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BATHOS Limited.

A GEOLOGICAL RECONNAISSANCE OF BATHURST AND MELVILLE ISLANDS, NORTHERN TERRITORY.

Carried out in conjunction with preliminary Gravity Surveys.

Report for period ended
31/12/56

by

Dr. L.O. BRUNNSCHWEILER
Chief Petroleum Geologist.

INTRODUCTION.

Bathurst Island (ca.800 sq.miles) and Melville Island (ca. 2200 sq. miles) are disconnected parts of the Australian continent. They are separated from the mainland by the shallow Clarence Strait.

The islands are geologically little known. Until very recently the only information available was contained in a report by a former South Australian Government geologist, who had visited a few coastal localities on the islands by boat many years ago (Brown 1906). Some Cretaceous fossils discovered by him were described by Etheridge fil. (1907). Recently a more detailed study of the Cretaceous rocks was carried out by Daily (1954). Daily's investigations were, in fact, the first step in the present exploration of the islands and had been partly financed by BATHOS Limited. Since 1954 there has been further activity on the islands but it was restricted to the prospecting of beach sand deposits, and little general geological information resulted from it.

The present reconnaissance was carried out during most of October and the first half of November 1956. The party first moved by boat along part of the coast line and through Apsley Stait. Because of locally heavy rainfalls only limited work could be carried out on land, but extensive air reconnaissance was undertaken, both with BATHOS' own and with chartered aircraft, to link up certain observations on the ground and along the coasts.

Concurrent with the geological reconnaissance a gravimetric survey was carried out. Its results will be subject of a separate report by D. Regum B.Sc.

The following members of Geosurveys' staff took part in the reconnaissance: Dr. L.O. Brunnschweiler (in charge), I. Freytag, B.Sc. (Geologist), I. McLeod, B.Sc. (Geologist), D. Regum, B.Sc. (Geophysicist), and K. Campbell (Field Assistant). The motor launch was skippered by Mr. ("Snowy") Kenney of Darwin. Some Bathurst Island natives were employed as guides and helpers.

The writer gratefully acknowledges the assistance received from the Catholic Mission authorities in Darwin and on the islands. Without their kindly help operations would have been much more difficult. Appreciation is also due to the officers of the Native Affairs Department, the Mines Department, and the Bureau of Mineral Resources in Darwin for their efficient handling of the party's permit affairs and the technical assistance given freely.

GENERAL OBSERVATIONS.

a. Physiography.

Both islands show a higher and more varied relief than the coastal districts of the mainland to the south, but their features are rather similar to those of

Coburg Peninsula to the east. The main elevations are along the southern coast. One or two rise to about 350 feet but most are not higher than 250 feet. All these higher hills consist of Cretaceous rocks and they carry a more or less conspicuous lateritic profile on top.

The northern and central parts of the islands are rather deeply dissected by meandering tidal creeks which divide the country into many NW-SE trending low ridges and tongues. This dissection trend is also reflected in the features of the western and northern coasts and the Apsley Strait which separates the two islands.

Most of the cliffed shores of the headlands of the northern coastline consist of young, poorly consolidated, sediments that are supported by a rigid platform of harder, old, rocks. This platform extends in places in the form of shoals and shallows well out into the Timor Sea and, together with associated extensive sandbanks and some coral reefs, makes low tide landings in many coastal areas impossible. Even at high tide a number of areas have very dangerous approaches. Tides are high; up to 23 feet.

b. Access and communications.

The islands are reached by boat from Darwin in 7 to 8 hours, the distance to the southern entrance of Apsley Strait being about 50 miles. There are no regular boat services, but supply luggers operate fairly frequently between the mainland and the three island settlements of Bathurst Island Mission, Garden Point Mission, and Snake Bay. There is a fortnightly air service (Mondays) operated by MacRobertson-Miller Airlines of W.A. Private charter aircraft are available from Muir Aviation at 2/9 per mile (Proctor) and 3/9 per mile (DH Dragon). Bookings are rather heavy during the northern field season, and arrangements have to be made in advance.

Boat hire charges (e.g. motor launch) are at present 25£ per day, exclusive food for the party members. A motor launch can be hired from the Haritos Brothers in Darwin.

