DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 82/73
PROGRESS REPORT NO. 4: ORGANIC CARBON AND TRACE ELEMENT INVESTIGATIONS, COOPER BASIN SEDIMENTS: BIG LAKE NO. 10

GEOLOGICAL SURVEY

by

W.G. SHACKLETON

SEPTEMBER, 1982

DME.225/78

CONTENTS PAGE

FIGURES

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept Bk. No. 82/73
D.M.E. No. 225/78
Disk No. 117

PROGRESS REPORT NO. 4: ORGANIC CARBON AND TRACE ELEMENT INVESTIGATIONS, COOPER BASIN SEDIMENTS: BIG LAKE NO. 10

ABSTRACT

Continued investigations confirm that conventionally defined rock units in the Cooper Basin generally exhibit characteristic trace-element signatures. In Big Lake No. 10 the Nappamerri Formation may be sub-divided into three chemostratigraphic units; the Toolachee Formation into two units; the Daralingie Beds into two units; and the Epsilon Formation into at least two units. However, the distribution of chemo-stratigraphic units in the interval from the top of the Roseneath Shale to the bottom of the Epsilon Formation (as sampled) suggests that a reappraisal of formation boundaries may be justified.

INTRODUCTION

In April, 1978, a joint project - "Organic Carbon and Trace Element Investigations" - was commenced by the S.A. Department of Mines and Energy and W.G. Shackleton of Salisbury College of Advanced Education (S.C.A.E.). The major purpose of this project was to identify possible relationships between the organic carbon (C_{org}) content and the trace metal content of sedimentary rocks.

Results indicated that there is no significant correlation between C_{org} and trace metal content but that rock units may be identifiable by their trace element content (Shackleton, 1979, 1981a,b). To further investigate these latter aspects, cuttings from selected wells in the Big Lake petroleum field were analysed. This report deals with the results from Big Lake No. 10.

PREPARATION AND TREATMENT OF SAMPLES

Cuttings were treated as described by Shackleton (1979, 1981a,b). A lithologic log for the interval investigated is presented as Appendix I. The results of the Australian Mineral Development Laboratories (AMDEL) determinations by ES and AAS (initially reported as AMDEL Jobs AC 4189/79, A55/79 and AC 914/80) are presented as Appendix II.

The results of the analyses are plotted against depth in Fig. 1, which also includes a stratigraphic (lithological) column taken from the well completion report and cuttings description log. Only those elements considered to have potential for chemostratigraphic studies are plotted.

DISCUSSION OF RESULTS

I. Raw Data - Refer to Figure 1

Carbonate Carbon (C_{CO_3}) Values are generally less than in Munkarie No. 1 and Big Lake No. 23, especially in the bulk of the Nappamerri Formation, except for a distinct group of high values in the upper part of that formation. There is a gradational change from the Toolachee Formation to the lower Daralingie Beds which makes determination of that stratigraphic boundary difficult. Thereafter values gradually increase with depth in the Roseneath Shale, but decrease sharply at the top of the Epsilon Formation. Values then indicate two distinct units within the Epsilon Formation.

Organic and Elemental Carbon (C_{Corg}) In general the values accurately reflect lithological and stratigraphic units. Note that in the Nappamerri Formation there is a distinct increase in values at the point where the group of high C_{CO_3} values decrease. Values are generally high but variable in the Toolachee Formation and similar but slightly lower in the

Daralingie Beds. The Epsilon Formation is composed of two distinct chemostratigraphic units - an upper unit with low values and a lower one with high values.

Trace Elements determined by ES at AMDEL These show variations with lithology and, to a lesser extent, with stratigraphic units. In this well, as in Munkarie No. 1, zinc is present in relatively high concentrations, especially in the lower portion of the Nappamerri Formation. Manganese generally reflects the C_{CO_3} values and barium, the C_{org} values.

Trace Elements determined by AAS at AMDEL. Mn and Fe both reflect C_{CO_3} values. Zn values are generally high, especially in the lower portions of the Nappamerri and Toolachee formations. The Daralingie Beds contain the lowest values of all elements determined by AAS, in contrast to Munkarie No. 1 and Big Lake No. 23 where the lowest values occur in the Toolachee Formation.

II. Manipulated Data

Because of the variation within stratigraphic units, particularly as apparent by the imprecise ES method, results were evaluated by a rolling mean technique, using five consecutive values (n = 5). See Shackleton (1979) for further discussion. As for Big Lake 23, however, in the present study all values were used to calculate rolling means.

Raw values and rolling means were plotted for C_{CO_3} and C_{org} (Fig. 2); the ES values for Cu, Pb, Zn, Mn and Ba (Fig. 3); and the AAS values for Cu, Pb, Zn, Mn and Fe (Fig. 4). Formation boundaries are taken from the well completion report.

Carbonate Carbon (C_{CO_3}) High values (up to 1%) occur in the upper portion of the Nappamerri Formation, down to 7200'. A lower-value "plateau" then exists to 7300' where values decrease to the generally low values that persist through the remainder of

the Nappamerri Formation and the Toolachee Formation. Very low values (approx. 0.2%) occur in the lowest portion of the Toolachee Formation. Values then gradually increase with depth in the Daralingie Beds to a "plateau" of about 0.65% in the upper Roseneath Shale. Values then increase toward a maximum of 1.75% at the bottom of that unit. The values in the Epsilon Formation indicate an upper, moderately high but variable-value unit and a lower, lower-value unit, the boundary occurring at 8310'.

Organic and Elemental Carbon (C_{org}) By comparison with the Munkarie No. 1 and Big Lake No. 23 values in the Nappamerri Formation the Big Lake No. 10 data for this interval indicate three units. The upper unit contains values much less than 1%. Between 7200' and 7300' in the middle unit values are about 1%. This zone corresponds to the plateau of C_{CO_3} values noted above. The principal increase in values passing down into the coaly Toolachee Formation occurs at 7570', although there is one very high value at 7520-30'. Values are variable but generally high through the Toolachee Formation, and although they decrease towards the bottom, the Daralingie Beds are also very coaly. Note the characteristic "tail" of values in the Daralingie Beds as depicted by the rolling mean plot (Fig. 2). This is similar to the one in Big Lake No. 23, although in that well the "tail" is within the Toolachee Formation.

Values then remain moderately low in the Roseneath Shale, decreasing to even lower values in the upper part of the Epsilon Formation. The lower part of the sampled Epsilon Formation is characterised by a definite unit of high values commencing at 8320'.

Zinc Values are variable throughout the interval sampled and do not clearly correspond with any stratigraphic unit. The Nappamerri Formation contains high Zn_{AAS} values which increase to a unit of very high values before passing into the Toolachee Formation. Another unit of high values occurs at the bottom of that formation. The Daralingie Beds are characterised by very low values (both ES and AAS). There is a slight group of higher values in the middle of the Roseneath Shale, and a further group in the lower portion of the Epsilon Formation.

Copper Values show little variation except that AAS values are low in the Daralingie Beds and the upper portion of the Epsilon Formation. Values then increase in the lower portion of the Epsilon Formation.

Lead Both ES and AAS values show little variation with stratigraphic units except in being slightly lower in the Daralingie Beds.

Barium Barium generally reflects the average values of C_{org}, apart from being lower where C_{org} values are exceptionally high. Values clearly indicate the lower unit of the Epsilon Formation.

Manganese As in the wells previously investigated, both ES and AAS values relate to stratigraphic units, although the AAS values show less variation. The very low values in the Hutton Sandstone increase steadily through the upper part of the Nappamerri Formation in a similar fashion to the C_{CO_3}. Values then remain relatively constant down to the Toolachee Formation where they decrease slightly in the upper portion. There is a slight increase in values between about 7630-7680', but this may be due to coaly units in the uppermost Toolachee Formation. Underlying values then decrease to about half of those in the

Nappamerri Formation. In the Daralingie Beds, there is a slight decrease followed by a gradational increase to the Roseneath Shale.

Iron Values very closely reflect Mn values.

III. Chemostratigraphy

Under this heading in earlier reports attempts were made to show how trace-element content of the sediments could be used to identify previously defined lithostratigraphic units and even, in some cases, subdivide these units. A preliminary examination of the data accumulated so far suggests that although the elemental profiles for one element are similar from well to well, there are sufficient differences from lithostratigraphic units to warrant an attempt to correlate variations between wells in the trace element values determined.

From this and previous reports, it is apparent that C_{org}, C_{CO_3} and Mn_{AAS} are valuable in defining chemostratigraphic units. In this report figures 5, 6, 7 and 8 show the trace element relationships between Munkarie No. 1, Big Lake No. 23 and Big Lake No. 10 for the rolling mean values of C_{org}, C_{CO_3}, Mn_{ES} and Mn_{AAS} respectively. Fig. 7 (Mn_{ES}) was included to show that Mn_{AAS} values enables finer subdivisions to be made. Contour line values were chosen to emphasise the chemostratigraphy. The Toolachee Formation - Daralingie Beds stratigraphic boundary is used as a reference line.

C_{org} and C_{CO_3} data from Narcoonowie No. 1 became available during the construction of Figs. 5 and 6 and have been included to illustrate the persistence of chemostratigraphic units.

