CSIRO
AUSTRALIA

RECHARGE STUDIES IN THE WESTERN MURRAY BASIN

1. RESULTS OF A DRILLING PROGRAM AT BORRIKA

By M.W. Hughes, P.G. Cook, I.D. Jolly, T.A. Beech and C.T. Fiebiger

TECHNICAL MEMORANDUM 88/10
AUGUST 1988

CSIRO
INSTITUTE OF NATURAL RESOURCES AND ENVIRONMENT, DIVISION OF WATER RESOURCES

RECHARGE STUDIES IN THE WESTERN MURRAY BASIN

1. Results of a drilling program at Borrika

By M.W. Hughes
Retired, Hydrology Group, Division of Soils

P.G. Cook, I.D. Jolly
Division of Water Resources, Adelaide Laboratory

and

T.A. Beech, C.T. Fiebiger
Routine Analysis Services, Division of Soils

Technical Memorandum 88/10

August 1988

CSIRO

Institute of Natural Resources and Environment

Division of Water Resources

ISBN 0 643 04820 0

Publications enquiries to:

Divisional Editor
CSIRO Division of Water Resources
G.P.O. Box 1666
Canberra A.C.T. 2601

ABSTRACT

This report presents the results of a drilling program carried out between July 1984 and February 1987 near Borrika, South Australia. The aim of the project was to study the small-scale spatial variability of groundwater recharge. The holes are located beneath mallee (Eucalyptus spp.) vegetation, and on land which was cleared 50 years ago, and has since been used for pasture and crops under a dryland farming regime. Samples were analysed for water content, chloride, matric suction, particle size, oxygen-18, deuterium and tritium.

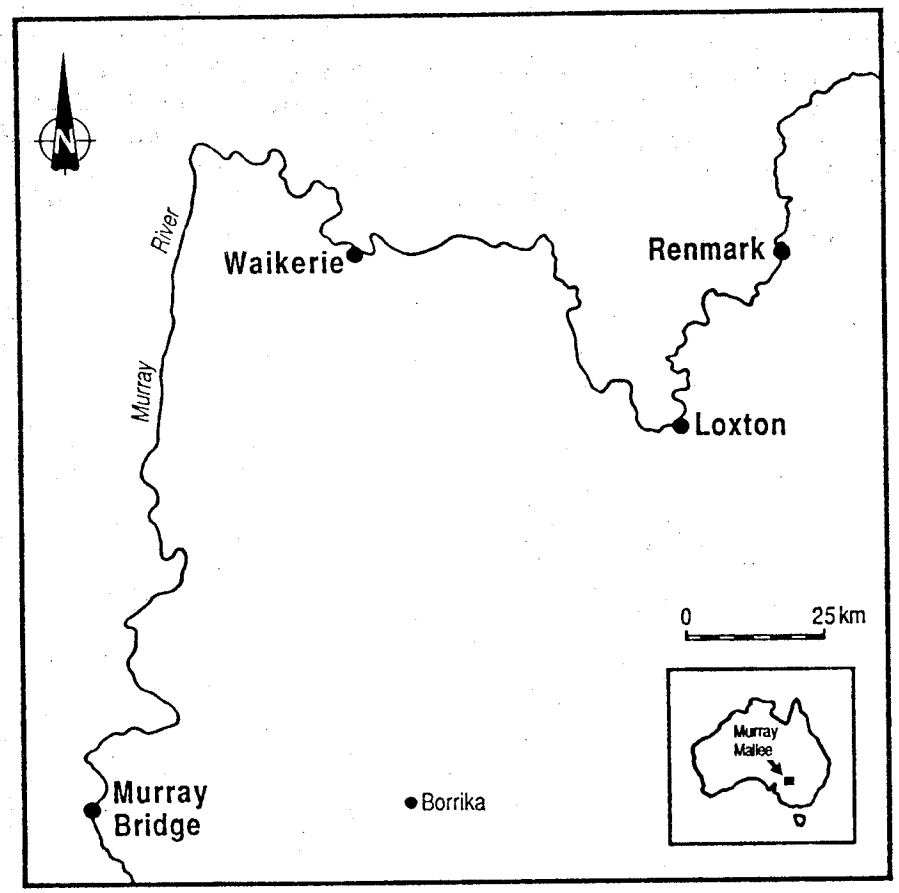


Figure 1 : Location of the site.

1. INTRODUCTION

This Technical Memorandum presents the results of a drilling program carried out between July 1984 and February 1987 in the Murray Basin near Borrika (Latitude 35° 2' S, Longitude 140° 3' E), South Australia (Fig. 1). The work was undertaken initially as a CSIRO funded project and then as part of an Australian Water Research Advisory Council (AWRAC) funded project, and is aimed at determining the rates of groundwater recharge in the western Murray Basin. The principal objective of this project is to determine the changes in recharge which occur as a result of clearing native Mallee (*Eucalyptus* spp.) vegetation for agricultural production, and their effect on the flow of saline groundwater to the River Murray. In all, 15 holes were drilled in a paddock cleared approximately 50 years ago, and in the adjacent Mallee vegetation. The site was selected for study because of the extreme variations in crop growth which had been observed over a number of years, possibly indicating large variations in soil water flux in the unsaturated zone above the unconfined Murray Group aquifer. The locations of the holes within the site are illustrated in Fig. 2.

2. SAMPLING

Drilling was carried out using 100 mm diameter hand augers (holes BUF02-18) and by rotary drilling with the Division of Soils 'Investigator' drilling rig, using hollow-stemmed augers and wireline recovery equipment (BUF01, BVD01-02, BVF01-02). Where possible, continuous coring was carried out, although small gaps exist in several of the profiles where sampling was not possible due to excessively hard strata or lack of core recovery. Sub-samples of each core were collected for water content and chloride analysis and stored in small air-tight

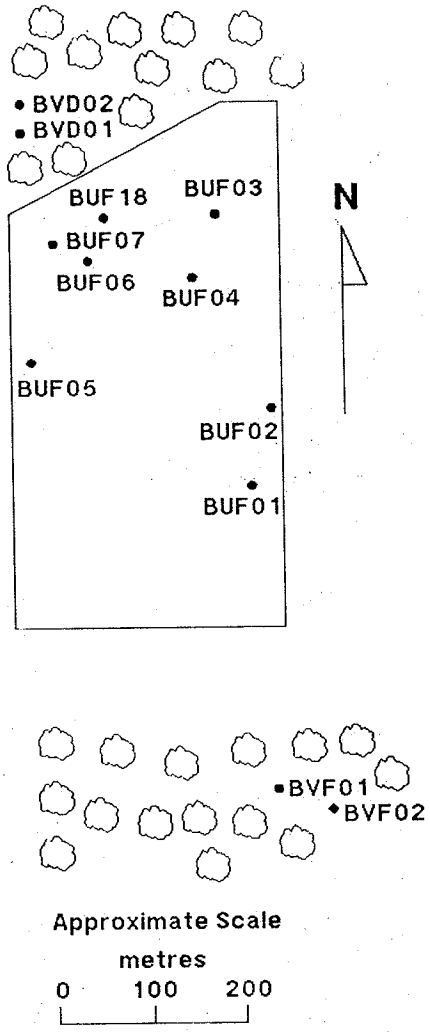


Figure 2 : Location of core holes. Holes BUF12, BUF13, BUF15 are adjacent to holes BUF02, BUF03 and BUF05 respectively.

P.V.C. containers (chippettes). In the case of the deep holes (BUF01, BVD01-02 and BVF01-02), sub-samples were also collected for stable isotope, matric suction and particle size analysis and stored in glass jars with airtight caps. In two of the holes (BUF15 and BUF18) sampling was also conducted for tritium analysis, and samples were stored in several heavy-walled P.V.C. bags. Groundwater samples were collected from the water table at holes BVD01, BVD02 and BUF01, and analysed for chloride.

3. ANALYSIS

Gravimetric water content and chloride concentration in the soil solution were determined on all samples. These are the principal data used for estimating groundwater recharge by the methods of Allison *et al.* (1985) which are used in this study. Stable isotope analyses (deuterium and oxygen-18) were carried out on the deep (> 20 m) profiles in order to estimate the deuterium excess, a parameter required for an alternative estimate of recharge. Holes BUF15 and BUF18 (located near holes BUF05 and BUF08) were drilled late in the program primarily to enable sampling for tritium analysis. These were used to test the validity of the assumptions made when the above methods are used to estimate recharge. Matric suction was determined on samples from three of the earlier drilled profiles (BUF02, BUF03 and BUF06) to examine the changes in the suction profile which occur as the result of clearing native Mallee vegetation.

4. RESULTS

Tables 1 to 15 contain the results of the drilling program. The terminology employed in these tables is given in the following section.

Figs 3 to 6 show the profiles of gravimetric water content, chloride concentration in the soil water, and the deuterium and oxygen-18 concentration in the soil water, of the core holes located in the Mallee vegetated areas. Figs 7 to 17 depict the same profiles (where applicable) for the holes located in the cleared area. Note that for several of these holes, profiles of tritium concentration of the soil solution and matric suction are also depicted. Chloride concentration of the soil solution plotted against cumulative water for all holes is shown in Figs 18 to 22.

5. TERMINOLOGY

Theta g (g/g) : The gravimetric water content (grams of water per gram of dry soil) of the sampled interval. Determined by oven drying a 20-50 g sub-sample for 24 hours at 105 ^{0}C.

Cum Wat (cm)^{1} : The cumulative amount of water stored in the soil profile to the bottom of the sampled interval. A bulk density of 1.5 g cm^{-3} was assumed in order to calculate the volumetric water content.

[Cl]-ss (mg/l) : The chloride ion concentration in the soil solution. Total chloride in the soil sample (grams of chloride per kilogram of dry soil) was determined colorimetrically (Taras *et al.*, 1975) and converted to the concentration in the soil solution using the gravimetric water content (Theta g).

Cum Cl (mg/cm2)^{1} : The cumulative amount of chloride stored in the soil profile to the bottom of the sampled interval.

Mat Suc (kPa) : The matric suction of the soil as determined by the

filter paper method described by Greacen *et al.* (1987). This value is the mean of three replicate filter papers.

Delta-2 (SMOW) : The deuterium concentration in the soil solution, measured using the methods described by Allison *et al.* (1985). It is reported in delta units, the deviation in $^{0}/_{00}$ from V-SMOW (Vienna-Standard Mean Ocean Water).

Delta-18 (SMOW) : The oxygen-18 concentration in the soil solution, measured using the methods described by Allison *et al.* (1985). It is reported in delta units, the deviation in $^{0}/_{00}$ from V-SMOW (Vienna-Standard Mean Ocean Water).

Tritium (T.U.) : The tritium concentration in the soil solution as determined by liquid scintillation counting. The concentrations are reported in tritium units (T.U.) where 1 T.U. represents one atom of tritium in 10^{18} atoms of hydrogen.

% Sand, % Silt and % Clay : The particle size distribution of the soil material. The silt and clay fractions were determined using the pipette method (Lewis, 1983) and the sand fraction calculated by difference. Sand is taken as material coarser than 0.02 mm, silt between 0.02 and 0.002 mm, and clay finer than 0.002 mm. Breakdown of the sand fraction was carried out for samples from hole BUF15 only, and is presented in Table 14a.

[1]For the purposes of cumulative water and chloride calculations, when a depth interval was not sampled (eg 950-1100 cm in BVF01), Theta g and [Cl]-ss were taken to be the mean of the samples of the intervals above and below.

5. REFERENCES

Allison, G.B., Stone, W.J., and Hughes, M.W. (1985). Recharge in karst and dune elements of a semi-arid landscape as indicated by natural isotopes and chloride. J. Hydrol., 76, 1-25.

Greacen, E.L., Walker, G.R., and Cook, P.G. (1987). Evaluation of the filter paper method for measuring soil water suction. International Conference on the Measurement of Soil and Plant Water Status, 1, 137-43, Utah State University, July, 1987.

Lewis, D.W. (1983). Practical Sedimentology. Hutchinson Ross, Pennsylvannia.

Taras, M.J., Greenberg, A.E., Hoak, R.D. and Rand, M.C. (Eds) (1975). Standard Methods for the Examination of Water and Wastewater. American Public Health Association, U.S.A. 14th Ed. pp.613-614.

Table 1 : Core data for Mallee vegetated hole BVD01.

Hole: BVD01
Drilled: 16.07.84
Vegetation: Native Mallee
Land Unit: Sand Dune
Comments:

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Delta-2 (SMOW)	Delta-18 (SMOW)
3318	0- 10	0.102	2	21	0	-108.1	-14.1
3319	10- 20	0.040	2	124	0	-68.4	-9.1
3320	20- 30	0.012	2	700	0	-45.4	-5.3
3321	30- 40	0.015	3	606	0	-26.0	-2.1
3322	40- 50	0.011	3	804	1	-19.7	-0.6
3323	50- 60	0.012	3	761	1	-19.8	-0.7
3324	60- 70	0.013	3	911	1	-23.6	-1.7
3325	70- 80	0.026	3	498	1	-8.1	
3326	80- 90	0.035	4	566	1	-27.5	-2.7
3327	90-100	0.028	4	651	2	-27.0	-2.9
3328	100-120	0.025	5	472	2	-25.2	-2.7
3329	120-140	0.018	6	1813	3	-25.0	-2.7
3330	140-160	0.016	6	5753	6	-25.5	-3.0
3331	160-180	0.016	7	3721	7	-27.7	-3.1
3332	180-200	0.015	7	5069	10	-24.3	-2.1
3333	200-233	0.014	8	6669	14	-25.5	
3334	233-267	0.014	8	8317	20	-28.8	-3.0
3335	267-300	0.013	9	9966	27	-32.9	
3336	300-333	0.014	10	13120	36	-23.7	-1.0
3337	333-367	0.015	11	14244	47	-30.0	
3338	367-400	0.017	11	15044	60	-30.4	-2.3
3339	400-433	0.040	13	15691	91	-34.4	
3340	433-467	0.061	16	17665	144	-35.7	-4.2
3341	470-493	0.058	18	17754	180	-36.9	
3342	493-516	0.053	20	17582	212	-34.9	-4.3
3343	516-540	0.052	22	17665	245		
3344	540-575	0.061	25	17574	301	-36.1	-4.0
3345	575-610	0.061	29	20031	365		
3346	610-645	0.068	32	18290	430	-34.2	-4.0
3347	645-680	0.066	36	16859	489		
3348	680-715	0.069	39	18438	556	-35.6	-4.1
3349	715-750	0.058	42	18751	613		
3350	750-785	0.067	46	18618	679	-35.1	-4.1
3351	785-820	0.063	49	18864	741		
3352	820-855	0.062	52	19523	805	-36.3	-4.1
3353	855-890	0.061	56	19961	868		
3354	890-925	0.056	59	18920	924	-34.4	-3.9
3355	925-960	0.052	61	18901	975		
3356	960-1030	0.058	67	18664	1088	-33.1	-3.5
3357	1030-1065	0.055	70	20585	1148		
3358	1065-1100	0.062	73	21333	1218	-30.4	-2.6
3359	1100-1135	0.059	77	20126	1280	-68.4	-9.1
3360	1135-1170	0.052	79	18475	1330	-30.7	-3.0

Table 1 continued.

