1978/7. Tertiary lead and basin-Winnaleah Map Sheet.

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Abstract

The remnants of a river system with an internal basin termination occurs on the Winnaleah Map Sheet. This system was infilled during the mid-Tertiary with material derived from the surrounding country rock and was then covered by basaltic flows.

RINGAROOMA LEAD

During the mid-Tertiary (Harris, 1968), country rocks of the Ringarooma region acted as source material for the infilling of an active river system, locally known as the 'Ringarooma Lead'. This lead consists of a main channel with numerous tributaries and ends in an inland basin to the south of Mt Cameron (fig. 1). The basement rock is mainly granitic, but Mathinna Beds occur to the south-west. The main channel of the lead runs roughly due north from west of the present township of Ringarooma, swings north-easterly under Branxholm, onto the north-west of Derby, south-east of Winnaleah and north-west of Herrick before spreading out into an inland basin to the south of Mt Cameron. During an erosional phase, basaltic magma extruded through basement rocks and capped the lead with more than 100 m of alkali olivine basalt flows.

Field mapping with associated drill hole and seismic data from the Winnaleah area indicates that the down slope direction of the gutter is north-easterly from Derby towards Mt Cameron. The main gutter has a very low gradient, but most of the tributaries, which have been worked for tin, have a fairly steep initial gradient which flattens out within 800 m, before reaching the main gutter.

Known tributaries towards the northern end of the lead are the Cascade (Derby) and Main Creek (Mutual) leads (Nye, 1925) from the south-east, Weld Lead (Echo Mine) from the south (Scott, 1930; Anon, 1930); O.K. Lead (Herrick) from the south-east (Nye, 1925); Wyniford Lead (Pioneer) and its tributary, the Gladstone Lead from the south-east (Nye, 1925; Austral-Malay, 1935), Eastern Lead (Warin & Appleby, 1965) from the east and the Endurance (Standard, 1973) - Hasties (Appleby & McEwan, 1966) - Clarence (Twelvetrees, 1913) system from the north-west.

Several previous authors have suggested a possible outlet to Bass Strait, either along the western edge of Mt Cameron, or under the Winnaleah basalt plateau and out under the present Boobyalla River. The present writer considers that the above two suggestions are no longer valid and that the original lead ended in a land locked basin. This conclusion is based on new field mapping, geophysical and drill hole data, as well as the reinterpretation of primary data from previous workers.

Drilling carried out by the Department of Mines during 1972-73 established the depths to the granitic basement along a north-south line from Herrick to the western end of Mt Cameron. Older drilling programmes indicated the shape of the basement around Pioneer (Austral-Malay, 1935), Echo (Scott,1930) and Clarence (Twelvetrees, 1913) leads. Drilling by the Utah Development Company outlined the shape in the Hasties area and of the Eastern Lead (Appleby & McEwan, 1966), whilst similar work by BMI Mining Pty Ltd on the Endurance Lead (Standard, 1973) gives an idea of the basement topology in that area. Recent seismic investigations and drilling by the Department of Mines to the west of the Endurance mine has upgraded the knowledge of the basement shape between Hasties and Endurance (Moore, *in prep.*)

The deepest point so far encountered in the basin is approximately 800 m south of Mt Cameron. This occurs at a reduced level of 18-21 m above present mean sea level at EQ762573. This depth was derived from seismic results (Leaman and Moore, 1973), but four drill holes east of this area, on a surface level of 76 m APMSL, all penetrated 45 m of Tertiary sediment without bottoming, thus indicating the depth to solid basement is at least 30 m APMSL (Appleby & McEwan, 1966, D.H 201). Approximately 2 km south-west of this point, drill hole data indicates a granitic basement at 36 m APMSL, thus giving a fall of only 13.5 m in approximately 2.25 km. The Wyniford Lead drops from 79 m APMSL under the Pioneer-Gladstone road at Pioneer to 43 m APMSL 800 m to the north-west (in the present Pioneer open cut). From this point, it only drops another 6 m over the next 1.5 km to where it enters the main gutter. Other tributaries have a similar geometry. The deepest proven remaining thickness of sediment occurs in a Department of Mines drill hole (No. 7, Winnaleah area, Appendix 1) on the Herrick-Boobyalla road. In this hole, the sediment has a thickness of 123 m.

