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DISTRIBUTION OF PERMIAN SEDIMENTS IN THE EASTERN OFFICER BASIN, S.A.

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INTRODUCTION

The purpose of this study is to determine the extent, thickness and facies of the Permian Arckaringa Basin where it overlies the Officer Basin in central northern South Australia. Marine sediments provide important data for sea level curves and coal-bearing strata can be analysed for vitrinite reflectance. Isopach and structure contour maps can determine the timing of structural events. All such information is necessary for comprehensive geohistory analysis of the region. The area of interest for this report and associated maps is located in the north western section of the Arckaringa Basin and is bounded by the Latitudes 27° and 29° South and Longitudes 132°30' and 134°30' East (Figure 1). The information needed to produce the top of Permian and total Permian isopach maps and associated data was obtained from several sources, these included:

1) Comalco seismic up holes
2) D.M.E. up hole drilling program
3) Comalco coal holes
4) Comalco stratigraphic/mineral holes

The data obtained from these sources was either in the form of a written stratigraphic log or a pictorial representation of the core along with some depth vs. velocity plots (Figure 3). This resulted in 92 points of reference spread over the map area, enabling contouring to be done. However the density of reference points varies over the area of interest, therefore in some sections the degree of accuracy is greater than in other areas, where a certain amount of "artistic" licence has been used. Also as there was no direct interpretation of rock samples the exact location of formation boundaries at present is subject to further clarification.

REGIONAL STRUCTURE

Despite the limitations mentioned above it is possible to observe several structural trends. On the total Permian isopach map it is can be seen that the western part of the map is governed by the northeasterly trending thins of the Ammaroodinna and Middle Bore Ridges, with the thick of the Manya Trough in between the two ridges. To the south of the Middle Bore Ridge the thickness increases. The area southeast of the Marla Overthrust Zone marks the end of Middle Bore Ridge and the start of the Wintinna and Boorthanna Troughs. The Boorthanna Trough is characterised by a thickening of Permian sediments to the east of the area. By examining the top of Permian map it is possible to also detect several regional trends. Firstly the western part of the map is dominated by deeper strata. Secondly the area to the south of the Marla Overthrust Zone is severely faulted, with the faults appearing to have two dominant directions. One fault set trends towards the northeast and the other set is almost perpendicular to the first and tends to the northwest. By comparing the two maps it is possible to see that the northeasterly trending faults have not been reactivated post Permian, whereas the northwesterly trending faults have been reactivated. Another area of interest lies southwest of the Marla Overthrust Zone. This area is dominated by a series of troughs and ridges that trend roughly north-south. Although these ridges form a pronounced feature on the top of Permian map they are not present on the isopach map, which implies that if more information was available and analysed then more control could be exerted on the maps making them more accurate. This lack of correlation on a small scale is a point of interest, for although the two maps observe similar regional trends it is on the smaller scale that more detailed work is needed. The north-south trends may also indicate post-Permian deformation, perhaps during the Tertiary as seen in the Pedirka Basin region

On the larger scale the northwestern proximity of the Arckaringa Basin can be identified but from other work done to the west, in the Officer Basin, more Permian sediments have been found. Coupling this with the fact that there is trend towards the Tallaringa Trough in the southwest it would be reasonable to postulate that the Arckaringa Basin has at one time covered a larger area than at present.

STRATIGRAPHY

As no rock samples have been examined, the following lithological descriptions are based on summarising previous descriptions. The Permian sequence in the Arckaringa Basin consists of, from oldest to youngest, the Boorthanna, Stuart Range and Mount Toondina Formations (Figure 2).

BOORTHANNA FORMATION

The Boorthanna Formation consists of two units, the lower unit is composed of diamictite. The diamictite is characterised by pebbly claystone, with a pinkish-grey colour. Also present are shale interbeds, which are thin, fissile and clean, they can also be micaceous, sandy or silty, in places grading into siltstone. The presence of the diamictite indicates that the environment of deposition would have been marine with glacial influences. This unit is present mainly in the centre of the area and along the Middle Bore Ridge, with none being present in the eastern section. According to Townsend (1976) the diamictite was restricted to the southeastern portion of the Arckaringa Basin, however, as a result of current work, the diamictite has now been identified in the northeast of the basin (Table 2).