Examination of the figures reveals that:-

(a) correlation of trace element values is possible from well to well, but the detail of correlation is much finer than that provided by lithostratigraphic data;

(b) although there is a general relationship between lithostratigraphic and chemostratigraphic units, there are many instances of chemostratigraphic units cutting across lithostratigraphic unit boundaries; and

(c) there is a close similarity between C_{CO_3} and Mn_{AAS} units, whereas C_{CO_3} and C_{org} units are significantly different.

CONCLUSIONS AND RECOMMENDATIONS

Investigations of the trace-element distribution in cuttings from Big Lake No. 10 support the potential of using such data to recognise and define rock units. In Big Lake No. 10 there are some differences in the character of these chemostratigraphic units compared with those in the wells examined previously and it may be necessary, when further information is available, to review the selection of stratigraphic boundaries. C_{org}, C_{CO_3} and Mn_{AAS} are again the most valuable elements although several others also support the subdivisions proposed.

This project will continue to investigate trace element distributions in the Cooper Basin and results will be presented in subsequent reports.

ACKNOWLEDGEMENTS

The author thanks the Director-General of the Department of Mines and Energy, South Australia, for making financial and other assistance available for this project.

Mr. P.M. Austin, of the same Department, contributed stimulating discussion, constructive criticism and valuable advice throughout this investigation.

This report was compiled in the Mining Geology Division of the Department of Geology, Royal School of Mines, Imperial College of Science and Technology, London, where the author was a visiting academic during his sabbatical from Salisbury C.A.E. The author would like to thank the Director and Council of Salisbury C.A.E. for making available this opportunity and also Professor G.R. Davis, of the Department of Geology, Imperial College for providing facilities.

W Shackleton

WGS:AF

W.G. SHACKLETON

REFERENCES

Shackleton, W.G., 1979. Organic carbon and trace element investigations, Cooper Basin sediments, progress report: Munkarie No. 1. Unpub. Rept., S.A. Dept. Mines and Energy.

Shackleton, W.G., 1981a. Organic carbon and trace element investigations, Cooper Basin sediments, second progress report: Munkarie No. 1. Unpub. Rept., S.A. Dept. Mines and Energy.

Shackleton, W.G., 1981b. Organic carbon and trace element investigations, Cooper Basin sediments, third progress report: Big Lake No. 23. Unpub. Rept., S.A. Dept. Mines and Energy.

APPENDIX I

Big Lake Number 10

Summary Lithologic Log

From	To	Description
7000'	7010'	Sandstone, clear, white, coarse grained. Minor interbedded shale.
7010'	7410'	Interbedded shale, siltstone and sandstone. Dark grey shale; light grey slightly carbonaceous siltstone; sandstone, clear, white, fine grained.
7410'	7570'	Shale with minor interbedded siltstone and sandstone as above. Slightly coaly at bottom.
7570'	7590'	Coal, black, bituminous with interbeds of shale as above.
7590'	7600'	Interbedded siltstone and shale, carbonaceous with minor coal.
7600'	7620'	Coal, as above with interbeds of siltstone and shale as above.
7620'	7630'	Shale as above with minor siltstone, sandstone and coal.
7630'	7650'	Sandstone, clear, white, fine grained. Shaley at top.
7650'	7660'	Sandstone as above but very coaly.
7660'	7676'	Sandstone as above.
7676'	7680'	Shale as above, very sandy.
7680'	7700'	Sandstone as above.
7700'	7710'	Coal as above.
7710'	7740'	Sandstone as above with interbeds of shale as above. Slightly coaly.
7740'	7750'	Coal as above.
7750'	7760'	Interbedded siltstone and shale as above.
7760'	7770'	Coal as above.
7770'	7780'	Sandstone, clear, white, very fine to medium grained. Minor shale as above.
7780'	7790'	Sandstone as above with minor coal.
7790'	7800'	Coal as above.

7800'	7850'	Interbedded sandstone and shale as above. Coaly in top 20'.
7850'	7900'	Interbedded shale, siltstone and sandstone. Shale is dark grey, carbonaceous; siltstone, dark grey carbonaceous; sandstone, clear, white, very fine grained.
7900'	7910'	Coal black, bituminous.
7910'	7950'	Interbedded shale and sandstone as above. Very coaly.
7950'	8020'	Sandstone as above, with minor shalke and siltstone as above.
8020'	8150'	Shale as above, with minor sandstone and siltstone as above.
8150'	8200'	Shale dark grey, hard, silty.
8200'	8210'	Shale as above, slightly sandy.
8210'	8220'	Shale as above.
8220'	8240'	Sandstone, clear, white, very fine grained. Minor shale, as above.
8240'	8250'	Shale as above.
8250'	8320'	Sandstone as above, with minor shale and siltstone as above.
8320'	8330'	Shale as above, with minor sandstone and siltstone.
8330'	8360'	Sandstone as above, with minor shale and siltstone. Moderately coaly.
8360'	8370'	Shale as above.
8370'	8420'	Interbedded shale siltstone and sandstone as above. Very coaly in bottom 10'.
8420'	8430'	Coal as above.

APPENDIX II

Big lake No. 10

Analytical Results

BIG LAKE 10

FROM (FEET)	TO	<- ANALYSIS BY ES -> SB (30)	SN (1)	ZN (20)	<-------- ANALYSIS BY AAS --------> CU	PB	ZN	MN	FE	NA	K
****	****	****	****	****	****	****	****	****	****	****	*****
7000	7010	X	1	X	12	110	20	230	1200		
7010	7020	X	1	X	8	65	30	150	1100		
7020	7030	X	2	100	15	570	35	320	2000		
7030	7040	X	3	200	20	130	55	360	2600		
7040	7050	X	X	30	20	25	65	450	3000		
7050	7060	X	3	200	20	190	80	500	3300		
7060	7070	X	4	500	20	40	100	560	4000		
7070	7080	X	4	300	190	130	130	510	4100		
7080	7090	X	3	200	30	70	85	660	4800		
7100	7110	X	4	200	10	30	28	410	2000		
7110	7120	X	3	200	20	45	60	800	6700		
7120	7130	X	3	200	25	65	70	800	7300		
7130	7140	X	2	400	70	40	150	850	7800		
7140	7150	X	4	200	28	70	75	550	5000		
7150	7160	X	5	300	30	35	90	530	6100		
7160	7170	X	3	400	28	35	130	620	5900		
7170	7180	X	1	400	490	150	580	740	5500		
7180	7190	X	3	300	30	70	110	530	5400		
7200	7210	X	X	200	25	25	150	430	4300		
7210	7220	X	2	200	32	40	110	640	4400		
7220	7230	X	2	500	28	55	210	580	4500		
7230	7240	X	2	100	32	70	170	630	5700		
7240	7250	X	2	100	30	25	110	550	4200		
7250	7260	X	2	400	28	35	180	530	4200		
7260	7270	X	3	700	32	40	390	550	4700		
7270	7280	X	3	400	28	40	110	600	4500		
7280	7290	X	2	400	25	45	220	590	3800		
7300	7310	X	2	200	30	20	95	480	4100		
7310	7320	X	4	300	30	30	120	480	4000		
7320	7330	X	3	500	30	25	230	510	3900		
7330	7340	X	1	100	35	25	130	490	4300		
7340	7350	X	2	200	32	150	160	510	4100		
7350	7360	X	2	600	32	170	350	550	4600		
7360	7370	X	3	700	25	30	300	500	4000		
7370	7380	X	2	200	28	20	170	550	4200		
7380	7390	X	X	200	28	25	200	580	4100		
7400	7410	X	2	200	35	45	120	520	4800		
7410	7420	X	3	200	35	110	1000	600	4600		
7420	7430	X	2	300	35	60	170	550	4600		
7430	7440	X	1	200	35	90	100	490	4400		
7440	7450	X	2	400	35	55	200	540	4800		
7450	7460	X	3	200	32	55	140	480	4700		
7460	7470	X	2	300	35	75	140	600	5000		
7470	7480	X	4	500	28	35	260	790	4400		
7480	7490	X	1	200	32	50	140	690	4800		
7500	7510	X	3	700	30	85	580	700	4200		
7510	7520	X	3	1000	30	70	610	680	4100		
7520	7530	X	4	700	30	45	430	540	3500		
7530	7540	X	8	1000	25	75	470	490	2700		
7540	7550	X	4	2000	35	85	1200	560	4100		
7550	7560	X	3	300	35	110	250	560	4200		
7560	7570	X	4	700	35	80	530	490	4400		
7570	7580	X	4	400	32	40	170	340	2100		