In the Winnaleah area, ferricrete underlies basaltic rock and overlies the Tertiary sediment. If ferricrete lag overlying Tertiary sediment in other localities can be used as criteria for the basalt-sediment interface, then in the Pioneer-Mt Cameron area the lag would suggest a possible interface at 180 m APMSL. This level corresponds with the interface level over the majority of the area covered by the Winnaleah Sheet. Variations from this level occur in the Herrick area, where the interface occurs at 150 m APMSL and at Derby, where the lowest interface exposed in the Briseis open cut is at approximately 170 m APMSL. This flow is 12 m thick and is overlain by 3 m of sediment. From this level (185 m APMSL), a continuous basalt cover occurs along the open cut to the eastern end where the interface is at about 200 m APMSL. These variations are probably due to a period of erosion, during which small streams cut into the unconsolidated sediment before the extrusion of basalt. Thus in the Pioneer-South Mt Cameron area, at least 75 m of sediment and an unknown thickness of overlying basalt have been eroded and transported to the north of the region. In the Derby-Winnaleah area, most of the sediment and up to 105 m of overlying basalt remains.

Drilling undertaken by BMI Mining Pty Ltd in the Endurance mine area indicates the presence of a gutter along the southern face of Mt Cameron that is separated from the northernmost extent of the Ringarooma Lead by an east-west ridge of granitic rock (Standard, 1973). This ridge is thought to be 21 m under the present day surface, but 30 m higher than the lowest points of the gutter on either side. Drilling and seismic work carried out by the Department of Mines (Moore, *in prep.*) delineated the direction on the westward continuation of this ridge and gutter and confirms that the basement shallows in a southerly direction and that the Hasties-Clarence-Endurance gutters originally emptied in a southerly direction into the inland basin.

Sediments of the lead and basin are very similar in lithology. Basal conglomerate and coarse gravel up to 3 m thick have been exposed overlying granitic basement in the Pioneer open cut. Similar sequences have been intersected by five drill holes along the main lead where conglomerate and gravel lenses, with a maximum thickness of 18 m, overly the basement rock (Appendix I). The conglomerate is composed of boulders of granitic rock, rounded pieces of vein quartz and rounded metamorphosed Mathinna Beds boulders in a matrix of grit, sand and clay dominantly from the weathering of the granitic rock.

Overlying the basal conglomerate are irregularly interbedded and interdigitating beds and lenses, composed of one or more of grit, sand and clay. The most common occurrences are beds and lenses of glassy quartz grit with a matrix of sand and clay, grit lenses, sand and clay lenses and clay lenses. In some places the sand and grit are cemented by iron oxide.

In the Pioneer open cut, the cross-sectional size of a lens can vary from 100 m by 30 m of thick buff coloured clay down to 150 mm by 25 mm of grit or coarse sand. In lower parts of the lead and basin, some of the sequences contain carbonaceous material such as tree stems, branches and leaves which are partly altered to coal and in many places replaced by marcasite. Such layers are exposed in the Hasties and Pioneer open cuts and were intersected by two of the five drill holes along the Herrick-Boobyalla road. The overall character of the sediment, as seen in the open cuts and quarries, suggests a deltaic rather than lacustrine environment.

In general, it appears that after deposition of about 75 m of sediment, the original basement gutters were infilled and the spurs forming the tributary boundaries became covered. This led to a change in the depositional environment from small streams to material from the various sources crossing and intermixing in a deltaic type basin, the northern extent of which was at Mt Cameron.

Sediment from the area contains microflora that has been correlated with those from marine sediments of Longfordian age (Lower Miocene) by Harris (1968). Harris obtained fifteen samples from five different localities in the Ringarooma area; Branxholm, Wood's property, Endurance, Amber Hill and the New Edina pit. All proved to be of Longfordian age. Potassium-argon age determination of three whole rock basalt samples from flows that overly the Tertiary sediment gave an age range of 15.9 ± 0.6 Ma (Brown, 1977), corresponding to the top of the Lower Miocene.