The upper unit is mainly coarse grained to conglomeratic, rhythmically bedded and generally contains less clay than the upper unit. The conglomerate clasts are generally subrounded with their long axes orientated parallel to bedding. The clasts are often igneous or metamorphic in composition, with a varied matrix ranging from sandstone, micrite, sparry carbonate, dolomite to clay (kaolin). The rhythmic nature of the sediments comprising the upper unit suggests a turbidity current associated system (Hibburt, 1984), with detrital material originating from both before and after glaciation. The Boorthanna Formation is the most wide spread of the Permian formations within the map area and is not restricted to one particular locality.

STUART RANGE FORMATION

The Stuart Range Formation conformably overlies the Boorthanna Formation and is typically a pale to dark grey shale or mudstone with poor bedding and minor laminations. Townsend (1976) suggests that the depositional environment was a deep, low energy, post-turbidity current, marine environment. Further to this, Hibburt (1984) clarifies the situation by suggesting that the presence of thin sandy and pebbly beds indicate minor periods of tectonic activity. Also that the presence of anhydrite near the top of the formation indicates the development of evaporitic conditions, therefore a shallower marine environment, but still under low energy conditions. The Stuart Range Formation is mainly restricted to the an area south of the Marla Overthrust Zone. This restrictive occurrence could be due in part to the fact that it has been mostly identified in SADME upholes and not in the Comalco holes, which could be due to different interpretations of cuttings by separate geologists.

MOUNT TOONDINA FORMATION

The Mount Toondina Formation conformably overlies the Stuart Range Formation and can be divided into two units. The upper unit consists of interbedded sandstones, siltstones, coals and carbonaceous shales. The coals are dark brown to black, fibrous and best developed towards the top of the formation.

The lower unit also consists of interbedded sandstones, siltstones and shales, but is not carbonaceous and more sandy than the upper unit. There is also a coaly interval near the base of the unit (Hibburt 1984).

Bedding is fair throughout the formation and the sandstones contain small scale sedimentary structures. The depositional environment was non-marine lacustrine, with occasional swamps, intermittent fluvial influences and localised lagoonal environments. The Mount Toondina Formation is not present in the area of the Wintinna Trough, but is present through out the rest of the map, although it is not as prolific as the Boorthanna Formation. The coal intervals have been intersected in a limited number of holes (Table 3) and are mainly located in the southwestern corner except for one uphole in the middle of the Marla Overthrust Zone.

REFERENCES

Appraisal of the 1983-1984 uphole data and the proposed 1985 uphole program. D.M.E. open file, envelope 5073, pages 598-767

Gravestock, D. 930F (Wallatinna) seismic survey. Uphole drilling program cutting descriptions. D.M.E. envelope 8591

Hibburt, J., 1984. Review of exploration activity in the Arckaringa Basin region 1858-1983. Volume 1 and Volume 2, Rept. Bk. No. 84/1.

Hibburt, J., 1990. Exploration opportunity, Officer Basin. Rept. Bk. No. 90/64

Mackie, S. and Gravestock, D., 1993. Summary of seismic interpretation Marla area, Officer Basin. D.M.E. envelope 8591

Manya 2 drill hole completion report. D.M.E. open file, envelope 6259, pages 3-5.

Manya 3 drill hole completion report. D.M.E. open file, envelope 6259, pages 36-42

Manya 4 drill hole completion report. D.M.E. open file, envelope 6259, pages 115-117.

Manya 6 drill hole completion report. D.M.E. open file, envelope 6259, pages 247-264.

Mt. Willoughby 2 drill hole completion report. D.M.E. open file, envelope 6259, pages 348-360.

Nicholson 2 drill hole completion report. D.M.E. open file, envelope 6259, pages 360-363.

Technical report on the drilling for the 1983 coal exploration program. D.M.E. open file, envelope 6259, pages 1113 and 1115-1154.

Townsend, I.J., 1976. A synthesis of stratigraphic drilling in the Arckaringa Basin 1969-1971. Rep. Invest., geol. surv. S. Aust., 45.