Sample	Depth (cm)	Mid Dpth (m)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Delta-2 (SMOW)	Delta-18 (SMOW)
3361	1170-1205	-11.88	0.061	82	17785	1388	-26.0	-2.1
3362	1205-1240	-12.23	0.052	85	17532	1435	-30.9	-3.1
3363	1240-1275	-12.57	0.056	88	14080	1477	-19.8	-0.7
3364	1275-1310	-12.92	0.043	90	16227	1514	-28.1	-2.4
3365	1310-1345	-13.27	0.054	93	17829	1564	-8.1	
3366	1345-1380	-13.62	0.051	96	16276	1608	-30.2	-3.2
3372	1380-1425	-14.03	0.047	99	17382	1663	-26.5	-2.9
3371	1425-1430	-14.28	0.036	99	18400	1668	-27.1	-2.8
3370	1430-1435	-14.33	0.040	100	17901	1673	-31.2	-2.7
3369	1435-1440	-14.38	0.037	100	17421	1678	-30.9	-3.4
3368	1440-1445	-14.43	0.040	100	18928	1683	-28.4	-3.1
3367	1445-1450	-14.48	0.041	101	17659	1689	-29.1	-2.9
3373	1450-1485	-14.68	0.038	103	24740	1738	-25.5	
3374	1485-1520	-15.03	0.037	104	16374	1770	-27.2	-2.8
3375	1520-1555	-15.38	0.036	106	17464	1803	-32.9	
3376	1555-1590	-15.73	0.031	108	17559	1831	-25.8	-2.8
3377	1590-1625	-16.08	0.037	110	17104	1864	-30.0	
3378	1625-1660	-16.43	0.045	112	18365	1908	-24.4	-2.6
3379	1660-1695	-16.78	0.076	116	19276	1984	-26.8	
3380	1695-1730	-17.13	0.085	121	19124	2070	-23.7	-2.2
3381	1730-1765	-17.48	0.047	123	18759	2116	-36.9	
3382	1765-1800	-17.83	0.044	125	17507	2156	-24.6	-1.9
3383	1800-1870	-18.35	0.049	131	17521	2246	-25.6	
3384	1870-1940	-19.05	0.046	135	19522	2339	-31.3	-3.2
3385	1940-2010	-19.75	0.034	139	17436	2402		
3386	2010-2080	-20.45	0.036	143	15386	2461	-31.6	-3.8
3387	2080-2150	-21.15	0.032	146	13938	2508		
3388	2150-2220	-21.85	0.032	150	13383	2552	-33.6	-3.7
3389	2220-2290	-22.55	0.032	153	12333	2594		
3390	2290-2360	-23.25	0.041	157	11615	2644	-32.9	-4.3
3391	2360-2430	-23.95	0.046	162	11645	2700		
3392	2430-2500	-24.65	0.026	165	10649	2729	-31.6	-3.8
3393	2500-2570	-25.35	0.114	177	8448	2830		
3394	2570-2630	-26.00	0.053	181	8328	2869	-33.3	-4.3
3395	2630-2700	-26.65	0.043	186	7661	2904		
3396	2700-2770	-27.35	0.045	191	6530	2935	-33.3	-4.8
3397	2770-2850	-28.10	0.067	199	5982	2983		
3398	2850-2920	-28.85	0.050	204	4849	3008	-32.3	-4.4
3399	2920-2990	-29.55	0.094	214	3973	3048		
3400	2990-3060	-30.25	0.133	228	3802	3101	-33.3	-4.4
3401	3060-3130	-30.95	0.141	243	3158	3148		
3402	3130-3190	-31.60	0.147	256	3045	3188	-34.3	-4.7
3403	3190-3230	-32.10	0.096	262	2896	3205		
3404	3230-3300	-32.65	0.127	275	2485	3238	-33.5	-4.4
3405	3330-3380	-33.55	0.147	286	2070	3261		
3406	3600-3780	-36.90	0.224	408	1956	3502	-36.2	-4.6

Total depth drilled = 41.14 m
Water table at 36.95 m
Chloride = 1900 mg/l

Table 2 : Core data for Mallee vegetated hole BVD02.

Hole: BVD02
Drilled: 25.07.84
Vegetation: Native Mallee
Land Unit: Sand Dune
Comments:

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Delta-2 (SMOW)	Delta-18 (SMOW)
3407	0- 10	0.068	1	115	0	-52.4	-6.82
3408	10- 20	0.027	1	259	0	-51.8	-5.93
3409	20- 30	0.017	2	406	0	-34.9	-3.31
3410	30- 40	0.017	2	224	0	-26.7	-1.69
3411	40- 50	0.016	2	231	0	-32.3	-3.03
3412	50- 60	0.023	3	157	0	-35.6	-3.15
3413	60- 70	0.033	3	142	1	-32.9	-3.35
3414	70- 80	0.022	3	455	1	-22.4	-1.46
3415	80- 90	0.022	4	1668	1	-21.5	-0.35
3416	90-100	0.031	4	2152	2	-23.1	-1.32
3417	100-120	0.020	5	2415	4	-21.8	-1.73
3418	120-140	0.017	5	3500	5	-21.7	-2.16
3419	140-160	0.016	6	4694	8	-23.8	-2.1
3420	160-180	0.015	6	6247	11	-23.7	-2.41
3421	180-200	0.015	7	7953	14	-26.4	-2.17
3422	200-233	0.015	7	9453	21	-25.8	-2.55
3423	233-267	0.015	8	10640	29	-28	-2.76
3424	267-300	0.015	9	11080	38	-27.4	-2.91
3425	300-333	0.017	10	11959	48	-28.8	-3.54
3426	333-367	0.015	10	12600	57	-29.6	-3.4
3427	367-400	0.037	12	13011	81	-30.4	-3.36
3428	400-433	0.043	14	12367	107	-30.1	-3.27
3429	433-467	0.041	17	12959	134	-29.1	-3.19
3430	467-500	0.043	19	12347	161	-29.3	-2.5
3431	500-533	0.045	21	13333	190		
3432	533-565	0.049	23	13149	221	-28.1	-3.43
3433	565-600	0.055	26	11065	253		
3434	600-635	0.061	29	13370	296	-28.7	-3.58
3435	635-670	0.058	32	13316	337		
3436	670-705	0.060	36	13855	380	-28.3	-2.93
3437	705-740	0.056	38	14239	422		
3438	740-775	0.062	42	13942	468	-28.5	-2.64
3439	775-810	0.062	45	14044	513		
3440	810-845	0.060	48	14388	559	-29.9	-3.45
3441	845-880	0.059	51	14622	604		
3442	880-915	0.056	54	14125	645	-27.3	-3.4
3443	915-950	0.057	57	13581	686		
3444	950-985	0.056	60	14282	728	-27.8	
3445	985-1020	0.062	63	14379	775		
3446	1020-1055	0.056	66	14679	818	-26.8	-2.65
3447	1055-1090	0.055	69	14331	859		
3448	1090-1125	0.058	72	14731	904	-27.3	-2.82
3449	1125-1160	0.053	75	14717	945		

Table 2 continued.

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Delta-2 (SMOW)	Delta-18 (SMOW)
3450	1160-1195	0.055	78	14591	987	-29.7	-2.98
3451	1195-1230	0.054	81	14544	1029		
3452	1230-1265	0.052	83	14469	1068	-28.9	-2.78
3453	1265-1300	0.051	86	14741	1108		
3454	1300-1335	0.060	89	15475	1156	-29.1	-3.23
3455	1335-1370	0.043	92	15288	1191	-51.8	
3456	1370-1405	0.045	94	13936	1224	-28.9	-3.04
3457	1405-1440	0.053	97	11709	1256	-26.7	
3458	1440-1475	0.030	98	14277	1279	-25.5	-3.08
3459	1475-1510	0.038	100	19634	1318	-35.6	
3460	1510-1545	0.041	102	16798	1354	-28.3	-3.08
3461	1545-1580	0.040	105	15910	1388	-29.1	
3462	1580-1615	0.062	108	15645	1438	-29.4	-2.73
3463	1615-1650	0.099	113	15976	1521	-23.1	
3464	1650-1685	0.042	115	15252	1555	-28.5	-3.04
3465	1685-1720	0.043	117	17042	1594	-21.7	
3466	1720-1780	0.043	121	11119	1637	-29.6	-2.85
3467	1780-1805	0.049	123	12312	1659	-23.7	
3468	1805-1840	0.043	125	15191	1694	-31.9	-3.33
3469	1840-1875	0.056	128	14207	1735	-25.8	
3470	1875-1910	0.046	131	13846	1769	-30.9	-4.81
3471	1910-1935	0.043	132	12995	1790	-27.4	
3472	1935-1965	0.040	134	15105	1817	-32.7	-3.41
3473	1965-2000	0.044	136	13132	1847	-29.6	
3474	2000-2030	0.030	138	12473	1864	-31.3	-3.55
3475	2030-2065	0.037	140	13770	1891	-30.1	
3476	2065-2100	0.035	142	12457	1914	-34	-3.75
3477	2100-2135	0.029	143	12766	1933	-29.3	
3478	2135-2170	0.033	145	13594	1957	-33.6	
3479	2170-2240	0.027	148	11530	1989	-28.1	
3480	2240-2275	0.036	150	12692	2013	-31.2	-3.48
3481	2275-2310	0.041	152	11810	2039	-28.7	
3482	2310-2345	0.043	154	11807	2065	-32.6	-3.45
3483	2345-2380	0.045	156	11416	2092	-28.3	
3484	2380-2415	0.034	158	12341	2114	-33.7	-4.23
3485	2415-2450	0.044	160	11425	2141	-28.5	
3486	2450-2485	0.064	164	9480	2173	-35.3	-5.42
3487	2485-2520	0.117	170	10476	2237	-29.9	
3488	2520-2555	0.045	172	11620	2264	-32.8	-3.93
3489	2555-2590	0.054	175	10533	2294	-27.3	
3490	2590-2635	0.038	178	9503	2319	-32.3	-4.13
3491	2635-2660	0.039	179	9492	2333	-27.8	
3492	2660-2690	0.089	183	7763	2364	-33.7	-4.02
3493	2690-2730	0.043	186	8600	2386	-26.8	
3494	2730-2765	0.056	189	7595	2408	-33.1	-4.15
3495	2765-2800	0.065	192	7700	2434	-27.3	
3496	2800-2820	0.062	194	7455	2448	-35.4	-4.35
3497	2830-2865	0.067	198	6763	2479	-29.7	
3498	2865-2900	0.054	201	5704	2495	-34.6	-4.2

Table 3 : Core data for Mallee vegetated hole BVF01.

Hole: BVF01
Drilled: 27.08.84
Vegetation: Native Mallee
Land Unit: Sand Flat
Comments:

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Delta-2 (SMOW)	Delta-18 (SMOW)
3615	0- 10	0.044	1	434	0	-9.4	-0.4
3616	10- 20	0.036	1	361	0	-20.4	-1.9
3617	20- 30	0.045	2	569	1	-18.9	-0.8
3618	30- 40	0.039	2	80	1	-14.6	0.7
3619	40- 50	0.047	3	126	1	-15.4	-0.2
3620	50- 60	0.040	4	133	1	-14.7	-0.8
3621	60- 70	0.030	4	293	1	-16.5	-1.6
3622	70- 80	0.038	5	642	2	-18.1	1.4
3623	80- 90	0.039	5	1313	2	-17.0	-2.3
3624	90-100	0.032	6	2925	4	-17.2	-1.3
3625	100-110	0.027	6	3663	5	-19.2	-2.0
3626	110-120	0.031	7	5058	8	-21.0	-2.6
3627	120-130	0.031	7	4636	10	-19.0	-1.5
3628	130-150	0.024	8	7592	15	-24.9	-2.5
3629	150-170	0.032	9	3950	19	-24.3	-2.5
3630	180-195	0.036	10	11128	32	-24.9	-3.0
3631	195-210	0.035	11	9769	40	-22.7	-2.3
3632	210-245	0.035	13	13134	64	-25.5	-3.0
3633	245-280	0.028	14	12357	82	-24.5	-2.4
3634	280-315	0.034	16	13856	107	-24.8	
3635	315-350	0.034	18	14829	133	-26.0	-2.9
3636	350-385	0.034	20	14624	159	-25.6	
3637	385-425	0.035	22	13663	188	-25.0	-2.4
3638	425-460	0.028	23	14275	209	-24.3	
3639	460-500	0.030	25	13697	233	-27.2	-2.6
3640	500-535	0.033	27	14942	259	-28.4	
3641	535-575	0.032	29	11834	282	-28.4	-2.6
3642	575-610	0.037	31	11051	304	-28.6	
3643	610-650	0.019	32	12963	318	-27.9	-2.5
3644	650-685	0.017	33	12653	330		
3645	685-725	0.033	35	12858	355	-28.1	-2.6
3646	725-765	0.020	36	12825	370	-27.2	
3647	765-800	0.041	38	11839	396	-25.7	-2.6
3722	800-835	0.053	41	14232	436	-27.0	-2.5
3723	835-875	0.034	43	17053	470		
3724	875-895	0.030	44	15630	484	-26.6	-2.5
3725	910-950	0.019	45	12958	507		
3726	1100-1125	0.027	52	13737	590	-24.7	
3727	1125-1150	0.053	54	9932	610		
3728	1150-1250	0.038	59	12676	682	-27.4	-3.2
3729	1250-1288	0.031	61	12694	704		
3730	1288-1325	0.036	63	12428	729	-25.9	-3.0
3731	1325-1363	0.041	65	13832	762		

Table 2 continued.

