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AUSTRALIAN ANGLO AMERICAN LIMITED

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A REVIEW OF THE EXPLORATION CONCEPT IN THE RINGAROOMA VALLEY WITH REFERENCE TO THE RESULTS OF INVESTIGATIONS BY AUSTRALIAN ANGLO AMERICAN LIMITED FROM 1981 TO 1984

1. INTRODUCTION

Following a study of previous exploration activity for alluvial tin in the Ringarooma Valley in early 1981 a conceptual model for the accumulation of detrital tin in the area was established (1). This conceptual model was subsequently tested by exploratory drilling and palynological dating during the period 1981 to 1984. This work, together with on-going drilling by the Tasmanian Department of Mines, has added considerably to our knowledge of the Ringarooma Basin; it has however failed to locate any ore reserves beyond the immediate vicinity of the Pioneer and Endurance Leads.

This present report seeks to review the earlier conceptual model for the accumulation of alluvial tin in the light of exploration carried out between 1981 and 1984. In as much as parts of the model have proved to be untenable additional lines of thought are included which may serve to augment any on-going exploration programme.

2. EXPLORATION REVIEW 1981-1984

The results of exploration designed to test the conceptual model are discussed below together with some salient features of the drilling carried out in the Pioneer-Endurance area and by Santos Ltd on the Great Northern Plain.

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2.1 Arba

The present interpretation (plan TAS-10-171, South Mount Cameron Office) appears the most logical and indicates the Arba Lead flowing northeast to join a major east flowing river, presumably the proto-Ringarooma. The presence of tin within the sediments overlying the postulated course of the lead indicates that tin was being contributed from the Arba Lead drainage system throughout the period of sedimentation although the aggrading system was devoid of a concentrating mechanism for ore formation.

Exploration at Arba has proved the existance of a proto-Ringarooma River, at least in this part of the drainage basin, and by inference implies that any capture of a north flowing drainage towards the Bass Basin by headward erosion of an incipient northeast flowing proto-Ringarooma was pre-deep lead (i.e. pre-Upper Oligocene). Any detrital tin from the Blue Tier which may have found its way into the Boobyalla, Tomahawk or Lower Forester Valleys will therefore be confined to sediments of pre-Upper Oligocene age.

The lack of gold within the Tertiary sediments in this area is explained by the aggrading system but the corresponding lack of gold in the overlying Quaternary sediments is disturbing particularly in view of its presence some 2 km downstream at Frasers Flats.

2.2 Davids Creek

Exploration drilling in the Davids Creek area was inconclusive as only one hole reached bedrock. The presence of basalt and dolerite pebbles within the sedimentary sequence adds weight to the existence of local pre-Lower Miocene basic volcanics and the occurrence of 230 gms SnO_2 /cu m at 10m-12m in DRC1 indicates the existence of localised conditions for heavy mineral concentration throughout a dominantly aggrading sequence.

2.3 Gellibrand Plains

Exploration drilling at Gellibrand Plains located a probable northeast trending palaeovalley lying close to holes GR6 and GR4. It is not possible to determine whether this palaeovalley represents the proto-Boobyalla or one of its south bank tributaries but the presence of gold favours the proto-Boobyalla interpretation. The lack of tin in the Tertiary sediments of the palaeovalley suggests that the sediments post date the formation of the proto-Ringarooma and confirms the inference from the Arba drilling that no post Upper Oligocene tin will be found in the Upper Boobyalla River. It is assumed at this stage that the Tertiary sediments encountered during the drilling are Upper Oligocene to Lower Miocene in age although there are no facts to support this assumption.

The presence of gold in hole GRC4 is to be expected in view of proximity to the Warrentina Goldfield. A grade of 32.01 mg/cu m is encouraging from the Jetstream rig as experience with this rig on alluvial gold prospects elsewhere suggests that the true grade can be double that obtained with the Jetstream rig.

2.4 Trout Creek

Exploration drilling at Trout Creek located a north trending palaeochannel passing through hole TRC1. No tin was located and the conclusions to be drawn from this drilling are as for Gellibrand Plains.