BIG LAKE 10

FROM (FEET)	TO	<- ANALYSIS BY ES -> SB (30)	SN (1)	ZN (20)	<------- ANALYSIS BY AAS --------> CU	PB	ZN	MN	FE	NA	K
****	****	****	****	****	****	****	****	****	****	****	*****
7590	7600	X	2	400	38	85	310	350	2700		
7600	7610	X	5	X	25	30	50	220	1400		
7610	7620	X	X	20	28	30	95	190	1200		
7620	7630	X	3	300	35	70	110	300	2300		
7630	7640	X	3	30	30	50	95	630	4600		
7640	7650	X	2	200	35	50	140	380	4400		
7650	7660	X	2	300	35	110	120	930	7900		
7660	7670	X	2	300	32	35	120	740	6300		
7670	7680	X	3	300	35	55	140	810	6200		
7680	7690	X	3	100	22	55	80	250	2100		
7700	7710	X	2	X	25	20	25	60	420		
7710	7720	X	3	200	28	110	100	380	2800		
7720	7730	X	2	200	32	95	100	580	4700		
7730	7740	X	2	300	30	35	85	360	2600		
7740	7750	X	3	200	28	35	90	260	1900		
7750	7760	X	2	100	32	140	120	400	3000		
7760	7770	X	4	500	28	40	150	250	2000		
7770	7780	X	4	500	30	75	380	300	2600		
7780	7790	X	3	400	28	65	250	260	2200		
7790	7800	X	2	X	18	20	30	60	450		
7800	7810	X	3	300	18	30	120	190	1400		
7810	7820	X	2	400	25	95	360	250	2200		
7820	7830	X	5	500	28	55	350	180	1700		
7830	7840	X	3	400	30	90	390	210	1900		
7840	7850	X	3	400	25	50	260	190	1700		
7850	7860	X	3	X	12	45	40	100	820		
7860	7870	X	3	30	15	95	30	170	1200		
7870	7880	X	50	2000	18	25	43	150	1200		
7880	7890	X	3	100	15	30	120	160	1300		
7900	7910	X	1	70	30	20	55	120	950		
7910	7920	X	5	200	20	35	60	170	1400		
7920	7930	X	5	100	20	35	70	180	1500		
7930	7940	X	3	X	20	30	55	140	1300		
7940	7950	X	5	200	15	35	70	180	1500		
7950	7960	X	3	500	20	65	75	200	1900		
7960	7970	X	3	300	18	35	100	210	1800		
7970	7980	X	4	200	22	40	95	260	2200		
7980	7990	X	3	100	22	40	70	350	2700		
8000	8010	X	4	400	10	30	130	250	1500		
8010	8020	X	5	200	12	25	70	370	2500		
8020	8030	X	7	1000	25	45	350	420	2800		
8030	8040	X	5	200	20	25	80	410	2800		
8040	8050	X	4	200	20	35	90	410	2800		
8050	8060	X	7	400	20	30	75	320	1700		
8060	8070	X	4	400	30	120	150	440	3200		
8070	8080	X	3	100	32	60	110	410	3300		
8080	8090	X	4	1000	28	45	470	460	3000		
8100	8110	X	4	400	32	50	190	580	4200		
8110	8120	X	2	200	30	55	140	600	4200		
8120	8130	X	3	300	35	45	120	780	4700		
8130	8140	X	5	600	30	75	290	820	4000		
8140	8150	X	8	400	30	60	150	770	3800		
8150	8160	X	4	200	35	35	110	790	4500		

BIG LAKE 10

FROM (FEET)	TO	<- ANALYSIS BY ES -> SB (30)	SN (1)	ZN (20)	<-------- ANALYSIS BY AAS --------> CU	PB	ZN	MN	FE	NA	K
****	****	****	****	****	****	****	****	****	****	****	*****
8160	8170	X	X	30	32	35	90	1050	4600		
8170	8180	X	5	200	35	55	120	1450	7000		
8180	8190	X	2	30	30	35	120	1300	5600		
8200	8210	X	3	700	32	55	130	1450	7600		
8210	8220	X	5	300	32	40	120	1600	7900		
8220	8230	X	5	200	15	35	65	740	3100		
8230	8240	X	5	200	25	35	80	980	4200		
8240	8250	X	4	300	25	25	120	1250	5300		
8250	8260	X	5	200	15	30	90	870	3400		
8260	8270	X	5	200	19	30	30	670	2800		
8270	8280	X	2	50	18	25	95	1050	4300		
8280	8290	X	5	200	20	30	65	1150	5200		
8300	8310	X	4	300	20	25	100	1850	8700		
8310	8320	X	3	200	12	90	70	430	2100		
8320	8330	X	4	100	12	30	48	430	2000		
8330	8340	X	3	X	12	25	65	660	2600		
8340	8350	X	4	100	25	35	95	630	3000		
8350	8360	X	4	200	25	35	140	770	4000		
8360	8370	X	5	600	32	40	310	640	3400		
8370	8380	X	4	200	20	40	110	650	3100		
8380	8390	X	3	300	42	55	130	470	3400		
8400	8410	X	3	300	30	55	120	680	4100		
8410	8420	X	1	200	25	50	560	750	3700		
8420	8430	X	2	500	25	25	55	100	570		

BIG LAKE 10

FROM (FEET)	TO	CARBONATE CARBON %	ORGANIC CARBON %	ANALYSIS BY EMISSION SPECTROSCOPY												
				BA (200)	BE (1)	CE (300)	CO (5)	CR (20)	LA (100)	MN (10)	MO (3)	NB (20)	NI (5)	SC (3)	SR (50)	TA (100)
****	****	*****	*****	****	****	****	****	****	****	****	****	****	****	****	****	****
7000	7010	0.13	0.46	X	X	X	10	60	X	100	X	X	5	4	X	X
7010	7020	0.09	0.37	200	1	X	20	50	X	300	X	X	30	6	X	X
7020	7030	0.27	0.21	200	2	X	48	80	X	700	X	X	40	8	50	X
7030	7040	0.39	0.35	200	2	X	10	70	X	500	X	X	20	5	X	X
7040	7050	0.48	0.41	300	1	X	20	70	X	400	X	X	30	7	50	X
7050	7060	0.40	0.50	200	2	X	20	80	X	1000	X	X	30	8	50	X
7060	7070	0.63	0.44	300	2	X	40	100	X	700	X	X	30	10	50	X
7070	7080	0.53	0.37	X	3	X	50	100	X	500	X	X	200	8	X	X
7080	7090	0.69	0.36	300	2	X	30	80	X	300	X	X	10	8	50	X
7100	7110	0.85	0.30	200	3	X	50	70	X	1000	X	X	30	7	50	X
7110	7120	0.97	0.38	200	2	X	40	100	X	2000	X	X	30	8	X	X
7120	7130	1.04	0.44	X	2	X	50	80	X	1000	X	X	30	8	X	X
7130	7140	1.24	0.34	200	2	X	70	70	X	1000	X	X	30	8	50	X
7140	7150	0.70	0.39	200	4	X	30	80	X	800	X	X	30	15	50	X
7150	7160	0.89	0.37	200	1	X	20	70	X	200	X	X	20	10	X	X
7160	7170	0.84	0.44	300	4	X	40	70	X	1000	X	X	20	10	50	X
7170	7180	0.74	0.56	200	3	X	40	70	X	1000	X	X	30	8	50	X
7190	7190	0.67	0.68	400	4	X	50	80	X	500	X	X	30	20	50	X
7200	7210	0.36	1.00	300	2	X	20	70	X	600	X	X	30	10	50	X
7210	7220	0.39	0.89	300	3	X	50	80	X	300	X	X	30	20	100	X
7220	7230	0.43	0.85	200	3	X	40	80	X	500	X	X	20	15	50	X
7230	7240	0.20	14.40	200	3	X	30	80	X	500	X	X	20	3	50	X
7240	7250	0.35	0.93	300	2	X	30	60	X	400	X	X	30	15	50	X
7250	7260	0.36	1.31	300	3	X	40	80	X	500	X	X	30	10	100	X
7260	7270	0.32	1.32	200	3	X	40	80	X	300	X	X	30	20	100	X
7270	7280	0.45	1.41	300	4	X	50	100	X	600	X	X	30	15	100	X
7280	7290	0.47	4.60	200	2	X	30	80	X	300	X	X	20	10	100	X
7300	7310	0.21	0.92	300	5	X	40	80	X	500	X	X	30	15	100	X
7310	7320	0.23	0.97	200	3	X	40	70	X	700	X	X	30	20	50	X
7320	7330	0.21	0.97	300	4	X	50	150	X	700	X	X	30	20	100	X
7330	7340	0.21	0.96	500	3	X	40	80	X	400	X	X	30	20	100	X
7340	7350	0.26	0.82	200	2	X	40	80	X	500	X	X	30	15	50	X
7350	7360	0.30	0.84	400	2	X	40	80	100	300	X	X	30	20	100	X
7360	7370	0.31	1.70	200	5	X	60	100	X	500	X	X	30	30	100	X
7370	7380	0.31	0.84	300	4	X	60	100	X	700	X	X	30	20	100	X
7380	7390	0.32	1.06	200	2	X	30	50	X	500	X	X	30	8	50	X
7400	7410	0.24	0.93	300	4	X	50	100	X	700	X	X	40	15	100	X
7410	7420	1.04	0.44	X	2	X	50	80	X	1000	X	X	30	8	X	X
7420	7430	0.21	0.97	300	3	X	50	80	X	1000	X	X	30	15	50	X
7430	7440	0.24	1.02	300	3	X	40	70	X	1000	X	X	30	15	100	X
7440	7450	0.25	0.98	300	3	X	50	80	X	600	X	X	40	15	100	X
7450	7460	0.26	0.94	600	5	X	50	100	50	800	X	X	30	10	50	X
7460	7470	0.39	0.83	300	3	X	30	70	X	700	X	X	30	10	50	X
7470	7480	0.70	0.78	500	3	X	60	100	X	1000	X	X	30	15	100	X
7480	7490	0.58	1.33	400	3	X	50	80	X	500	X	X	30	10	50	X
7500	7510	0.54	0.86	500	4	X	30	70	X	300	X	X	30	15	50	X
7510	7520	0.54	1.57	500	3	X	40	100	X	800	X	X	30	20	100	X
7520	7530	0.23	29.00	300	2	X	40	100	X	400	X	X	30	15	150	X
7530	7540	0.46	0.87	500	3	X	50	150	50	800	X	20	30	15	100	X
7540	7550	0.52	1.06	500	7	X	40	100	100	700	X	X	30	10	50	X
7550	7560	0.44	1.71	400	3	X	40	70	50	500	X	X	30	15	100	X
7560	7570	0.52	2.64	700	4	X	40	150	50	700	15	X	30	10	50	X
7570	7580	0.25	18.40	500	5	X	50	100	50	200	X	X	50	20	50	X

