overlying red sandstone sequence, or a strike fault in the Mithaka Beds. No sign of a basal conglomerate or a breccia has been found near the lowest exposures of the red sandstone unit. At a location in the Toomba Range (Fig.1), the following part-section has been measured in this unit:-

Top of ridge

| | |
|---|---|
| 20 feet of | quartz sandstone; hard, medium-grained, cross-bedded, with numerous narrow silica veins; |
| 25 feet of | quartz sandstone; red and brown, hard, medium-grained, with some silica veins; |
| 35 feet of | quartz sandstone; poorly outcropping, red, hard, medium-grained; |
| 45 feet of | quartz sandstone; strongly-outcropping, red, friable, clean, medium-grained, cross-bedded; |
| 15 feet | concealed; |
| 45 feet of | quartz sandstone; poorly-outcropping, red, medium-grained; |
| 35 feet of | quartz sandstone; red, medium-grained, cross-bedded, silty, with some mud pellets; |
| 65 feet of | quartz sandstone; red, medium-grained, thin to medium-bedded, cross-bedded; |
| 90 feet of | quartz sandstone; red, friable, medium-grained, cross bedded, with numerous large mud pellets; |
| 35 feet of | quartz sandstone; red, friable, medium-grained, cross-bedded, with a few mud pellets; |
| 25 feet of | quartz sandstone; red, coarse-grained, cross-bedded, friable, with some thin interbeds of medium-grained, cream, silty quartz sandstone. |
| 25 feet of | quartz sandstone; red, clean, laminated, medium to coarse grained; |
| Total 460 feet | thickness of part-section, whose base is not exposed. This sequence is summarised in Figure 2. |

Both the Mithaka Beds and the red sandstone sequence are overlain unconformably by thin Cretaceous sediments. For the present, the age of the red sandstone is referred to ? Ordovician.

Underground Water.

During 1960, Tobermory Station drilled six bores on the Hay River four-mile sheet area. Five of these were along the Field River and the sixth in the Toomba Range area. The bores along the Field River were logged by the party, from samples kept by the driller. The sixth bore was sited by the party but the samples have not yet been available for examination; information in this bore has been supplied by driller, D.J.Shepley. All available logs of bores drilled on the Hay River four-mile sheet have been collected by the party and are listed below for Marqua and Tobermory Stations. The list of equipped bores is complete, but some of the numerous unsuccessful bores have not been located; it is known that all of the unsuccessful bores were drilled into the Upper Proterozoic Field River Beds.

(a) Tobermory Station.

| Name. | Noakes | Aroota(Nos.18 &19) | | Yardida | Gnallan-a-gea |
|---|---|---|---|---|---|
| Location | 57 miles S.S.W. of Homestead | 54 miles S.S.W. of Homestead | | 72 miles S.S.W. of Homestead | 68 miles S.S.W. of Homestead. |
| | | No.18 | No.19 | | |
| Altitude | | 652' | 652' | 573' | 610' |
| Water Struck at Pump Depth | 89' | 96' | 54' | 108' | 50' |
| Standing Water Level | | 72' | | | 41' |
| Total Depth | 106' | 159' | 72' | 114' | 60' |
| Supply (g.p.h.) | 700 - 1000 | 700 | 2000 | "Good" | |
| Quality | "Drinkable" | | "Epsom salt" | | Good drinking |
| Driller | | | | | |
| Date | | | | | |
| Analyses | No data | No data | | No data | |
| Strata | See below. | | | | 0-60' gravel & conglomerate. |

Strata Noakes — 0'- 106' Fine micaceous, green-grey shale with some dark shale (Field River Beds).

Aroota-- No information in log. Either in alluvium or Field River Beds.

Yardida - No information in log. Drilled into Field River Beds.

Gnallan-a-gea — Drilled into soil and gravel, on banks of Field River.

| Name | — | Yank's Bore | ? | — | Desert Bore | |
|---|---|---|---|---|---|---|
| Location | 5 miles S of Noakes Bore | 6 miles S of Noakes Bore | 16 miles SSE of Gnallan-a-gea Bore | 18 miles SSE of Gnallan-a-gea | 28 miles SSE of Gnallan-a-gea | Toomba Range |
| Altitude | | | | | | |
| Water Struck at | 55' | 45' | 85' | 97' | (a)80' (b)88' | (a)200' (b)394-398' |
| Pump Depth | | 160' | | | | 398' |
| Standing Water Level | | 45' | | | | 360' |
| Total Depth | 55' | 411' | 85' | 173' | 118' | 438' |
| Supply (g.p.h) | Not tested | 300 | 750 | Not tested | (a)200 (b)520 | 1400 |
| Quality | Salt | Fresh | Fresh | Salt | Saline | "Good Stock" |
| Driller | D.J.Shepley | D.J. Shepley | D.J.Shepley | D.J.Shepley | D.J.Shepley | D.J. Shepley |
| Date | 1960 | 1960 | 1960 | 1960 | 1960 | 1960/61 |
| Analyses | | | | | | |
| Strata | See below | See below | See below | See below | See below | See below |

Strata (Individual bores are listed from left to right across the page.)

1. 0' - 55' Green siltstone of Field River Beds. Bore abandoned

2. (Yank's Bore) 0-45' gravel; 45'-65', green-grey micaceous siltstone; 65'-411', grey micaceous siltstone.

Remarks. Drilled through alluvials into siltstone in the upper part of the Field River Beds; dips in these are steep and true thickness penetrated should be small.

3. 0-30', soil and gravel; 30-38'. Pink and yellow silty fine sandstone; 38-60', pink and brown sandy siltstone; 60-68' pink, silty, fine - grained sandstone; 68-71', white, medium- grained sandstone; 71-76', buff, medium-grained silty sandstone; 79-82', micaceous siltstone; 82-85', white medium-grained silty sandstone.

Remarks. This bore has been drilled into 55' of consolidated sediments which probably belong to the ? Triassic Tarlton Formation; they do not crop out. The bore was stopped before it could penetrate underlying Field River Beds which may have yielded

salt water to contaminate the fresh water obtained at 85'. Bore sited by field party.

4. 0-30', Soil and gravel; 30' - 97', Purple brown siltstone with some sandstone bands; 97-112', brown, laminated, micaceous siltstone; 112-122', brown, micaceous, sandy siltstone; 122-173', grey-green micaceous siltstone.

Remarks. Bore abandoned at 173', in Field River Beds.

5. (Desert Bore) 0-20', soil; 20' - 70' pebbly silty sandstone; 70' - 79', silty coarse white sandstone with some pink micaceous siltstone; 79' - 80', white, friable well sorted sandstone (AQUIFER); 80' -82', hard, silty, coarse white sandstone; 82 - 85', white micaceous siltstone; 85' - 88', coarse, pebbly sandstone (AQUIFER); 88' - 95', yellow - brown quartz siltstone; 95 - 108', white sandy siltstone; 108-118', green and yellow siltstone.

Remarks. Water fresh at first but turned saline due to contamination with water drawn in from Field River Beds. Bore equipped with windmill only until stock prove water *no* consumable.

6. 0- 192', sandstone and siltstone (Mithaka Beds); 192 '- 438' red sandstone (Carlo Sandstone).

Remarks. Log incomplete yet; bore sited by field party to drill 125*ft* (apparent) of Mithaka Beds before penetrating Carlo Sandstone; discrepancy in depth to formation boundary due presumably to sub-surface flexure or to fault. Water reported good stock water, but barely fit for human consumption. Drilling rate in Carlo Sandstone averaged 16 feet per day (D.J.Shepley,pers. comm.).

| Name | A. Brown's dud. | Coles dud | Dud | Dud | Dud | Dud |
|---|---|---|---|---|---|---|
| Location | 67 miles SSW of Homestead | 59 miles SSW of Homestead | 62 miles SSW of Homestead | 64 miles SSW of Homestead | 75 miles SSW of Homestead | Toomba Range |
| Altitude | | | | | | |
| Water Struck at | | 40' | 40' | | 47' | 275' |
| Standing water level | | 40' | | | | |
| Total Depth | 207' | 204' | 140' | 100' | | 275' |
| Supply (g.p.h) | Nil | 2000 | | | | |
| Quality | | Very salty | Salty | | Salty | Salty |
| Driller | A. Brown | J.P.Cole | | | | |
| Analyses | | | | | | |
| Strata | See below | | | | | Silt-stone of Mith-aka Beds |

Strata. A. Brown's dud. 0-60', boulders; 207', granite boulders.

Remarks. Drilled into the Field River Beds.

Coles dud. 0-7', red clay; 7'-64', white clay; 64'-98', grey limestone; 98 -114', clay; 114' -204', grey limestone.

Remarks. Drilled into the Field River Beds.

(b) Marqua Station

| | |
|---|---|
| Name | Desert Bore |
| Location | 26 miles S of Marqua homestead |
| Altitude | |
| Water Struck at | 115-120' |
| Standing Water Level | |
| Pump Depth | |
| Total Depth | 142' |
| Supply (g.p.h.) | 500 |
| Quality | Very saline. Unfit for humans and horses |
| Driller | |
| Analysis | 6583 ppm salt |
| Strata | 0-112', limestone and sandstone; 112-115' quartz; 115-120', water on top of hard blue slate; 120-140', purple and blue micaceous shale; 140 -142' quartzite. |

Remarks. Drilled into upper part of Field River Beds.

About 90% of all suitable grazing land in the north-eastern part of the Hay River four-mile sheet is underlain by the lower part of the Field River Beds and most of the unsuccessful bores have been drilled into that stratigraphical unit. It consists mainly of stratified green siltstone with "tillitic" texture, and roughly-stratified boulder beds; the thickness is about 2000 feet. The lithologies are not favourable as aquifers but in many places the beds have zones of strongly-developed shear cleavage and water is obtained from these fractures. Some high yields have been obtained but the water is almost always too salty for stock. Exceptions to this are Noakes and Yardida bores; both of these produced water of reasonable quality but the reasons are unknown.

Some unsuccessful ones have been drilled through alluvium and/or thin cover of another formation to enter the Field River Beds. In such cases, salt water has sometimes contaminated a first supply of fresh water. This has occurred in some bores drilled along the Field River; usually the first supply of fresh water is insufficient for pastoral purposes, but it should always be tested for quantity because one bore drilled in 1960 produced 750 gallons per hour at a depth of 85 feet, which should have been within a few feet of green siltstone of the Field River Beds. Provided such bores do not become contaminated by drawing in salt water, a K series of shallow, inexpensive holes drilled along the Field River might produce a sufficient number of bores with good quality water.

Much of the country in the Toomba Range area is suitable for grazing but the position of the Northern Territory - Queensland border and the proximity of the watering point at Black Stump dam to the west restricts drilling in the Northern Territory to a small area on the eastern side of the Toomba Range, where the natural target is the Carlo Sandstone. The recent bore drilled into this unit is the only one attempted in the Northern Territory, because elsewhere to the north and west the Carlo Sandstone caps the Toko and Tarlton Ranges and these locations are unsuitable. On the western side of the Toomba Range it may be possible to obtain water from the Lower Ordovician carbonate rocks, but the location of suitable sites would be difficult because of complexities of faulting.

## 2 TOBERMORY FOUR-MILE SHEET

Certain areas of the Tobermory 4-mile sheet, originally mapped systematically in 1959, were revisited in 1960 in an attempt to clear up outstanding problems. These were primarily:-

(a) the stratigraphic position of numerous sandstone bodies around the margin of the Ninmaroo Formation as then mapped,

(b) whether there was a valid division between the similar lithologies of the Kelly Creek Formation and an un-named Cambro-Ordovician sandstone unit around the Tarlton Range,

(c) the age of the Tarlton Formation.

The problems were not completely solved, but a better understanding of the stratigraphy of these units was gained. Further information about some of the other units was also obtained.

### LOWER PROTEROZOIC

A second pegmatite was located in the south-east quadrant approximately one mile south-east of the one previously reported (Smith & Vine, 1960 p.5), and about five miles north-west of Craigie Dam. The pegmatite is exposed for a distance of 20 yards and strikes at 90°. It has been tested by pitting but little or no mica was found.

### CAMBRO-ORDOVICIAN & LOWER ORDOVICIAN

#### Ninmaroo Formation & Tomahawk Beds

Prior to the 1960 field season there was much confusion about numerous discontinuous sandstone outcrops scattered throughout the Tobermory Sheet area. It was recognised that the mapping of the Ninmaroo Formation, carried through from Queensland, could not be integrated completely with the mapping of the Tomahawk Beds eastwards from the Huckitta area.