2.5 East Banca

Exploration drilling at East Banca was inconclusive as there remains the possibility of a palaeovalley existing in the vicinity of BHP hole 12000. The drilling of BP1 and BP2 further upstream tends to confirm the results of the Gellibrand Plains and Trout Creek drilling and no tin can be anticipated in the Boobyalla Valley above drill hole BP1.

2.6 Pioneer-Endurance

Exploration drilling in the Pioneer-Endurance area has determined the presence of a previously unsuspected basalt adjacent to the Pioneer Lead and a sequence of lithologically distinct sediments at the west end of the Endurance Lead. These two discoveries are shown plan TAS-5-67. The presence of basalt is not readily explained and the lack of an age on this material makes several interpretations possible. The simplest interpretation is that it represents minor flows of early Miocene basalt within the sedimentary succession. However, it could also represent a sill or feeder dyke within Miocene sediment or a dyke within basement. An alternative interpretation is that the basalts represent valley flows of Eocene age beneath which tin-bearing Eocene sediments may be present; potassium-argon dating of the basalt would resolve this alternative.

The sediments encountered in the lower part of holes drilled at the western end of the Endurance Lead are lithologically different from those encountered elsewhere in the Ringarooma Basin. These sediments are described as "grey-green sandstone and quartzite pebbles with some degree of rounding and abundant mottled grey-green to white tenacious clays with units of grey-green clay". This material is generally poor in tin. It is considered here that these sediments are equivalent to those in the upper part of Boobyalla DDH2 which are Middle Eocene to Early Oligocene (N. Asperus). This correlates with palynological dating at the adjacent Hasties Lead which has yielded Lower N. Asperus zone pollens. An unconformity is therefore established within the Ringarooma Basin succession with a Late Eocene to Early Oligocene hiatus.

Basement relief within the Ringarooma Basin, as indicated by exploration drilling, permits several possible pre-Middle Miocene outlets for the proto-Ringarooma river all of which

may have existed at some stage in the evolution of the Basin. Central to any reconstruction of the palaeodrainage is the direction of flow of the Hasties Lead which remains to be ascertained. The presence of presumed Eocene sediments in the Hasties-Endurance area suggests the most likely palaeodrainage at this time to be northwards towards the Boobyalla Graben via the gap to the west of Mount Cameron. All drainage downstream of and including the Winiford river would have reached the Bass Basin through this gap. The Ringarooma River together with its south bank tributaries above the Wyniford may also have reached the Bass Basin by this route although the earlier proposed route via the Boobyalla and Forester Valleys cannot be discounted on present evidence.

The Ringarooma River above the Weld occupied a position similar to that of today by Late Oligocene time. Downstream from the Weld-Ringarooma confluence three possible palaeo-drainage directions present themselves; the gap west of Mount Cameron, under the basalt cap of Toronna Hill into the Boobyalla Valley or westwards into the Boobyalla Valley via upper Ruby Creek, upper Little Boobyalla River and upper Walpole Creek.

2.7 Locharber

Exploration drilling at Locharber has provided evidence of Cainozoic tectonics in the form of an east northeast trending fault with a 17m downthrow to the south. This fault cuts the Locharber Lead which has been dated as Middle Eocene thus providing a maximum age for the fault. The trend and direction of throw on the fault is such as to induce the "downwarps" described earlier and it is suspected that a similar style and age of faulting has contributed to river capture within the Ringarooma Basin.