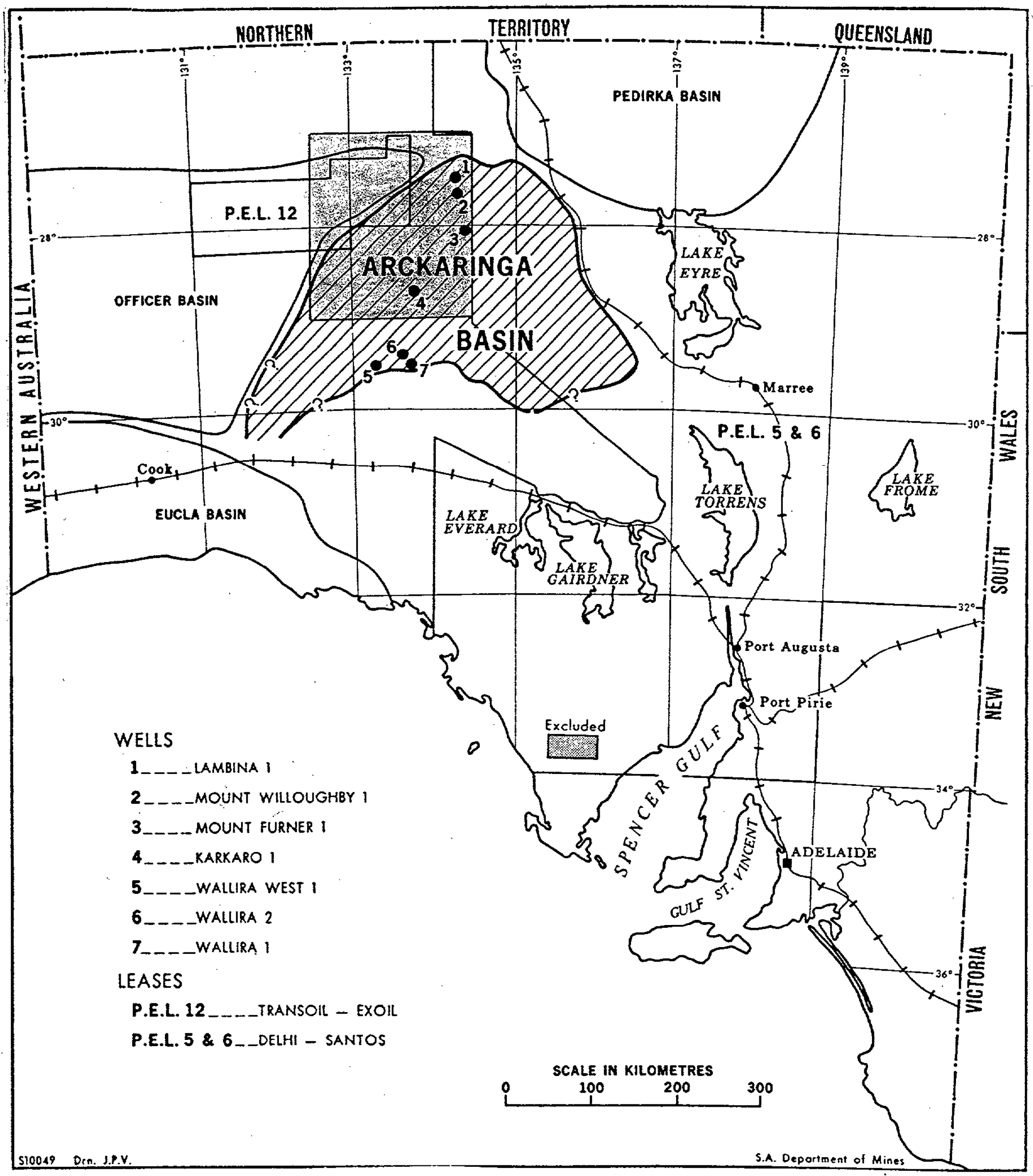


Fig. 1. Map showing localities of the Arckaringa Basin and the area of study.