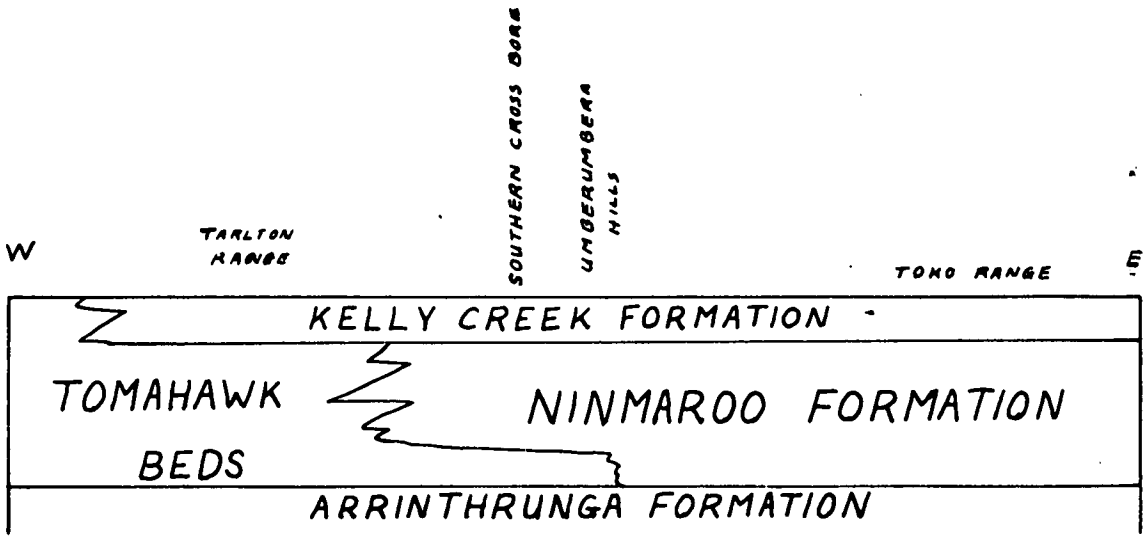
Many of the sandstone outcrops have now been examined in more detail in an attempt to determine their stratigraphic position and their relation to the Tomahawk beds and the Ninmaroo Formation. It is now clear that much of the confusion was due to varying lateritic effects on the interbedded lithologies of the two units: sandstone, carbonate rocks and siltstone.

The effects of lateritisation in any outcrop depend upon the proportion of each lithology present, the degree of purity and the extent to which lateritisation has progressed. These effects may be summarised as follows:

(a) Carbonate Rocks. Leaching until only the residual impurities remain; these are then ferruginised and silicified. As the carbonate rocks are seldom pure and are characterised by marked lateral variations, especially in the central and western parts of the area, this results in very irregular end-products. In particular the volume of material leached is very variable, and overlying beds collapse

Fig. 3

# DIAGRAMATIC SECTION THROUGH UPPER CAMBRIAN & LOWER ORDOVICIAN ROCK UNITS



into the resultant cavities, giving rise to very marked and often large scale collapse structures. These collapse structures are very common in the areas where interbedding of carbonates and clastics is best developed, and in which lateritisation is well advanced.

(b) Sandstone. Lateritisation only slightly alters a pure sandstone, but some ferruginisation and silicification occurs. Clay and carbonate matrix are subject to strong leaching and may be completely removed. The inherent strength of the rock is maintained, although some of the beds have not always been rigid as shown by smooth rolls into lateritic collapse structures, but most are sharply folded and fractured along crests. When silicified, sandstone may form very resistant beds which protect underlying soft lateritic products from all except lateral erosion. This gives rise to the sharp bluffs and cliffs which are so characteristic of the lateritised areas.

(c) Siltstone/shale. Alteration proceeds by leaching, ferruginisation and silicification. They evidently retain their plasticity far more than sandstone beds, for in lateritic collapse structures they often show large smooth rolls. Some of the lutites were probably dolomitic or limey. The fresh rocks are seldom exposed, but after hardening by alteration they have sufficient strength to remain as sharp cliffs when protected by a sandstone cap.

In general lateritisation results in (a) removal of carbonates, (b) exposure of lutites by hardening, but with some volume reduction by leaching (c) hardening of sandstone and (d) increase in proportion of sandstone by reduction of other lithologies.

The increase in proportion of sandstone by lateritisation was primarily responsible for the confusion caused by the numerous sandstone outcrops. It must be emphasised that the effects described above only occur where the lithologies are mixed. Although it was reported (Smith & Vine, 1960 p.15) that east of the Tarlton Range the equivalent of the whole of the Ninmaroo Formation appeared to have a sandstone lithology, it is now evident that much carbonate rock is present, but nevertheless sandstone ~~was~~ is still the major rock type.

It is now possible to establish the broad relationship of the Ninmaroo Formation with the Tomahawk Beds. This is a facies variation: gradation from carbonate rocks and siltstone with some sandstone, to sandstone and siltstone with some carbonate rocks. Local facies changes have already been reported (loc. cit. p.15); many of the small sandstone bodies scattered throughout the area probably represent such local changes or even the limits of various larger tongues.

A boundary between the two units has been drawn on the map; this is essentially a broad division between a fossiliferous, sandy formation on the west, and a less fossiliferous carbonate formation on the east. The mapping has shown that this is not a simple lateral change: many tongues and members are certainly present, the most obvious being the sandy unit in the vicinity of Southern Cross Bore (Smith & Vine, 1960 p.15). This is well enough exposed to be mapped as a basal

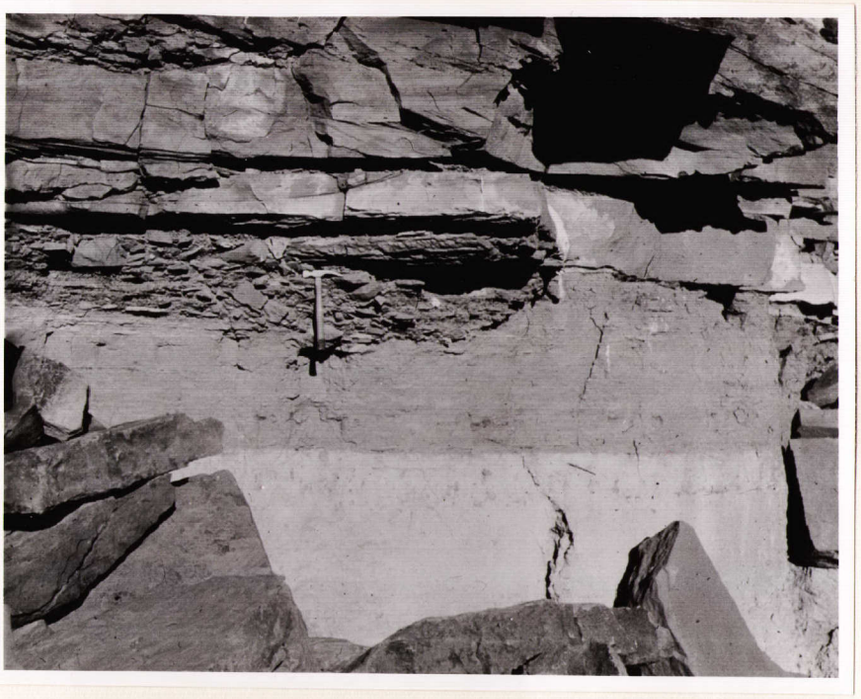


Photo 1 Disconformity between siltstone of the Nora Formation (below) and Carlo Sandstone (above), with scour channel at junction. The Pinnacles, Tarlton Range.

Photo 2 Disconformity between Nora Formation and Carlo Sandstone - detail. Shows scour breccia, and flute casts in overlying sandstone bed.

tongue. Exposures are not good enough to delineate others from the present reconnaissance mapping, although an area of carbonate rocks west of the floodout of Algamba Creek possibly forms a tongue of Ninmaroo Formation, with Tomahawk beds above and below. It has not been plotted as such as the margins are not sufficiently well exposed for its continuity with the mapped limits of the Ninmaroo Formation to be established at this stage.

The relationship of the Tomahawk Beds to the Ninmaroo Formation is shown diagramatically in Fig. 3.

Kelly Creek Formation.

The effects of lateritisation similarly complicated the mapping of the Kelly Creek Formation, which is also a sandstone/siltstone unit with some carbonate rocks. Around the Toko and most of the Tarlton Ranges where exposures are generally fairly good, the formation is well defined and easily mapped. On the north of the Tarlton Range, however, lateritisation has obscured the boundary between the formation and the underlying Tomahawk Beds. Insofar as this is, in any case, a gradational boundary between two very similar units, it becomes almost completely obscured by lateritisation. While attempting to unravel the effects of lateritisation in this area several less weathered localities were found which give a control for placing the boundary, enabling it to be interpolated topographically through the badly altered hills, as the observed dips were everywhere low.

North-west of the Tarlton Range exposures are once more poor, and it is impossible to distinguish the Kelly Creek lithologies from those in the Tomahawk Beds in small outcrops. Further west, in the Huckitta area, the Tomahawk Beds are the time equivalents of both the Ninmaroo and Kelly Creek Formations of the Tobermory area. North-west of the Tarlton Range, therefore, where rocks of Kelly Creek age can no longer be divided lithologically from ones in the Tomahawk Beds, they are included in the Tomahawk Beds. This relationship is shown in Fig. 3.

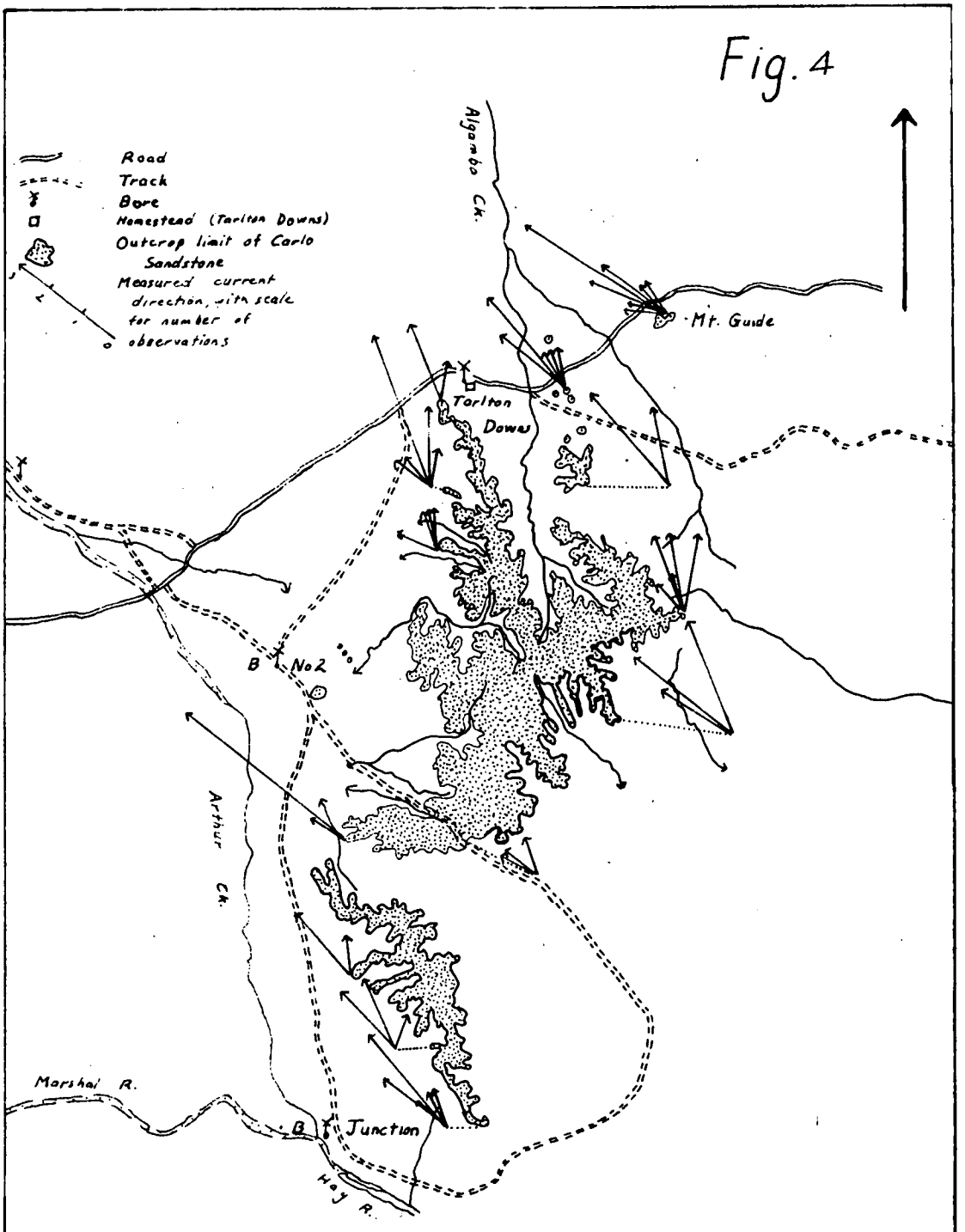
MIDDLE ORDOVICIAN

Carlo Sandstone

On the most northerly of the Pinnacles (Tarlton Range) the contact between the Nora Formation and the Carlo Sandstone was found (Photos 1&2). Here the Nora Formation consists of massive siltstone, disconformably overlain by pale brown sandstone with well developed flute casts. At the contact is what appears to be a scour channel cut into the Nora siltstone and filled with an angular breccia, composed mainly of sandstone lithologically similar to Carlo Sandstone. Although this may represent a period of emergence and erosion an alternative explanation is possible: the Carlo Sandstone marks the advent of shallow water, current swept, shelf conditions; such currents would be quite sufficient to cause local scouring of the underlying soft muds, and even scouring and redistribution of the first few sandstone beds laid down.