2.8 Great Northern Plain

Investigations by Santos (2) on the Great Northern Plain indicate a stratigraphic succession from bedrock through a tin-bearing wash unit to an overburden of clay, silt and finally a surface veneer of sand. The bedrock is described by Santos as a "grey-green clay which often contains weathered pebbles..." This clay has been dated by Harris (in Braithwaite 3) as Quaternary but recent work by Hill (4) casts some doubt on these earlier datings by Harris in northeast Tasmania. Further, the description of bedrock is akin to the postulated Eocene unit in the lower part of the Endurance Lead (see section 2.6) and lies at an R.L. equivalent to the Lower Scoloch Lead which has been dated as Middle Eocene (4). In addition drill profiles provided by Santos indicate an east northeast trending channel within this unit emanating from the Scoloch Lead and passing through boreholes Mayfield/68, BL8/63, BL5/45, BL3/35 and SB/94. It is therefore suggested that this may be a possible downstream continuation of the Scoloch Lead beneath the Great Northern Plain.

Descriptions of the tin-bearing wash are rare and it can only be assumed that it represents a fluviatile deposit probably representing a braided reach of the Ringarooma River at some stage during the early to middle Pleistocene when sea level was lower than present. Most of the tin-bearing wash appears to be restricted to a northeast flowing channel about 1500m wide but there is evidence of an earlier high terrace at the western end of lines BL2 and BL3 and the eastern end of lines SB and BL8.

The tin-bearing wash is overlain by estuarine silt and clay deposited in response to a rising base level and finally by aeolian dunes which can be related to the cold dry glacial maximum during the late Pleistocene ($\pm$17,000 B.P.).

3. GEOLOGICAL SYNTHESIS

The inferred stratigraphy of the Ringarooma Basin is shown on plan TAS-5-68 with that of adjacent basins for comparison. The evolution of the Ringarooma Basin is discussed in more detail below.

The Ringarooma Basin appears to have developed following a period of tectonism during the Palaeocene to early Eocene. This tectonic episode is marked by an unconformity within the Bass Basin between the Upper and Lower Eastern View Coal Measures (5) and can also be seen within the Boobyalla Graben. Prior to the development of the Ringarooma Basin drainage off the Blue Tier highlands to the south flowed unimpeded north and northwest into the Bass Basin and Boobyalla Graben.

Middle Eocene deposition within the Ringarooma Basin is witnessed by the grey-green fluvial to lacustrine sediments intersected in bore holes at the western end of the Endurance Lead (section 2.6). The Hasties Lead was tributary to this Eocene basin and it is likely that the Wyniford River also flowed into the basin. Tributaries of the present Ringarooma west of the Wyniford may have drained into this basin or may have continued northwestward into the Bass Basin. Sedimentation within the Ringarooma Basin was influenced by contemporaneous basic volcanic activity on the Blue Tier which probably sent pulses of basaltic lava down the valleys causing local drainage modifications and sedimentological breaks within the Basin. It is considered that the Basin was open to the north via the gap west of Mount Cameron to the Boobyalla Graben.

North and east of Mount Cameron fluvial deposition occurred in the Locharber Lead, tributary to the Boobyalla Graben, in response to a rising regional base level. Fluvial and lacustrine sediments may also have accumulated in the Boobyalla Valley at this time as there is some evidence that the Monarch and Banca Leads may have been formed at this time (6).

Sedimentation in the Ringarooma Basin was interrupted during the Late Eocene to Middle Oligocene by a period of tectonism and base level lowering. During this period intense erosion mainly by rivers caused the removal of much of the unconsolidated Eocene sediment deposited within the Ringarooma Basin together with any which may have been deposited within the Lower Boobyalla Valley. Faulting along a north northeast strike aided fluvial erosion by creating ideal conditions for the capture of streams flowing north and northwest off the Blue Tier highlands by rivers developing parallel to the fault planes.

The Late Oligocene to Middle Miocene was a period of rising regional base level and this is reflected in widespread fluvial and lacustrine deposition within the Ringarooma Basin and Boobyalla Valley. Sedimentation commenced with braided stream deposits possibly induced by climatic cooling (7, 8, 9) and was followed by lacustrine clays and peats with minor sands and gravels as the base level continued to rise. In excess of 135m (10) of Late Oligocene to Lower Miocene sediments were deposited in the Ringarooma Basin before sedimentation ceased with the outpouring of basaltic lava flows in the Middle Miocene. Sedimentation in the Boobyalla Valley continued following the basaltic eruption as witnessed by 22m of post basaltic sediment of presumed Miocene age at Martins Hill.