Roads on the islands are few and rather rough. During the summer rains - from end of November into March - all except one of them are impassable, especially where they lead through low-lying swamp lands or across creeks. Most of the roads are only occasionally used, mainly for timber trucking, and the fast growing grasses and scrubby undergrowth tends to obliterate them quickly. There is, however, the firm intention - especially by the Melville Island settlements (Garden Point and Snake Bay) - to maintain the existing timber tracks and to extend them during the next few years into previously inaccessible areas.

All three settlements possess authorised airstrips that are in good repair. Care is nevertheless necessary, particularly with light aircraft, for take-offs at Bathurst Island and at Snake Bay during certain times of the year. Gusty crosswinds with swiftly changing directions arise from local shifting of coastal air masses. The settlements are also serviced by the Northern Territory Health authorities and operate radio transceivers.

c. Climate.

The islands are situated in the tropical summer rainfall belt of northern Australia. Except for a few winter months when it is warm and dry the climate is warm to hot and humid. During our reconnaissance there were several days with the maximum temperature over 100° F in the shade and with the humidity at a most uncomfortable level. However, these five or six weeks before the beginning of the summer rains (December to February) are climatically the worst. Normally the maximum temperature is around 95° F which, despite often high humidity, is quite bearable. Nights are usually mild to cool along the coast, but may be oppressive inland.

The islands experience occasional hurricanes although the main cyclone danger zones are more to the south-west along the northern shores of Western Australia.

d. Vegetation.

Both islands are covered by an open-forest type vegetation of the nearby mainland type (eucalypts and acacias) that is fairly often broken by patches

of open swamp and grass land. Along the tidal stretches of the creeks there are extensive mangrove thickets. Dense undergrowth is a feature of the forest lands. This grass and scrub undergrowth is burnt off by the natives during the winter months in some areas in order to facilitate access.

The missionaries have introduced useful plants such as coconut, mango, pineapple, banana, bread fruit, citrus trees, cashew nut, and various vegetables. Their cultivation has reached a stage where the native population is well provided with fresh foods and actually independent from mainland sources. Exploration camps in the area should also have no difficulties in procuring these commodities from local sources.

e. Water Supply.

There are unlimited supplies of exeellent fresh water on the settlements. Away from them, however, there are few natural sources. Some of the creeks have a permanent pool or two, usually a mile or so upstream from the tidal, lower, reaches. Judging from the existing wells in the settled areas and the geological features in general there should be fair possibilities in many areas to find good shallow groundwater.

f. Population - Food Supplies.

There are about 800 full-blood natives on Bathurst Island. Most of them live permanently at the mission which is situated at the south-east corner of the island. The Mission (Catholic Order of the Sacred Heart) belongs to the Diocese of the Bishop of Darwin (H.L. Bishop O'Loughlin) and is in the care of two priests (Father Cosgrove-in charge), five nuns, and three lay brothers. The health of the natives is excellent. They are cleanly and of very friendly disposition towards strangers.

On Melville Island are two settlements. At Garden Point - just north of the ruins of the first British settlement in northern Australia, Fort Dundas - there is the Catholic Mission for halfcasts. In charge is Father Correy, assisted by four nuns and a lay brother. The halfcast population is around 120 at present and is drawn largely from the coastal mainland. A comparable number of mixed natives are attached to the non-denominational government settlement at Snake Bay, some 20 miles east of Garden Point.

It is interesting to note that the almost three times smaller Bathurst Island has a four times greater native population than Melville Island. This seems to be due to the fact that the Bathurst Mission has been there for over 50 years and has pursued a vigourous programme of agricultural expansion which provided the nomadic and carefree natives with a convenient "flesh-pot". The settlements on Melville Island are, in their present form, much younger but steady growth of their populace should now also take place with the agricultural expansion that is in progress there.

Native labour can be employed after obtaining a respective permit from the Native Affairs Department in Darwin. Medical checks and entry permits are also necessary for entering the area because it is an Aboriginal Reserve. The Mission authorities do definitely welcome projects such as SANTOS' oil search because they believe in "work-therapy" for the natives, and there is not enough work available at present. They want the natives to learn to earn a living in the white man's way in view of their ultimate assimilation into the Australian community at large.

Apart from fruit and vegetable, meat and fish are also available locally. Bathurst Island has a mob of about 150 cattle. A start in that direction has been made at Snake Bay, and on Melville Island there are buffalos in case of an emergency. The coastal waters teem with edible fish. Thus, with the exception of stock groceries, an exploration and/or drilling team can be supplied from local sources.

REGIONAL GEOLOGY.

a. Summary.