BIG LAKE 10

FROM (FEET)	TO	CARBONATE CARBON %	ORGANIC CARBON %	ANALYSIS BY EMISSION SPECTROSCOPY												
				BA (200)	BE (1)	CE (300)	CO (5)	CR (20)	LA (100)	MN (10)	MO (3)	NB (20)	NI (5)	SC (3)	SR (50)	TA (100)
****	****	*****	*****	****	****	****	****	****	****	****	****	****	****	****	****	****
7580	7590	0.37	26.00	700	4	X	50	70	100	300	X	X	50	10	50	X
7600	7610	0.32	29.60	600	2	X	X	70	50	50	X	X	20	10	X	X
7610	7620	0.24	35.90	500	7	X	15	100	100	250	X	X	70	8	X	X
7620	7630	0.43	11.50	500	3	X	40	100	X	100	X	X	30	8	X	X
7630	7640	0.90	7.30	1000	3	X	50	100	X	300	X	X	40	6	50	X
7640	7650	0.25	3.92	300	10	X	50	30	X	1000	X	X	30	15	50	X
7650	7660	0.61	2.76	500	2	X	20	X	X	1000	50	X	30	8	50	X
7660	7670	0.51	1.99	300	3	X	30	80	X	500	30	X	30	10	100	X
7670	7680	0.46	2.16	1000	2	X	30	100	X	1000	30	X	30	15	100	X
7680	7690	0.27	11.70	2000	3	X	30	70	X	100	X	X	30	10	50	X
7700	7710	0.08	56.70	400	4	X	10	40	X	70	X	X	30	5	X	X
7710	7720	0.35	4.24	700	3	X	30	70	X	300	X	X	20	8	50	X
7720	7730	0.37	9.44	600	2	X	20	100	X	500	20	X	30	8	50	X
7730	7740	0.30	7.90	1000	2	X	30	80	X	100	X	X	20	10	100	X
7740	7750	0.23	29.00	5000	5	X	100	200	250	300	30	X	150	30	200	X
7750	7760	0.29	8.90	700	3	X	40	80	X	500	15	X	40	10	50	X
7760	7770	0.22	23.00	500	2	X	20	60	X	200	X	X	30	8	X	X
7770	7780	0.22	7.48	1000	4	X	30	100	50	500	X	X	30	8	50	X
7780	7790	0.23	8.34	1000	4	X	40	80	50	200	X	X	20	20	100	X
7790	7800	0.02	63.10	300	7	X	40	70	50	30	X	X	100	10	X	X
7800	7810	0.21	34.70	X	1	X	X	50	X	30	X	X	20	4	X	X
7810	7820	0.20	14.40	600	3	X	30	80	X	200	X	X	30	7	50	X
7820	7830	0.15	9.50	1000	4	X	30	80	X	100	X	X	20	15	50	X
7830	7840	0.18	12.90	400	5	X	30	100	X	200	X	X	30	8	50	X
7840	7850	0.17	10.00	500	5	X	30	80	X	100	X	X	30	10	50	X
7850	7860	0.13	6.34	X	1	X	20	50	X	100	X	X	10	5	X	X
7860	7870	0.20	11.00	200	1	X	10	50	X	100	X	X	20	8	50	X
7870	7880	0.48	0.41	700	2	X	X	80	X	70	X	X	10	6	X	X
7880	7890	0.26	8.64	500	4	X	30	150	100	100	X	X	20	15	X	X
7900	7910	0.17	44.20	400	4	X	40	60	100	200	X	X	100	8	X	X
7910	7920	0.31	10.30	600	7	X	30	100	150	200	X	X	30	20	50	X
7920	7930	0.32	12.00	500	5	X	40	80	50	200	X	X	30	10	50	X
7930	7940	0.25	18.40	400	3	X	20	70	50	70	X	X	30	10	X	X
7940	7950	0.35	5.82	400	4	X	20	100	X	100	X	X	20	10	50	X
7950	7960	0.40	6.94	500	3	X	30	80	X	200	X	X	20	7	X	X
7960	7970	0.40	4.14	700	3	X	30	80	X	100	X	X	20	10	X	X
7970	7980	0.49	6.38	600	2	X	10	70	X	100	X	X	20	15	X	X
7980	7990	0.62	12.40	700	2	X	20	80	50	100	X	X	30	15	X	X
8000	8010	0.67	4.80	300	4	X	30	80	X	300	X	X	30	8	X	X
8010	8020	0.64	0.30	500	4	X	40	150	100	500	X	X	30	15	50	X
8020	8030	0.70	3.52	800	4	X	70	200	150	300	X	20	40	20	50	X
8030	8040	0.70	2.92	800	5	X	80	200	50	500	X	X	40	20	50	X
8040	8050	0.55	2.72	700	10	X	70	150	150	500	X	X	50	20	100	X
8050	8060	0.62	2.52	300	5	X	30	100	X	300	X	X	30	8	X	X
8060	8070	0.65	2.35	400	3	X	40	30	100	300	X	20	40	15	50	X
8070	8080	0.61	2.66	600	2	X	30	100	X	300	X	X	20	7	X	X
8080	8090	0.62	3.94	500	4	X	40	150	X	200	X	X	30	10	50	X
8100	8110	0.68	3.52	400	5	X	30	70	X	500	X	X	20	10	50	X
8110	8120	0.69	3.08	200	4	X	40	80	X	700	X	X	30	7	50	X
8120	8130	0.86	5.00	500	4	X	40	100	X	500	X	X	30	7	50	X
8130	8140	0.90	4.20	600	3	X	30	80	X	200	X	X	30	15	50	X
8140	8150	0.85	4.00	600	2	X	30	80	X	500	X	20	30	10	X	X
8150	8160	0.88	10.00	700	4	X	40	100	100	500	X	X	40	15	X	X

BIG LAKE 10

FROM (FEET)	TO	CARBONATE CARBON %	ORGANIC CARBON %	ANALYSIS BY EMISSION SPECTROSCOPY												
				BA (200)	BE (1)	CE (300)	CO (5)	CR (20)	LA (100)	MN (10)	MO (3)	NB (20)	NI (5)	SC (3)	SR (50)	TA (100)
****	****	*****	*****	****	****	****	****	****	****	****	****	****	****	****	****	****
8160	8170	1.09	2.79	300	2	X	20	70	X	600	X	X	50	7	X	X
8170	8180	1.50	2.82	700	3	X	50	150	100	1000	X	X	40	15	X	X
8180	8190	1.38	2.88	500	2	X	30	100	X	700	X	X	100	7	X	X
8200	8210	1.62	3.06	500	4	X	40	100	X	1000	X	X	40	7	X	X
8210	8220	1.71	2.38	300	3	X	40	100	X	1000	X	X	30	10	X	X
8220	8230	0.80	1.30	800	3	X	40	150	X	700	X	X	20	15	50	X
8230	8240	1.11	1.93	300	2	X	30	150	X	700	X	X	20	8	X	X
8240	8250	1.35	2.22	600	5	X	80	200	50	1000	X	X	50	20	50	X
8250	8260	0.87	0.97	300	4	X	20	80	X	1000	X	X	20	8	X	X
8260	8270	0.74	0.96	300	4	X	20	70	X	1000	X	X	30	8	X	X
8270	8280	1.18	1.36	200	3	X	20	70	X	800	X	X	30	7	X	X
8280	8290	1.33	1.86	200	3	X	20	80	X	700	X	X	20	10	X	X
8300	8310	2.02	1.94	200	3	X	30	100	X	2000	5	X	30	10	X	X
8310	8320	0.53	0.72	200	2	X	10	70	X	1000	X	X	20	6	X	X
8320	8330	0.52	6.48	2000	2	X	20	80	X	200	X	X	20	6	50	X
8330	8340	0.55	2.72	800	2	X	20	70	X	500	X	X	20	8	X	X
8340	8350	0.74	6.36	1000	3	X	30	80	X	1000	X	X	30	15	X	X
8350	8360	0.91	4.84	700	2	X	10	70	X	300	X	X	20	10	X	X
8360	8370	0.80	2.48	500	5	X	40	100	X	500	X	X	30	15	50	X
8370	8380	0.95	7.84	500	4	X	50	100	X	400	X	X	30	10	X	X
8380	8390	0.74	3.70	500	5	X	40	80	X	300	X	20	30	8	X	X
8400	8410	0.80	4.60	400	3	X	30	80	X	700	X	X	20	7	X	X
8410	8420	0.81	6.10	400	2	X	5	50	X	400	X	X	20	6	X	X
8420	8430	0.21	61.10	800	10	X	80	150	150	100	3	70	100	10	X	X