A detailed search was made on the Tarlton Range for exposures of the Carlo Sandstone with current indicators in situ. Despite the apparent resistance of the rock it seldom outcrops well, and normally forms a rubbly rim to the range, cloaking the slopes below with scree. However sufficient exposures were found

Fig. 4




# Current Direction Measurements in Carlo Sandstone - Tarlton Range

to give a reliable indication of the general current direction during the time of deposition of the formation. The directions measured at each locality are shown on Fig. 4. Fig. 5. is a composite rose diagram of all the measurements. It shows clearly that the currents came from the south-east, although they varied locally through a complete quadrant. The measurements are of festoon bedding and lamination, flute casts, current ripple marks and current lineations.

A complete section, 120 feet thick, was measured in the Carlo Sandstone on the Tarlton Range, six miles south of Tarlton Downs Homestead. Most of the section (110 feet) has only rubbly outcrop of fine to medium-grained rounded, well sorted, friable sandstone, thin bedded and laminated; some benches 2 to 5 feet thick are present of a similar but harder sandstone, with well developed festoon bedding, some mud pellets, ripple marks and flute casts. A little rubble of felspathic sandstone and ferruginised siltstone was also seen. It is overlain with apparent conformity by siltstone of the Mithaka Formation. The underlying Nora Formation is concealed.

Mithaka Formation

More fossils, including trilobites and brachiopods, were collected from the Mithaka Formation on the Tarlton Range six miles south of Tarlton Downs Homestead. The sequence is of siltstone with a few sandy laminae; it is strongly lateritised and is about 60 feet thick.

?TRIASSIC

Tarlton Formation.

The fossil locality 4 miles north of the type section and 7 miles south of Tarlton Downs Homestead was recollected. This later collection has been examined by Mary White (1961); she reported the presence of Linguifolium denmeadi, Dicroidium odontopteroides, Elatocladus sp., and several poorly determinable fragments and impressions. She concludes that although the preservation of the impressions is unsatisfactory (apart from Linguifolium denmeadi), the weight of evidence seems to indicate Triassic or Lower Jurassic age.

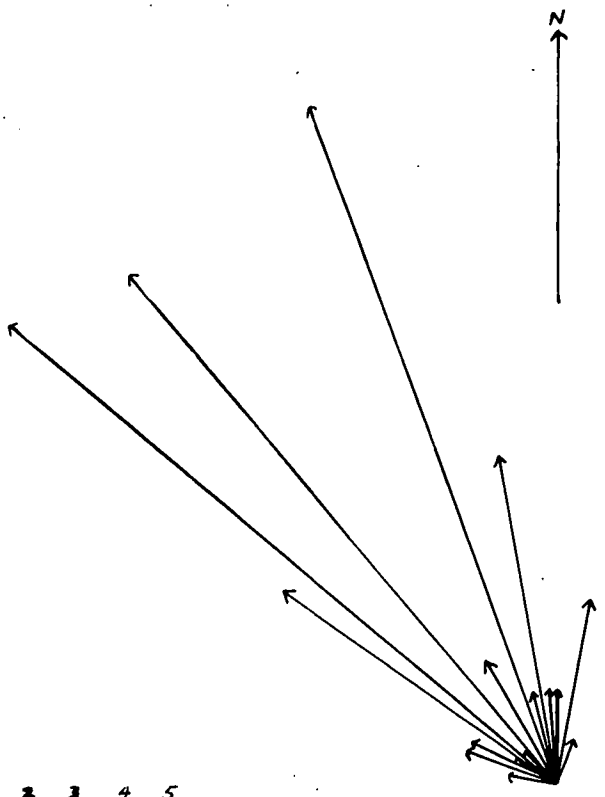
This age is not in accord with a Permian glacial origin postulated by Condon & Smith (1959). A glacial origin and therefore a Permian age, is based on the single occurrence of a thin, presumed ground moraine at the type locality, succeeded by fluviatile sandstone and siltstone, and by the presence of striated cobbles.

JOINTING

Field measurements were made of joints, where observed, during the 1959 field season. These have now been supplemented by a systematic photo-interpretation of the joint patterns on the Tobermory Sheet, and the results have been compiled onto the amended map.

A well defined joint pattern has emerged. The dominant directions are $60^{\circ}$ (parallel to the cross faults of the Toko Range) and $300^{\circ}$. A subsidiary direction of $90^{\circ}$ is also apparent, but this is usually more easily seen on the ground than on the photos. No appreciable movement is evident on any of these joints.

Fig. 5




Scale: 0 1 2 3 4 5
readings

# Summary of Current Direction Measurements in Carlo Sandstone Tarlton Range

The joint pattern is best developed in dolomites of the Ninmaroo Formation, but can also be traced unchanged into carbonates of the Tomahawk Beds and the Kelly Creek Formation. It is best seen in flat-lying beds.

Underground Water.

During 1960, four new bores were drilled on the Tobermory four-mile Sheet and all were successful. Three of these sites were selected by the field party, and one by D.R.G. Woolley who was a member of this party in 1959. All available bore data have been collected and are listed below for each pastoral property on the Tobermory four-mile Sheet.

Abbreviations used in the bore records are:-

| | |
|---|---|
| alt. | = alternating |
| baro. | = heights calculated from barometric readings |
| calc. | = calcareous |
| camb. | = Cambrian |
| carb. | = carbonaceous |
| congl. | = conglomerate |
| dol. | = dolomitic |
| dolom. | = dolomite |
| f. | = fine |
| gr. | = grained |
| gran. | = granular |
| hrd. | = hard |
| level. | = levelled by Dept. of Interior surveyors |
| lst. | = limestone |
| m. | = medium |
| mst. | = mudstone |
| qtz. | = quartz |
| silic. | = siliceous |
| sltst. | = siltstone |
| sst. | = sandstone |
| w. | = with |
| v. | = very |
| x/lline. | = crystalline |

(a) Marqua Station.

| | Homestead No.2. | Southern Cross | | No.3.(Dud) | 6 Mile |
|---|---|---|---|---|---|
| Location | At Homestead | 16m.NW | 11mWSW | 5½m W | 5mNNE |
| Altitude | 755(Baro) | 840(Baro) | | | |
| Water Struck at | | 280' | 1)170' 2)435-444 | | |
| Pump Depth | | | | | |
| Standing Water level | | | | | |
| Total depth | 86' | 290' | 444' | 375' | |
| Supply | 1400 | 2000 | 1)240 2)1440+ | | |
| Quality | brackish | Stock | | | |
| Driller | | D.Shepley | | | |
| Strata | limestone | see below | see below | No data | No data |
| Analyses | no data | no data | no data | No data | No data |

Strata:

Southern Cross: pale brown dolomite w. some sandy beds

11m.WSW : 0-175' ?Tarlton F. 175-444' Arrinthrunga F.
Aquifer a glauconitic sandy dolomite.

| | Shepleys | McGuiness | Black Tank | Dud | Old Marqua |
|---|---|---|---|---|---|
| Location | 12m NE | 18m NE | 8m ESE | 13mWNW | 9½m ESE |
| Altitude | | | | | 710'(Baro) |
| Water Struck at | | | | | |
| Pump Depth | | 270' | | | |
| Standing Water level | | 220' | | | |
| Total depth | | 505' | | 238' | 37' |
| Supply | 1500 | 500 | | | |
| Quality | | Drinking | Drinking | | |
| Driller | D.Shepley | | | W.Bohning | |
| Strata | see below | see below | no data | see below | limestone |
| Analyses | no data | no data | no data | no data | no data |

Strata:

Shepleys: Much green mica silt with dolomite. Some S.S.

McGuiness: 0-15' soil etc. 15-105' cream fine porous ss. 105-115' blue shale, 115-180' calc shales, lst, some s.s. 180-190' blue lst some s.s. 190'-250' cream sugary lst. 250-275' cream sugary lst and blue lst. 275-280' blue lst. 280-300' cream lst, some blue lst 300-315' cream lst, 315-350' brown grey lst., 350-375' cream sandy lst, 375-440' white and cream lst. 440-450' white lst, ?dolomite 450-474' cream brown lst. 475-505' brown blue lst.

Dud 13m.WNW: 0-40' soil; 40-175' lst., 175 - 238' blue shales.

| | Dud | Christmas Ck. (Dud) | Red Heart (Dud) | Desert | Store (Dud) | Dud |
|---|---|---|---|---|---|---|
| Location | 8m ENE | 17mESE | 11m SE | 26m S | 12m N | 3½ W |
| Altitude | | | | | 800(Baro) | |
| Water Struck at | 200' | 130' | | | 200' | |
| Pump Depth | | | | | 270 | |
| Standing Water level | | | 60' | | | |
| Total Depth | 550' | 600' | 70' | 142' | 600' | |
| Supply | 50 | nil | init. 1250 now nil | 500 | 450 | |
| Quality | | | good drinking | 6583 | | |
| Driller | | D. Shepley | W. Bohning | | | |
| Strata | lst. and blue shale | Marqua lst. | see below | see below | see below | No data |
| Analyses | no data | no data | no data | no data | no data | no data |

Strata:

Red Heart: 0-2' soil; 2'-61' s.s.; 61-70' blue shale (Field R. Beds).

Desert: 0-112' lst; s.s. all moderately metamorphosed; 112-115' buck qtz. 115'-120' water on top of hard blue slates. 120-140' purple & blue micaceous shales 140-142' quartzite.

Store: Blue laminated micaceous sltst. blue lst, dolomite, hard sst in bore drain.

(b) Manners Creek Station.

| | Homestead | Coles | Cloughs | McCraes | West End |
|---|---|---|---|---|---|
| Location | Homestead | 37WSW | 39 W | 33WNW | 24 W |
| Altitude | 655 (Baro) | | 645(Baro) | 635(Baro) | |
| Water Struck at | 300' | | 190-202' | 610' | 123',142',270' 326 |
| Pump Depth | ca 300' | 190' | | | 178' |
| Standing Water level | | 170' | 194' | 290' | 125' |
| Total Depth | 430' | 215' | 215' 220' | 613' | 335' |
| Supply | 480' | 2800 | 1540 + | 1200 | 1800 |
| Quality | 1,609 | 4612 | 1975 | 1807 | 3832 |
| Driller | | S.Cole | | | W.Fell |
| Strata | limestone | see below | see below | see below | see below |
| Analyses | no data | no data | no data | no data | no data |

Strata:

Coles: 0-2' red soil; 2-45' lst.boulders; 45-135' clay; 135'-150' white lst.

Cloughs: 0-30' soil, boulders of lst.etc. 30-190' s.s. and thin lst. bands 190-202' cave, water in S.st. 202-220' lst. and blue shales and msts.

McCraes: 0-20' lst; 20-456' blue shales; 456-470' f.g. grey lst., 470-505' cherty grey & white lst.; 505-518' white chert after lst; 518-552' grey chert after lst; 552-575' white cherty lst.; 572-598' grey calc. shale 598-613' grey calc shale w.lst.

| | Fells | Dummy (Dud) | No.3 Site | No. 5. | No.6. | |
|---|---|---|---|---|---|---|
| Location | 4m.NE | 33WSW | | 36 SW | 52 SW | 63SW |
| Altitude | 710(Baro) | | | | 690' (level) | |
| Water Struck at | | | 208' | | | 300' |
| Pump Depth | | | | | 290' | |
| Standing Water level | | | | | | |
| Total Depth | 182' | 516' | 452' | | 300' | 300 |
| Supply | 1400 + | 5 | small | 900 | 600 | 1000 |
| Quality | | | | | 2123 | |
| Driller | | | | | | |
| Strata | No data | see below | see below | no data | no data | |
| Analyses | No data | no data | no data | no data | no data | |

Strata:

Dummy: 0-130' sst w a few lsts. 130-135' decomposed sst; 135-455' alt. lst and shls.

No.3 Site: 0-5' clay loam w msts. and calc.gvl. 5-52' ferrig. sandy mst. 52-96' f.g. buff & white lst. 96-107' calc.shl. & dolomite 107-138' grey sandy mst & dolomite; 138-202' f.g. grey mst; 202-272' hard ✗/lline silic.lst.; 272-276' f.g. white calc. s.s.; 276-321' f.g. grey dolomite; 321-364' dark grey mst.; 364-370' light grey s.st & grey shale 370-379' grey shales, 379 grey shales 380' purple & grey shales; 380-435 f.g. grey & blue shale w.white dolomite 435-452' silic.grey lst.