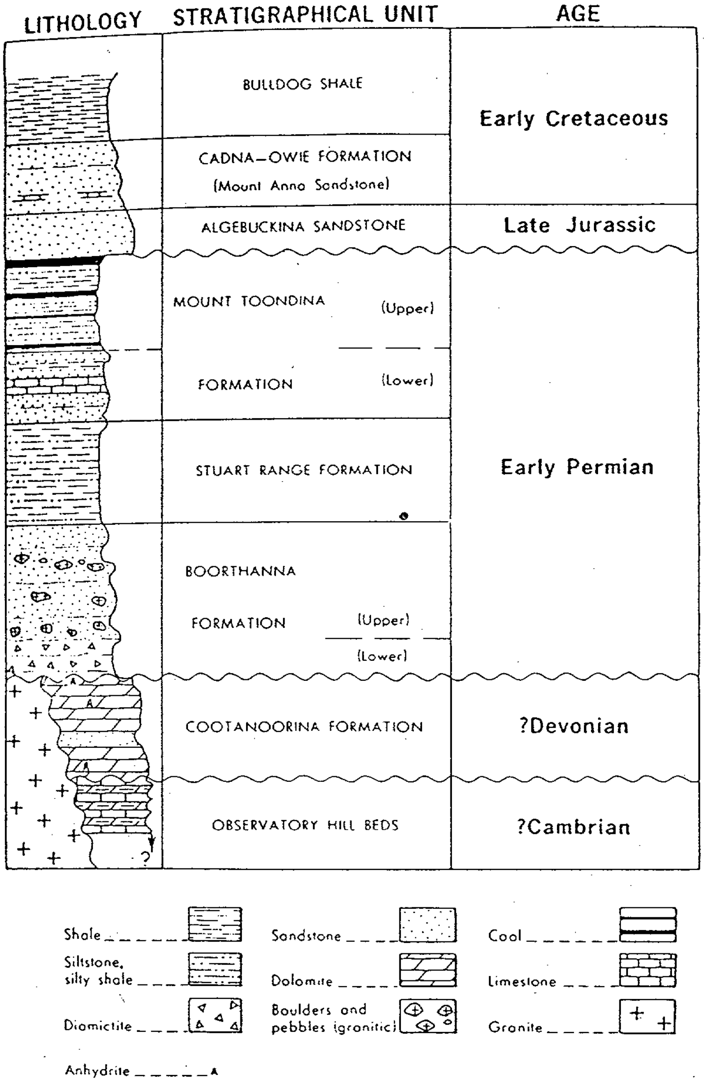
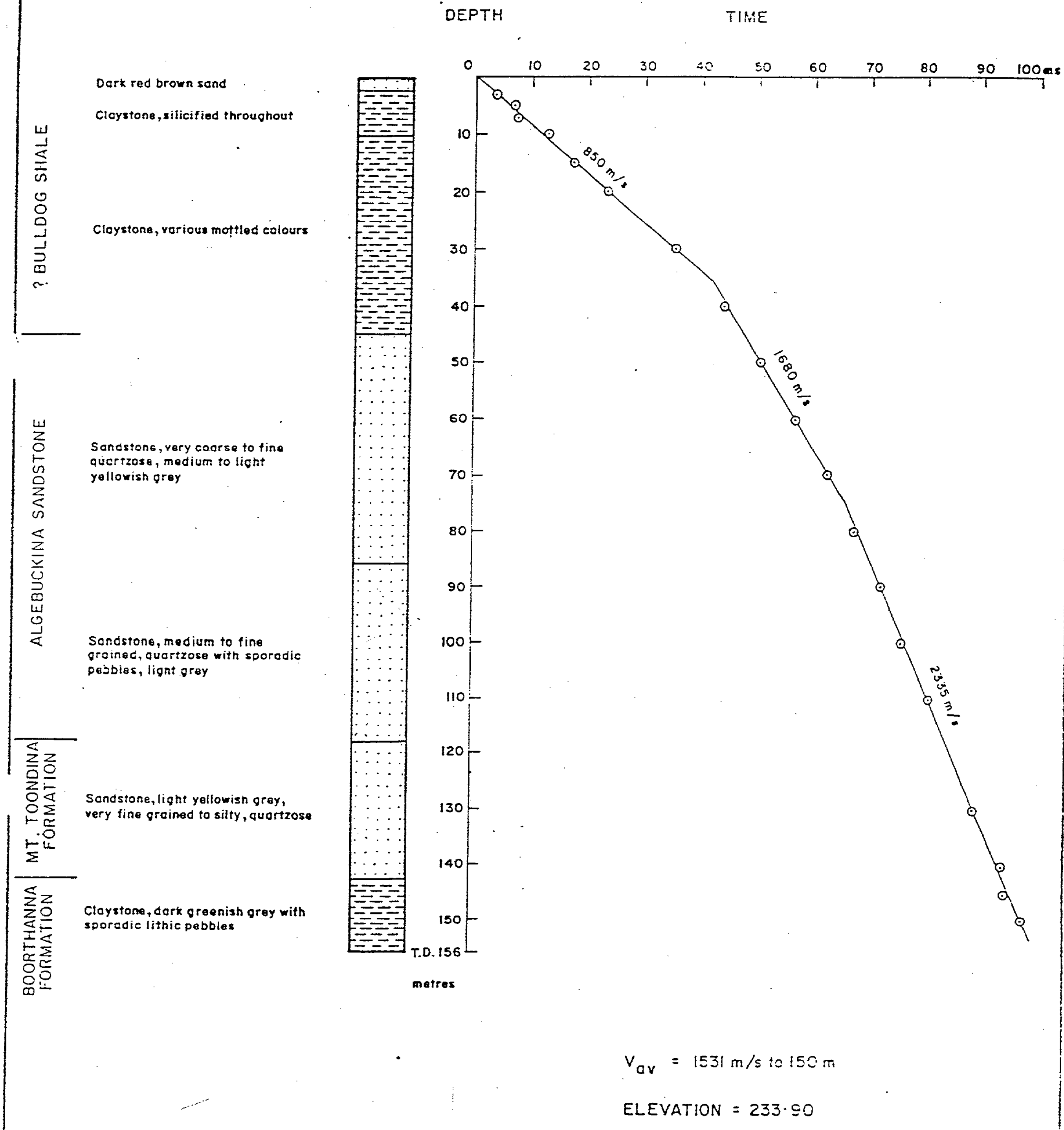