BIG LAKE 10

FROM (FEET)	TO	ANALYSIS BY EMISSION SPECTROSCOPY																
		TH (100)	TI (100)	V (10)	Ag (50)	Y (10)	YB (1)	ZR (10)	AG (0.1)	AS (50)	BI (1)	CD (3)	CU (1)	GA (1)	GE (3)	IN (10)	PB (1)
****	****	****	*****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
7000	7010	X	600	80	X	10	1	70	0.50	X	X	X	10	5	X	X	300
7010	7020	X	1000	100	X	20	4	70	0.60	X	X	X	40	2	2	X	300
7020	7030	X	2000	100	X	40	10	100	0.70	X	X	X	50	10	2	X	3000
7030	7040	X	3000	100	X	20	7	70	0.70	X	X	X	50	8	2	X	700
7040	7050	X	2000	100	X	30	4	80	0.10	X	X	X	50	5	X	X	80
7050	7060	X	2000	200	X	50	8	100	0.50	X	X	X	50	10	2	X	1000
7060	7070	X	3000	300	X	70	10	100	0.40	X	X	X	50	10	1	X	100
7070	7080	X	5000	200	X	70	10	100	1.00	X	X	X	70	10	2	X	300
7080	7090	X	1000	100	X	40	7	100	0.50	X	X	X	50	15	2	X	300
7100	7110	X	3000	200	X	70	10	100	0.30	X	1	X	40	20	2	X	200
7110	7120	X	4000	200	X	60	10	100	0.40	X	X	X	30	10	1	X	200
7120	7130	X	3000	100	X	30	8	100	0.40	X	X	X	50	15	2	X	300
7130	7140	X	4000	200	X	70	15	100	0.40	X	X	X	50	10	X	X	300
7140	7150	X	2000	100	X	40	15	100	0.50	X	1	X	40	15	2	X	400
7150	7160	X	2000	100	X	70	5	80	0.50	X	X	X	40	15	2	X	80
7160	7170	X	3000	200	X	50	10	100	0.40	X	X	X	40	10	2	X	100
7170	7180	X	3000	200	X	70	7	80	0.50	X	X	X	40	20	X	X	300
7180	7190	X	5000	300	X	80	15	100	0.40	X	X	X	40	10	1	X	80
7200	7210	X	3000	200	X	40	5	100	0.30	X	X	X	50	10	1	X	50
7210	7220	X	5000	400	X	80	15	100	0.40	X	X	X	40	20	2	X	80
7220	7230	X	3000	200	X	60	8	100	0.40	X	X	X	50	10	3	X	100
7230	7240	X	3000	100	X	70	8	80	0.30	X	X	X	50	10	2	X	300
7240	7250	X	3000	300	X	60	7	80	0.60	X	X	X	20	15	X	X	80
7250	7260	X	3000	400	X	60	10	80	0.30	X	X	X	50	15	1	X	100
7260	7270	X	3000	300	X	80	10	80	0.40	X	X	X	40	15	3	X	100
7270	7280	X	4000	300	X	70	8	100	0.40	X	1	X	70	15	3	X	100
7280	7290	X	3000	200	X	70	7	80	0.50	X	X	X	30	10	1	X	100
7300	7310	X	4000	400	X	70	10	100	0.30	X	X	X	50	15	2	X	70
7310	7320	X	5000	600	X	70	10	200	0.30	X	X	X	50	25	2	X	100
7320	7330	X	5000	300	X	70	20	200	0.50	X	X	X	50	20	1	X	70
7330	7340	X	5000	400	X	100	10	200	0.50	X	X	X	50	20	X	X	80
7340	7350	X	3000	300	X	70	10	100	0.50	X	X	X	50	15	2	X	600
7350	7360	X	3000	500	X	100	10	100	0.40	X	1	X	50	15	3	X	400
7360	7370	X	5000	300	X	100	20	200	0.40	X	1	X	50	10	2	X	100
7370	7380	X	4000	300	X	80	20	200	0.60	X	X	X	50	10	X	X	80
7380	7390	X	2000	150	X	30	3	70	0.20	X	X	X	50	10	1	X	70
7400	7410	X	4000	300	X	100	10	100	0.30	X	X	X	50	20	3	X	200
7410	7420	X	3000	100	X	30	8	100	0.40	X	X	X	50	15	2	X	300
7420	7430	X	4000	400	X	80	10	200	0.30	X	X	X	50	10	2	X	200
7430	7440	X	3000	300	X	80	10	100	0.40	X	X	X	50	15	2	X	300
7440	7450	X	4000	200	X	80	15	100	0.30	X	X	X	50	10	2	X	200
7450	7460	X	5000	100	X	80	15	100	0.40	X	1	X	50	20	2	X	200
7460	7470	X	2000	100	X	70	8	80	0.50	X	X	X	50	15	2	X	200
7470	7480	X	5000	300	X	150	20	200	0.40	X	X	X	50	15	3	X	80
7480	7490	X	5000	300	X	70	10	100	0.40	X	X	X	50	8	1	X	100
7500	7510	X	3000	300	X	100	15	100	0.50	X	1	X	40	20	X	X	100
7510	7520	X	3000	300	X	70	15	100	0.60	X	X	X	50	15	2	X	500
7520	7530	X	3000	300	X	80	15	100	0.40	X	X	X	50	10	10	X	70
7530	7540	X	4000	400	X	150	20	200	0.40	X	X	10	50	10	2	X	200
7540	7550	X	5000	200	X	50	15	100	0.40	X	1	X	50	15	3	X	400
7550	7560	X	3000	400	X	80	10	100	0.60	X	X	X	70	20	5	X	1000
7560	7570	X	5000	300	X	40	15	100	0.30	X	X	X	50	20	10	X	200
7570	7580	X	3000	300	X	80	10	80	0.70	X	1	X	40	15	15	X	60