(c) Tarlton Downs Station.

| | Homestead No. 1. | No. 2. | Canyon | Lucky (Dud) | Beantree (Dud) |
|---|---|---|---|---|---|
| Location + | Homestead Bore | 8mls.SW | 17 mls.SSW | 18mls SSE | 12 mls.SSE |
| Altitude | 928' (levelled) | 840' | | 890' | |
| Water Struck at | 60' bottom | 1) 40' 2) 280' | 133' | | |
| Pump Depth | 380' | | | | |
| Standing Water Level | | | | | |
| Total Depth | 406' | 280' | 330' | 1) 40' 2) 100' | 1) 330' 2) 565' |
| Supply (g.p.h.) | 1,000 | "good" | 400 | init. 3,000 now almost nil. | nil |
| Quality (p.p.m)* | 3,762 | 1) "salt 2) 3,228 | "salty" (stock) | | |
| Driller | | S.Cole | | S.Hayes | Deepened by Robinson |
| Strata | Kelly Creek Formation see below | Nora/Kelly Ck. Fm. see below | no data | Tomahawk Beds | see below |
| Analyses | see below | see below | no data | no data | none |

* Dissolved solids in parts per million

+ direct distance from homestead, in miles.

Strata: Homestead No.1: 0-60' hard lst; 60'-406' grey,white soft drilling
No. 2. : 0-8' red soil; 8-70' red clay. Nora and Kelly Creek Formations.

Beantree: 0-60' soil & gvl.; 60'-140' grey,f.gr.lst & little black carb. lst.w shales; 140-160' increase in clay, -shale & mst w. 1-2" hrd., white lst bands rapidly alternating; 160-240' clay & lst. beds; 240-350' thin bands hrd. white lst. in mst. & shls. 10' sandylst. at 340'( Through Kelly Ck. F. into Tomahawk Beds;mainly silty - K.G.S.)

Analyses (p.p.m.) Homestead No.1.
(Jan. 1954) $Cl_2$ : 1562 Na : 10 5
$SO_4$ : 401 K : 145
$F_2$ : 1.86 Mg : 94
Ca : 58 (Fe,Si,$Al_2O_5$:5.
$HCO_3$ : 450

No.2.(Dec.1951)
(hypothetical compounds).

$CaCO_3$ : 457
$MgHCO_3$ : 85
$MgSO_4$ : 285
$Na_2SO_4$ : 171
NaCl : 2228

| | Mulga | Algamba | Dud No.1. | Dud No.2. | Junction | un-named |
|---|---|---|---|---|---|---|
| Location | 16m.SE | 7m.N. | | | 18m.SSW | 14m. E. |
| Altitude | | | | | | 800' |
| Water Struck at | 1)250' 2)400' | | | | | 333' |
| Pump Depth | | 240' | | | | 340' |
| Standing water level | | | | | 85' | |
| Total Depth | 400' | 280' | 220' | 270' | 100' | 360' |
| Supply (g.p.h.) | 1)250 2)600 | 1,600 | nil | nil | 1,200 | 600 |
| Quality (p.p.m.) | | | | | 568 | |
| Driller | C.G. McIntyre | Robinson | | | ~~Catley~~ | C.G. McIntyre |
| Strata | see below | no data | see below | see below | see below | see below |
| Analyses | no data | no data | none | none | see below | No data |

Strata

Mulga: 0-250' shale; 250-400' lst. (Not yet available - through Tomahawk Beds into Arrinthrunga Formation. )

Dud No.1: 0-10' loam; 10-35' travertine; 35-185' clay & gvl.; 186-220' micaceous clay & gvl.

Dud No.2.: pure white f.gr. lst. throughout.

Junction: s.st. & feldsp. s.st. (probably Tarlton F- K.G.S.)

Un-named: 0-186' f.gr. X/lline dolomite pale grey lst; 186'-190' f.gr. pale grey X/lline lst.; & olive green calc. sltst.; 190'-240' f.gr. grey X/lline dolomite; 240-250 f. gr. X/lline dolomite & grey clay; 250-260' f.-m.gr. & oolitic X/lline dolomite; 260-270' f.gr. pale grey dolomite; 270-290' m.gr. grey dolomite & f.gr. white dolomite; 290-295' white f.gr. dolomite & grey f.gr. dolomitic lst.: 295-300' f.gr. grey dolomite & grey clay 300' f.gr. white & grey dolomite 300-305' v.f.gr. pale grey dolomite; 305'-310' f.gr. dark grey dolomite; 310-315' f.gr. dark grey dolomite; 315-325' f.gr. pale grey dolomite; 325-330' f.gr. pale grey dolomite & some cream calc. sltst.; 330-336' dark grey micaceous & dolomitic slt.st.; 336'-340' dark grey dolomitic sltst. & f.gr. grey dolomite; 340'-345' f.gr. x/lline grey dolomite; 353-360' pale grey clayey sltst.

Analyses for Junction Bore:-

| | |
|---|---|
| Cl | : 25 |
| $SO_4$ | : 16 |
| $F^4$ | : 0.23 |
| $HCO^2_3$ | : 411 |
| $CO^3$ | : 0 |
| $Na^3$ | : 45 |
| K | : 4 |
| Mg | : 40 |
| $NO_3$ | : 15.5 |

(d) Tobermory Station.

| | No.1. | No2. | No. 3. | No. 4. | No. 7. | No. 8. |
|---|---|---|---|---|---|---|
| Location | 8m.N. | 11m.S. | 20m.WSW | 13m.WNW | 22m.SW. | 36m.SSW |
| Altitude | 655' | | 586' (level) | 650' (baro) | 638' (level) | 804' (level) |
| Water Struck at | 1) 96' 2)300' | 1)128' 2)151' | | 1)190' 2)140 + | | |
| Pump Depth | Cal50' | 152' | 185 | 154' | 153' | |
| Standing water level | | | | | | |
| Total Depth | 330' | 162' | 214' | 177' | 160' | 204' |
| Supply (g.p.h.) | 1)400 2)1800 | 1)small 2)1600 | init:900 1958:300 | 1)small 2)good | "unlimited" | |
| Quality | | 2169 | "warm sodary" | "sodary" | | 15,102 |
| Driller | | | | | | |
| Strata | see below | see below | no data | no data | no data | see below |
| Analyses | no data | no data | "mg salts" | no data | no data | see below |

Strata:

No.1.: 0-5' surface clay; 5-7' broken rock; 7-20' grey rock; 20-23' white rock (with soft seams 3-4") 23-58' grey rock; 59' yellow clay; 59-65' yellow rock; 65-75' white rock with soft seam @ 72; 75-78' grey rock; 78-85' yellow rock; 85-97' yellow clay & sand; 97-100' soft yellow rock; 100-107' hard white rock; 107-122' grey rock with soft seam at 121'; 122-129' soft white porous rock; 129-138' yellow rock; 139' soft yellow s.st. & clay; 139-149' white rock; 149-158' hard white lst.; 158-168' dark blue lst.; 168-279' dark blue lst. 1' cave at 169'; 279-285' yellow rock; 285-290' green rock; 290- 320' blue lst.: 330' yellow porous rock.

No.2.: 0-5' surface clay; 5-16' red s.st.; 16'-43' yellow clay & sand; 43-70' brown clay & sand; 70-151' yellow clay & sand; 151-162' hard rock. Cave at 153'.

No.8.: White calc. siltst. w. chips of hard m.gr. gran.lst. in bore drain

Analyses No. 8.

$Ca\ Mg\ HCO_3$ : 585
$Ca\ Mg\ SO_4$ : 3,672
$Na_2SO_4$ : 743
$Na\ Cl$ : 10,026

| | Goatyard No. 9. | Homestead No.10. | No. 11 | Boomerang No.12. | No.13 (Dud) |
|---|---|---|---|---|---|
| Location | 6½m.WSW | at Homstead | | 16.m.SW | 21m W.N.W. |
| Altitude | 561 (level) | 552 (level) | 650 (baro) | 600 (level) | 710 (baro) |
| Water Struck at | | | 140' | 120' | |
| Pump Depth | | 46' | 190' | 138' | |
| Standing Water level | 45-48' | | | 120' | |
| Total Depth | 79' | 60' | 204' | 147' | 337' |
| Supply | 700 | 800 | 1,200 | 2,000 | nil |
| Quality | "drinking" | 2123 | 3,150 | 3,426 | |
| Driller | | | | | |
| Strata | fine white sand | no data | no data | no data | see below |
| Analyses | no data | no data | no data | no data | no data |

Strata No.13: Calc. silty sand, chips of white lst. and some quartzite in bore drain.

| | No. 14. | No. 15. (Dud) | No. 16 (Dud) | No. 21 | Indeca No. 22. |
|---|---|---|---|---|---|
| Location | | | | | 14 WSW |
| Altitude | | | | | 572' |
| Water Struck at | | | | | |
| Pump Depth | 41' | 146' | | 86' | 126' |
| Standing Water Level | | | | | |
| Total Depth | 50' | 160' | 200' | 103' | 132' |
| Supply | | | nil | | 700 |
| Quality | | "poisonous" | | | |
| Driller | | | | | |
| Strata | no data | no data | no data | | |
| Analyses | no data | no data | no data | | |

| | Mungala No.23 | Wests No.24 | Blue Bush No. 25. | Shepley's or Lucerne No.26. |
|---|---|---|---|---|
| Location | 12m.SW | 15m.SSW | 11m.WSW | 6m.NW. |
| Altitude | 578' | | 567' (level) | |
| Water Struck at | 100' | 158' | | |
| Pump Depth | 155' | 152' | | |
| Standing Water Level | | 40' | | |
| Total Depth | 177' | 169½' | 112' | 124' |
| Supply | 1,600 | 1440 + | 2,000 | |
| Quality | | | | |
| Driller | | D.Shepley | D.Shepley | |
| Strata | m.gr.qtz s.st. | see below | no data | no data |
| Analyses | no data | no data | no data | no data |

Strata: No.24, Wests

0-50' soil; 50-169' f.gr. micaceous s.st. Bore drain - f.gr. fawn mica. s.st. w. some coarse qtz. & chert grains.

| | Mistake No.27 | No. 28 | No. 29 | Kelly's Creek | Burnt Well |
|---|---|---|---|---|---|
| Location | 23m. SSW | | | 22m. S. | 48m. S. |
| Altitude | | | | | |
| Water Struck at | 356' | | | 163 | |
| Pump Depth | 330' | | | 168 | |
| Standing Water Level | | | | 163 | 160' |
| Total Depth | 368' | 141 | 134 | 200 | 170 |
| Supply | 800 | | | 750 | good |
| Quality | | | "v.salty" | "good" | drinking |
| Driller | | | | | |
| Strata | no data | no data | no data | see below | see below |
| Analyses | no data | no data | no data | no data | no data |

Strata:

Kelly's Creek: 0-4' surface soil; 4-73' lst. boulders; 73-130' white lst.; 190-200' blue clay.

Burnt Well: f.g.qtz.ss. thin bedded & flaggy w. trilobite tracks.

Dud

| | |
|---|---|
| Location | 29 SW |
| Altitude | |
| Water Struck at | 140' |
| Pump depth | |
| Standing Water level | |
| Total Depth | 300' |
| Supply | 200 |
| Quality | |
| Driller | |
| Strata | slt.st. & clay |
| Analyses | no data |

(e) Government Bores.

Stock Route No. 3. Tarlton

Location 11½ WNW

Altitude 895'

Water Struck at

Pump depth 360'

Standing Water level

Total depth 500'

Supply

Quality Poor, sweet and salty

Driller

Strata see below

Analyses no data

Strata:

No. 3. Tarlton : Red clay, quartz, brown ss. brown grey shale - non calc..