Bathurst and Melville Islands form the exposed portion of an elsewhere shallowly submerged mainland threshold that must have been above sea level during

long periods of the later Tertiary and the Pleistocene.

As a result of this reconnaissance it is believed that there are four major geological formations (in the widest sense) that are responsible for the present form and location of these islands.

These formations are:

1. The Precambrian basement complex underlying at rather shallow depth the southern parts of the area.

2. A north-easterly trending sedimentary trough or basin of later Palaeozoic and/or earlier Mesozoic age, underlying the northern parts of the islands.

3. An extensive, but rather thin, veneer of marine Middle and early Upper Cretaceous sediments found chiefly in the southern part of the islands. To the north this veneer is patchy.

4. An irregular, chiefly coastal, accumulation of waterlaid and aeolian sediments of later Tertiary and Pleistocene/Recent age. Particularly well developed around western and northern peninsular headlands.

The suspected general apposition of these major formations is shown in a summary cross section (Fig.1).

Precambrian rocks are not exposed on the islands. On the mainland they are also covered by younger deposits over large portions of the coastal districts but the younger sediments there are much thinner than on the islands.

The Late Palaeozoic trough sediments to the north appear to have been moderately folded and/or faulted before Middle Cretaceous times. The Cretaceous sediments do not show tectonic disturbance of any significance, they show a slight, depositional, dip to the west or south-west and some minor faulting resulting from compaction. The post-Cretaceous sediments are undisturbed and flat lying.

b. Stratigraphy.

1. Precambrian.

The nature of the Precambrian rocks underlying the southern parts of the islands (underneath the Cretaceous) is naturally unknown. In the Darwin area - the nearest area available for comparison - the basement consists of strongly folded paragneisses and phyllites that are believed to belong to the Brocks Greeks Group (Noakes 1949). There are also granitic and other intrusives in this region and pegmatitic quartz stringers can be seem in the light-coloured phyllites around Darwin Harbour.

The question of the nature of the basement might, theoretically, be of some importance in the interpretation of the local gravimetric results. Certain gravity anomalies could conceivably be due to strong basement influences. However, relevant investigations over the exposed basement complexes south of Darwin show that the gravity variations over a number of different basement rock types are within rather narrow limits (information courtesy Bur.Min.Resour.Darwin). In other words, any larger anomaly - especially, as in our case, a negative anomaly - that should appear in areas where younger rocks cover the basement would most likely reflect a property of the younger rocks (e.g. thickness) rather than of the basement. The nature of the basement is therefore probably of less importance as far as the interpretations of the gravimetry on the islands is concerned. There is no obvious reason to assume marked changes in the basement north of the Darwin area.

There have been reports claiming that the islands' natives procure milky vein quartz for spearheads from an area not far inland from the central western coast of Bathurst Island. A careful aerial search from various, even very low, altitudes over the relevant country showed no sign whatever of anything else but more or less horizontally disposed post-basement rocks. The occurrence of Precambrian rocks is considered most unlikely on Bathurst Island.

Moreover, it seemed to us that the natives carve their spears, including the spearhead, in one piece out of wood. The use of stone, glass, etc. for weapons is - certainly now - not common there at all. The few there may be (we did not see a single one) have either been brought over from the mainland, or one or the other island native saw the thing on a mainland visit, obtained an already shaped spearhead there, and thence copied the mainland weapon after returning home to the island. The islanders are most accomplished (traditional, I presume) wood carvers and are in this art certainly far superior to the mainland natives. The art of chipping and sharpening stone or glass is not theirs although their brothers on the mainland are masters in it.

The reason for the absence of the craft of stone shaping is most likely to be sought in the lack of suitable raw materials. If there were vein quartz outcrops in the islands the natives would surely have made extensive use of the material as did the mainland tribes.

2. Garden Point Formation. (Late Palaeozoic and/or Early Mesozoic).

Proceeding northward through Apsley Strait one notices from about point JD3 (Astrofix) on a slight but unmistakable change in the morphology of the low coastal hills to both sides. While to the south the landforms show gently convex rounded slopes which gradually merge with the level of the mangrove belts there appears to the north a landscape of low-top hills with steep, concave or straight, slopes towards the water. Since these parts of Apsley Strait are along well sheltered waters the change in morphology must be attributed to a significant change in the lithology of the relevent formations. It is noticeable too that the creek pattern is influenced by this change in morphology. There is a SW-NE tendency appearing in this area.