Fig. 2. Composite idealised section of the Arckaringa Basin.

Fig. 3. Example of the information used to determine formation boundaries.



GEOLOGY AND VELOCITY OF UPHOLE Nº 95
LINE 0085
S.P. 206

COMALCO
EXPLORATION DEPARTMENT

COMPILED:	23/5/1984	DRAWING Nº
DRAWN: J.E.Harrison	17/1/1985	SA-84-786/95

Permian Occurrences

Table 1

Hole	Elevation (m)	Overlying unit	Mt. Toondina, top of	Stuart Range, top of	Boorthanna, top of	Pre Perm. top of	T.D.	Total Perm.
Comalco coal holes								
1	237.45	Algebuckina SST.	163	NP	NP	NP	265	>102
2	224.65	Algebuckina SST.	167	NP	NP	NP	241	>74
3	227.74	Algebuckina SST.	186	NP	NP	NP	301	>115
4	283.00	Algebuckina SST.	204	NP	NP	NP	234	>30
5	244.89	Algebuckina SST.	NP	NP	110	NP	200	>90
Manya 1	241.00	NP	NP	NP	122	146		24
Manya 2	236.00	Algebuckina SST	248	NP	279	523	646	275
Manya 3	244.00	Algebuckina SST	90	NP	115	174	812.9	84
Manya 4	234.00	Algebuckina SST.	106	NP	162	408.3	806.7	302
Manya 6	265.60	Algebuckina SST.	118	NP	180	457.7	176.7	339.7
Middle Bore 1	262.40	Bulldog Shale	40	NP	NP	157	557.6	113
Nicholson 2	308.00	Bulldog Shale	186	NP	NP	200	814.5	4
Mt. Willoughby 1	200.00	Algebuckina SST.	199.6	292.6	389.6	623.6	639.7	424
Mt. Willoughby 2	240.50	Algebuckina SST.	160	NP	262	NP	395	>235
SADME up holes								
4		Algebuckina SST.	NP	48	NP	134	156	86
5	290.00	Recent	NP	6	NP	12	78	6
6	256.00	Algebuckina SST.	NP	114	156	NP	180	>66
8	286.00	Recent	NP	6	60	69.3	73.7	63.3
9	258.00	Recent	NP	6	96	NP	132	>126
10	242.00	Algebuckina SST.	NP	42	105	NP	116	>74
14	278.00	Bulldog shale	NP	42	114	NP	144	>102
15	273.00	Algebuckina SST.	NP	108	NP	NP	162	>54
17	258.00	Algebuckina SST.	NP	94	117	NP	132	>38
19	284.00	Recent	NP	18	60	NP	108	>90
21	259.00	Algebuckina SST.	NP	102	117	NP	138	>36
22	283.00	Recent	NP	12	NP	75	77	63
24	277.00	Recent	NP	9	NP	62	73	53
Comalco upholes								
45	306.68	Bulldog shale	84	100	NP	NP	134	>50
47	292.50	Algebuckina SST.	NP	NP	160	NP	164	>4
48	309.37	Bulldog shale	NP	NP	76	NP	187	>76
49	283.63	Bulldog shale	NP	NP	51	NP	126	>75
50	268.34	Algebuckina SST.	93	NP	133	NP	143	>50
53	298.72	Bulldog shale	NP	NP	87	NP	156	>69
54	271.86	Bulldog shale	NP	NP	81	NP	138	>57
55	261.63	Bulldog shale	NP	NP	58	NP	138	>80
60	309.27	Bulldog shale	NP	NP	110	NP	187	>77
61	272.55	Bulldog shale	NP	NP	66	NP	124	>72
62	260.03	Bulldog shale	118	NP	150	NP	155	>37
63	247.90	Algebuckina SST.	92	NP	NP	NP	168	>76
64	247.90	Algebuckina SST.	94	NP	117	NP	138	>44
66	305.99	Bulldog shale	140	NP	NP	NP	174	>34
67	279.40	Bulldog shale	NP	NP	108	NP	201	>93
71	255.51	Algebuckina SST.	NP	NP	107	NP	156	>49
72	246.21	Bulldog shale	NP	NP	39	NP	138	>99
75	280.46	Bulldog shale	NP	NP	117	NP	157	>40
78	253.66	Bulldog shale	NP	NP	62	NP	85	>23
79	240.41	Algebuckina SST.	NP	NP	137	NP	156	>19
80	230.80	Algebuckina SST.	97	110	NP	NP	122	>25
89	233.01	Algebuckina SST.	NP	52	NP	NP	144	>92
93	259.66	Bulldog shale	85	NP	NP	NP	107	>22
95	233.90	Algebuckina SST.	118	NP	143	NP	156	>38