BOOBYALLA LEAD

Another Tertiary river system, here called the 'Boobyalla Lead', starts in the central north of the Winnaleah Sheet, between the present Boobyalla and Little Boobyalla rivers to the north of the Winnaleah basalt plateau. Seismic and gravity work by the Bureau of Mineral Resources in 1961-62 (Sedmik, 1964) outlined this lead which was later confirmed with drilling by BHP (Chesnut, 1965) and the Department of Mines (Jennings, 1966). This northerly trending lead has previously been considered as one of two possible continuations of the Ringarooma Lead, due to an extrapolation joining the two systems by a channel under the basalt plateau. Field mapping and the above mentioned drilling and geophysical work has shown that this is not possible.

The Boobyalla Lead starts as two separate, northerly trending gutters, with a granitic rock basement, to the north of the Winnaleah basalt. About 3 km north of their source, the gutters join into a single channel and continue to deepen to the north. After joining, seismic data suggests that the channel consists of two nearly parallel gutters. Drilling confirms the channel but does not define its shape. In the area of drilling, geophysical data indicates up to 90 m of sediment, whereas drilling has indicated the bottom at between 59 and 61 m.

This system appears to have been infilled at the same time as the Ringarooma Lead, subsequent to which a nearly continuous sedimentary cover extended inland from the sea to the northern face of Mt Cameron, around the western side of Mt Cameron west to Little Mt Horror, then south-east to between Wagners Hill and the high granite country to the south of Garibaldi. From there, the cover swung to the south-west, between Mathinna Beds sequences to the north-west and granitic hills to the south-east, inland towards the present township of Ringarooma to a level which is currently represented by an altitude of about 180 m APMSL.

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APPENDIX 1

Logs of drill holes

During 1972-73, eight Cable Tool and Rotary drill holes were drilled at locations covered by the Winnaleah Sheet of the Ringarooma Quadrangle by the Department of Mines. All these holes were intended to bottom in unweathered basement rock. The placement of the holes was influenced by an attempt to obtain maximum data on the topology of the old Tertiary river valley and the underground water potential of the area. Drill hole No. 2 was not drilled in the area of this report.

Hole 1 [EQ676468]

Depth (feet)	*Reduced Level (feet)*	*Thickness (feet)*	*Remarks*
0	830	-	Soil
2	828	2	Chocolate soil
5	825	3	Basaltic clay
10	820	5	Basalt boulder gravel
26	804	16	Basalt boulders
140	690	114	Solid basalt
180	650	40	Softer basalt
206	624	26	Solid basalt
210	620	4	Basaltic clay
220	610	10	Basalt-silt-clay
235	595	15	Clay-gravel
470	360	235	Sand-clay
530	300	60	Ironstone-gravel
585	245	55	Gravel-clay
675+	155+	?	Sandstone - (Mathinna Beds)

Surface 830'
Basalt 220' thick
Tertiary 365' thick

Basement Mathinna Beds at R.L. 245'
Basalt-Tertiary Interface at R.L. 610'.

Hole 3 [EQ685478]

Depth (feet)	*Reduced Level (feet)*	*Thickness (feet)*	*Remarks*
0	960	-	Soil
2	958	2	Chocolate soil
10	950	8	Soil and boulders (basalt)
65	895	55	Basaltic clay and stones (?)
80	880	15	Basalt
85	875	5	Basaltic clay and pebbles
91	869	6	Hard basalt
109	851	18	Honeycomb basalt with clay seams
203	757	94+	Hard basalt

Hole abandoned.

Hole 4 [EQ698504]

Depth (feet)	*Reduced Level (feet)*	*Thickness (feet)*	*Remarks*
0	700	-	Soil
4	696	4	Chocolate soil
12	688	8	Basaltic clay
25	675	13	Weathered basalt
29	671	4	Basalt
36	664	7	Clay and pebbles
85	615	49	Hard basalt
98	602	13	Clay and sand
131	569	33	Hard basalt
138	562	7	Hard sand
148	552	10	Basalt (?)
315	385	167	Clay and sand
333	367	18	Clay
360	340	27	Clay and sand
368			Clay
396			
435		39	Clay and gravel
476		41	Coarse stone and clay
535		59	Boulders and clay (coarse gravel and clay)
554		19	Soft sandstone (?) (Fine sand, A.V.B.)
574	126	20	Sandstone (?) (Fine sand, A.V.B.)

Hole abandoned at 574 ft.