Such a difference in lithology was confirmed on inspection of the rock series exposed in the area. It was found that the relevant formation consists of a sequence of hard ferruginous sandstones with interbedded tight shales. This formation is forthwith called "Garden Point Formation" from its type area around Garden Point Mission, Fort Dundas, and Arrimu Creek. The more rounded landforms south of JD3 are carved out on younger (Cretaceous) series which consist of soft, clayey, argillites and friable sandstones.

Most conspicuous differences are the absence from the Garden Point Formation of macroscopically noticeable glauconite (a mineral that characterises the Cretaceous rocks throughout the area) and the tantalising lack of fossils. In the Garden Point Formation the degree of diagenesis is incomparably higher than in the Cretaceous series which has only suffered partial surface hardening and lateritisation.

Although direct proof is lacking at present, we do not believe that the Garden Point Formation is connected genetically with the coastal Cretaceous to the south. It is more likely a pre-Cretaceous formation akin to the Upper Palaeozoic (and/or Lower Mesozoic) of the Bonaparte Gulf region and the Kimberley Division of Western Australia. The macroscopic features of the formation are certainly most similar to those e.g. of the Permian and Triassic rocks in the Fitzroy/Canning Basin. It is, of course, quite possible that the Garden Point Formation is as young as Late Jurassic when all possibilities of analogy with north-western Australia are considered. The lack of fossils prevents a decision on this question. It may, however, be remembered that the main outlines of the Australian continent are in these regions essentially of Early Mesozoic age, or Late Jurassic at the most. All later geological events did not change the then born features much. It is therefore not really surprising that e.g. Permian series should take part as major elements in the subsurface sequences of the islands.

On lithologic grounds alone a Permian or Permo-Triassic age is the most likely. The post-Permian sequences of the Kimberley area (Brunnschweiler 1951,1954) do look rather different and their degree of diagenesis is somewhat lower than that in the Garden Point Formation.

In view of all these geological observations it seems most significant that associated with the change in morphology and lithology at JD3, the geophysicists have demonstrated a rather sudden and substantial increase in the negative gravity values, at this point (Report by D. Regum in progress). Since it is most unlikely - as explained above - that these marked negative gravity values are

due to basement influences, it can only be concluded that they are indicative of a rapidly increasing thickness of post-basement sediments, i.e. of the Garden Point Formation and whatever additional, non metamorphosed, series that may be present. In other words, there appears to be a trough or basin, open to the north generally, of the Cretaceous sediments in the northern and western parts of the islands. Its southern margin was demonstrated gravimetrically and morphologically at Lubra Point (south coast of Bathurst Island) in the same way as it is indicated near point JD3. From JD3 it may trend towards Cape Fleming but without gravimetry this is only conjecture. In fact, there are some structural features in the Snake Bay area which recall those near JD3, and it may be that the southern basin margin strikes out to sea in the vicinity of Snake Bay.

The Garden Point Formation, although on the whole apparently flat lying, does show some evidence of having been tectonically disturbed. In the southern marginal zone of the basin dips as high as 45° (to the NW) have been noticed. Farther north along Apsley Strait such steep dips are absent but readings of between 3 and 10° have been made in places. All these are to the west or northwest. No reversals have been observed. It should, however, be remembered that no real structural survey has yet been carried out.

Rather steeply dipping beds were noticed from the air at the north-western entrance to Snake Bay, but the relationships of the respective formation are not known. If it is the Garden Point Formation the marginal zone of the basin may be indicated.

3. The Cretaceous Rocks.

The detailed studies carried out by Daily (1954) give a good picture of the nature of the Cretaceous series that are so prominently exposed along the south coasts of both islands. There is no need to expand much on Daily's findings because the Cretaceous appears now to be of minor importance as a potentially oil bearing sequence.

Daily (1954, p. 23-25) summarises his observations as follows:

"The Cretaceous rocks are composed essentially of interbedded glauconitic sands and clays. Minor amounts of quartz silt-to-sand and muscovite are associated with the glauconitic sands. Muscovite is generally present in the clays. Various types of concretions occur in both sands and clays and are aligned and flattened parallel to the bedding. In the cross-bedded sands concretions parallel the bedding even though it is inclined in different directions and at many angles.

The predominance of glauconitic sediments with minor amounts of quartz and muscovite seems to indicate an offshore facies far enough from land to prevent the introduction of the more normal (coarser-ROB) clastic sediments, or that little sediment was being deposited on the continental shelf at the time of glauconite formation. The latter implies a low adjacent landmass from which little sediment was shed.