Middle Miocene basalt flowing down the Ringarooma Valley caused the river to occupy the southern edge of the valley and forced a new outlet to the sea south of Mount Cameron. A falling regional base level through the remainder of the

Miocene caused entrenchment of the Ringarooma and its tributaries resulting in the superimposed drainage seen today above Gladstone.

Little evidence is available of events in the Ringarooma Basin during the Pliocene and Early Pleistocene but with a deteriorating climate and a generally low regional base level an erosional regime prevailed. With the onset of cold wet conditions during the Late Pleistocene (Mungo Lacustrine phase $\pm$40,000 B.P.) braided river conditions developed in the swollen lower part of the Ringarooma River providing ideal conditions for the accumulation of low grade heavy mineral deposits. A falling regional base level caused the formation of at least one river terrace below the first knick point on the river at a height of about 75m in the vicinity of Pioneer. River gravels of this age have been worked for tin and gold by Amdex at their Riverside Mine and also underlie the Great Northern Plain. A minor marine incursion followed during which time estuarine clay and silt was deposited on the Great Northern Plain prior to the onset of cold dry conditions during the glacial maximum phase ($\pm$17,000 B.P.) when aeolian dunes accumulated on the coastal plain.

4. CONCLUSIONS

Exploration activity during the period from 1981 to 1984 has disproved the simplistic sequence of Cainozoic river capture as proposed in the preliminary review of the Ringarooma Valley (1). Clearly tectonically induced river capture and basin subsidence (previously regarded as downwarping) have played a major part in the development of the Ringarooma Basin and its associated sediments, and it is noted that the tin-bearing leads in the north are older than in the south as predicted in the preliminary review.

The current geological synthesis as outlined above leaves many questions unanswered but the following conclusions can be drawn which may aid any future exploration.

a. The Arba, Valley, Cascade and Main Leads flowed into a northeast flowing proto-Ringarooma River. No tin will therefore be found on rising basement to the northwest of the main channel of the proto-Ringarooma.

b. Economic concentrations of tin are unlikely to be present in the Boobyalla Valley above drill hole BP1.

c. Alluvial gold as a by-product of alluvial tin mining operations will be restricted to the late Pleistocene gravels of the Ringarooma River below Pioneer and under the Great Northern Plain.

d. The mode of formation of the above Pleistocene alluvials suggests that grade enhancements above current known reserves are unlikely although an increase in volume can be anticipated.

e. Exploration drilling at Arba and Pioneer suggests that high tin values in the overburden may indicate the presence of a lead at depth. This would be anticipated as a consequence of the perpetuation of the drainage course through the aggrading sequence which overlies the lead.

5. RECOMMENDATIONS

Recommendations for further work in the Ringarooma Basin include on-going sponsored research accompanied by limited field investigations.

5.1 Sponsored Research

Useful regional correlations and the understanding of the local stratigraphy have followed from palynological studies and dating of the basaltic rocks; it is recommended that both these lines of investigation be continued.

Palynological data from the grey-green clay unit beneath the Great Northern Plain and in the lower part of the Endurance Lead would provide valuable information as would any definitive studies on material from the Boobyalla Valley and Clarence Lead.

Dating of the basalt located in holes RRC3 and RRC5 would eliminate some interpretive possibilities. Similarly dating of the Martins Hill Basalt would provide additional data to aid correlation.