Hole 5 [EQ747502]

Depth (feet)	*Reduced Level (feet)*	*Thickness (feet)*	*Remarks*
0	440	-	Tertiary sediments in quarry 20' under basalt
40	400	40	Gravel and clay
110	330	70	Rotten wood - pyrite - clay - gravel
140	300	30	Gravel
180	260	40	Clay-gravel-pyrite
185	255	5	Rounded pebbles-gravel-pyrite
195	245	10	Fine gravel
240	200	45	Rounded pebbles-gravel
330	110	90	Decomposed granite
330+	-	?	Hard granite

Surface 440'
Basalt-Tertiary sediment interface 460'
Tertiary sediment-decomposed granite interface R.L. 200+
Soft granite-hard granite interface R.L. 110'.
Tertiary sediment thickness 260'
Decomposed granite thickness 90'

Hole 6 [EQ751519]

Depth (feet)	*Reduced Level (feet)*	*Thickness (feet)*	*Remarks*
0	390	-	Black-grey soil and gravel
1	389	1	Soil
5	385	4	Hard gravel
16	374	11	Gravel, clay and clay seams
33	357	17	Gravel
56	334	23	Clay
80	310	24	Clay and gravel
120	270	40	Gravel
180	210	60	Rounded pebbles-clay-gravel
200	190	20	Decomposed granite
200+	-	?	Hard granite

Surface 390' in Tertiary sediments
Tertiary sediments-decomposed granite interface R.L. 210'

Decomposed granite-hard granite interface R.L. 190'
Decomposed granite thickness - 20'

Hole 7 [EQ742543]

Depth (feet)	*Reduced Level (feet)*	*Thickness (feet)*	*Remarks*
0	550	-	Black-grey soil and gravel
1	549	1	Surface soil
7	543	6	Clay
73	477	66	Gravel and clay
99	451	26	Gravel
132	418	33	Clay and gravel
145	405	13	Gravel
165	385	20	Clay and gravel
175	375	10	Coarse gravel
194	356	19	Clay
238	312	44	Coarse gravel
270	280	32	Clay
310	240	40	Clay and gravel
245	205	35	Clay-rotten wood-pyrite
356	194	11	Gravel
405	145	49	Rounded pebbles and clay and gravel
435+	115+	30+	Soft granite
-?	?	?	Hard granite

Surface 580'
Tertiary sediment-soft granite interface R.L. 145'

Tertiary sediment thickness 405'
Weathered granite 30'+ thick

Hole 8 [EQ751560]

Depth (feet)	*Reduced Level (feet)*	*Thickness (feet)*	*Remarks*
0	440	-	Black-grey soil and gravel
1	439	1	Soil
6	434	5	Hard gravel
17	423	11	Gravel

Hole 8 (continued)

Depth (feet)	*Reduced Level (feet)*	*Thickness (feet)*	*Remarks*
43	398	26	Hard gravel
73	368	30	Gravel
89	352	16	Clay
99	342	10	Clay, rotten wood, pyrite
106	335	7	Gravel, pyrite
158	283	52	Clay, gravel, rotten wood, pyrite
208	233	50	Gravel and clay seams
216	225	8	Clay with small amounts of gravel
353	88	137	Gravel, clay
356	85	3	Harder granite
365	76	9	Soft granite
366	75	1	Harder granite
378	63	12	Soft granite
386	55	8	Harder granite
388+	-	?	Hard solid granite

Surface 440'
Soft granite-Tertiary sediment interface R.L. 85'