It is interesting to note that glauconitic muds are forming in these regions today. They can be seen in places along the north coast of Melville Island, well away from the river mouths: e.g. between Carslake Island and Snake Bay peninsula and in the Garden Point anchorage.

That the site of deposition was not very far from shore seems to be well illustrated by the presence of numerous lignitic particles and occasional twigs and tree trunks which are most obvious throughout the unlateritised parts of the sequence. Along the present day coasts, particularly along the north coast where many tidal rivers and mangrove thickets are present, abundant particles of leaves and pieces of sticks are common along the shore lines. They are also black and resemble closely the lignitic fragments found in the Cretaceous rocks.

The cross-bedding of the sands indicates sedimentation in shallow waters. This is also substantiated by the faunas, predominantly molluscan, of which both benthonic and pelagic forms are represented. Minor lateral facies change from glauconitic sand to clay is frequent (also indicative of shallow waters -ROB). Most of the sand bands, when traced over any distance, are found to lens out and give way to clay deposits. The whole facies is typical of shallow shelf conditions with a slow rate of subsidence.

Precise stratigraphic correlation of the various sections is virtually impossible as it is only in the lower parts of the sections (where there is no lateritisation) that fossils can be found.

Three different ammonoid faunas were found in situ, whilst a fourth fauna was found only in beach boulders. The latter is held to be the oldest. The second oldest is the one found in the south coast exposures on Melville Island and in the cliffs along the eastern part of the south coast of Bathurst Island (from Mirindow to Mirialampi). The youngest two faunas appear in the lower portion of the cliffs along the central part of Bathurst Island's south coast (west of Mirindow). They are in close vertical proximity of each other and there is no indication whatever of their presence east of Pipiyanyamili Creek. The beds that contain these youngest two faunas are tentatively correlated with lateritised sediments overlaying the Acanthoceras bearing beds (of fauna 2) in the Headinga section.

Basement for the Cretaceous of these regions was not found. The nearest known basement rocks are exposed around Darwin (e.g. Bullocky Head), where from 30 to 60 feet of flat lying Cretaceous strata are unconformable upon vertically dipping Precambrian schistose rocks of the Brocks Creek Group. There is a basal Cretaceous quartz conglomerate (up to 1 foot thick) which is overlain by about 4 feet of a rusty brown silty rock that contains appreciable amounts of quartz and muscovite, especially near the base. This member appears to be an oxidised glauconitic silt or sand sediment. It is overlain by a predominantly white, silicified, clay, containing numerous moulds of Belemnites guards, which show the outline of the phragmocone, traces of bivalves and gastropods, and fossil wood. This silicified clay is known as "Radiolarian Chert" or "Porcellanite". It is generally stained by oxides of iron to varying degrees, and the whole profile shown by these former (glauconitic ?) clays represents the mottled to pallid zone of a typical lateritic profile altered by the introduction of a siliceous cement. These observations are in accordance with those that Noakes (1949) made with reference to the Darwin Formation to which the above beds belong.

It seems that this Darwin Formation is stratigraphically older than any of the Cretaceous sediments found in situ on the islands. Belemnites fragments washed up on the south coast of Bathurst Island are very similar to those from the Darwin Formation, but no conclusions can be drawn on this evidence. Correlations with the Point Charles fauna (west of Darwin) cannot be made until the new ammonoid faunas from the islands are identified.

An aggregate thickness of about 350 feet of Cretaceous sediments is present on southern Melville Island, whilst on Bathurst Island a total of about 250 feet has been measured (that is, for the equivalent beds there between Mirindow and Mirialampi). If the correlation by the ammonite faunas is correct, then about 375 feet would appear to be the maximum exposed thickness for this (lower) part of the Cretaceous series.

180 feet of strata have been measured along the central south coast of Bathurst Island, but a thickness of as much as 200 to 250 feet is possible there. If the base of this series is correlated (on the evidence of the two younger ammonoid faunas in it) with the strata below the lateritic cap at Headinga the aggregate thickness of the Cretaceous over the whole length of the exposed sequence is at least 400 feet. If, however, this series has no correlatives to the east, and therefore is additive, then the aggregate thickness is at least 620 feet. Since the basement is at some depth still, the Cretaceous series may attain a thickness of 800 to 1000 feet or more, especially to the west (gravimetry indicates rather shallow basin though - ROB).