5.2 Field Investigations

No clear exploration targets can be identified but consideration of the following areas would appear to be justified.

a. **The Main Lead:** This lead is entirely sub-basaltic and has not been examined in any detail. It represents the best chance in the Ringarooma Valley of locating a high grade alluvial tin deposit.

b. **The Clarence Lead:** Conflicting grades are reported from the valley west of Mount Cameron. The grade of the Cainozoic sediments and nature of the basement in this area should be resolved unequivocally.

c. **Martins Hill Area:** The area to the southwest of Martins Hill including Walpole Creek, Motts Creek and the upper Little Boobyalla River should be mapped in search of a possible outlet from the Ringarooma Basin into the Boobyalla Basin.

d. **The Great Northern Plain:** The tin-bearing wash beneath the Great Northern Plain is predicted to contain accessory gold yet none has been reported in the drilling done to date. Further drilling on the Great Northern Plain may be warranted where the postulated extension of the Scoloch Lead underlies the tin-bearing wash.

e. **Pioneer:** An older, probably Eocene, tin-bearing wash in the Pioneer area is a possibility and should be a consideration when any further drilling is carried out in this area. If present this lead will have a higher RL and possibly a cover of Eocene Basalt. The trend of the lead will be north or northwest.

J Newton-Smith

Melbourne
April 1984

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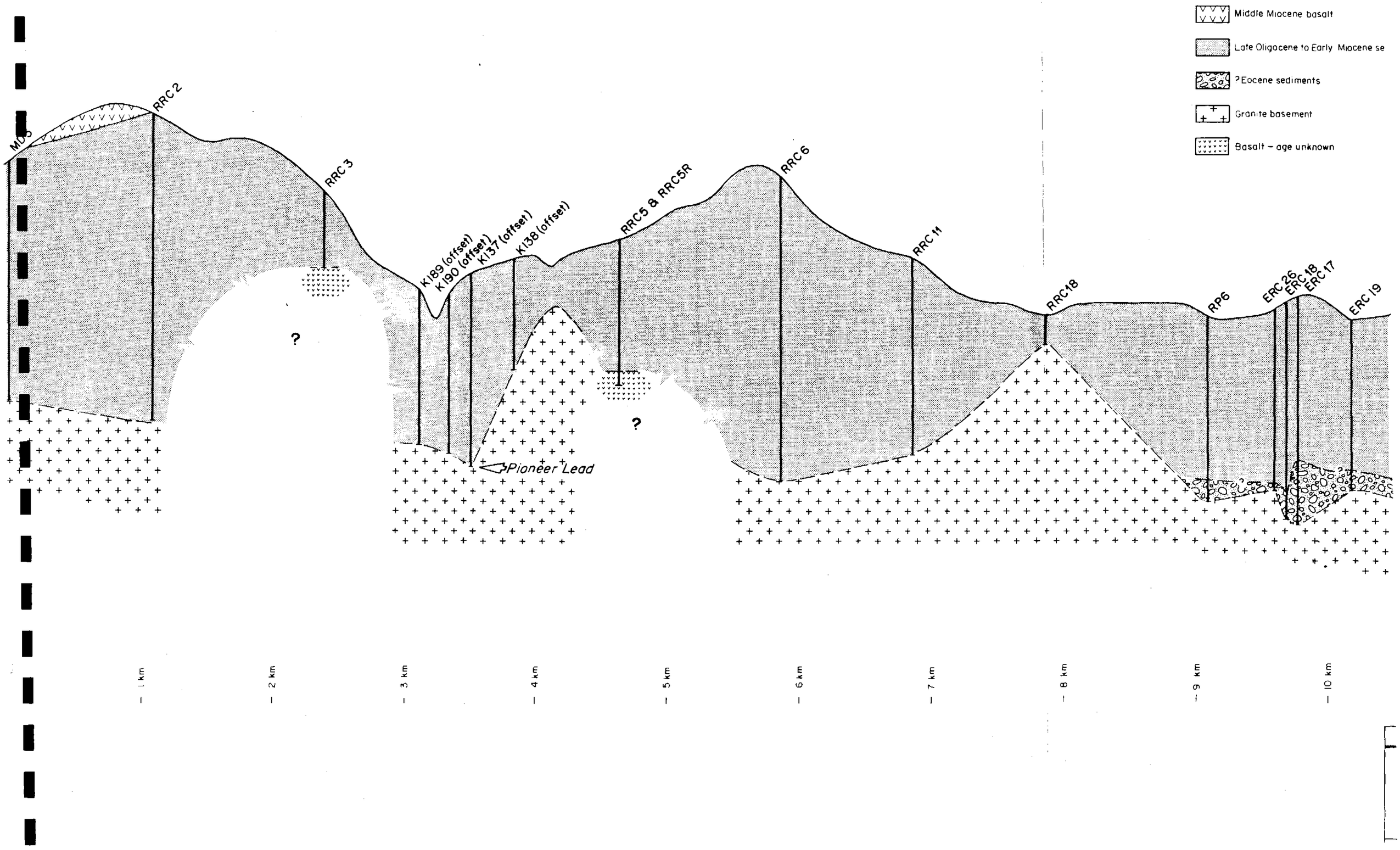
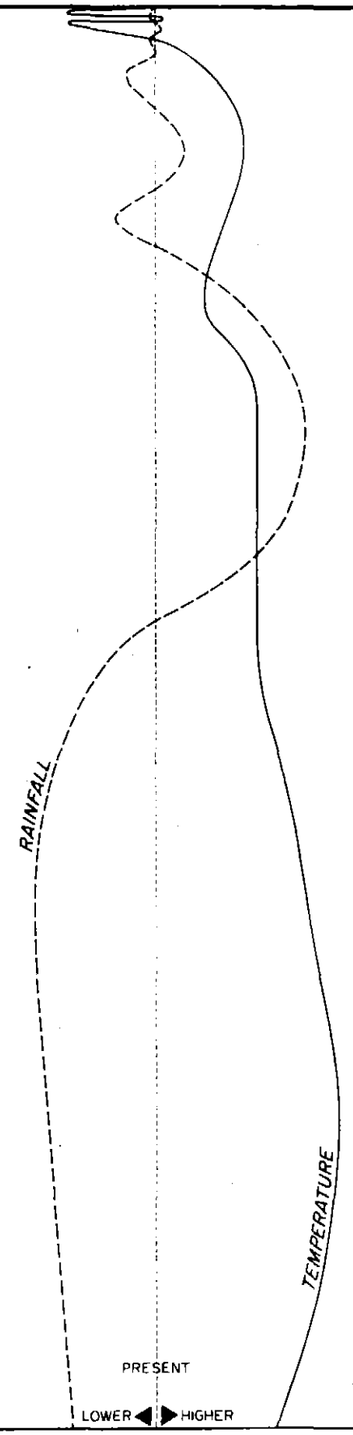