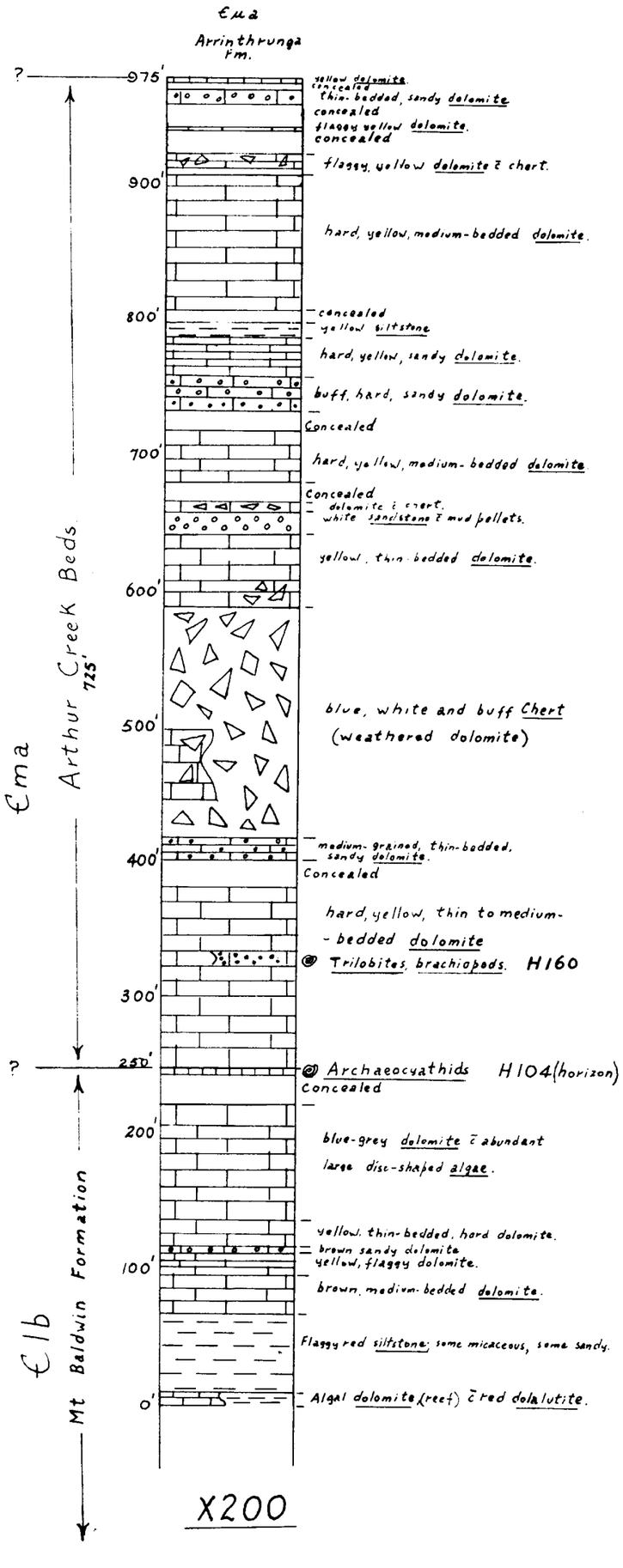
# Fig 6.

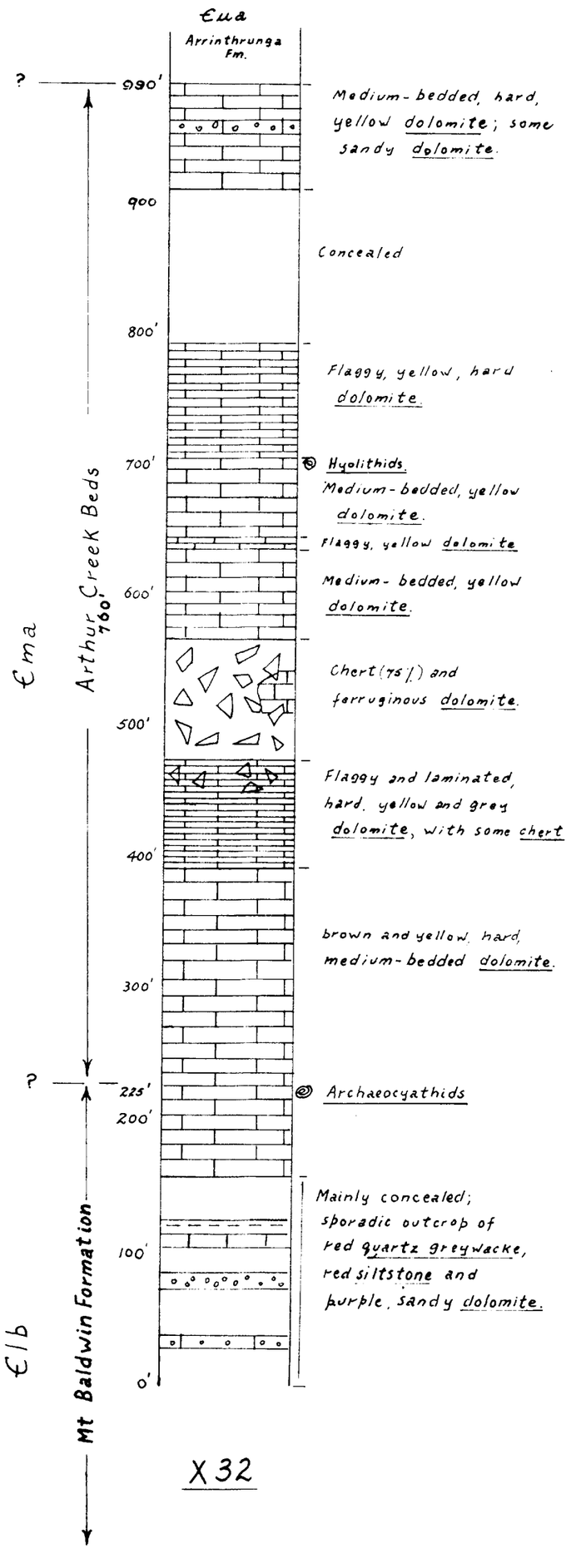
## Sections in the Arthur Creek Beds and the top of the Mt. Baldwin Fm.

1960

Vertical Scale:

Feet 100 50 0 100 200 Feet



3 HUCKITTA 4-MILE SHEET

Work on this Sheet was directed mainly towards solving problems in Cambrian sediments. One new fossil horizon was located in the Middle Cambrian Arthur Creek Beds, and three horizons (the first) in the Upper Cambrian Arrinthrunga Formation. In addition, some work was done in Cambro-Ordovician and Devonian sediments.

(a) CAMBRIAN.

In the area west and south-west of Huckitta Homestead, the Mount Baldwin Formation, the Arthur Creek Beds and the Arrinthrunga Formation were examined. In this area, formation boundaries are indistinct, and the lithology of the sparsely-fossiliferous Arthur Creek Beds differs from its normal and richly-fossiliferous type exposed in the eastern part of the Huckitta Sheet. This difference had been reported previously (Smith et al, 1960, loc.cit.). In the area west and south-west of Huckitta, the Arthur Creek Beds consist of dolomite, chert, limestone, soft dolomites and soft sandstone, which overlies red siltstone, red greywacke and dolomite with archaeocyathids (Sample No.H104) which are placed in the Mount Baldwin Formation. The archaeocyathids are of Lower Cambrian age (Joyce Gilbert-Tomlinson, pers. comm.) and can be traced for about 30 miles. In 1960, trilobites and brachiopods (Sample No.H160) were found 85ft stratigraphically above the archaeocyathid-bearing beds (refer Section X200, Fig. 6) but their age has not yet been determined; however they were collected within about 10 feet stratigraphically, of the beds containing sample No. H22 which Casey and Tomlinson (1956) regarded provisionally as upper Middle Cambrian. In younger beds of the sequence, the only fossil found is one specimen of a hyolithid (refer Section X32, Fig.6).

No unconformity or disconformity can be found between Samples H104 and H160; if any break occurs, it is between dolomite and dolomite - and only the accurate ages of the two fossil horizons will reveal any time break. At present, the boundary between the Mount Baldwin Formation and the Arthur Creek Beds to the west and south-west of Huckitta, is placed at the top of the archaeocyathid - bearing beds.

The boundary between the Arthur Creek Beds and the overlying Arrinthrunga Formation is also indefinite in the Huckitta area. Again, it is a boundary between dolomite and dolomite, and no fossils have been found near the postulated boundary. For convenience the boundary is placed between two mappable units of dolomite; the lower one is yellow dolomite and the upper one (in the Arrinthrunga Formation) is a sequence of blue-grey and purple dolomite with thin interbeds of soft yellow siltstone; although this boundary may be in error by about 400 feet stratigraphically, field mapping has failed to reveal any better place for it and there are no evident breaks in the whole sequence.

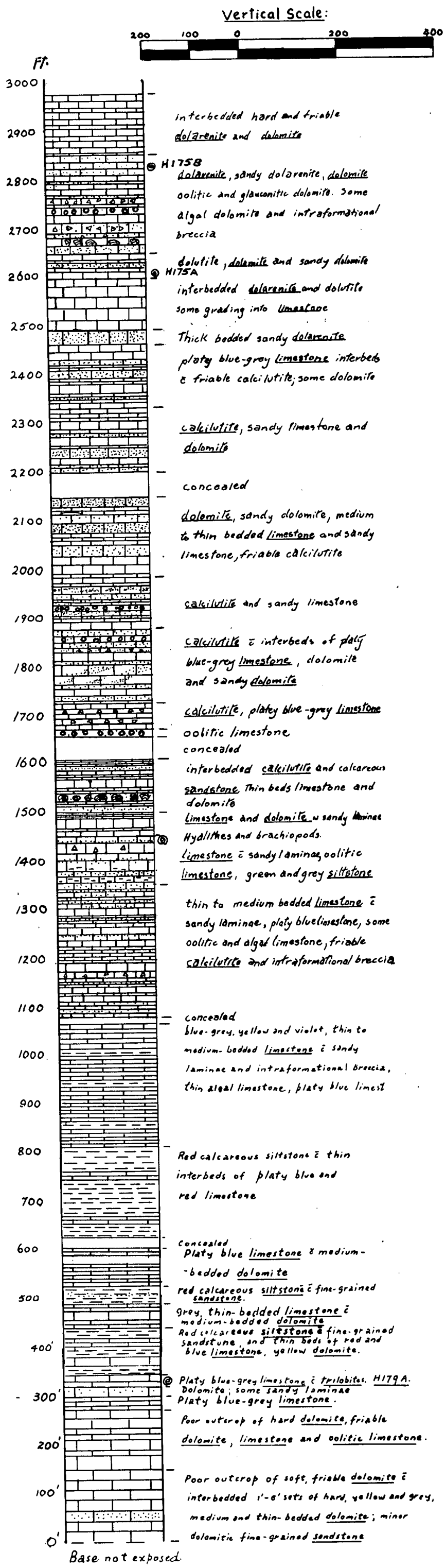
The lithologies and thickness of two sections measured in the Arthur Creek Beds are shown on Fig. 6.

No ~~further~~ outcrops of either the Arthur Creek beds or the Arrinthrunga Formation are known past a point about 8 miles north-west of Huckitta Homestead.

# Fig 8.

## Section X 91

## Arrinthrunga Formation



The Grant Bluff Formation, and in places the Mount Baldwin Formation, are exposed, but between them and the Tomahawk Beds (about 4 miles) in the foothills of the Dulcie Range, only scattered inliers of Tertiary sediments crop out. This area of concealed rocks was re-examined in 1961, but no outcrops of Palaeozoic rocks were located. The examination was extended westwards onto the adjoining Alcoota 4-mile Sheet, with a similar result.

During 1960, lower Upper Cambrian trilobites (A.A.Opik pers. comm.) were discovered (at H179A, Fig.8.) in sediments previously mapped as Arthur Creek Beds; therefore a revision of the Arthur Creek Beds - Arrinthrunga Formation boundary became necessary. In addition, some previous structural mapping was checked and found incorrect. The result of remapping and boundary shift changed the thickness of the Arrinthrunga Formation from 1000ft to about 3000ft. In the eastern part of the Huckitta 4-mile Sheet a thick sequence of carbonate rocks of the Arrinthrunga Formation dip west and south-west towards the Dulcie Range over a distance of 20 miles. Poor exposure and low dips prevent the accurate measurement of the formation in this area. To the west of Huckitta Homestead, the formation is thick but structural complexities prevent reliable measurement. However, about six miles south-south-east of Huckitta Homestead (Refer Fig. 7.) 3000 feet of section has been measured (Fig. 8.). This section is a composite one, compiled from parts of three measured sections; the base is not exposed.

The lithology shown in the section (Fig.8.) differs in part from the lithology of the Arrinthrunga Formation in the eastern and north-eastern part of the Huckitta 4-mile Sheet, wherefour broad units are recognised. These are, in descending order:

(4) hard brown dolomite, thin quartz sandstone, quartz sandstone grading laterally to dolomite, green siltstone and soft, buff fine-grained dolomite;

(3) quartz sandstone with ripple marks and halite pseudomorphs - the Eurowie Sandstone Member (50-100ft);

(2) blue oolitic limestone, blue algal limestone, thin quartz sandstone, and numerous concealed beds (blue-grey siltstone has been obtained in several water bores)

(1) Hard brown dolomite, sandy dolomite.

The section on Fig. 8. does not contain unit (3), and the basal unit differs from unit (1). In the eastern and north-eastern part of the Sheet, there are numerous changes, along the strike, from limestone to dolomite; nevertheless, the broad pattern of units (1) to (4) is fairly easily recognised. During 1960, unit (4) and some areas mapped as unit (3) were remapped. This mapping showed that unit (4) contains several lenses of unfossiliferous quartz sandstone, in various stratigraphic positions, and that these do not belong to the Eurowie Sandstone Member. This has important structural implications in the location of a regional anticlinal axis in the Arrinthrunga Formation.