Sample	Depth (cm)	Mid Dpth (m)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Delta-2 (SMOW)	Delta-18 (SMOW)
3499	2900-2935	-29.18	0.112	207	5055	2525	-28.9	
3500	2935-2970	-29.53	0.103	213	4658	2550	-36	-4.14
3501	2970-3005	-29.88	0.130	219	4065	2578	-29.1	
3502	3005-3040	-30.23	0.133	226	4252	2608	-35.8	-4.12
3503	3040-3075	-30.58	0.125	233	4332	2636		
3504	3075-3110	-30.93	0.140	240	4035	2666	-36	-3.79
3505	3110-3145	-31.28	0.133	247	3902	2693		
3506	3145-3180	-31.63	0.077	251	3573	2707	-36	-4.25
3507	3180-3215	-31.98	0.119	258	3446	2729		
3508	3215-3250	-32.33	0.126	264	2999	2749	-34.9	
3509	3250-3280	-32.65	0.123	270	2854	2764		
3510	3280-3310	-32.95	0.100	274	2580	2776	-35.5	-4.44
3511	3330-3355	-33.43	0.149	284	2287	2798		
3512	3355-3380	-33.68	0.158	289	2235	2811	-36.3	-4.32

Total depth drilled = 42.50 m
Water Table at 36.4 m
Chloride = 1670 mg/l

Table 4 : Core data for Mallee vegetated hole BVF02.

Hole: BVF02
Drilled: 15-16.02.88
Vegetation: Native Mallee
Land Unit: Sand Flat
Comments: Approximately 30 m east of BVF01

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/kg)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Mat Suc (kPa)
1	0- 50	0.052	4	368	7049	28	2492.9
2	65-100	0.052	9	744	14307	96	1413.6
3	100-150	0.042	12	615	14598	142	1711.3
4	150-200	0.051	16	821	16251	204	1452.4
5	200-250	0.038	19	606	16006	249	1369.7
6	250-300	0.037	22	559	14944	291	1414.0
7	300-350	0.042	25	602	14422	336	656.4
8	350-400	0.037	27	562	15273	378	924.7
9	400-450	0.041	31	609	14848	424	716.2
10	450-500	0.048	34	698	14403	476	491.1
11	500-550	0.041	37	570	14039	519	504.6
12	550-600	0.044	41	591	13361	563	402.2
13	600-650	0.052	44	695	13402	616	598.6
14	650-700	0.056	49	684	12108	667	286.6
15	700-750	0.052	53	650	12542	716	285.2
16	750-800	0.045	56	586	13043	760	478.0
17	800-850	0.036	59	491	13452	796	345.5
18	850-900	0.046	62	721	15630	850	306.6
19	900-950	0.050	66	956	19027	922	412.6
20	950-1000	0.049	70	818	16580	983	302.7
21	1000-1050	0.061	74	1250	20430	1077	167.7
22	1050-1100	0.037	77	630	16824	1124	266.9
23	1100-1150	0.056	81	903	16002	1192	156.8
24	1150-1200	0.047	85	758	16100	1249	206.7
25	1200-1250	0.072	90	1648	22921	1373	92.9
26	1250-1275	0.068	95	1453	21336	1482	85.0
27	1300-1350	0.048	101	799	16781	1584	51.3
28	1350-1400	0.057	105	1129	19974	1668	45.9
29	1400-1450	0.038	108	656	17384	1718	43.5
30	1450-1500	0.045	111	836	18557	1780	44.5
31	1500-1550	0.035	114	653	18916	1829	44.9
32	1550-1600	0.032	116	582	18256	1873	33.1
33	1600-1650	0.029	119	567	19251	1915	31.3
34	1650-1700	0.039	122	686	17788	1967	43.3
35	1700-1750	0.048	125	615	12893	2013	74.0
36	1750-1800	0.043	128	752	17674	2069	48.3
37	1800-1850	0.039	131	708	18084	2123	62.1
38	1850-1900	0.064	136	1021	16040	2199	61.0
39	1900-1950	0.060	141	1003	16691	2274	118.0
40	1950-2000	0.067	145	1008	15153	2350	99.2
41	2000-2050	0.069	151	1005	14531	2425	210.3
42	2050-2100	0.043	154	638	15004	2473	90.6
43	2100-2150	0.043	157	727	16968	2528	115.5

Table 3 continued.

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Delta-2 (SMOW)	Delta-18 (SMOW)
3732	1363-1400	0.037	67	12949	788	-25.7	
3733	1400-1438	0.060	71	11568	827		-3.1
3734	1438-1475	0.034	73	12206	851	-26.4	-3.0
3735	1475-1513	0.028	74	10771	868		
3736	1513-1550	0.033	76	11761	889	-26.1	-3.0
3737	1550-1625	0.035	80	14103	945		
3738	1625-1700	0.062	87	13702	1041	-29.3	-3.6
3739	1700-1775	0.033	91	11130	1082		
3740	1775-1850	0.056	97	9213	1140	-30.9	
3741	1850-1925	0.062	104	15810	1250		
3742	1925-2000	0.066	111	13800	1353	-30.1	-4.0
3743	2000-2075	0.054	118	9798	1412		
3744	2085-2150	0.049	123	10965	1473	-30.3	-3.8
3745	2150-2225	0.054	129	9626	1531		
3746	2225-2300	0.063	136	7813	1586	-31.2	-3.9
3747	2325-2375	0.089	146	5956	1646		
3748	2375-2400	0.103	150	5951	1669	-32.1	-4.0
3749	2450-2520	0.186	180	4377	1810		
3750	2520-2600	0.229	207	5955	1974	-36.7	-4.4
3751	2600-2645	0.249	224	2368	2014		
3752	2675-2715	0.245	250	4063	2109	-35.9	-4.5

Table 4 continued.

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/kg)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Mat Suc (kPa)
44	2150-2190	0.042	160	719	17199	2582	126.6
45	2200-2250	0.038	164	685	18091	2644	204.8
46	2250-2300	0.048	167	811	16734	2704	200.7
47	2300-2330	0.041	170	597	14597	2749	260.4
48	2350-2400	0.059	176	851	14547	2835	229.4
49	2400-2450	0.076	182	990	13057	2909	233.3
50	2450-2500	0.099	189	1292	12990	3006	171.1
51	2500-2550	0.117	198	1782	15256	3139	148.9
52	2550-2600	0.155	210	2305	14861	3312	165.7
53	2600-2650	0.163	222	2140	13132	3473	109.3
54	2650-2675	0.166	234	1950	11767	3619	211.8
55	2700-2750	0.162	253	2062	12740	3849	88.2
56	2750-2800	0.169	265	2263	13428	4019	54.5

Table 5 : Core data for cleared hole BUF01.

Hole: BUF01
Drilled: 13.08.84
Vegetation: Cleared 50 years
Land Unit: Sand Flat
Comments:

Sample	Depth (cm)	Mid Dpth (m)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Delta-2 (SMOW)	Delta-18 (SMOW)
3516	0- 10	-0.05	0.050	1	266	0	-23.9	-3.3
3517	10- 20	-0.15	0.064	2	133	0	-21.7	-3.2
3518	20- 30	-0.25	0.068	3	106	0	-35.5	-4.7
3519	30- 40	-0.35	0.125	5	188	1	-28.9	
3520	40- 50	-0.45	0.131	7	186	1	-27.6	-2.5
3521	50- 60	-0.55	0.088	8	190	1	-28.2	-2.3
3522	60- 70	-0.65	0.065	9	358	2	-25.1	
3523	70- 80	-0.75	0.059	10	1097	3	-26.9	
3524	80- 90	-0.85	0.055	11	778	3	-26.3	
3525	90-100	-0.95	0.054	11	487	4		
3526	100-120	-1.10	0.063	13	1352	6	-26.9	
3527	120-140	-1.30	0.040	14	2778	10	-25.8	
3528	140-160	-1.50	0.053	16	1768	12		
3529	160-180	-1.70	0.064	18	1350	15		
3530	180-210	-1.95	0.054	20	1176	18		
3531	210-245	-2.28	0.055	23	1007	21	-32.0	
3532	245-280	-2.63	0.059	26	1100	24	-33.3	
3534	280-315	-2.98	0.058	29	1434	29	-33.4	
3535	315-350	-3.33	0.058	32	1252	32	-32.8	
3533	350-385	-3.68	0.064	36	1241	37	-32.6	
3536	385-420	-4.03	0.062	39	1684	42	-31.4	
3537	420-455	-4.38	0.069	43	1761	48	-32.7	
3538	455-490	-4.73	0.066	46	1877	55	-30.4	
3539	490-525	-5.08	0.061	49	1598	60	-32.8	-3.8
3540	525-560	-5.43	0.061	53	1423	65	-31.1	-3.7
3541	560-595	-5.78	0.064	56	1431	69	-32.6	-3.7
3542	595-630	-6.13	0.037	58	1695	73	-31.1	-3.4
3543	630-665	-6.48	0.042	60	1871	77	-30.3	-3.7
3544	665-700	-6.83	0.038	62	2276	81		
3545	700-735	-7.18	0.044	64	2411	87	-29.9	-3.8
3546	735-770	-7.53	0.049	67	2496	93	-25.6	-3.5
3547	770-805	-7.88	0.046	69	2711	100	-28.3	
3548	805-840	-8.23	0.053	72	2781	108	-28.1	-3.9
3549	840-875	-8.58	0.070	76	3111	119	-31.0	
3550	875-910	-8.93	0.051	79	3543	129		
3551	910-945	-9.28	0.066	82	3691	141	-29.0	
3552	945-980	-9.63	0.073	86	4538	159		
3553	980-1015	-9.98	0.059	89	4429	172	-28.6	-4.0
3554	1015-1050	-10.33	0.049	92	4414	184		
3555	1050-1085	-10.68	0.061	95	3977	197	-30.4	-4.2
3556	1085-1120	-11.03	0.057	98	4068	209		
3557	1120-1155	-11.38	0.041	100	3759	217	-27.8	-4.0
3558	1155-1190	-11.73	0.044	102	4102	226		

Table 5 continued.

Sample	Depth (cm)	Mid Dpth (m)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Delta-2 (SMOW)	Delta-18 (SMOW)
3559	1190-1225	-12.08	0.040	104	2138	231	-29.5	-4.1
3560	1225-1260	-12.43	0.026	106	4000	236		
3561	1260-1298	-12.79	0.045	108	2442	242	-32.0	-4.3
3562	1298-1335	-13.16	0.045	111	1758	247		
3563	1335-1373	-13.54	0.077	115	2870	259	-31.3	-4.5
3564	1373-1410	-13.91	0.057	118	2816	268		
3565	1410-1448	-14.29	0.052	121	2996	277	-33.4	-4.4
3566	1448-1485	-14.66	0.054	124	4700	291		
3567	1485-1560	-15.23	0.046	129	3500	309	-32.7	-4.1
3568	1560-1598	-15.79	0.062	133	5566	329		
3569	1598-1635	-16.16	0.056	136	5982	348	-29.4	-4.4
3570	1635-1660	-16.48	0.037	137	6757	357		
3571	1660-1690	-16.75	0.071	141	7639	382	-30.8	
3572	1690-1765	-17.28	0.065	148	5528	422	-29.9	
3573	1765-1840	-18.03	0.056	154	5909	459		
3574	1840-1870	-18.55	0.058	157	4786	472		
3575	1915-1953	-19.34	0.157	173	6745	574	-34.9	
3576	1953-1990	-19.72	0.128	180	3835	601		
3577	1990-2028	-20.09	0.063	183	4444	614	-34.0	
3578	2028-2065	-20.46	0.071	187	4215	631		
3579	2065-2103	-20.84	0.103	193	4151	656	-32.8	-4.4
3580	2013-2140	-21.21	0.071	197	3397	669		
3581	2140-2215	-21.78	0.081	206	3557	701	-31.3	-4.2
3582	2215-2290	-22.53	0.102	218	3189	740		
3583	2290-2365	-23.28	0.106	230	4203	790	-33.4	-4.3
3584	2365-2393	-23.79	0.159	236	5955	826		
3585	2393-2420	-24.06	0.185	244	4626	863	-34.4	-4.5
3586	2420-2458	-24.39	0.175	254	6656	929		
3587	2458-2495	-24.76	0.172	263	5673	980	-34.0	-4.2
3588	2495-2533	-25.14	0.243	277	5314	1055		
3589	2533-2570	-25.51	0.275	293	6139	1153	-35.2	-4.3
3590	2580-2600	-25.90	0.215	303	10404	1251		
3591	2600-2665	-26.33	0.285	331	4448	1375	-34.7	-4.9
3592	2665-2700	-26.83	0.245	344	4853	1438		
3593	2700-2740	-27.20	0.278	360	5805	1531	-34.9	-4.0
3594	2740-2755	-27.48	0.197	365	3874	1550		
3595	2755-2815	-27.85	0.283	390	4069	1652	-36.0	-4.4
3596	2815-2850	-28.33	0.300	406	3199	1703		
3597	2850-2890	-28.70	0.251	421	3791	1760	-35.8	-4.8

Total depth drilled = 35.30 m
Water table at 29.4 m
Chloride = 3750 mg/l

Table 6 : Core data for cleared hole BUF02.

Hole: BUF02
Drilled: 12.03.85
Vegetation: Cleared 50 years
Land Unit: Sand Flat
Comments:

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Mat Suc (kPa)	% Sand	% Silt	% Clay
4861	0- 25	0.002	0	4799	0				
4862	25- 55	0.067	3	79	1				
4863	55- 85	0.074	6	173	1				
4864	85-115	0.080	10	149	2		86	2	12
4865	115-145	0.067	13	135	2				
4866	145-175	0.065	16	89	2				
4867	175-205	0.064	19	111	3				
4868	205-235	0.075	22	105	3				
4869	235-265	0.069	25	90	3	227			
4870	265-295	0.065	28	99	4				
4871	295-325	0.072	31	102	4		93	0	7
4872	325-355	0.079	35	95	4	40			
4873	355-385	0.079	39	66	4				
4874	385-415	0.081	42	68	5				
4875	415-445	0.089	46	65	5	43			
4876	445-475	0.088	50	52	5				
4877	475-505	0.102	55	84	6		89	1	10
4878	505-535	0.159	62	76	6	29			
4879	535-565	0.148	69	73	7				
4880	565-595	0.104	73	56	7	34			
4881	595-625	0.089	77	66	7				
4882	625-655	0.097	82	62	7				
4883	655-685	0.086	85	71	8	20			
4884	685-715	0.097	90	68	8		89	1	10
4885	715-745	0.090	94	100	8				
4886	745-775	0.094	98	106	9	29			
4887	775-805	0.088	102	126	9				
4888	805-835	0.070	105	178	10				
4889	835-865	0.069	108	194	10	48			
4890	865-895	0.080	112	203	11				
4891	895-925	0.085	116	247	12		87	1	12
4892	925-955	0.086	120	275	13				
4893	955-985	0.051	122	367	14	41			

Table 7 : Core data for cleared hole BUF03.