Middle Miocene basalt
Late Oligocene to Early Miocene se
?Eocene sediments
Granite basement
Basalt – age unknown
MD6
RRC 2
RRC 3
K189 (offset)
K190 (offset)
K137 (offset)
K138 (offset)
RRC5 & RRC5R
RRC 6
RRC 11
RRC18
RP6
ERC 26
ERC 18
ERC 17
ERC 19
?
?
Pioneer Lead
1 km
2 km
3 km
4 km
5 km
6 km
7 km
8 km
9 km
10 km

AGE M.Y.	SYSTEM
	QUATERNARY
	PLIOCENE
10	
	MIOCENE
20	
	OLIGOCENE
30	
40	EOCENE
50	
	PALAEOCENE
60	
70	
80	UPPER CRETACEOUS
90	
100	
110	LOWER CRETACEOUS
120	
130	

MEAN GLOBAL TEMPERATURE & PRECIPITATION



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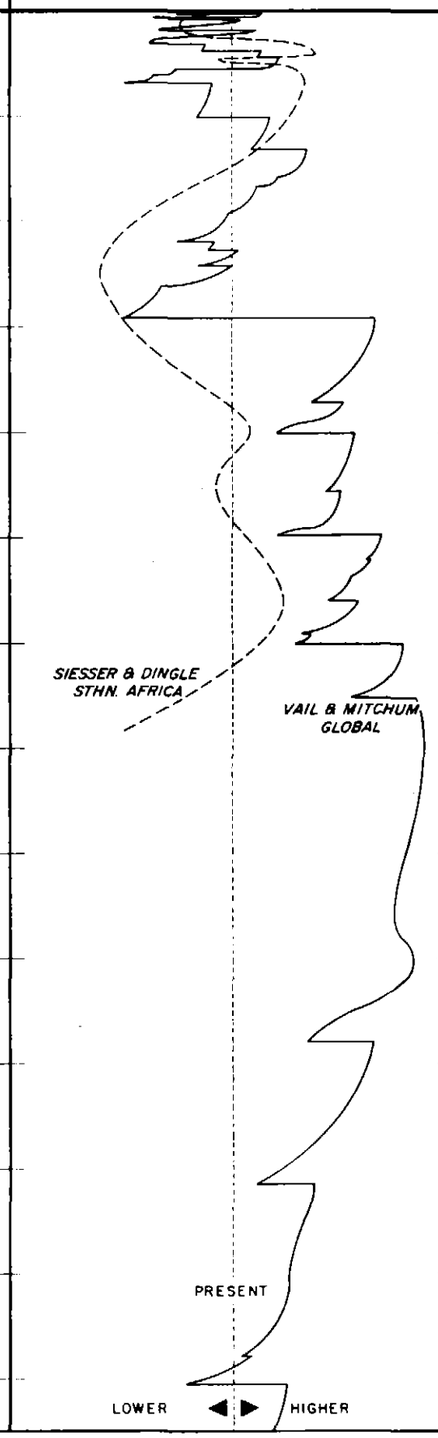

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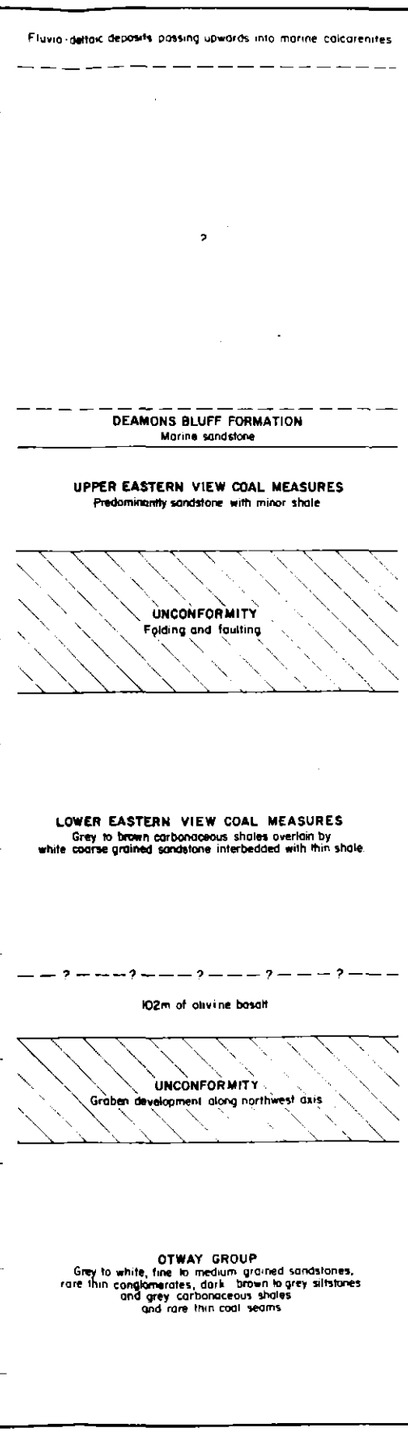