Hole	Elevation (m)	Overlying unit	Mt. Toondina, top of	Stuart Range, top of	Boorthanna, top of	Pre Perm. top of	T.D.	Total Perm.
97	258.99	Bulldog shale	75	NP	NP	NP	103	>28
98	251.99	Algebuckina SST.	78	NP	NP	NP	138	>60
99	241.42	Recent	12	NP	110	NP	138	>126
100	245.36	Bulldog shale	24	NP	118	NP	138	>114
101	226.86	Bulldog shale	15	NP	124	NP	138	>123
102	221.90	Bulldog shale	NP	NP	50	NP	126	>76
103	251.70	Algebuckina SST.	40	NP	96	100	136	60
104	278.22	Algebuckina SST.	65	NP	120	NP	144	>79
105	277.33	Bulldog shale	32	NP	121	NP	144	>112
106	285.51	Bulldog shale	28	NP	116	NP	138	>110
107	272.8	Algebuckina SST.	35	NP	86	91	94	56
108	242.92	Algebuckina SST.	48	NP	92	NP	134	>86
109	215.05	Algebuckina SST	40	NP	87	NP	138	>98
110	215.88	Recent	0	NP	91	NP	126	>126
111	258.52	Recent	0	NP	78	6	96	92
112	269.6	Recent	0	NP	56	62	84	>62
113	264.72	Recent	10	NP	55	68	105	58
115	274.35	Algebuckina SST	25	NP	82	NP	126	>101
116	243.79	Bulldog shale	46	NP	NP	60	60.6	14
117	232.68	Bulldog shale	60	NP	78	NP	114	>54
118	236.6	Bulldog shale	30	NP	106	NP	138	>108
119	228.1	Bulldog shale	12	NP	68	NP	114	>102
121	268.46	Algebuckina SST.	38	NP	120	NP	126	>98
122	263.44	Bulldog shale	28	NP	62	NP	114	.86
123	239.65	Bulldog shale	31	NP	68	NP	114	>83
124	276.55	Algebuckina SST.	30	NP	88	NP	126	>96
125	268.92	Algebuckina SST.	NP	NP	58	NP	114	>56
127	257.34	Algebuckina SST.	NP	NP	22	NP	114	>92
128	246.83	Algebuckina SST	28	NP	50	NP	114	>86
129	281.11	Algebuckina SST.	16	NP	100	NP	114	>98
130	292.8	Algebuckina SST.	22	NP	84	NP	114	>92
134	290.71	Algebuckina SST.	47	NP	NP	112	126	65
135	286.63	Algebuckina SST.	17	NP	61	66	126	49
136	295.48	Algebuckina SST	36	NP	50	100	114	64
137	301.81	Algebuckina SST	18	NP	27	33	92	15
143	291.16	Recent	NP	6	88	NP	124	118
145	306.17	Recent	NP	NP	10	37	102	22
146	287.09	Bulldog shale	10	NP	88	96	112	86
176	235.66	Algebuckina SST	33	NP	NP	NP	102	>69
177	217.34	Algebuckina SST.	NP	57	NP	NP	114	57
178	273.38	Algebuckina SST.	50	NP	137	NP	156	>106