Hole: BUF03
Drilled: 05.05.85
Vegetation: Cleared 50 years
Land Unit: Sand Flat
Comments:

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Mat Suc (kPa)	% Sand	% Silt	% Clay
5320	0- 50	0.050	4	972	4				
5321	50-100	0.127	13	1127	14				
5322	100-150	0.101	21	952	22		78	4	18
5323	150-200	0.092	28	969	28				
5324	200-250	0.080	34	1233	36				
5325	250-300	0.085	40	1444	45	154			
5326	300-350	0.081	46	1916	56		89	1	10
5327	350-400	0.080	52	1634	66				
5328	400-450	0.071	58	3215	83	345			
5329	450-500	0.079	63	3976	107				
5330	500-550	0.063	68	6683	139	178	91	0	9
5331	550-600	0.070	73	7765	179				
5332	600-650	0.079	79	9264	234	401			
5333	650-700	0.075	85	10879	295				
5334	700-750	0.084	91	11768	369	377	84	2	14
5335	750-800	0.080	97	13123	447				
5336	800-850	0.075	103	12904	520	680			
5337	850-900	0.079	109	13956	603	487			
5338	900-950	0.074	114	15411	688				
5339	950-1000	0.086	121	15377	787				
5340	1000-1050	0.050	124	15089	844	402	90	0	10
5341	1050-1100	0.078	130	13907	925				
5342	1100-1150	0.054	134	15575	988	1148			
5343	1150-1200	0.071	140	13627	1061				
5344	1200-1250	0.068	145	14129	1134	271			
5345	1250-1300	0.063	150	13815	1199				
5346	1300-1350	0.047	153	14254	1249				

Table 8 : Core data for cleared hole BUF04.

Hole: BUF04
Drilled: 05.05.85
Vegetation: Cleared 50 years
Land Unit: Sand Flat
Comments:

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Delta-2 (SMOW)	Delta-18 (SMOW)	% Sand	% Silt	% Clay
5350	0- 10	0.006	0	3118	0	-7.0				
5351	10- 50	0.129	8	162	2	-21.2	-2.8			
5352	50-100	0.101	15	228	3	-23.8	-3.8			
5353	100-150	0.076	21	316	5	-26.5	-3.3	86	2	12
5354	150-200	0.064	26	419	7	-25.9				
5355	200-250	0.072	31	472	10	-27.2	-3.2			
5356	250-300	0.082	37	257	11	-28.2				
5357	300-350	0.092	44	262	13	-29.6	-3.9	89	0	11
5358	350-400	0.098	52	286	15	-31.1				
5359	400-450	0.120	61	200	17	-29.7	-3.9			
5360	450-500	0.110	69	273	19	-31.0				
5361	500-550	0.102	77	333	22	-32.7		92	0	9
5362	550-600	0.098	84	296	24	-30.1	-3.7			
5363	600-650	0.094	91	351	26	-32.0	-4.0			
5364	650-700	0.099	98	395	29	-30.8				
5365	700-750	0.097	106	411	32	-33.6	-3.7	90	0	10
5366	750-800	0.080	112	588	36	-29.1				
5367	800-850	0.077	117	711	40	-31.6	-4.4			
5368	850-900	0.075	123	917	45	-31.8				
5369	900-950	0.083	129	937	51	-32.7	-4.6	89	1	10
5370	950-1000	0.096	137	865	57	-31.9				
5371	1000-1050	0.080	143	989	63	-32.1	-4.5			
5372	1050-1100	0.069	148	1108	69	-31.9				
5373	1100-1150	0.056	152	1199	74	-30.7	-4.0			
5374	1150-1200	0.069	157	1066	79	-33.4	-4.8			
5375	1200-1250	0.105	165	1048	88	-35.1				
5376	1250-1300	0.062	170	1408	94	-32.4				
5377	1300-1350	0.105	177	1665	107	-34.8	-4.9			
5378	1350-1400	0.066	182	2651	120	-34.1	-4.9			
5379	1400-1450	0.087	189	2813	139	-33.5	-4.8	92	2	6
5380	1450-1500	0.049	193	2936	149	-32.1	-4.4			

Table 9 : Core data for cleared hole BUF05.

Hole: BUF05
Drilled: 05.05.85
Vegetation: Cleared 50 years
Land Unit: Sand Flat
Comments:

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Delta-2 (SMOW)
5382	0- 10	0.084	1	263	0	-21.0
5383	10- 50	0.075	6	373	2	-24.9
5384	50-100	0.042	9	408	3	-29.9
5385	100-150	0.045	12	532	5	-27.5
5386	150-200	0.053	16	506	7	-30.2
5387	200-250	0.061	21	478	9	-33.6
5388	250-300	0.053	25	375	11	-34.0
5389	300-350	0.053	29	377	12	-31.2
5390	350-400	0.048	32	419	14	-32.5
5391	400-450	0.046	36	540	16	-33.1
5392	450-500	0.044	39	343	17	-27.5
5393	500-550	0.052	43	327	18	-29.2
5394	550-600	0.05	47	339	19	-31.0
5395	600-650	0.056	51	378	21	-30.5
5396	650-700	0.064	56	327	22	-31.3
5397	700-750	0.027	58	475	23	-30.9
5398	750-800	0.03	60	537	25	-30.3
5399	800-850	0.036	63	797	27	-27.1
5400	850-900	0.053	67	1057	31	-28.2
5401	900-950	0.042	70	1519	36	-26.2
5402	950-1000	0.047	73	2062	43	-27.7
5403	1000-1050	0.037	76	4011	54	-27.5
5404	1050-1100	0.047	80	5543	74	-28.9
5405	1100-1150	0.048	83	11194	114	-26.9
5406	1150-1200	0.049	87	9503	149	-29.7
5407	1200-1250	0.04	90	8286	174	-29.9
5408	1250-1300	0.052	94	10167	213	-29.6
5409	1300-1350	0.036	97	10581	242	-30.6
5410	1350-1400	0.049	100	9881	278	-30.8
5411	1400-1450	0.058	105	10752	325	-32.2

Table 10 : Core data for cleared hole BUF06.

Hole: BUF06
Drilled: 05.05.85
Vegetation: Cleared 50 years
Land Unit: Sand Flat
Comments:

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Mat Suc (kPa)	% Sand	% Silt	% Clay
5412	0- 50	0.064	5	281	1				
5413	50-100	0.115	13	236	3				
5414	100-150	0.085	20	225	5		89	0	10
5415	150-200	0.083	26	194	6				
5416	200-250	0.084	32	179	7				
5417	250-300	0.065	37	260	8	32			
5418	300-350	0.065	42	309	10		95	0	5
5419	350-400	0.096	49	333	12	53			
5420	400-450	0.135	59	347	16				
5421	450-500	0.169	72	320	20	20			
5422	500-550	0.182	86	346	25		86	2	13
5423	550-600	0.117	94	446	28	31			
5424	600-650	0.116	103	534	33				
5425	650-700	0.091	110	650	38	44			
5426	700-750	0.086	116	753	42		89	1	10
5427	750-800	0.094	123	989	49	63			
5428	800-850	0.076	129	1246	57				
5429	850-900	0.092	136	1405	66	50			
5430	900-950	0.053	140	2015	74		92	2	7
5431	950-1000	0.066	145	2571	87	62			
5432	1000-1050	0.061	149	3034	101				
5433	1050-1100	0.073	155	4526	125	43			
5434	1100-1150	0.061	159	7487	160				
5435	1150-1200	0.058	164	5293	183	54	92	1	7
5436	1200-1250	0.045	167	6159	204				
5437	1250-1300	0.047	171	6812	227	60			
5438	1300-1350	0.066	176	8176	268				
5439	1350-1400	0.070	181	7622	307	38			
5440	1400-1450	0.089	188	8576	365		86	1	13
5441	1450-1500	0.046	191	11517	404	40			

Table 11 : Core data for cleared hole BUF07.

Hole: BUF07
Drilled: 05.05.85
Vegetation: Cleared 50 years
Land Unit: Sand Flat
Comments:

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Delta-2 (SMOW)	Delta-18 (SMOW)	% Sand	% Silt	% Clay
5441	0- 50	0.128	10	297	3	-11.8				
5442	50-100	0.053	14	1034	7	-18.9				
5443	100-150	0.055	18	965	11	-20.2		86	1	13
5444	150-200	0.060	22	852	15	-23.4				
5445	200-250	0.071	28	931	20	-25.9				
5446	250-300	0.092	34	1158	28	-24.1	-1.52			
5447	300-350	0.084	41	1243	36	-27.0	-2.45	88	0	12
5448	350-400	0.070	46	2236	47	-25.3				
5449	400-450	0.087	52	3580	71	-26.6				
5450	450-500	0.092	59	5602	109	-26.9	-2.41			
5451	500-550	0.082	65	8447	161	-26.4		87	0	12
5452	550-600	0.081	72	7973	210	-28.1	-2.75			
5453	600-650	0.073	77	8960	259	-29.5				
5454	650-700	0.073	82	12401	326	-28.8	-3.12			
5455	700-750	0.074	88	12744	397	-31.2		87	0	13
5456	750-800	0.075	94	13692	474	-31.0	-3.19			
5457	800-850	0.084	100	13140	557	-30.8				
5458	850-900	0.083	106	14979	650	-31.0	-3.34			
5459	900-950	0.077	112	14981	736	-32.9				
5460	950-1000	0.052	116	14345	792	-30.7				
5461	1000-1050	0.065	121	14059	860	-31.4		89	0	11
5462	1050-1100	0.067	126	12977	925	-31.5	-3.46			
5463	1100-1150	0.058	130	13458	984	-31.9	-3.67			
5464	1150-1200	0.067	135	13770	1053	-29.5	-3.7			
5465	1200-1250	0.059	140	13226	1112	-30.9		92	1	7
5466	1250-1300	0.072	145	12939	1182	-31.1	-3.58			
5467	1300-1350	0.048	149	13605	1231	-31.5	-4.2			
5468	1350-1400	0.049	152	14219	1282	-30.3	-4.82			
5469	1400-1450	0.048	156	12727	1328	-30.5	-4.53	94	1	5
5470	1450-1500	0.093	163	12762	1417	-34.9	-5.69			

Table 12 : Core data for cleared hole BUF12.

Hole: BUF12
Drilled: 05-06.02.87
Vegetation: Cleared 50 years
Land Unit: Sand Flat
Comments: Drilled 1 m from BUF02

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)
31	0- 50	0.064	5	299	1
32	50-100	0.071	10	246	3
33	100-150	0.064	15	223	4
34	150-200	0.063	20	328	5
35	200-250	0.067	25	374	7
36	250-300	0.072	30	393	9
37	300-350	0.065	35	486	12
38	350-400	0.063	40	586	14
39	400-450	0.055	44	612	17
40	450-500	0.049	47	740	20
41	500-550	0.046	51	885	23
42	550-600	0.065	56	739	26
43	600-650	0.063	60	737	30
44	650-700	0.047	64	627	32
45	700-750	0.067	69	396	34
46	750-800	0.060	73	776	37
47	800-850	0.047	77	1052	41
48	850-900	0.064	82	1081	46
49	900-950	0.057	86	1472	53
50	950-1000	0.074	92	1198	59
51	1000-1050	0.068	97	1368	66

Table 13 : Core data for cleared hole BUF13.

Hole: BUF13
Drilled: 06.02.87
Vegetation: Cleared 50 years
Land Unit: Sand Flat
Comments: Drilled 1 m from BUF03

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)
52	0- 50	0.020	2	953	1
53	50-100	0.098	9	131	2
54	100-150	0.078	15	148	3
55	150-200	0.039	18	349	4
56	200-250	0.042	21	281	5
57	250-300	0.078	27	240	7
58	300-350	0.094	34	312	9
59	350-400	0.135	44	254	11
60	400-450	0.109	52	381	14

Table 14 : Core data for cleared hole BUF15.

Hole: BUF15
Drilled: 05.02.87
Vegetation: Cleared 50 years
Land Unit: Sand Flat
Comments: Drilled 1 m from BUF05

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2	Tritium (T.U.)	% Sand	% Silt	% Clay
1	0- 50	0.072	5	210	1	11.5			
2	50-100	0.053	9	269	2				
3	100-150	0.038	12	473	4		86	0	14
4	150-200	0.044	16	234	4	13.5			
5	200-250	0.041	19	205	5	13.4			
6	250-300	0.045	22	203	6	10.5			
7	300-350	0.055	26	124	6		90	0	10
8	350-400	0.047	30	207	7	10.5			
9	400-450	0.060	34	188	8		89	0	11
10	450-500	0.054	38	165	8	6.2			
11	500-550	0.055	42	155	9		88	0	12
12	550-600	0.053	46	224	10	4.7			
13	600-650	0.043	50	224	11		87	1	12
14	650-700	0.044	53	206	11	2.1			
15	700-750	0.040	56	349	12		93	1	6
16	750-800	0.040	59	274	13	1.8			
17	800-850	0.050	63	213	14		94	1	5
18	850-900	0.047	66	165	15	1.1			
19	900-950	0.056	70	224	16		94	0	6
20	950-1000	0.044	74	265	16				
21	1000-1050	0.044	77	275	17		95	1	4
22	1050-1100	0.050	81	456	19	0.6			
23	1100-1150	0.045	84	471	21		95	1	4
24	1150-1200	0.050	88	684	23		94	1	5
25	1200-1250	0.053	92	798	26				
26	1250-1300	0.050	96	1154	31	0.9			
27	1300-1350	0.046	99	1465	36		93	1	6
28	1350-1400	0.043	102	2140	43		94	1	5
29	1400-1450	0.055	106	2448	53				
30	1450-1490	0.052	110	3001	62	0.1			

Table 14a : Particle size analysis for hole BUF15.