BIG LAKE 10

FROM (FEET)	TO	ANALYSIS BY EMISSION SPECTROSCOPY																
		TH (100)	TI (100)	V (10)	W (50)	Y (10)	YB (1)	ZR (10)	AG (0.1)	AS (50)	BI (1)	CD (3)	CU (1)	GA (1)	GE (3)	IN (10)	PB (1)
****	****	****	*****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
7580	7590	X	3000	100	X	100	15	100	0.50	X	X	X	30	15	2	X	100
7600	7610	X	3000	200	X	80	5	70	0.60	X	X	X	40	20	2	X	60
7610	7620	X	2000	100	X	50	5	80	0.30	X	X	X	50	10	1	X	50
7620	7630	X	5000	100	X	80	8	70	0.40	X	1	X	50	15	3	X	100
7630	7640	X	5000	300	X	30	10	80	0.50	X	X	X	50	15	X	X	300
7640	7650	X	5000	200	X	80	20	100	0.40	X	1	X	70	10	2	X	200
7650	7660	X	2000	100	X	50	7	100	0.40	X	X	X	70	15	3	X	800
7660	7670	X	3000	300	X	70	7	100	0.30	X	X	X	30	10	2	X	80
7670	7680	X	2000	300	X	40	10	100	0.70	X	X	X	50	10	2	X	400
7680	7690	X	2000	200	X	70	7	80	0.50	X	X	X	40	10	2	X	200
7700	7710	X	1000	70	X	30	7	50	0.50	X	X	X	30	10	7	X	50
7710	7720	X	3000	300	X	70	8	70	0.50	X	X	X	50	15	3	X	200
7720	7730	X	3000	100	X	70	8	80	0.40	X	X	X	50	15	3	X	300
7730	7740	X	3000	200	X	80	8	200	0.40	X	X	X	40	10	1	X	200
7740	7750	X	9999	400	X	300	40	300	0.50	X	1	X	70	15	4	X	200
7750	7760	X	3000	300	X	70	10	100	0.50	X	X	X	50	10	2	X	800
7760	7770	X	3000	300	X	60	7	100	0.40	X	1	X	30	15	4	X	80
7770	7780	X	5000	200	X	40	10	80	0.40	X	X	X	50	15	3	X	300
7780	7790	X	4000	300	X	80	15	100	0.40	X	X	X	30	10	3	X	100
7790	7800	X	3000	500	X	80	15	70	0.40	X	1	X	50	5	5	X	50
7800	7810	X	2000	100	X	40	2	50	0.50	X	1	X	30	10	5	X	400
7810	7820	X	4000	100	X	80	10	80	0.40	X	1	X	40	10	2	X	500
7820	7830	X	3000	200	X	80	20	80	0.40	X	X	X	30	15	5	X	100
7830	7840	X	3000	100	X	30	10	80	0.50	X	X	X	50	10	2	X	600
7840	7850	X	3000	400	X	50	15	80	0.40	X	X	X	40	10	2	X	100
7850	7860	X	2000	80	X	30	7	80	0.50	X	X	X	30	10	3	X	100
7860	7870	X	2000	100	X	50	7	100	0.50	X	X	X	40	10	2	X	800
7870	7880	X	3000	100	X	70	20	70	2.00	50	3	X	30	30	4	X	80
7880	7890	X	3000	200	X	80	15	200	0.50	X	X	X	50	10	1	X	200
7900	7910	X	3000	100	X	60	3	250	0.30	X	X	X	50	5	5	X	20
7910	7920	X	5000	400	X	100	15	100	0.30	X	X	X	40	20	3	X	100
7920	7930	X	5000	200	X	100	10	100	0.50	X	X	X	40	20	2	X	100
7930	7940	X	3000	200	X	80	8	80	0.70	X	X	X	30	10	4	X	70
7940	7950	X	3000	200	X	80	10	100	0.50	X	X	X	30	15	2	X	100
7950	7960	X	4000	80	X	60	8	80	0.40	X	X	X	40	15	2	X	200
7960	7970	X	3000	300	X	70	8	80	0.40	X	X	X	30	15	2	X	80
7970	7980	X	3000	200	X	80	8	80	0.40	X	X	X	30	15	2	X	80
7980	7990	X	4000	300	X	80	10	100	0.40	X	X	X	30	10	3	X	80
8000	8010	X	3000	300	X	100	15	100	0.30	X	X	X	30	20	2	X	100
8010	8020	X	5000	300	X	100	30	300	0.50	X	X	X	50	20	3	X	300
8020	8030	X	5000	300	X	200	15	100	0.40	X	X	X	40	15	2	X	100
8030	8040	X	5000	300	X	100	30	200	0.50	X	0	X	50	20	2	X	200
8040	8050	X	5000	300	X	200	20	300	0.50	X	X	X	50	20	1	X	70
8050	8060	X	3000	300	X	60	8	80	0.30	X	X	X	30	25	2	X	80
8060	8070	X	3000	200	X	100	8	100	0.30	X	1	X	50	20	2	X	1000
8070	8080	X	5000	100	X	70	10	70	0.40	X	1	X	40	20	2	X	200
8080	8090	X	3000	200	X	80	10	80	0.60	X	X	X	40	20	1	X	100
8100	8110	X	3000	300	X	60	8	80	0.40	X	X	X	40	20	2	X	80
8110	8120	X	2000	100	X	60	10	80	0.40	X	1	X	50	15	1	X	300
8120	8130	X	4000	100	X	70	10	80	0.40	X	1	X	50	20	2	X	100
8130	8140	X	4000	300	X	80	20	100	0.40	X	1	X	50	15	3	X	100
8140	8150	X	4000	200	X	80	8	80	0.50	X	X	X	40	20	2	X	100
8150	8160	X	4000	300	X	100	20	100	0.40	X	X	X	40	20	2	X	80

BIG LAKE 10

FROM (FEET)	TO	ANALYSIS BY EMISSION SPECTROSCOPY															
		TH (100)	TI (100)	V (10)	W (50)	Y (10)	YB (1)	ZR (10)	AG (0.1)	AS (50)	BI (1)	CD (3)	CU (1)	GA (1)	GE (3)	IN (10)	PB (1)
****	****	****	*****	****	****	****	****	****	****	****	****	****	****	****	****	****	****
8160	8170	X	2000	80	X	40	3	70	0.20	X	X	X	150	10	X	X	60
8170	8180	X	4000	300	X	100	10	100	0.40	X	X	X	50	20	2	X	100
8180	8190	X	3000	100	X	50	3	70	0.20	X	X	X	100	15	X	X	70
8200	8210	X	3000	200	X	70	8	80	0.40	X	1	X	50	15	1	X	200
8210	8220	X	2000	300	X	50	6	100	0.60	X	X	X	50	20	1	X	100
8220	8230	X	4000	200	X	80	10	100	0.50	X	1	X	30	10	1	X	100
8230	8240	X	3000	200	X	80	5	80	0.50	X	X	X	40	20	X	X	100
8240	8250	X	5000	300	X	150	30	100	0.50	X	1	X	50	15	1	X	100
8250	8260	X	3000	200	X	60	10	80	0.40	X	X	X	30	15	1	X	100
8260	8270	X	4000	200	X	80	10	100	0.50	X	1	X	40	20	X	X	100
8270	8280	X	2000	100	X	50	4	150	0.10	X	X	X	70	10	X	X	80
8280	8290	X	2000	200	X	70	5	80	0.50	X	X	X	50	20	2	X	70
8300	8310	X	3000	200	X	70	7	100	0.50	X	X	X	40	15	X	X	80
8310	8320	X	2000	80	X	60	10	200	0.40	X	X	X	40	10	2	X	600
8320	8330	X	3000	200	X	70	8	100	0.60	X	X	X	30	10	5	X	100
8330	8340	X	4000	200	X	80	8	100	0.50	X	X	X	30	10	X	X	80
8340	8350	X	3000	200	X	70	10	100	0.50	X	X	X	40	15	2	X	100
8350	8360	X	2000	100	X	70	7	80	0.40	X	X	X	30	20	2	X	80
8360	8370	X	3000	300	X	70	10	80	0.40	X	1	X	50	20	2	X	100
8370	8380	X	2000	200	X	70	10	100	0.60	X	X	X	40	20	2	X	80
8380	8390	X	3000	100	X	70	10	80	0.40	X	1	X	50	15	2	X	100
8400	8410	X	5000	100	X	70	10	80	0.50	X	1	X	50	15	2	X	300
8410	8420	X	1000	80	X	30	2	70	0.20	X	X	X	50	7	X	X	80
8420	8430	X	5000	100	X	150	15	200	0.50	X	2	X	50	8	10	X	200

CARBON

AMDEL SPECTROSCOPIC ANALYSES (ppm)

ATOM ABSORPTION SPECTROPHOTOMETRY ANALYSES (ppm)

LITHOLOGIC COLUMN

CCO_3 %

C_{org} %

Ba

Be

Co

Cr

La

Mn

Ni

Sc

Sr

Ti

V

Y

Yb

Zr

Ag

Cu

Ga

Ge

Pb

Sn

Zn

Cu

Pb

Zn

Mn

Fe_2 %

MIDDLE TO LOWER JURASSIC

HUTTON SS?

Middle and Lower Triassic

Nappamerri Formation

Upper Permian

Toolachee Formation

Lower Permian

Daralingie Beds

Roseneath Shale

Epsilon Formation

LITHOLOGIC LEGEND

- Shale
- Sandstone
- Sandy/Silty
- Shaley
- Coaly shale
- Coal
- Minor coal seams