Diamictite Occurrences			Table 2
Hole	Diamictite interval (m)	Total depth of hole (m).	Diamictite thickness (m).
Comalco upholes			
47	160-164	164	>4
48	112-137	187	25
50	133-143	143	>10
64	117-138	138	>21
95	143-156	156	>13
99	110-138	138	>20
102	92-100	126	8
103	96-100	136	4
104	120-144	144	>24
105	121-144	144	>23
106	116-138	138	>22
107	86-91	94	5
108	92-134	134	>42
109	87-138	138	>51
110	91-126	126	>35
115	82-126	126	>44
117	78-114	114	>36
118	106-138	138	>32
124	112-126	126	>14
125	80-117	114	37
130	84-114	114	>30
143	88-103	124	15
146	88-96	112	8
Manya 2	279-523	646	244
Manya 3	115-170	813	55
Manya 4	162-408	807	246
Manya 6	288-290, 314-368	410	56
SADME up holes			
6	162-174	180	12
8	60-63	73.7	3
9	102-108	132	6
10	105-112	116	7
14	114-120	144	6

Coal Occurrences

Table 3

Hole	Depth (m)	Interval thickness (m)	Total thickness (m)
Comalco coal holes			
1	168-175	7	
	176-178	2	
	194-201	7	
	211-213	2	
	217-219	2	
	229-231	2	22
2	167-174	7	
	192-196	4	
	204-213	9	
	229-231	2	
	235-236	1	23
3	186-204	18	18
4	204-208	4	
	209-211	2	
	212-217	5	
	218-221	3	14
Up hole 30	116	1 (weathered)	
Up hole 76	130	Trace only	

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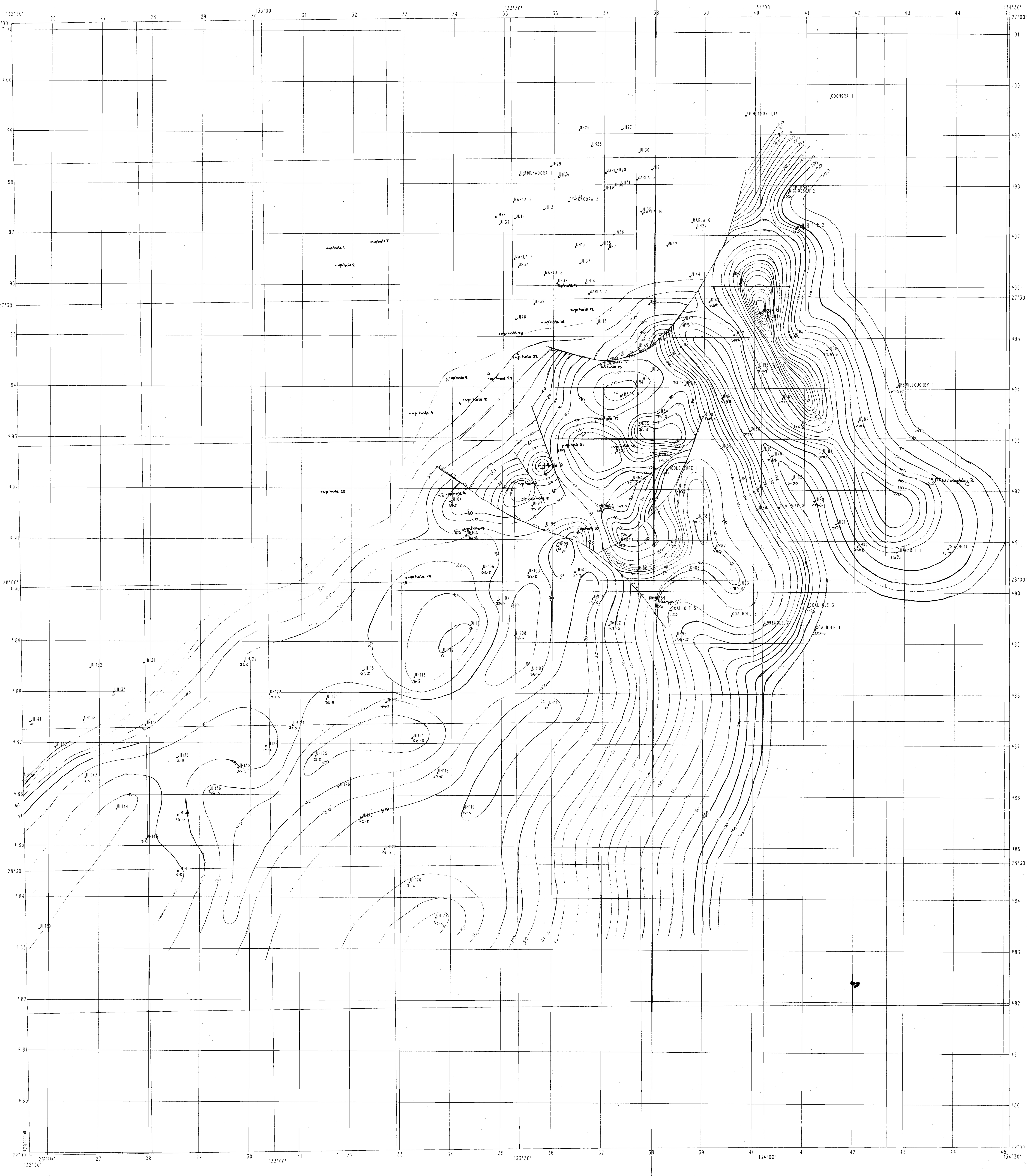