PARTICLE SIZE (microns)

Sample	Clay	Silt	Sand						Gravel
	<2	2-20	20-53	53-106	106-250	250-500	500-1000	1000-2000	>2000
	%	%	%	%	%	%	%	%	%
3	14.1	0.4	0.5	1.4	81.5	0.8	0.3	0.3	<0.1
7	10.3	0.3	0.2	1.7	86.6	0.3	<0.1	<0.1	<0.1
9	10.9	0.3	0.2	1.4	86.2	0.4	<0.1	<0.1	<0.1
11	12.3	<0.1	0.2	1.6	84.4	0.5	<0.1	<0.1	<0.1
13	11.7	0.6	0.4	1.3	79.1	6.0	0.2	0.1	<0.1
15	5.6	0.6	0.2	0.4	28.7	17.6	8.4	37.9	3.9
17	5.3	0.9	0.2	0.6	42.0	31.2	8.1	12.2	0.8
19	5.5	0.3	0.3	0.6	48.2	25.2	7.6	11.8	0.4
21	3.8	0.9	0.3	0.8	56.3	19.2	8.6	9.8	0.6
23	4.2	1.4	0.3	0.8	33.4	27.6	12.0	20.4	2.0
24	5.2	0.9	0.3	0.7	49.8	30.3	5.6	7.2	1.2
27	5.7	0.6	0.3	0.7	27.3	27.7	15.1	23.1	1.5
28	4.7	0.9	0.3	0.4	18.3	16.8	14.2	44.4	6.6

Table 15 : Core data for cleared hole BUF18.

Hole: BUF18
Drilled: 30.01.87
Vegetation: Cleared 50 years
Land Unit: Sand Flat
Comments:

Sample	Depth (cm)	Theta g (g/g)	Cum Wat (cm)	[Cl]-ss (mg/l)	Cum Cl (mg/cm2)	Tritium (T.U.)
18.1	0- 25	0.061	2	1434	3	
18.2	25- 50	0.063	5	4533	14	13.1
18.3	50- 75	0.044	6	6542	25	
18.4	75-100	0.061	9	4614	35	10.3
18.5	100-125	0.065	11	3592	44	
18.6	125-150	0.064	13	3575	53	9.4
18.7	150-175	0.066	16	3284	61	
18.8	175-200	0.073	19	3370	70	6.7
18.9	200-225	0.079	22	3492	80	
18.10	225-250	0.083	25	3637	92	
18.11	250-275	0.083	28	4710	106	
18.12	275-300	0.079	31	5016	121	2.0
18.13	300-325	0.074	34	5743	137	
18.14	325-350	0.075	36	6113	154	
18.15	350-375	0.076	39	6677	173	
18.16	375-400	0.073	42	7450	194	
18.17	400-425	0.070	45	8451	216	
18.18	425-450	0.078	47	8914	242	
18.19	450-475	0.080	50	8681	268	
18.20	475-500	0.079	53	9521	296	
18.21	500-525	0.075	56	10695	326	
18.22	525-550	0.080	59	10213	356	
18.23	550-575	0.082	62	9963	387	
18.24	575-600	0.082	65	10308	419	0.8
18.25	600-625	0.071	68	11072	448	
18.26	625-650	0.069	71	11557	478	
18.27	650-675	0.071	73	11823	509	
18.28	675-700	0.065	76	10853	536	
18.29	700-725	0.070	78	12150	568	
18.30	725-750	0.076	81	13068	605	
18.31	750-775	0.070	84	13688	641	
18.32	775-800	0.071	86	13747	677	1.3
18.33	800-825	0.071	89	13751	714	
18.34	825-850	0.068	92	13446	748	
18.35	850-875	0.072	94	13833	786	
18.36	875-900	0.077	97	14069	826	
18.37	900-925	0.078	100	13974	867	
18.38	925-950	0.084	103	13865	911	
18.39	950-975	0.072	106	13755	948	
18.40	975-1000	0.056	108	13158	976	
18.41	1000-1025	0.065	111	12841	1007	
18.42	1025-1050	0.056	113	12747	1034	

Figure 15 : Profiles for cleared hole BUF 13.

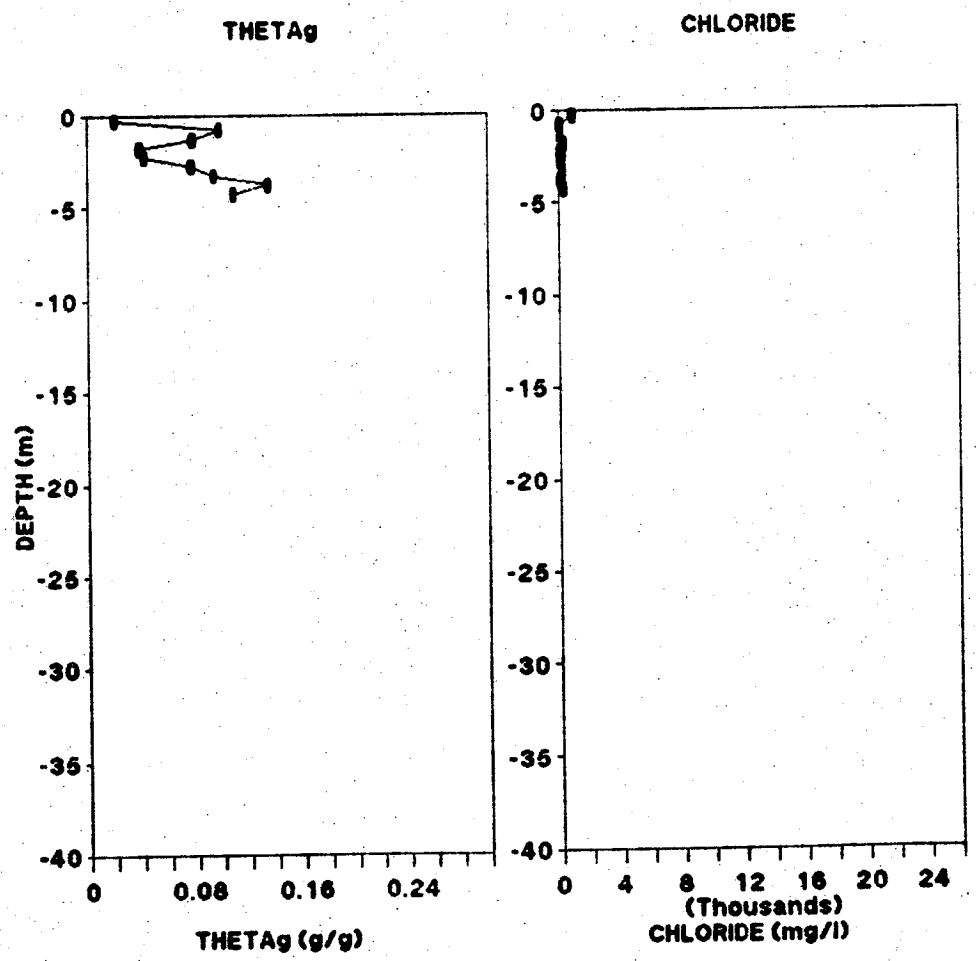


Figure 16 : Profiles for cleared hole BUF 15.

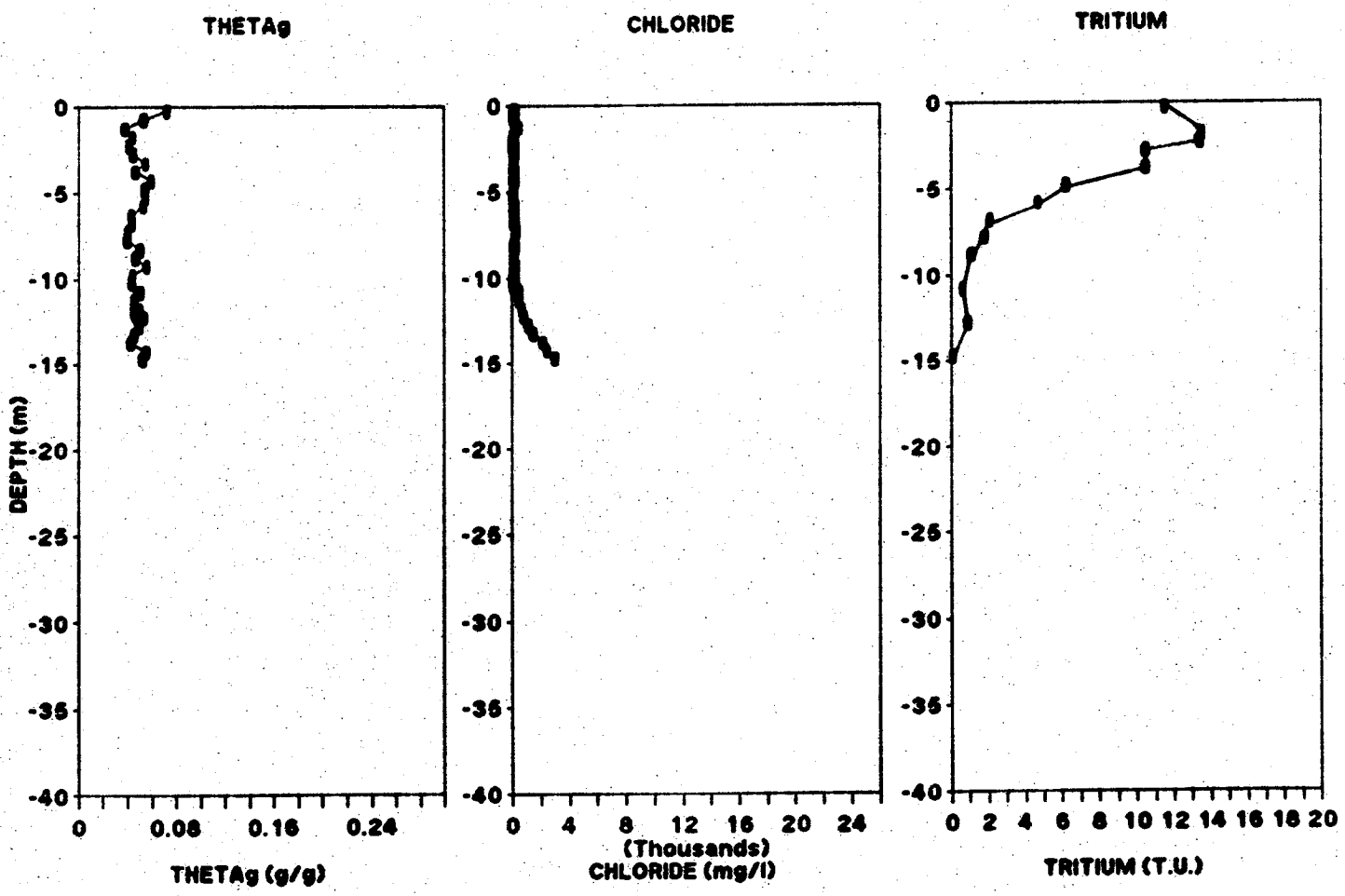


Figure 16 : Profiles for cleared hole BUF 15.

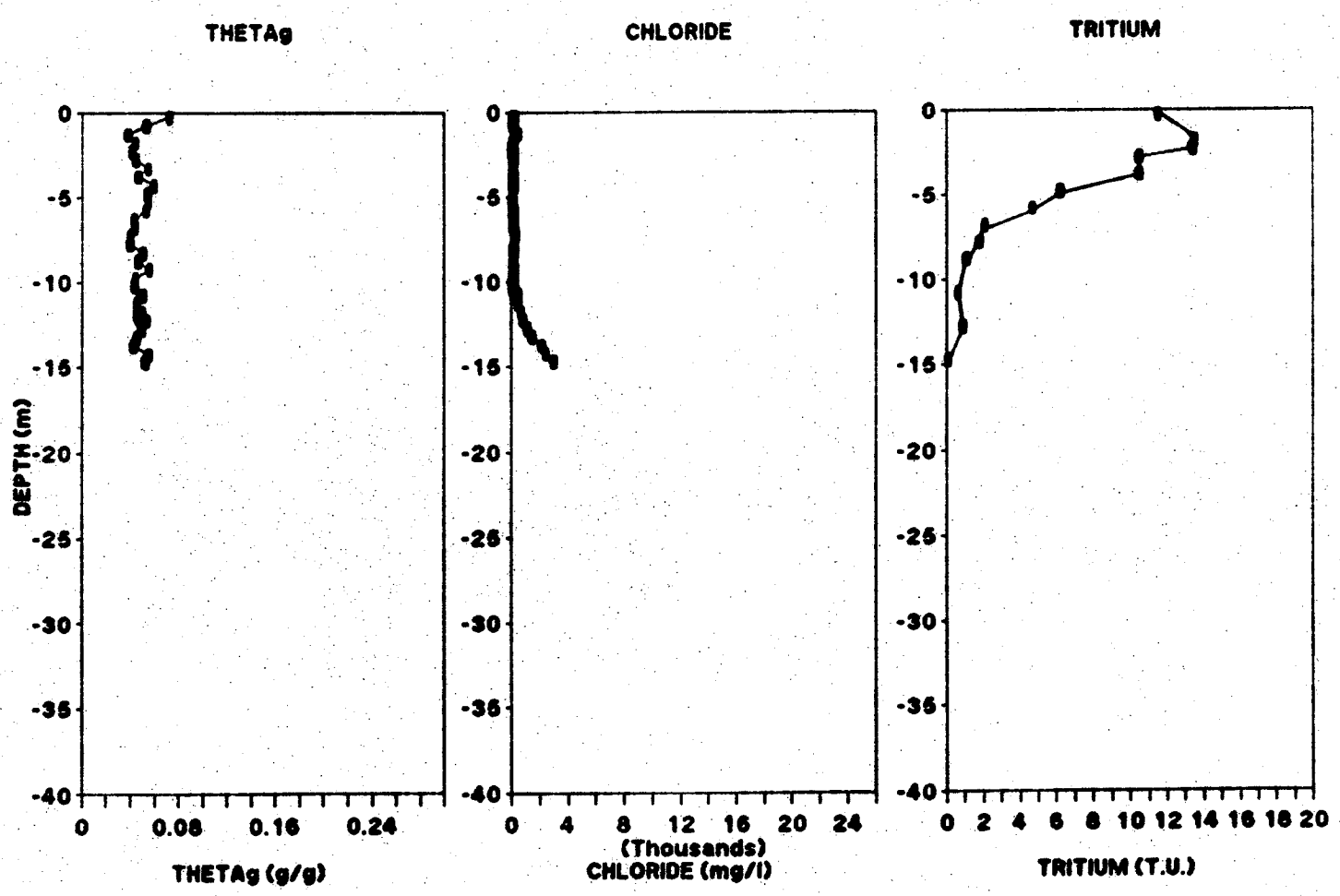


Figure 17 : Profiles for cleared hole BUF 18.