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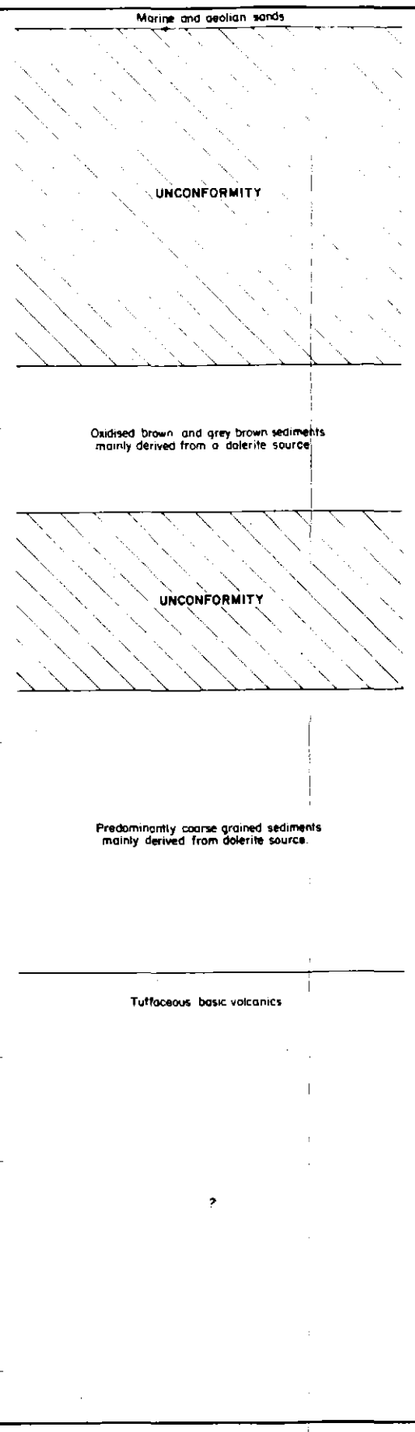
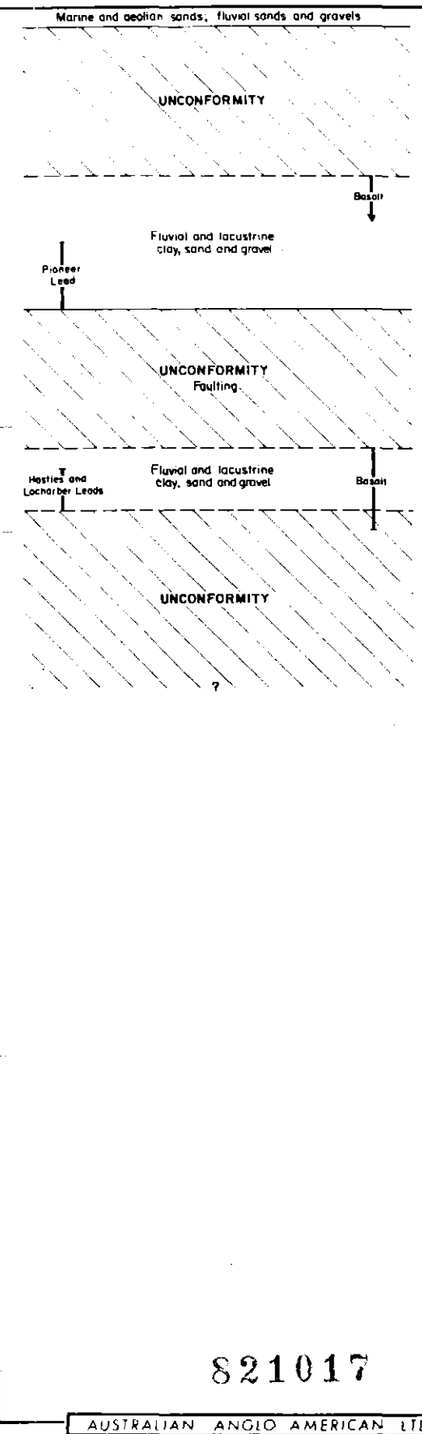


RINGAROOMA BASIN INFERRED STRATIGRAPHY



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PROJECT	
AREA	NORTH EAST TASMANIA
DATA	CORRELATION OF GEOLOGICAL EVENTS IN THE RINGAROOMA BASIN WITH EVENTS IN ADJACENT BASINS
COMPILED J. Newton-Smith	SCALE 1my : 5.5mm
DRAWN H. Rowley 4/84	REF No TAS-5-68
AMENDED	