FIG.1

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

BIG LAKE NO.10
DEPTH 7000 TO 8430 FT.
GEOCHEMISTRY OF CUTTINGS

COMPILED	W.G.S.
DRAWN	J. Williams
DATE	April '81
CHECKED	
C.D.O. DATE	
SCALE	
PLAN NUMBER	81-375

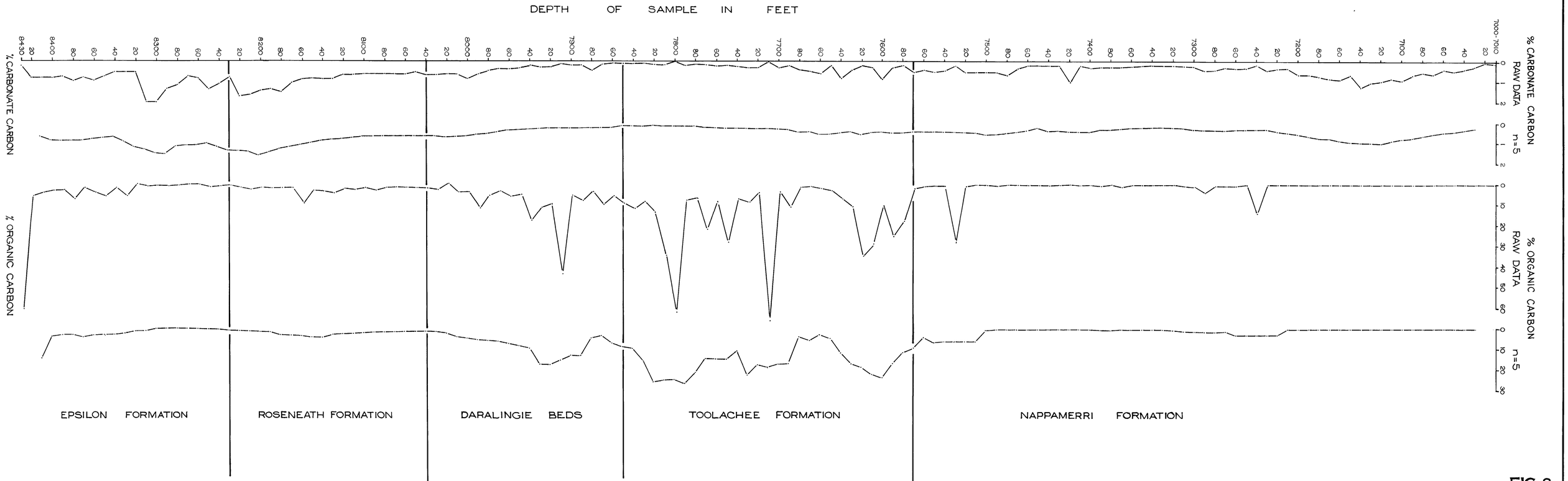


FIG. 2

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

BIG LAKE NO.10 CUTTINGS
CARBON CONTENT OF SHALES

COMPILED W.G.S.	CDO 14·4·81 DATE
DRAWN J.W	SCALE
DATE 30·4·81	PLAN NUMBER 81-376
CHECKED	

19-61

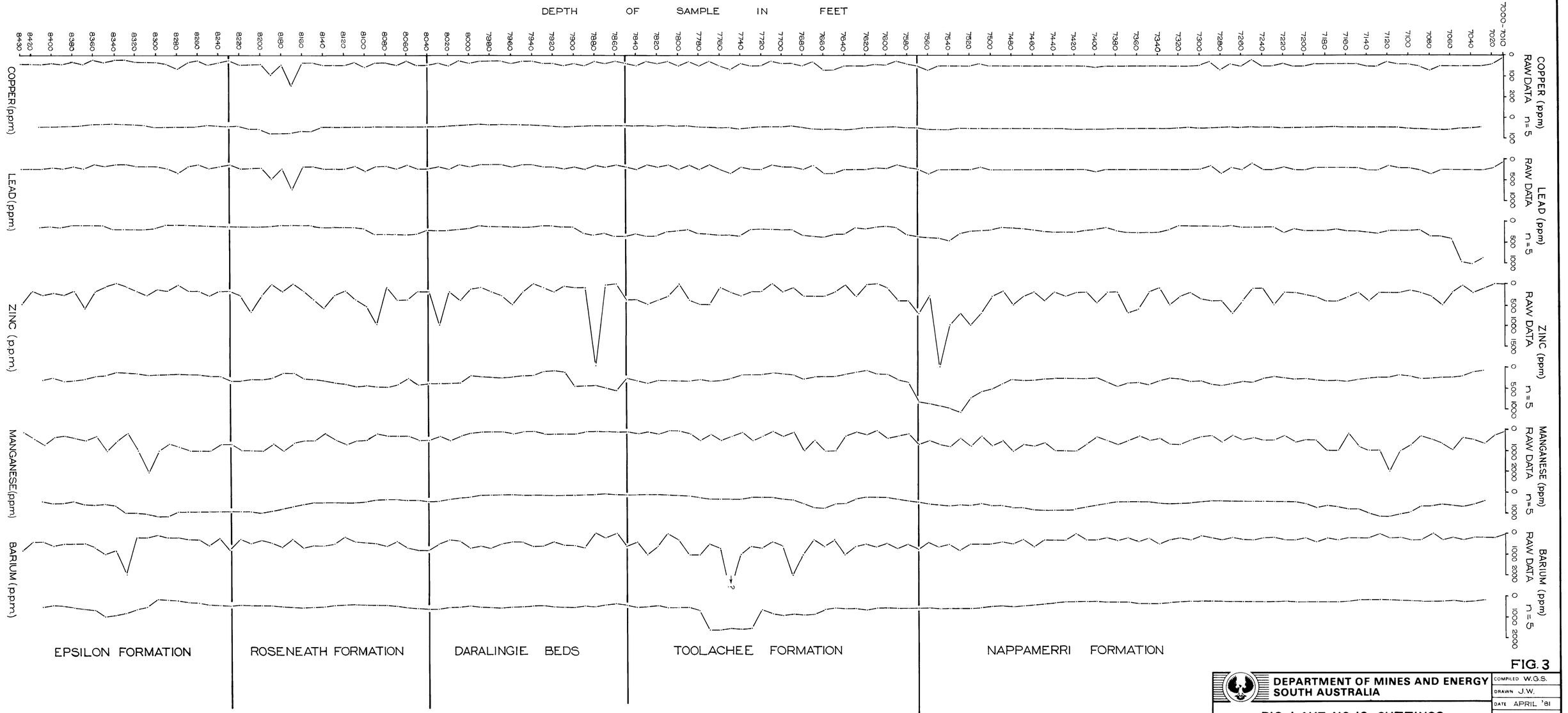


FIG. 3

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

BIG LAKE NO. 10 CUTTINGS
METAL CONTENT
BY EMISSION SPECTROSCOPY
RAW DATA & ROLLING MEANS n=5

COMPILED	W.G.S.
DRAWN	J.W.
DATE	APRIL '81
CHECKED	
CDO	14-4-82 DATE
SCALE	
PLAN NUMBER	81-377

DEPTH OF SAMPLE IN FEET

7000-7010 7020 7040 7060 7080 7100 7120 7140 7160 7180 7200 7220 7240 7260 7280 7300 7320 7340 7360 7380 7400 7420 7440 7460 7480 7500 7520 7540 7560 7580 7600 7620 7640 7660 7680 7700 7720 7740 7760 7780 7800 7820 7840 7860 7880 7900 7920 7940 7960 7980 8000 8020 8040 8060 8080 8100 8120 8140 8160 8180 8200 8220 8240 8260 8280 8300 8320 8340 8360 8380 8400 8420 8430

COPPER (p.p.m.)

LEAD (p.p.m.)

ZINC (p.p.m.)

MANGANESE (p.p.m.)

IRON (p.p.m.)

COPPER (ppm) RAW DATA 0 100 200 — 490

COPPER (ppm) n=5 0 100 200

LEAD (ppm) RAW DATA 0 100 200 — 570

LEAD (ppm) n=5 0 100 200

ZINC RAW DATA 0 100 200 300 400 500 — 560 530 1200 610 580 1000 580

ZINC (ppm) n=5 0 100 200 300 400 500 600

MANGANESE (ppm) RAW DATA 0 1000 2000

MANGANESE (ppm) n=5 0 1000 2000

IRON (ppm) RAW DATA 0 50,000 100,000

IRON (ppm) n=5 0 50,000 100,000

EPSILON FORMATION | ROSENEATH FORMATION | DARALINGIE BEDS | TOOLACHEE FORMATION | NAPPAMERRI FORMATION

FIG. 4

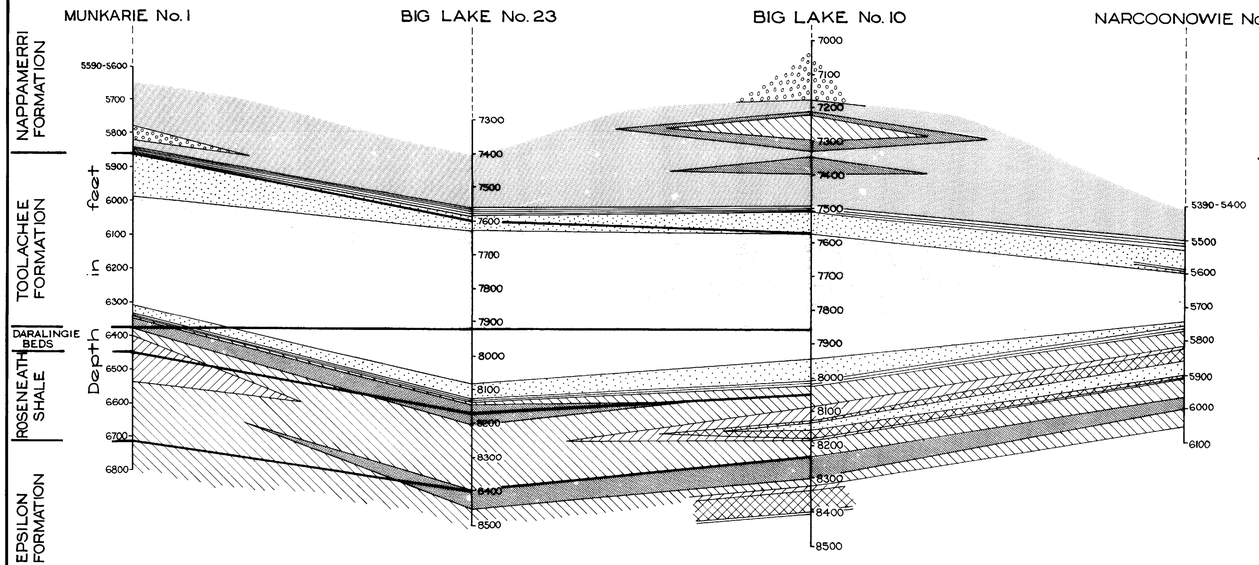
DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