The boundary of the Arrinthrunga Formation with the Tomahawk Beds was examined in a number of localities. Usually

this boundary is in soft sediments, and therefore difficult to locate precisely. It is considered to be gradational in the central part of the Huckitta Sheet; in the north-east the boundary is faulted, and in the east, near Lucy Creek Homestead, it may be disconformable.

In the central area, two important fossil collections were made during 1960 at localitiesH184 and H192. The localities are about 5 miles south-south-east of Huckitta Homestead on the southern flank of a dome in the Arrinthrunga Formation, and are from ~~about~~ the same stratigraphic horizon about 350 feet below the top of the Arrinthrunga Formation. The beds containing H192 are overlain by about 350 feet of Arrinthrunga Formation, but those of H184 are overlain by poorly-outcropping quartz sandstone, siltstone and soft dolomite. There may be a disconformity above H184, but probably the dolomite lenses into softer beds which could cause some of the known discrepancies (J.Gilbert-Tomlinson, pers. comm.) in ages of Upper Cambrian fossils collected previously in the basal part of the Tomahawk Beds. A comparison of the ages of H184 and H192 with Upper Cambrian fossils from the Tomahawk Beds may assist in showing the cause of some age discrepancies.

To the east and south-east of Lucy Creek homestead the top unit (4) of the Arrinthrunga Formation is less than about 300 feet thick; this is about half its normal thickness and in this area the fossiliferous Tomahawk Beds may be disconformable on the Arrinthrunga Formation. But low dips and poor outcrop in this area prevents solving this relationship.

Traverses were made in the northern part of the Sheet, between the Bundey River and Ooratippra Creek, to search for any outcrop of the Arrinthrunga Formation in an area which is largely sand-covered. No outcrops of any formation were located but numerous thick stands of mulga trees indicate that much of the area may be underlain by the Upper Cambrian part of the Tomahawk Beds.

(b) CAMBRO-ORDOVICIAN

The Tomahawk Beds were examined in several localities to obtain additional collections of fossils and, if possible, to map the top part as a separate formation - this was done; the name Tomahawk Beds is now retained for the sequence of green siltstone, quartz sandstone, limestone and dolomite, of Upper Cambrian - Lower Ordovician age, which overlies the Arrinthrunga Formation; the sequence of green mudstone, green and red siltstone, oolitic iron beds, ferruginous sandstone, quartz sandstone and thin, dark brown dolomite, which succeeds the Tomahawk Beds and is overlain by the (Devonian) Dulcie Sandstone, will receive a new name. It is of Middle Ordovician age; its lithology and fauna are generally similar to the Nora Formation (which is exposed in the Tarlton, Toko and Toomba Ranges to the east) and that name will be extended to include the Middle Ordovician sediments on the Huckitta 4-mile Sheet. The boundary between the Tomahawk Beds and the Nora Formation is apparently conformable but it will not be known definitely until palaeontological studies are completed.

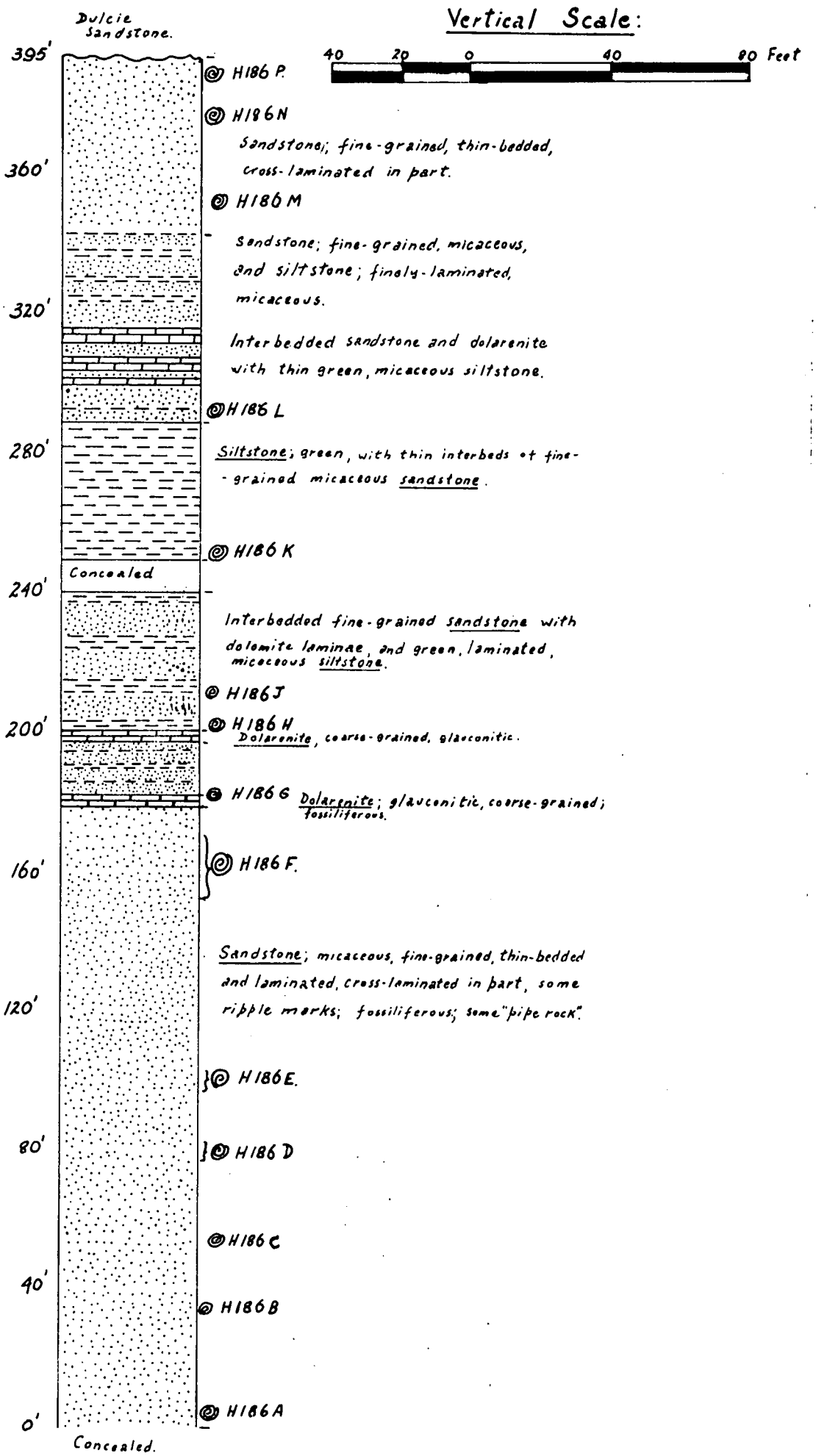
The Tomahawk Beds.

These crop out in the eastern and north-eastern part of the Huckitta 4-mile Sheet, and on the north-eastern and south-

# Fig 10.

## Section X 89,

## Tomahawk Beds.



western flanks of the Dulcie Range; on the north-eastern flank of the Dulcie Range the overlying Nora Formation has been completely eroded and the Tomahawk Beds are overlain unconformably by the Dulcie Sandstone.

The lithology of the Tomahawk Beds is generally that shown in the Reference Section (X30), measured previously (Smith et al, 1960, loc.cit) But to the west of the Bundey River outcrops of Tomahawk Beds on the south-western flank of the Dulcie Range are predominantly of quartz sandstone; there are very few beds of dolomite, and less of siltstone. Some badly-weathered dolomite beds were observed, but quartz sandstone forms at least 80% of the lithology. The Tomahawk Beds, or their equivalents, were observed to the west, on the adjoining Alcoota 4-mile Sheet; here, too, quartz sandstone predominates in the lithology.

One section (X89) was measured in the Tomahawk Beds, on the north-eastern flank of the Dulcie Range. The location is given in Fig. 9. and the section in Fig.10. An extensive collection of fossils was made from this section.

(c) MIDDLE ORDOVICIAN

The Nora Formation crops out only in the southern flank of the Dulcie Range. Its lithologies include some beds which may be suitable cap rocks to oil reservoirs, but in the Huckitta 4-mile Sheet much of the formation, and in places all of it, has been eroded prior to the deposition of the Dulcie Sandstone.

The maximum thickness of the Nora Formation in X30 (Smith et al, 1960 unpubl.) is about 400 feet. In many places on the south-western flank of the Dulcie Range, the formation is less than 100 feet thick; this thinning is due to erosion; lower beds of the formation include oolitic ironstone and ferruginous sandstone, which are easily recognised. In many places the upper beds of the Nora Formation are concealed by scree from the Dulcie Sandstone.

(d) DEVONIAN

One additional section, X93 (location on Figure 11) was measured in the Dulcie Sandstone. About 1690 feet was measured and fragments of fossil fish were obtained (Sample H183 B) from a bed 1640 feet above the base. The fossiliferous horizon is about 60 feet above a unit of white calcareous sandstone which also underlies the horizon where Upper Devonian placoderms (Sample H80 ) were obtained in 1958. They were described by Hills (1959).

Underground Water.

During the field season advice was given to Lucy Creek Station with regard to the deepening of No.9. Bore; deepening of the hole gave an additional 600 gallons per hour, pumped from a depth of 160 feet. Two additional sites were selected for this Station, but results of drilling are not yet available. The results from three new bores on Huckitta Station were recorded and all available data from bores drilled on the Huckitta four-mile Sheet have been collected. These data are listed for each pastoral property. Abbreviations used in the text are given on page 15.

(a) Dneiper Station.

| | Dud | Dud | Dud | Cackleberry |
|---|---|---|---|---|
| Location | 13½m.SSE | 12½m SSE | 13 m. SSE | 11m. E. 15½ S. |
| Altitude | | | | |
| Water struck at | 1)35' 2)50' 3)85' | | | Ca.50' |
| Pump depth | | | | |
| Standing Water level | | | | |
| Total Depth | 85' | 65' | 37' | 65' |
| Supply *(g.p.h.) | 700 | | | v.small |
| Quality | good | salt | salt | salty |
| Driller | C.G. McIntyre | C.G. McIntyre | C.G. McIntyre | C.G.McIntyre |
| Strata | clay and sand | | | |
| Analysis | | | | |

* gallons per hour

(b) Huckitta Station.

H = distance from old Huckitta Homestead.

RT = " " Red Tank Homestead.

| | Red Tank Homestead | Ilkyra (No.1) | | Bullock Paddock | | |
|---|---|---|---|---|---|---|
| Location | Homestd.R.T. | 25m. N -RT | 11m. WNW-RT | 11m W-RT | 11m.SW-RT | 5m.SW-H |
| Altitude | 1402 (level) | | | 1554 (level | | |
| Water Struck at | | | | 85' | | 1) 44' 2)188' |
| Pump Depth | | | | | | |
| Standing Water Level | 20' | | | | | |
| Total Depth | 60' | 240' | | 210' | 280' | 190' |
| Supply | excellent | | | 1,000 | | 1,000+ |
| Quality | v. good | | | | 819 | |
| Driller | | | | | | S. Hayes |
| Strata | river sand & gvl. | no data | no data | see below | no data | see below |
| Analyses | no data | no data | no data | no data | no data | no data |

Strata:

Bullock Paddock: 0-25' sand, gvl.; 25 -50' white clay, lst. seams; 50'-136' varicoloured clays, 2½ lst. bars; 136-139' sand, 139-190' clay, some thin seams of sand; 190'-210' clay peat. Marcasite at 200'

Bore 5m.SW: 188' sand to lime 190' chert bed, dolomite (Mt. Baldwin F.-lime facies of top ½)

| | 2 abandoned bores | | | Dud (drilling too hard) | | | Entire |
|---|---|---|---|---|---|---|---|
| Location | 12m E -RT | 6m. ESE - RT | 4m. ESE -RT | 11m. NE.-RT | 4½m. SSW - H | 7mS-H | 20m WSW -RT |
| Altitude | | | | | | | 1730' |
| Water Struck at | | | | | | | |
| Pump depth | | | | | | | |
| Standing water level | | | | | | | |
| Total depth | | | | 202' | 20' | 372' | |
| Supply | | | | 900 | | 1200 | |
| Quality | | | | good | | good | |
| Driller | | | | S.Hayes | | S.Hayes | |
| Strata | no data | no data | no data | alluvium | dolo-mite | see below | no data |
| Analyses | no data | no data | no data | no data | no data | no data | no data |

Strata:

7m. S. of Huckitta: 355' yellow and chocolate slt.st; 372' mgr.lst. (aquifer a pink sst. - KGS)

| | Eastern Chief | Kanandra | No. 2 |
|---|---|---|---|
| Location | 25m. WSW-RT | 27m. W.-RT | 8m.S.W. -H |
| Altitude | No data | No data | |
| Water Struck at | | | |
| Pump depth | | | |
| Standing water level | | | |
| Total depth | | | |
| Supply | | | Ca 300 |
| Quality | | | |
| Driller | | | |
| Strata | | | Mt. Baldwin F. |
| Analyses | | | |

| | | Dud | Dud | |
|---|---|---|---|---|
| Location | 7¾m SW-H | 13m.SW-H | 7mSSE-H | 2m.SE - H. |
| Altitude | | | | |
| Water Struck at | | | | |
| Pump Depth | | | | |
| Standing water level | | | | 70' |
| Total Depth | 206 | | 148 | 180' |
| Supply | ca 900 | | ca 200 | 1400 |
| Quality | | salt | | drinking |
| Driller | | | S.Hayes | S. Hayes |
| Strata | | Archaean | see below | |
| Analyses | | | no data | |

Strata:

Dud 7m.SSE - H : Ended in granite or Arunta gneiss

2m.S.E. - Huckitta Homestead: (Drillers record) 20' hard dense lst.; 60' alternating sst. & lst. 80' hard cream sst.; 135' brown sst. fairly soft. 180' brown soft.sst.w. limey patches. (samples) 20' hard grey lst.; 30' grey f.g. calc. sst.; 45' pale grey & cream slightly sandy lst.; 60 grey f.gr. lst.; 90' f. cream qtz. sst. 130' pale grey f.gr. micaceous qtz. sst.; some ? glauconite 155' soft brown ferruginised calc. sst.