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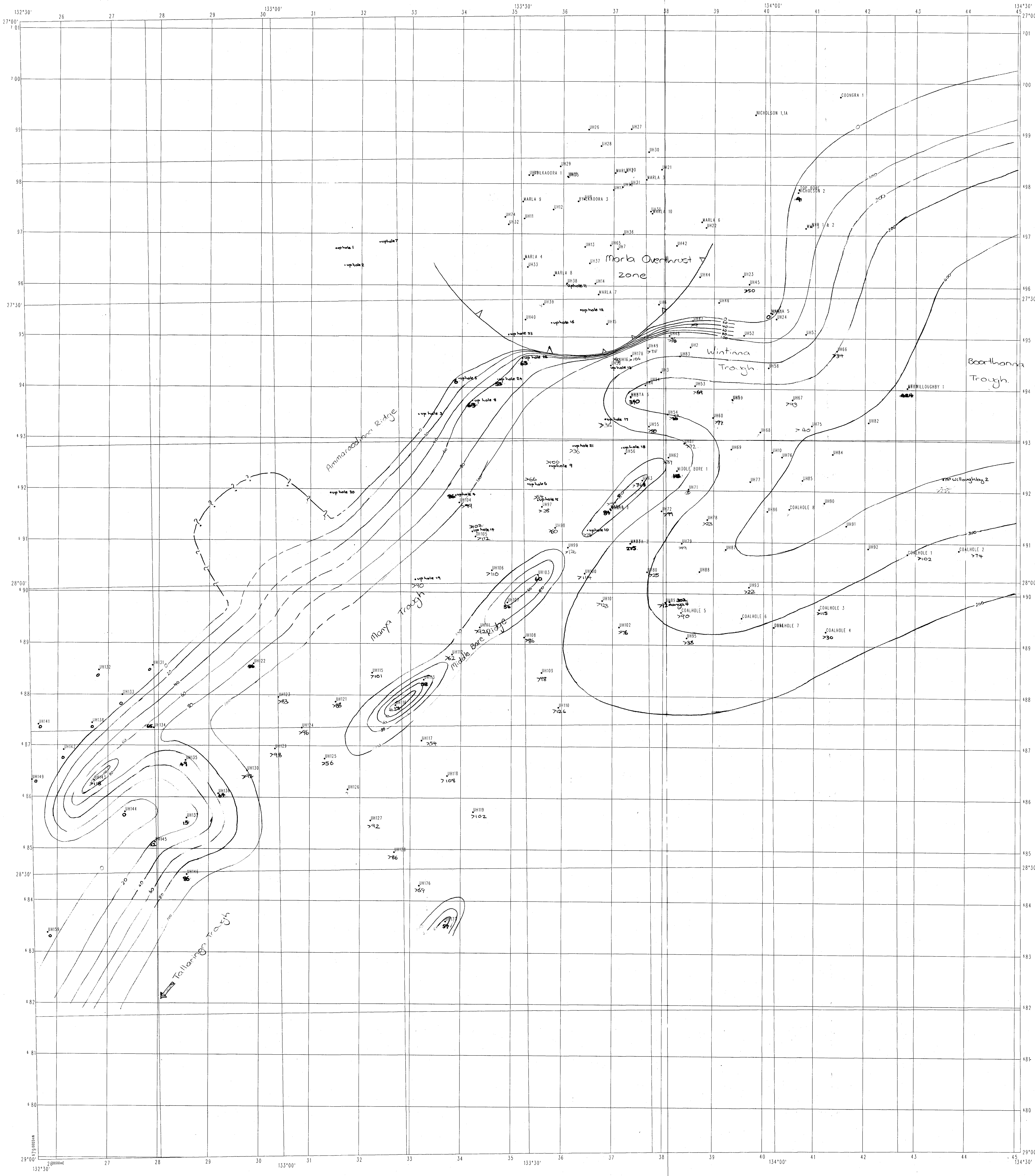

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