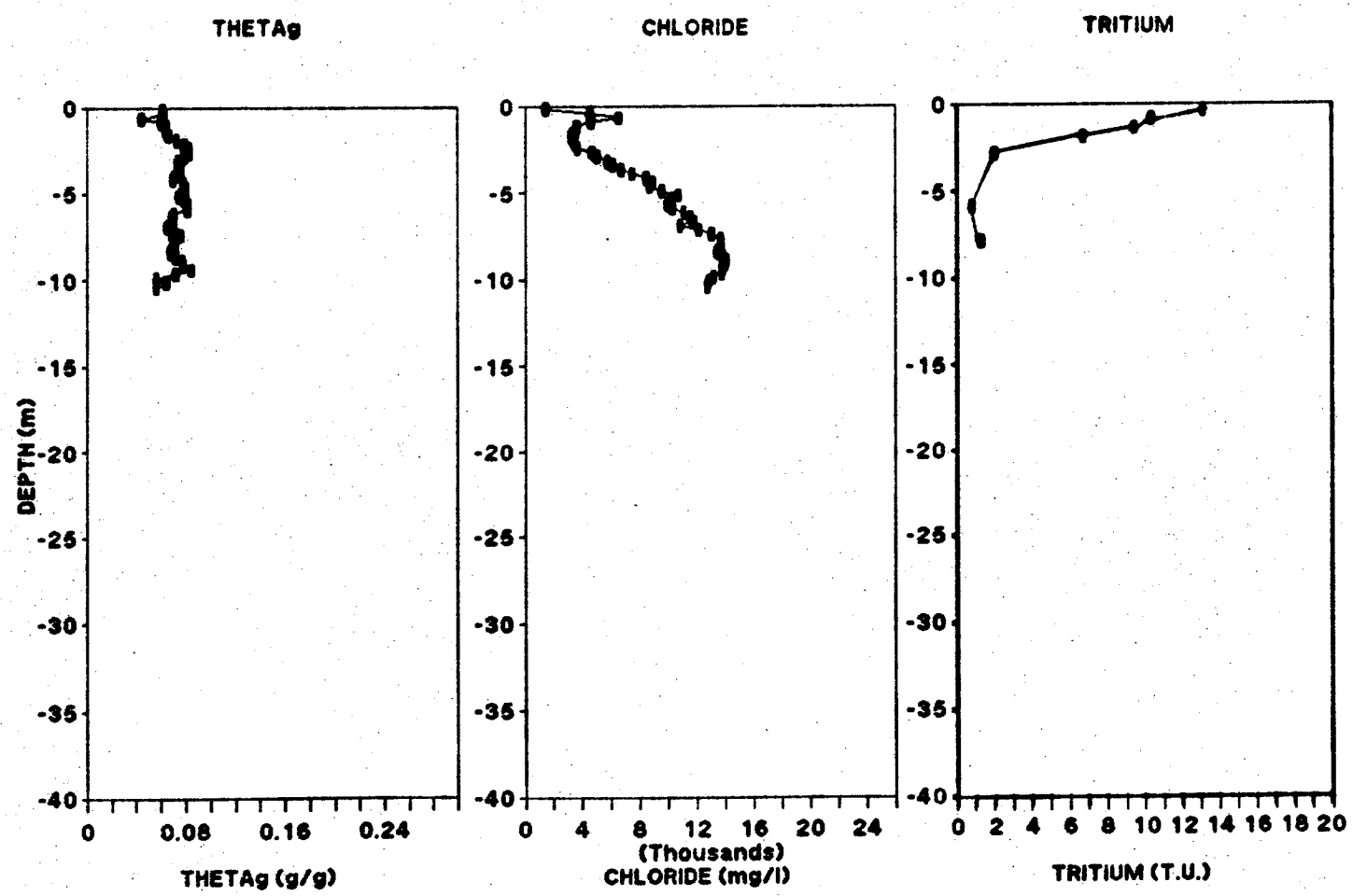


Figure 17 : Profiles for cleared hole BUF 18.

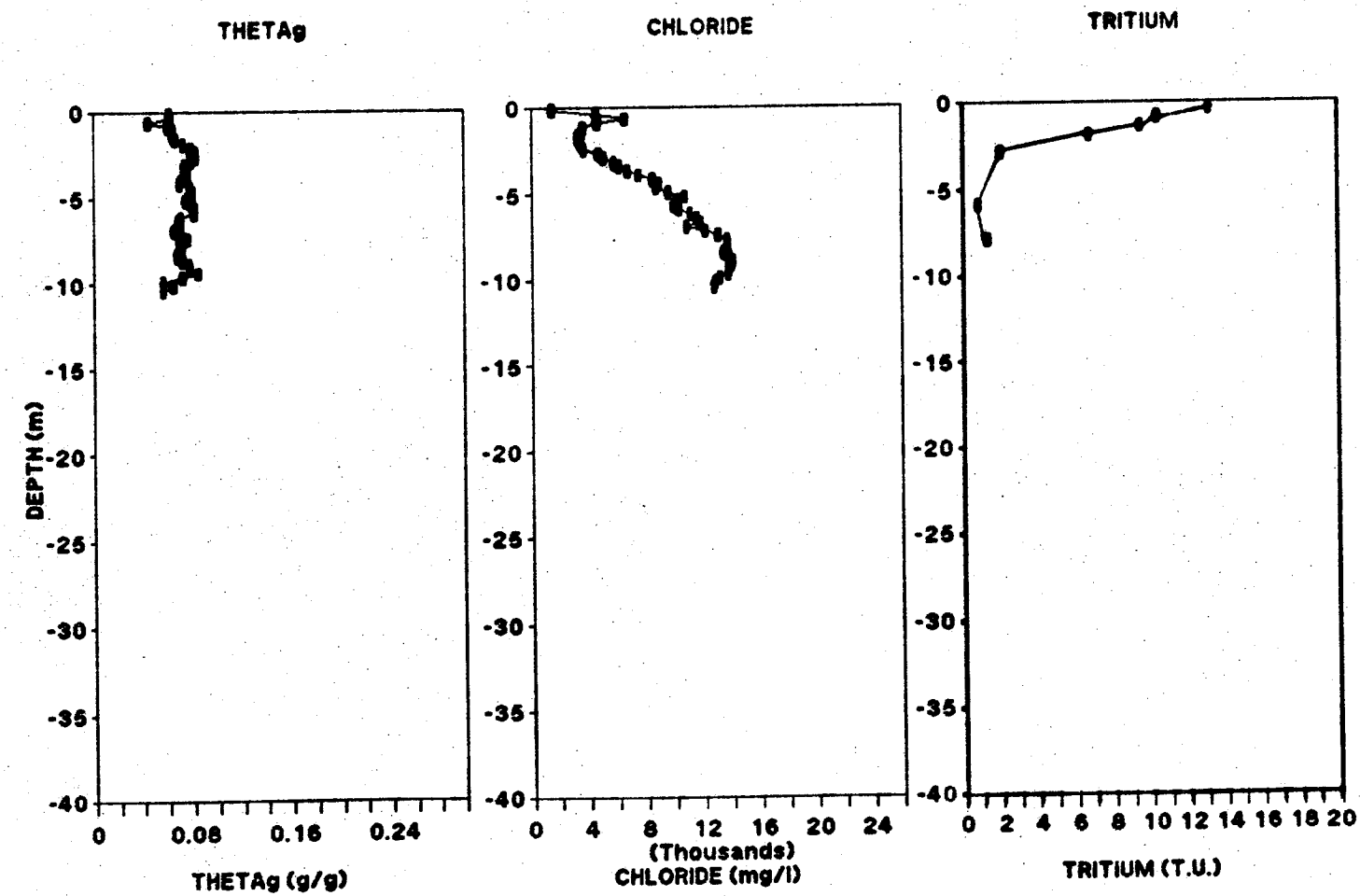


Figure 18 : Chloride versus cumulative water profiles for Mallee vegetated holes BVD01, BVD02, BVF01 and BVF02.

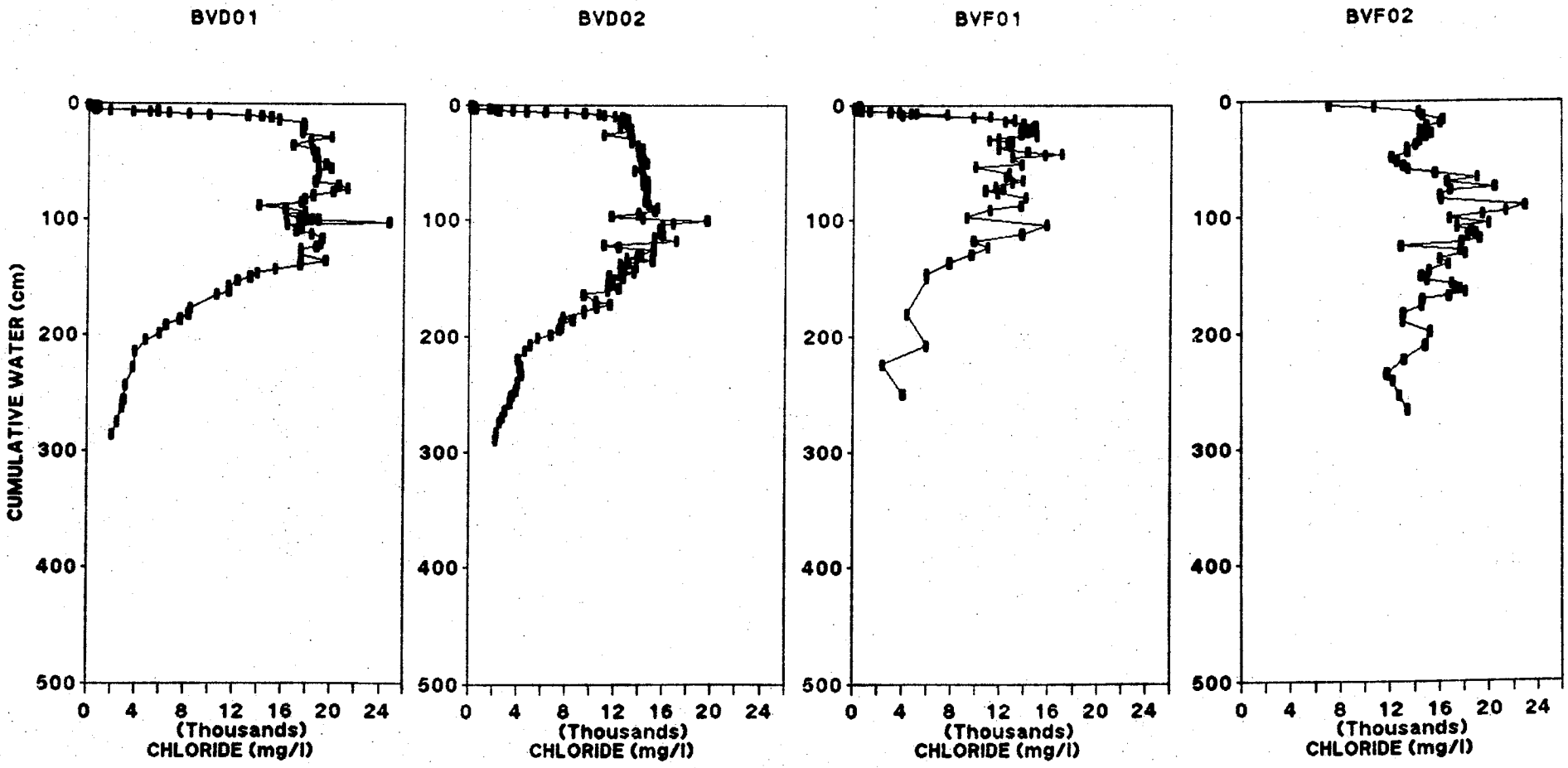
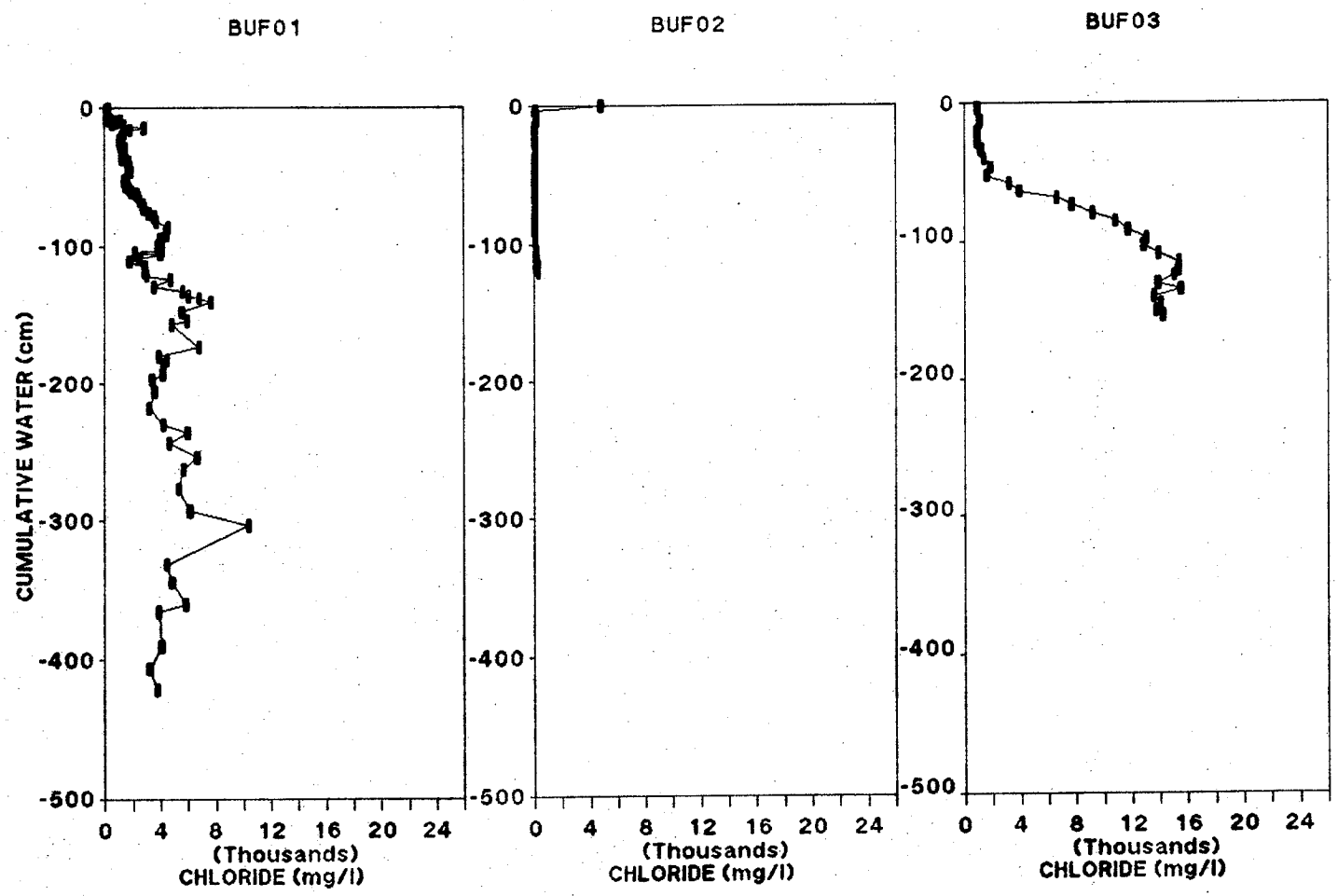