(c) Jervois Block

Distances in miles from Jervois Mine.

| | Thring | No. 2. | Dud | Jervois A. | Jervois B. | Paradise |
|---|---|---|---|---|---|---|
| Location | 22m.SSW | 6m.ESE | 19m. SW | At mine | At mine | 11m. NE. |
| Altitude | | | | | | |
| Water Struck at. | | | | | | |
| Pump depth | | 70' | | | 170' | |
| Standing water level | | | | | 85' | |
| Total depth | 75' | 120' | | Cal60 | 186' | ?50' |
| Supply (g.p.h.) | 1,200 | 1,800+ | | 400 | 400 | |
| Quality (p.p.m.)* | 666 | | | | 1,294 | drinking |
| Driller | | | | | Robinson | |
| Strata | no data | no data | Arunta bottom | | schist | |
| Analyses | see below | see below | | | see below | |

* Total dissolved solids in parts per million.

Analyses:

| | Thring | No. 2. | Jervois B. |
|---|---|---|---|
| Cl | 25 | 44 | 140 |
| $SO_4$ | 3 | 27 | 98 |
| $F_2$ | 1.2 | 0 | 1.1 |
| $Ca^2$ | 15 | 72 | 64 |
| $HCO_3$ | 449 | 395 | 712 |
| $CO_3$ | 24 | 0 | 0 |
| $Na^3$ | 43 | 23 | 190 |
| K | 10 | 7 | 5 |
| Mg | 72 | 38 | 80 |
| $NO_3$ | 24 | 4 | 4 |

(d) Jinka Block

(e) Picton Block

Distances in miles from Prossers soak.

| | Oorabra | Dud | Dud | Dud. | Box Hole | Horse Plain |
|---|---|---|---|---|---|---|
| Location | 13mE. | 15m.NE | 8NE | 11 NE | 15NW | |
| Altitude | | | | | | |
| Water Struck at | | | | | | |
| Pump Depth | | | | | | |
| Standing Water level | | | | | | |
| Total Depth | 130' | | | | 400'+ | under 200' |
| Supply | 3,000 | | | | 350 (1958) | 1000 + |
| Quality | | | | | good | good |
| Driller | Robinson | Robinson | Gorey | Gorey | Gorey | Pridmore | |
| Strata | no data | dolomite | Arunta | Arunta | Arunta | Arrinthrunga | Camb. dolom. & sst. |
| Analyses | no data | no data | no data | no data | no data | no data | no data |

(f) Lucy Creek Station

| | Homestead Soak | No.1. | No. 2. | No. 3. | No. 4. | No. 5. |
|---|---|---|---|---|---|---|
| Location | Homestead | 13m.WSW | 6m.SW | 6m.SE | 6m.NNE | 16m.NNE |
| Altitude | 1,052 (level) | 1,118 | | 1,010' | | |
| Water Struck at | | | | | 160' | 116' |
| Pump Depth | | | | | | |
| Standing water level | | 68' | 50' | | | |
| Total Depth | 28' | 92' | 247' | 106' | 402' | 510' |
| Supply | good | 1,600+ | 1,600+ | 2,000 | init.700 1960:250 | |
| Quality | good | drinking | drinking | drinking | fair | good |
| Driller | | A.J. Gorey | | | | |
| Strata | alluvium | boulders of lst.& dolomite | lst.w. chert. | lst.w. quartzite | no data | see below |
| Analyses | no data | no data | no data | no data | no data | no data |

Strata

No. 2. - 0-10' soil; 10-40' lst. 40-247' blue shale (interbedded lst. & shale)

No.5 : Dolomite & grey lst. with bands of fine red shade

| | No. 6. | No. 7. | No. 8. | No. 9. | No.11. |
|---|---|---|---|---|---|
| Location | 20m NE | 7½m NW | 15m.NE | 10½mSE (deepened 1960 ) | 20m.N. |
| Altitude | | | | | |
| Water Struck at | 218' | | | (100' (360' | 400' |
| Pump Depth | | | | 160' | |
| Standing water level | | | | | |
| Total depth | 260' | | prob.300'+ | 1)100' 2)365' | 405' |
| Supply | 1,500 | | "good" | 600 at 160' | 1000 |
| Quality | good | | "sweet" | Fresh | Fresh |
| Driller | D.J. Shepley | | | D.Shepley 1956 McIntyre 1960 | D.J.Shepley |
| Strata | see below | see below | see below | no data | no data |
| Analyses | no data | no data | no data | | no data |

Strata.

No. 6. 0-260' sandstone
No. 8. yellow dolom. w. sand grains in drain. Finished in blue lst. Upper Camb. sst. present around but mainly Arrinthrunga. grey sltst.
No. 9. 0-365', alternating sequence of grey dolomite and blue

| | No. 12. | No.13 | Dud. |
|---|---|---|---|
| Location | 26m.NW | 16m.WNW | 10m.NW. |
| Altitude | | | |
| Water Struck at | | | |
| Pump Depth | | | |
| Standing Water level | | | 105' |
| Total Depth | | 350' | 454' |
| Supply | | | 200 |
| Quality | | | Stock |
| Driller | | Robinson | A.J. Gorey |
| Strata | dol.lst. & marl | | |
| Analyses | no data | | |

Strata:

No.13: 0-80' pink & cream massive dolomite 250'-350' pink & grey massive dolomite

Dud: 0-10' soil; 10-95 brown clay & boulders; 95-200' lst. (or dolom) 200-454' sst. grading down to mst.

(g) MacDonald Downs Station

| | | Duds (2) | Dud | |
|---|---|---|---|---|
| Location | 34 NNE | 32m.NNE | 26m.NE. | 34m.NE |
| Altitude | | | | |
| Water struck at | 170' | | | 130' |
| Pump depth | | | | |
| Standing Water level | 170' | | | |
| Total depth | 211' | | 200' | |
| Supply | 800 | | less than 200 | |
| Quality | | | | good |
| Driller | S.McIntyre | S.McIntyre | S.McIntyre | H. Hopkins |
| Strata | see below | ?lst. & chert;shle. | slt.st.&sst. | see below |
| Analyses | no data | no data | no data | no data |

Strata

34m.NNE: 0-75' clay; 75-80' boulders; 80-100' clay; 100-180' sst. 180-196' lst. bars & shale; 196- 206' sst; 206-210' black lst. bars; 210' sst. (sample from 200' grey f.gr. sst/sltst. - compact & hard, probably dolomitic)
34m NE: Soil, lst. & shale; brown clay; 130-140' hard lst. (Allumium over Cambrian sst. over U.Cambrian dolomite & marl.)

| | Jocks | Macs | Carbine |
|---|---|---|---|
| Location | 12½m NE | 26mNNE | 20m N |
| Altitude | | 1322' | 1350' |
| Water struck at | | | |
| Pump Depth | | | |
| Standing Water Level | | | |
| Total depth | | | |
| Supply | | | |
| Quality | | | |
| Driller | | | |
| Strata | no data | no data | no data |
| Analysis | no data | no data | no data |

(h) Mt. Swan Station

| | [illegible] | Homestead | Dud. | |
|---|---|---|---|---|
| Location | 17m.SSE | at homestead | 5m.SSE | 2m.N.E. |
| Altitude | | | | |
| Water struck at | | | | |
| Pump Depth | 80' | | | |
| Standing Water level | 50' | | | |
| Total depth | 125' | | | |
| Supply | 1,000 | | | |
| Quality | 302 | | | |
| Driller | | | | |
| Strata | no data | | no data | no data |
| Analysis | see below | | | |

Analysis:

| | | | |
|---|---|---|---|
| Cl. | : 25 | Na | : 25 |
| $SO_4$ | : 7 | K | : 7 |
| $F_2$ | : 0 | Mg | : 32 |
| Ca | : 11 | $NO_3$ | : 0 |
| $HCO_3$ | : 170 | | |
| $CO_3$ | : 24 | | |

(i) Government Bores.

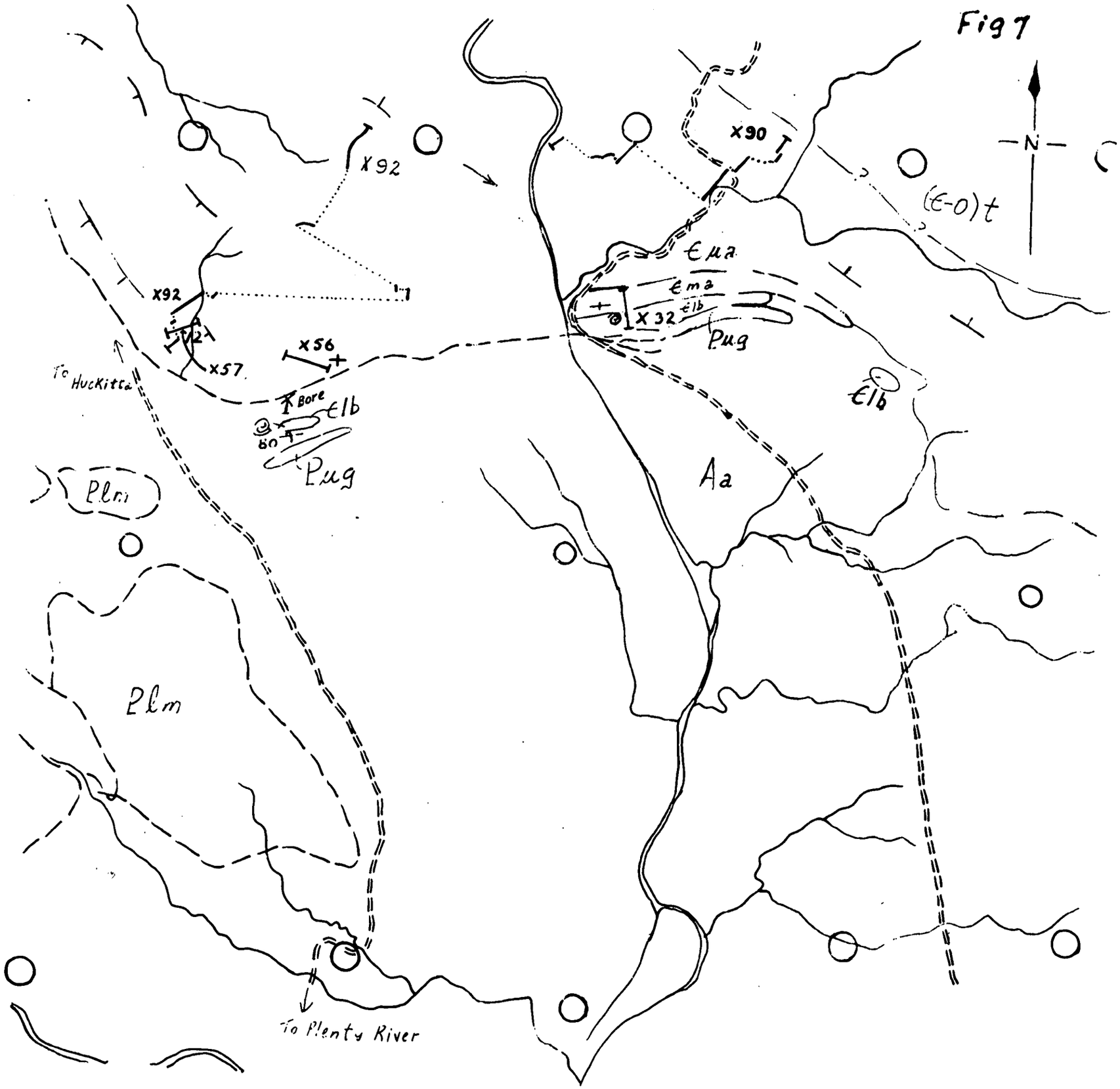
Distances in miles from Red Tank (RT), Prosser's Soak (PS), Jervois Mine (J).