The Cretaceous rocks are near-horizontal (broadly undulating). Compaction faults with small throws are common. They caused small but measurable dips near the zones of movement. These dips have only local significance. Some tectonic movement (faulting) may, however, have to be assumed to explain the appearance of younger Cretaceous beds in the central part of the south coast of Bathurst Island, but there is no evidence of it in the field. In fact, warping, producing a small regional dip to the west, could produce the same result." (end quote)

The analysis of the ammonoid faunas has revealed that the islands' Cretaceous ranges in age from Albian (possibly even Aptian) into Cenomanian and perhaps even up into basal Turonian. It would appear, however, that sedimentation was not

continuous through that considerable time interval. There must be disconformities in the sequence, but they are hard to pick in the field. According to Daily (verbal communications) some of the identifications of the ammonities (by W.Wright, London) are still doubtful and partly in contradiction to unshakable field evidence.

4. The Cainozoic Rocks.

As in many other regions of coastal northern and north-western Australia there is quite a variety of terrestrial and littoral formations which, in places are of Tertiary, more often however of Quaternary age. Except for irregular lateritic surface solidification and for concretionary features (ironstones: ferruginisation and solidifications of clay lenses in sands, etc) these young deposits have undergone very little diagenesis.

Some of these sediments are waterlaid, others are aeolian, the latter being mostly old dunes. The aeolian origin of some of these sediments is not always evident from the nature of the formations themselves, but it is indicated by their regional distribution. They are essentially coastal deposits and are strongly developed around large peninsular headlands such as Cape Fourcroy, Cape Van Diemen, etc. The prominent white cliff that extends from Point Piper (JD5) half way out towards Cape Van Diemen, for example, is an old beach-cum-dunes deposit that is now slowly being eroded away by the sea whose level must have fallen at least 25 feet since the deposit was laid down.

An interesting facet in this connection is the absence of such young deposits farther south, e.g. along Apsley Strait. A rise of the sea level by 25 feet would today submerge large low-lying areas, and there is reason to assume that it would also have done so (and leaving telltale deposits) during Pleistocene times. Since there is no evidence of this it seems the Pleistocene submergences were due to regional tectonic movements (chiefly large scale warping) rather than eastatic changes of the seas level alone. Noakes (1949) has expressed similar opinions about certain coastal features on the mainland.

There is no point in discussing these younger sediments further here. To our explorations they are neither important as potentially oil bearing strata nor as caprock sequences.

OIL POSSIBILITIES.

The Garden Point Formation - of whatever age it may be - which appears to fill a rather deep sedimentary basin beneath the northern parts of the Islands, must be regarded as the sequence with the greatest potential as regards oil search. The maximum thickness of the overlying Cretaceous series to the south is likely to be only of the order of 500 to 1000 feet. While this comparative thinness does not of course, preclude the presence of oil bearing strata, the chances are not considered to be very significant (except perhaps near the basal unconformity).

It does not matter much that the regional relationships and the age of the Garden Point Formation are uncertain at this junction. Whether it be of Permian or Jurassic age, it can be assumed that it forms some extension of the respective marine sedimentary sequences that are now so thoroughly searched for oil in the north-west of Western Australia and the Bonaparte Gulf region. The islands' sequences appear to be even more favourably situated palaeogeographically than most parts of Australia's north-west. They are much closer to the East Indian Island arc where it is known that comparable sequences (Timor e.g.) display oil seepages and are considered to possess definite commercial possibilities.

Since the Sahul Shelf, and therewith also the northern parts of Bathurst and Melville Islands are on the broad shelf side of both the Permian-Mesozoic Timor-East Celebes geosynclinal and the Alpine Geosynkline (see also Teichert 1947) the area must be considered to have definite possibilities, especially if the sedimentary basin that contains the Garden Point Formation is or was open to the north in such a way that the uplip southward migration of petroleum from marine beds at depth would be unobstructed.

SUGGESTIONS FOR FURTHER EXPLORATION.

1. By a comprehensive gravimetric survey the position of the northern margin of the newly discovered sedimentary trough should be accurately

defined and especially its eastward extension traced.

2. Concurrent with the gravimetric work detailed geological mapping is highly desirable.

3. Stratigraphic core drilling appears advisable in order to obtain factual information about the subsurface nature of the Garden Point Formation and whatever other basin sequences there may be below it.

Adelaide 30th November, 1956.

Dr. K.O. Brunnschweiler.

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