Figure 19 : Chloride versus cumulative water profiles for cleared holes BUF01, BUF02 and BUF03.



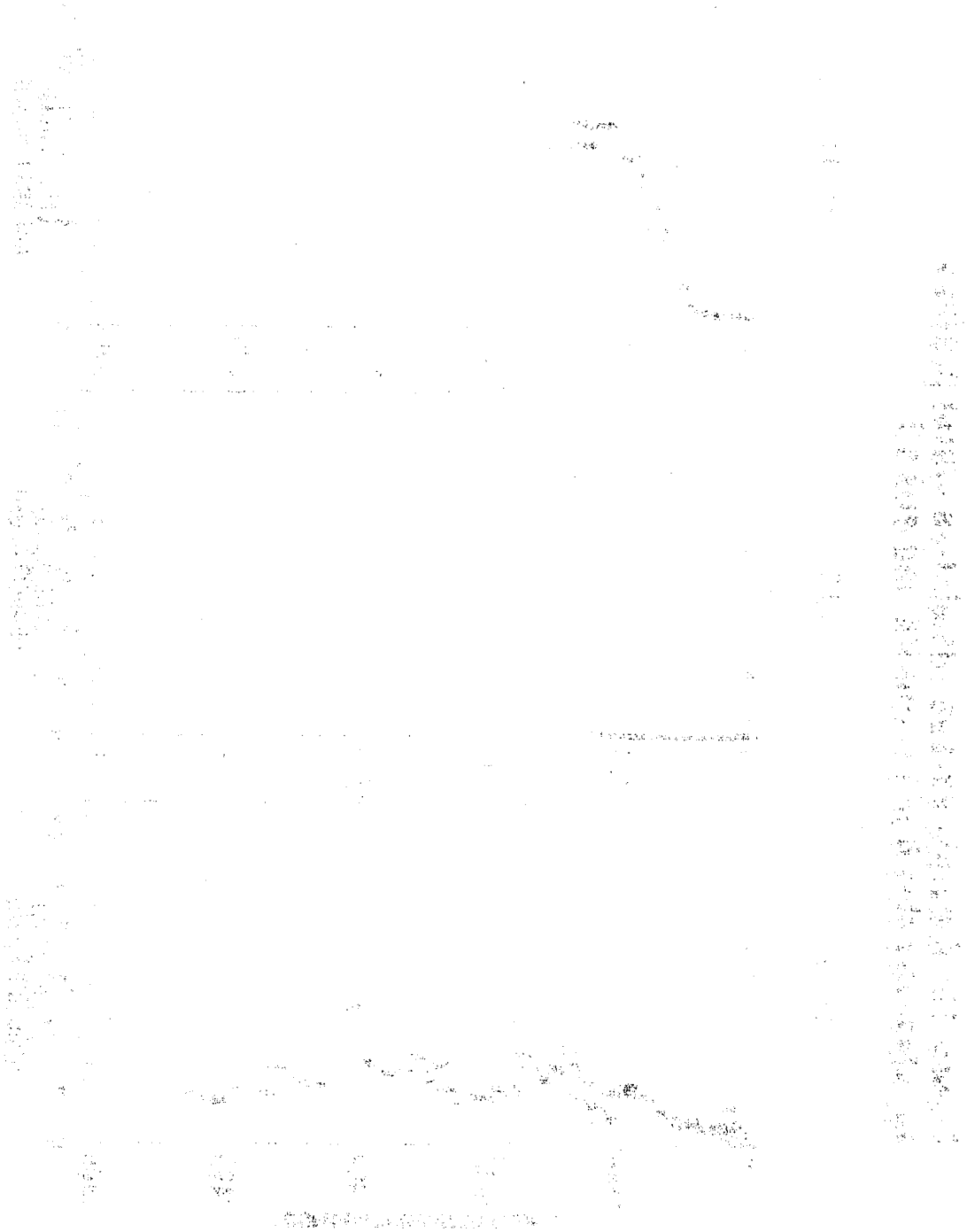


Figure 20 : Chloride versus cumulative water profiles for cleared holes BUF04, BUF05 and BUF06.

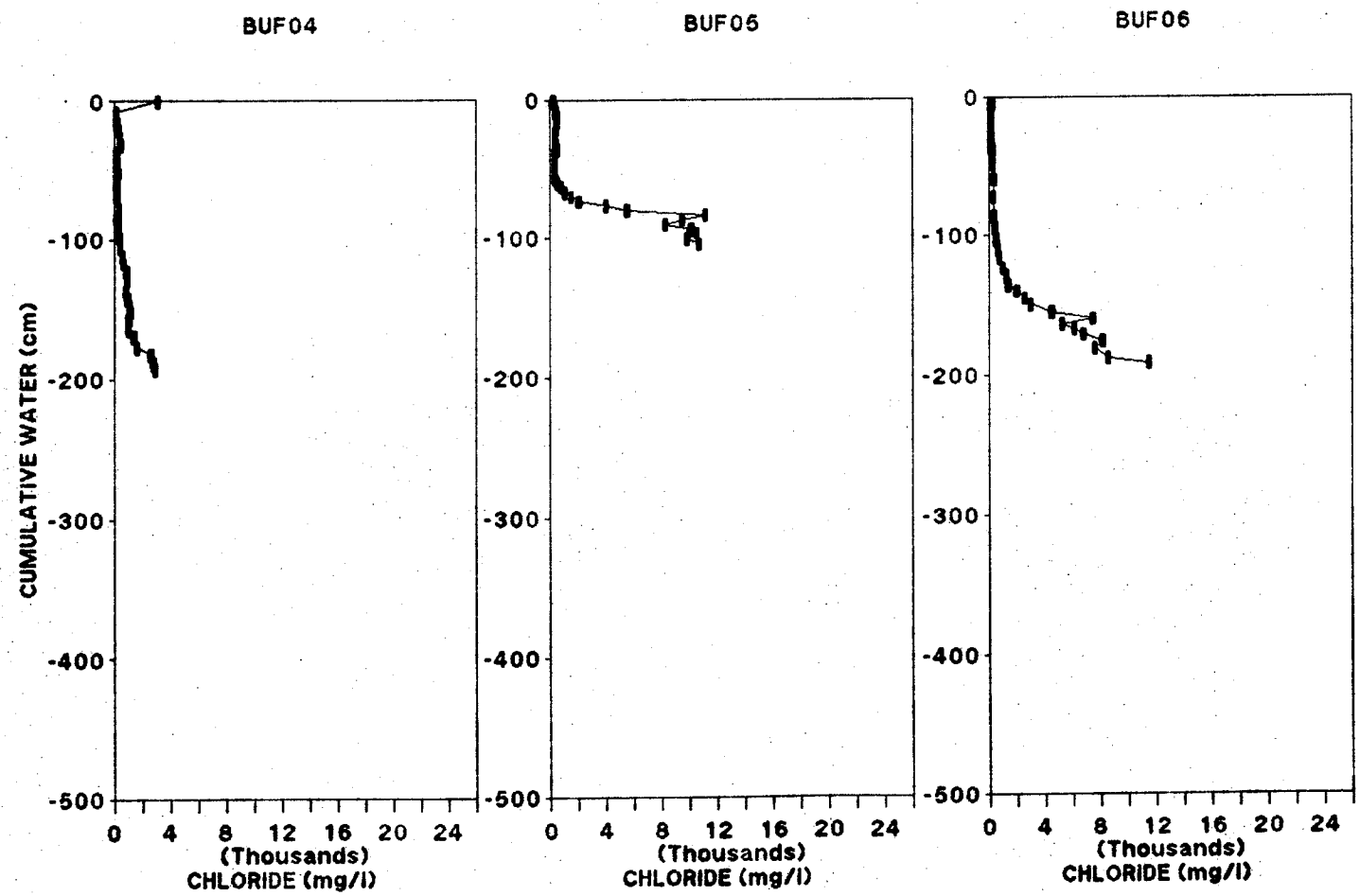
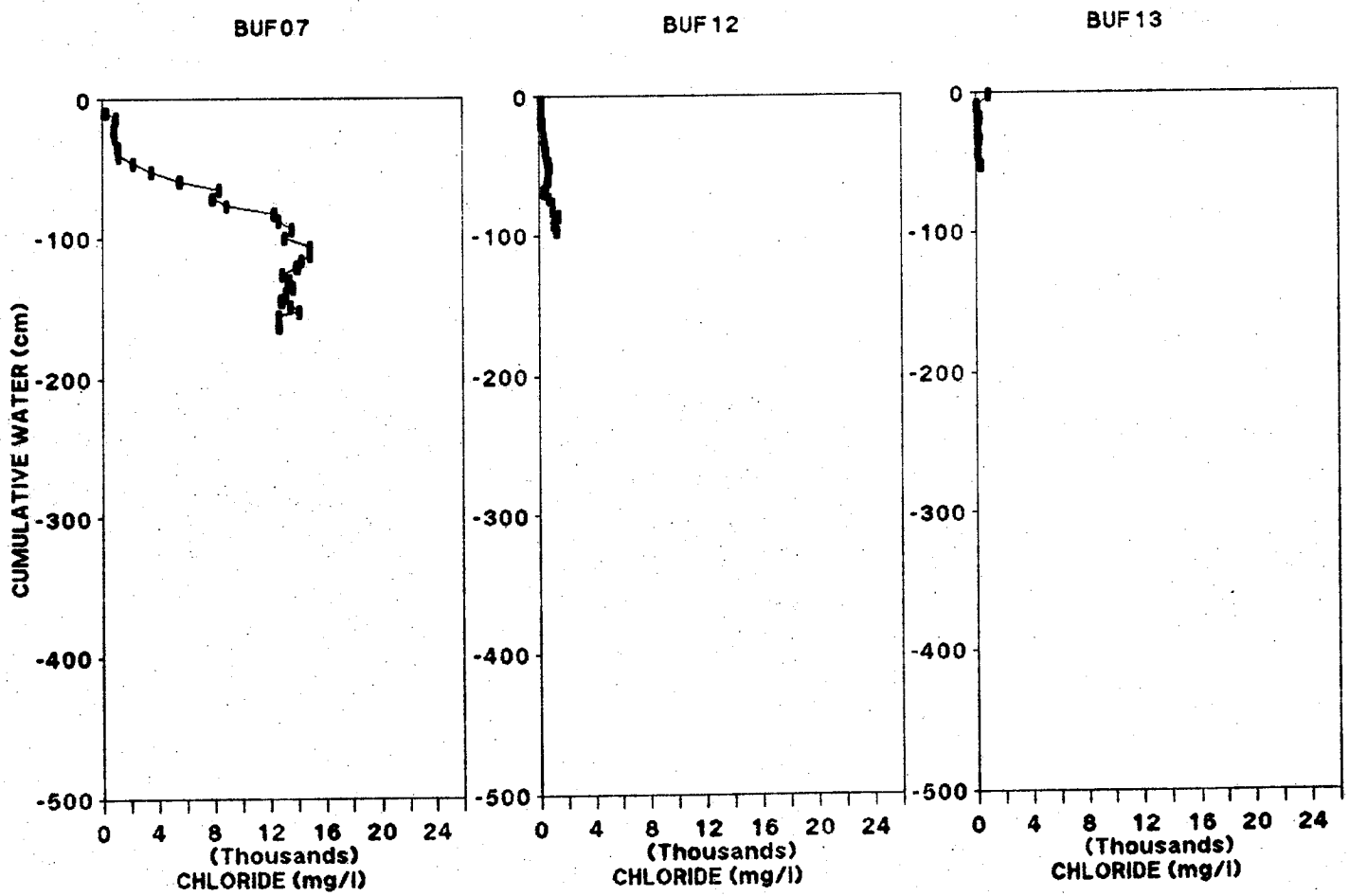


Figure 21 : Chloride versus cumulative water profiles for cleared holes BUF07, BUF12 and BUF13.