BIG LAKE NO. 10 CUTTINGS
METAL CONTENT
BY ATOMIC ABSORPTION SPECTROSCOPY
RAW DATA & ROLLING MEANS n=5

COMPILED	W.G.S.
DRAWN	J.W.
DATE	APRIL '81
CHECKED	
	16-4-82 C.D.O. DATE
SCALE	
PLAN NUMBER	81-378

1949

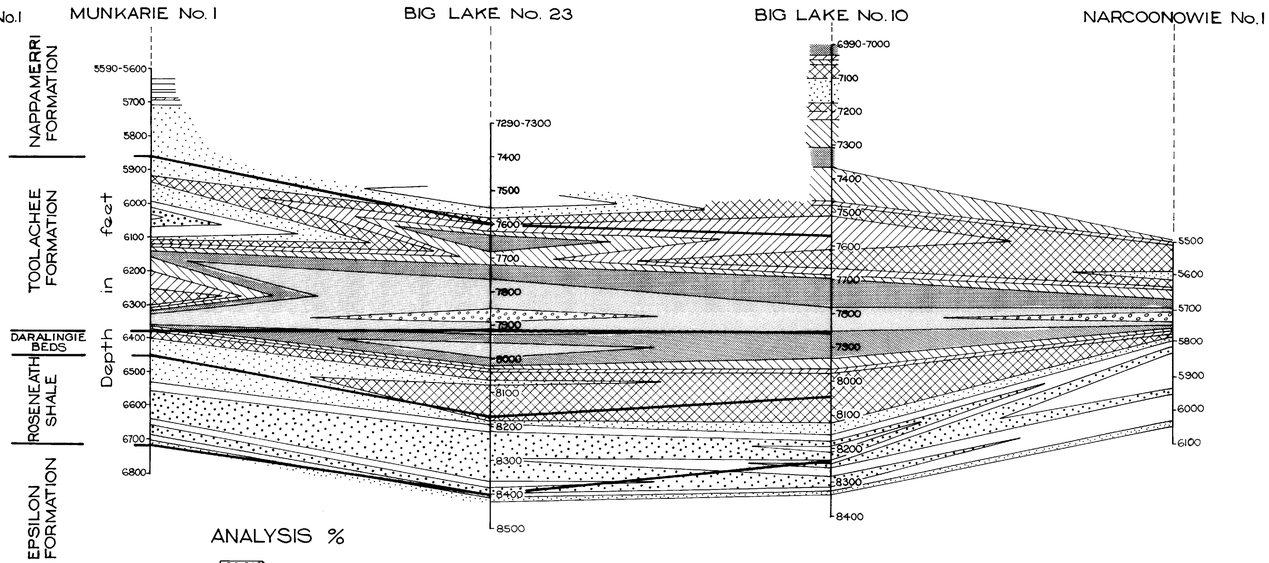
FIG. 5 C_{org} (n=5)



ANALYSIS %

- 0 to 0.5
- 0.5 to 1.0
- 1.0 to 2.0
- 2.0 to 3.0
- 3.0 to 4.0
- 4.0 to 5.0
- 5.0 to 10.0
- Greater

FIG. 6 C_{CO_3} (n=5)



ANALYSIS %

- 0 to 0.1
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.4
- 0.4 to 0.5
- 0.5 to 0.75
- 0.75 to 1.0
- 1.0 to 1.25
- 1.25 to 1.5

FIG. 5 & 6

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

CHEMO-STRATIGRAPHIC UNIT CORRELATION DIAGRAM

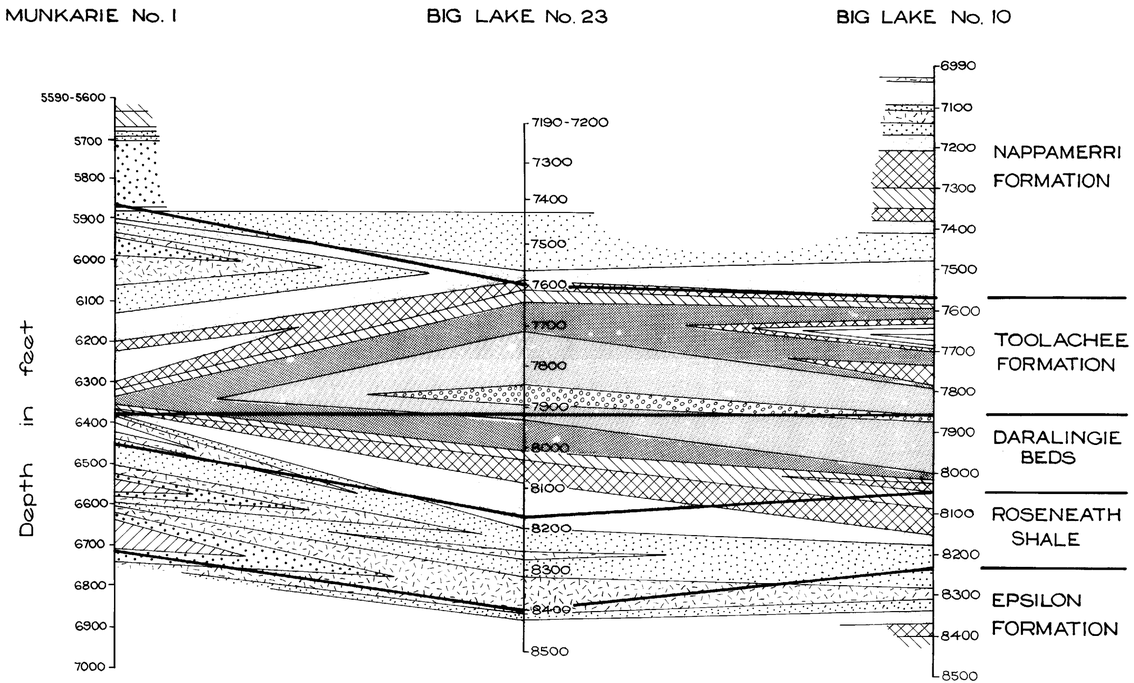
ORGANIC CARBON CONTENT OF SEDIMENTS

CARBONATE CARBON CONTENT OF SEDIMENTS

COMPILED	W.G.S.
DRAWN	J. Williams
DATE	MAY '81
CHECKED	
	14-4-82 C.D.O. DATE
SCALE	
PLAN NUMBER	81-379

1349

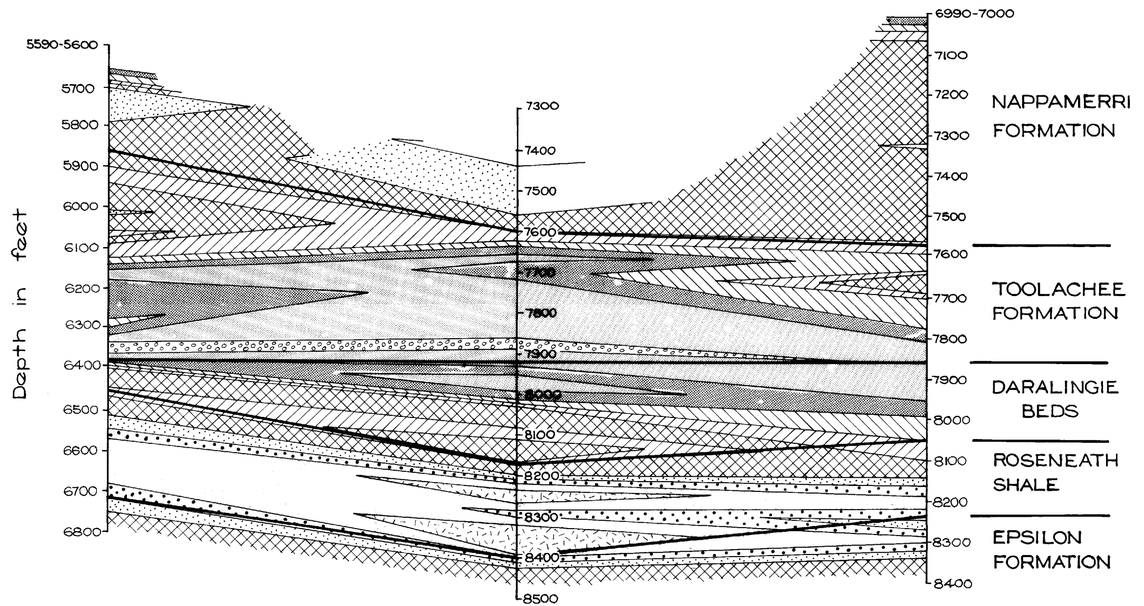
FIG. 7
MANGANESE (ES) n=5



ANALYSIS IN PARTS PER MILLION

- ..... 0 to 100
- ..... 100 to 200
- ..... 200 to 300
- ..... 300 to 400
- ..... 400 to 500
- ..... 500 to 750
- ..... 750 to 1000
- ..... 1000 to 1250
- ..... 1250 to 1500
- ..... Greater than 1500

FIG. 8
MANGANESE (AAS) n=5



ANALYSIS IN PARTS PER MILLION

- ..... 0 to 100.
- ..... 100 to 200.
- ..... 200 to 300.
- ..... 300 to 400.
- ..... 400 to 500.
- ..... 500 to 750.
- ..... 750 to 1000.
- ..... 1000 to 1250.
- ..... 1250 to 1500.
- ..... Greater than 1500.

FIG. 7 & 8

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

CHEMO-STRATIGRAPHIC UNIT CORRELATION DIAGRAM:
MANGANESE CONTENT OF SEDIMENTS BY AAS & ES METHODS BIG LAKE 10

COMPILED	W.G.S.
DRAWN	J. Williams
DATE	MAY '81
CHECKED	
C.D.O	14·3·82 DATE
SCALE	
PLAN NUMBER	81-380

1949