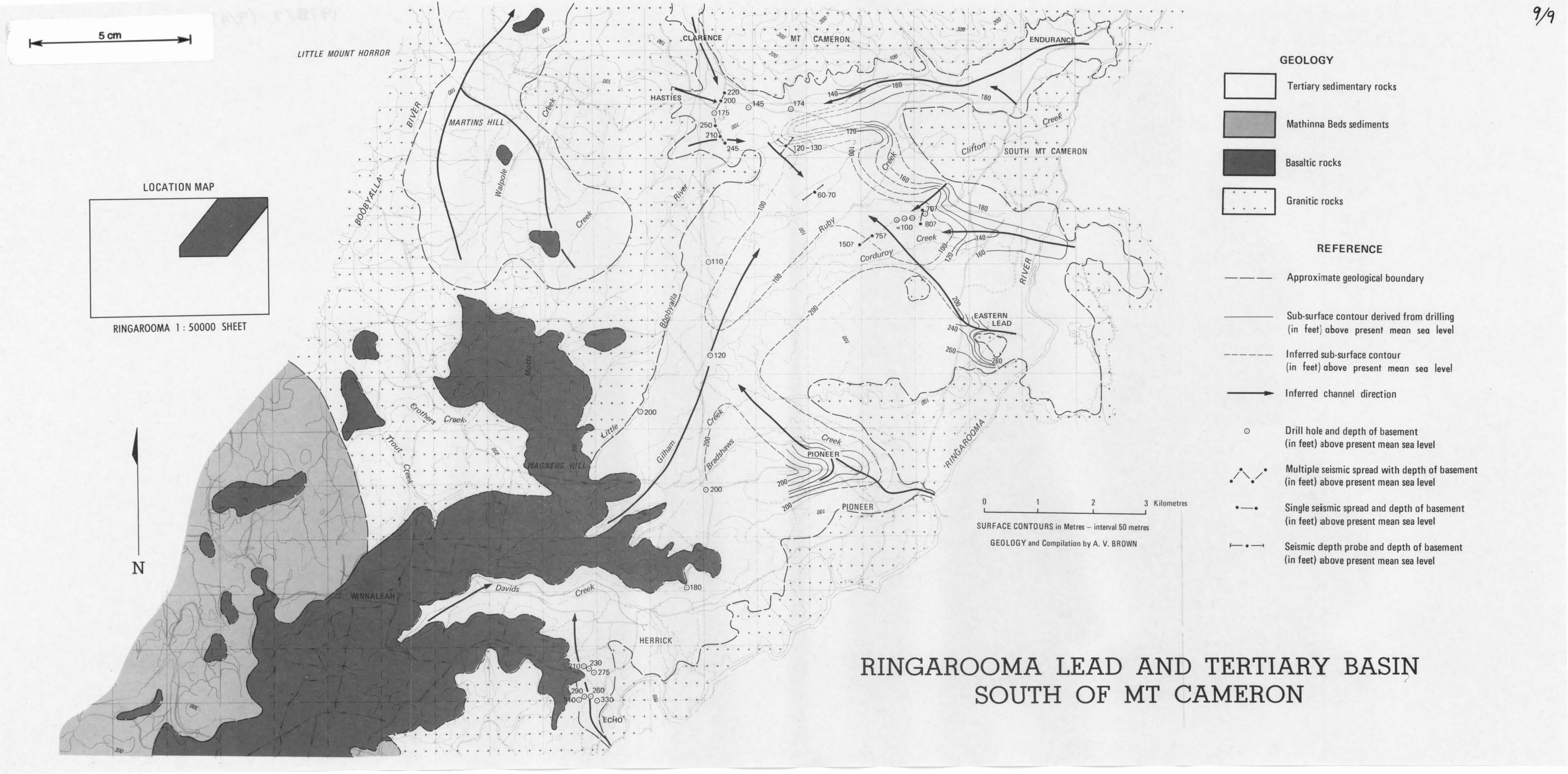
Hard granite - soft granite interface R.L. 55'
Tertiary sediment thickness 352'
Weathered granite thickness 33'

Hole 9 [EQ753589]

Depth (feet)	*Reduced Level (feet)*	*Thickness (feet)*	*Remarks*
0	275	-	Black-grey soil with gravel
1	274	1	Soil
3	272	2	Hard cemented gravel
22	253	19	Gravel, clay
54	221	32	Clay, gravel
95	180	41	Gravel and clay
108	167	13	Soft decomposed granite
112	163	4	Hard decomposed granite
115	160	3	Soft decomposed granite
146	129	31	Hard decomposed granite
153	122	7	Gravel, clay (?)
160	115	7	Granite gravel (?)
162+	-	?	Hard granite

Surface 275'
Decomposed granite-hard granite interface R.L. 115'

Tertiary sediment-decomposed granite interface R.L. 167'
Decomposed granite thickness - 52'
Tertiary sediment thickness - 108'



RINGAROOMA LEAD AND TERTIARY BASIN SOUTH OF MT CAMERON