| | Marshall | Elyuah | Bonya | Unca. | Oorabra |
|---|---|---|---|---|---|
| Location | 16m.NE- RT | 17½m ENE -PS | 12m SSW - J | 8m.ESE - J | 25m. ENE- PS |
| Altitude | | | 1113 | | |
| Water Struck at | | | | | |
| Pump depth | | | 129' | | |
| Standing Water level | 83' | 90' | | | |
| Total depth | 132' | 189' | 133' | | 130' |
| Supply | | ca600 | | 600 | 3000 |
| Quality | good | | salty | | good |
| Driller | R.M.Hall | | | | Robinson |
| Strata | Alluvium | dolomite | Schist | | Dolomite. |
| Analyses | | | | | |

## LIST OF REFERENCES


| | | |
|---|---|---|
| Casey, J.N., and Joyce Gilbert, Tomlinson, | 1956 | Cambrian Geology of the Huckitta-Marqua region, Northern Territory. In El Sistema Cambrico, Su Palaeografia Y El Problema De Su Base Parte II pp.55-74. |
| Condon, M.A. and Smith K.G | 1959, | Permian Glacials in Central Australia. Bur.Min.Resour.Aust. Rec. 1959/29, unpubl. |
| Hills, E.S. | 1959, | Record of Botherolepis and Phyllolepis from the Northern Territory of Australia. Trans. Roy. Soc. N.S.W., 92, 174-5 |
| Smith, K.G. et al, | 1960, | The Geology of the Marshall River Area, N.T. Bur.Min.Resour. Aust. Rec. 1960/34 unpubl. |
| Smith, K.G., et al, | 1960, | Second Progress Report in the Geology of the Huckitta Area N.T. Bur.Min.Resour.Aust.Rec. 1960/66 unpubl. |
| Smith, K.G. and Vine, R.R. | 1960, | Summary of the Geology of the Tobermory 4-mile Sheet, N.T. Bur.Min.Resour. Aust.Rec. 1960/71 unpubl. |
| Smith, K.G. | 1960, | Summary of the Geology of the Hay River 4-mile Sheet, N.T. Bur.Min.Resour.Aust.Rec. 1960/73 unpubl. |
| White, Mary E., | 1961, | Mesozoic Plant Fossils from the Tarlton Range, Northern Territory Bur.Min.Resour.Aust.Rec. 1961/32 unpubl. |

Fig 7



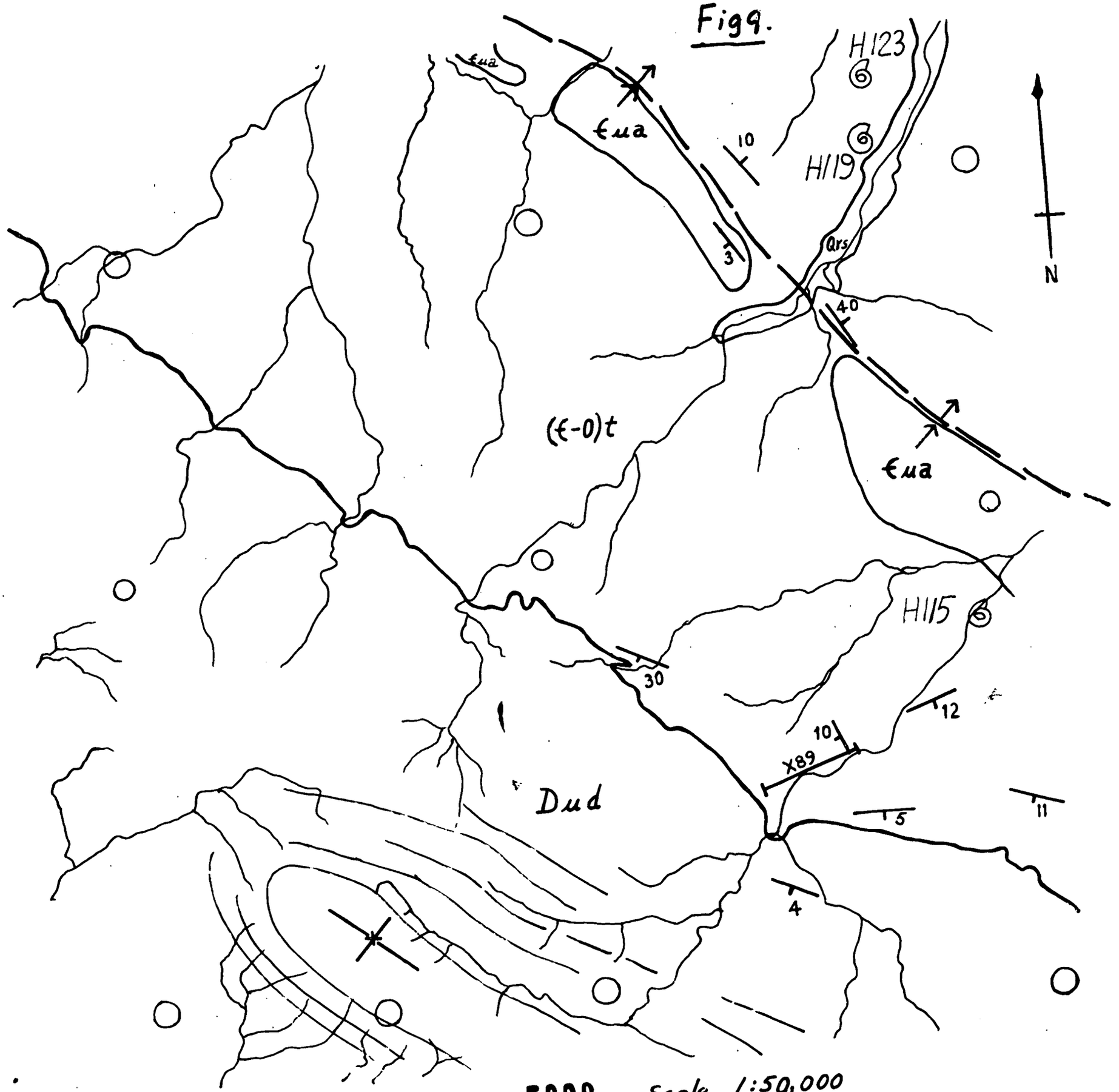

5195

HUCKITTA RUN 11

SCALE 1:50,000

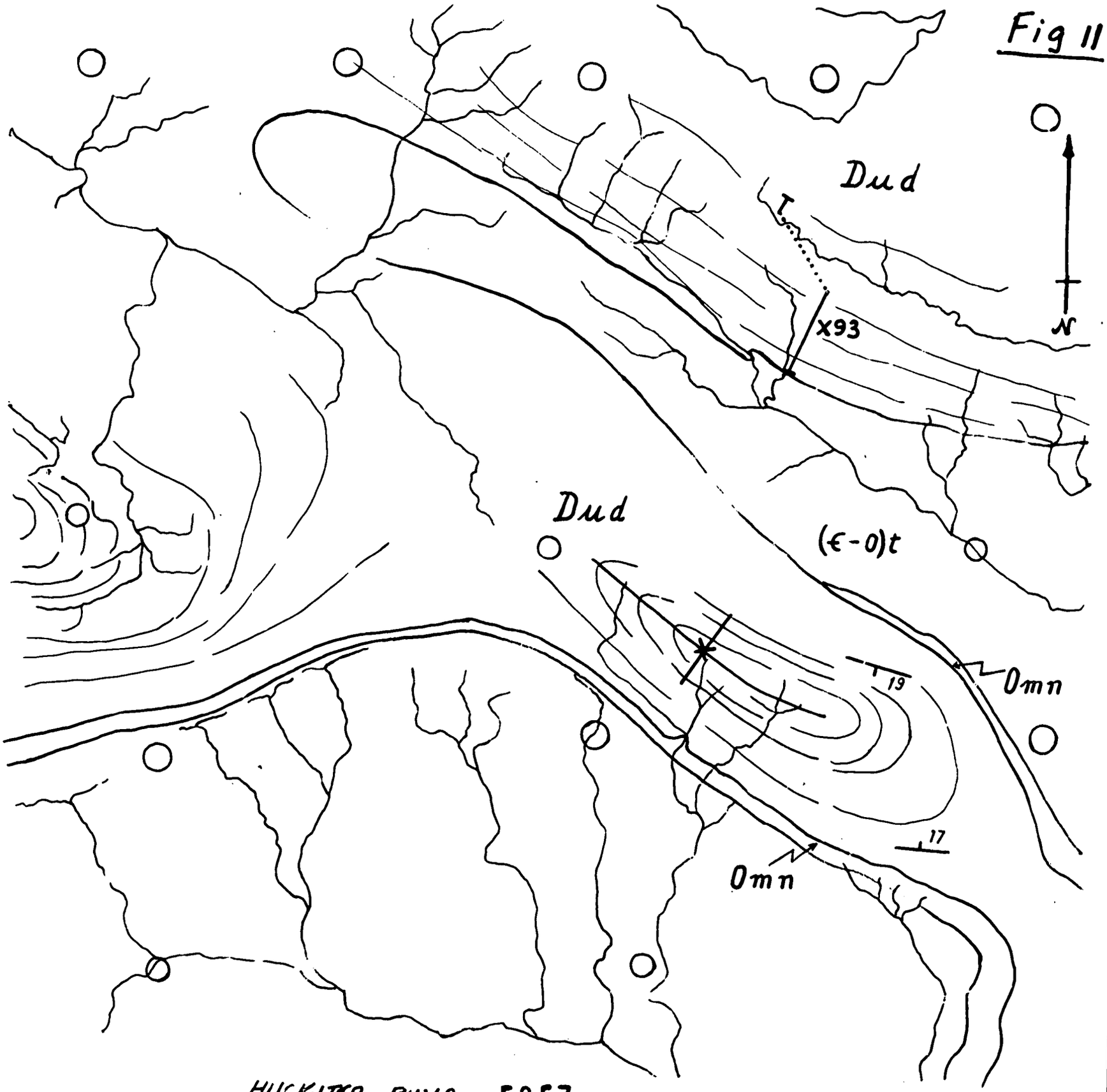
LOCATION OF MEASURED SECTIONS X32, X90 & X92.

Fig 9.




HUCKITTA Run's 5099 Scale 1:50,000

LOCATION OF MEASURED SECTION, X89.




HUCKITTA RUN 9 5057.
LOCATION OF MEASURED SECTION, X93, IN DULCIE SANDSTONE.

Scale 1:50,000

GEOLOGY OF

# SOUTH WESTERN

(NT) PART OF THE

# GEORGINA BASIN

135°00'

22°00'

23°00'

136°30'

24°00'

138°00'

## REFERENCE

| | | | |
|---|---|---|---|
| QUARTERNARY | | Qs | sand, alluvium |
| TERTIARY | | T | impure limestone |
| MESOZOIC | undifferentiated | M | conglomerate, sandstone |
| TRIASSIC | Tarlton Formation | Rt | conglomerate, sandstone |
| PALAEOZOIC | | | |
| ORDOVICIAN | Mithaka Formation | Omm | siltstone, sandstone, coquinite |
| | Carlo Sandstone | Omc | sandstone |
| | Nora Formation | Omn | siltstone, sandstone, coquinite |
| | Coolibah Formation | Olc | limestone |
| | Kelly Creek Formation | Olk | sandstone, siltstone, dolomite |
| | Ninmaroo Formation | (€-O)n | sandstone, calcarenite, dolomite |
| | Tomahawk Beds | (€-O)t | sandstone, sandy dolomite, limestone |
| CAMBRIAN | Arrinthrunga Formn. | €ua | dolomite, limestone, some sandstone |
| | Arthur Creek Beds | €ma | dark limestone, shale |
| | Marqua Beds | €mm | limestone, siltstone |
| | Mt. Baldwin Formn. | €lb | dolomite, greywacke |
| PROTEROZOIC | | | |
| UPPER PROT. | Grant's Bluff Formn. | Pug | Sandstone, siltstone |
| | Elyuah Formation | Pue | arkose, red & green shale |
| | Mt. Cornish Formation | Puc | boulder beds, dolomitic arkose |
| | Field River Beds | Puf | boulder beds, arkose, dolomite |
| LOWER PROT. | Jervois, Jinka, Dneiper, Marshall, Mt. Swan granites | + + | granite |
| ARCHAEAN | Arunta complex | Aa§ | metamorphics |

## SCALE

Miles. 10 8 6 4 2 0 5 10 20 30 40 Miles

## INDEX TO 4-MILE SHEETS

| | |
|---|---|
| HUCKITTA | TOBERMORY |
| | HAY RIVER |


## LEGEND

- Geological boundary
- Anticline
- Syncline
- Major fault
- Strike and dip of strata (e.g. 3)
- Sand dunes
- Homestead
- Bore (·B)
- Major local roads