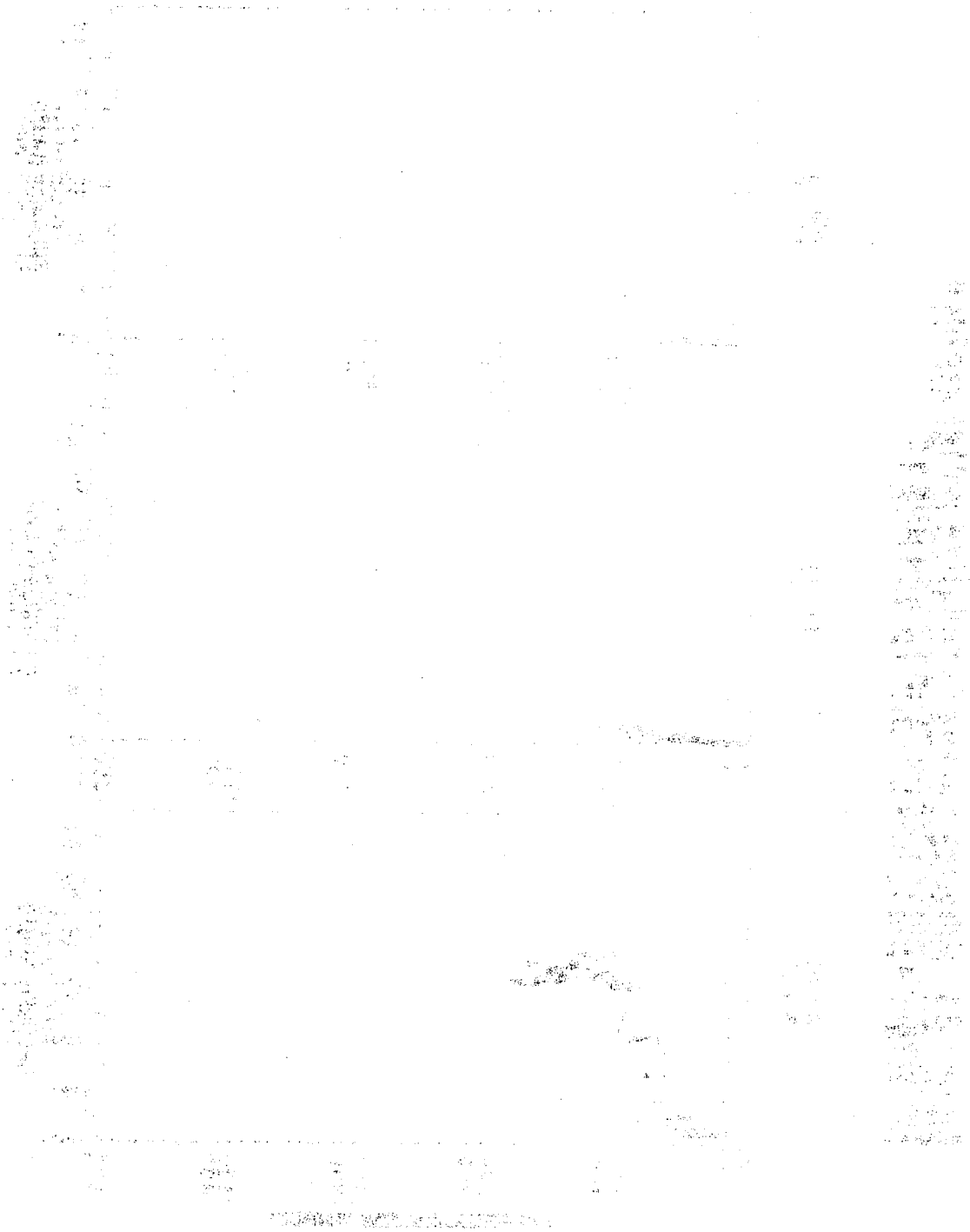


Figure 22 : Chloride versus cumulative water profiles for cleared holes BUF 15 and BUF 18.

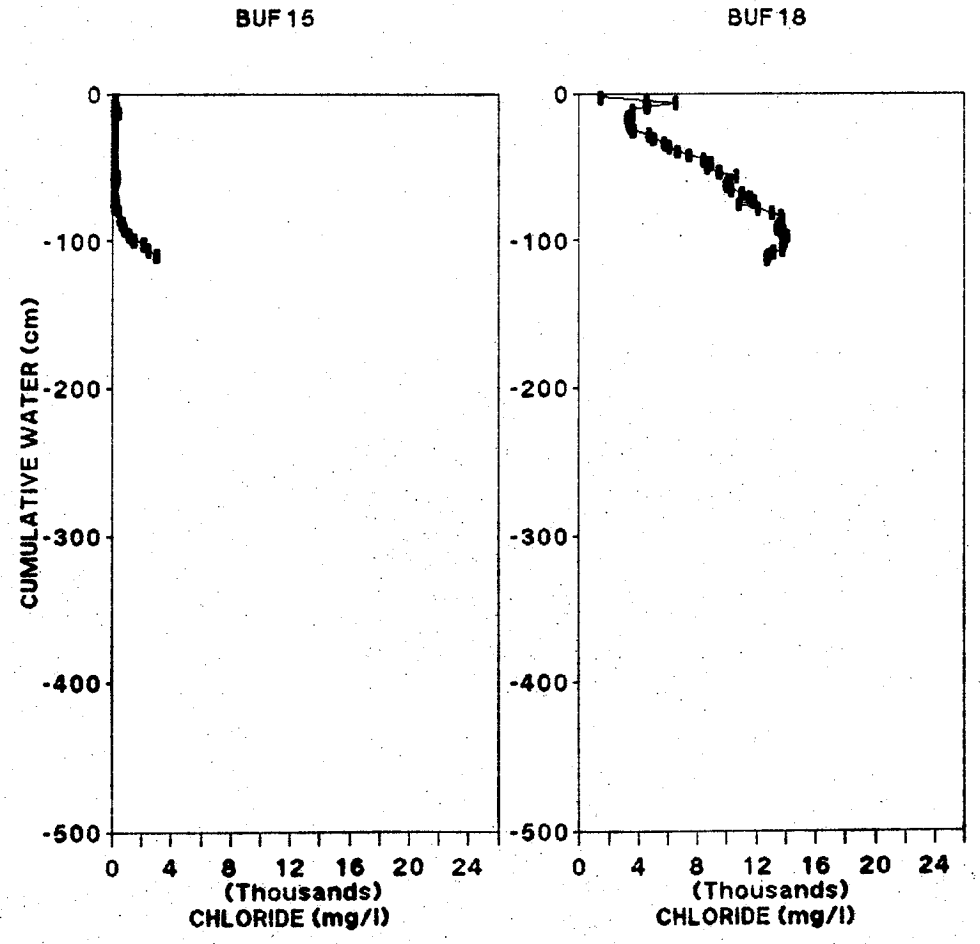


Figure 3 : Profiles of Mallee vegetated hole BVD01.

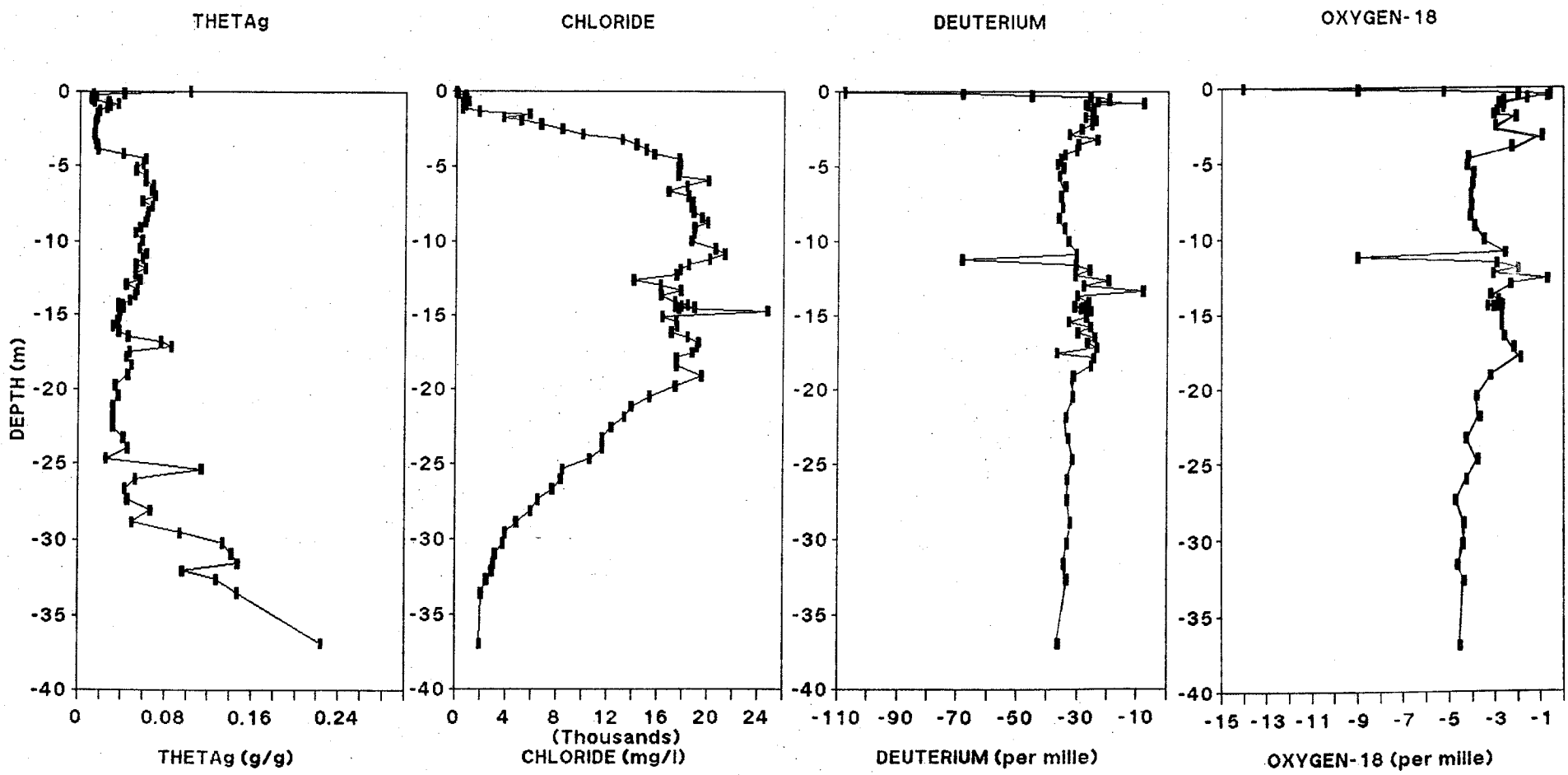


Figure 4 : Profiles of Mallee vegetated hole BVD02.

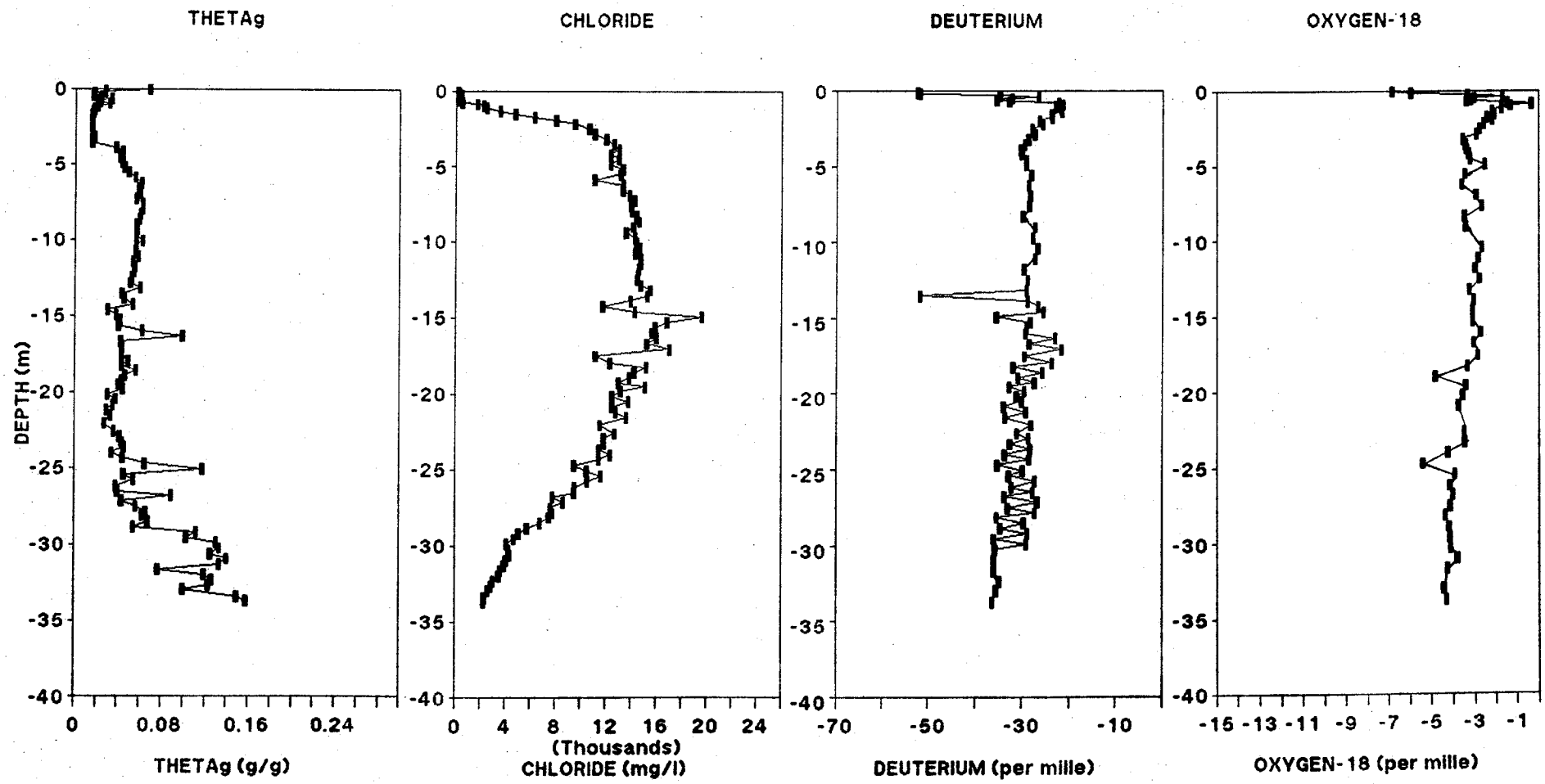


Figure 5 : Profiles of Mallee vegetated hole BVF01.

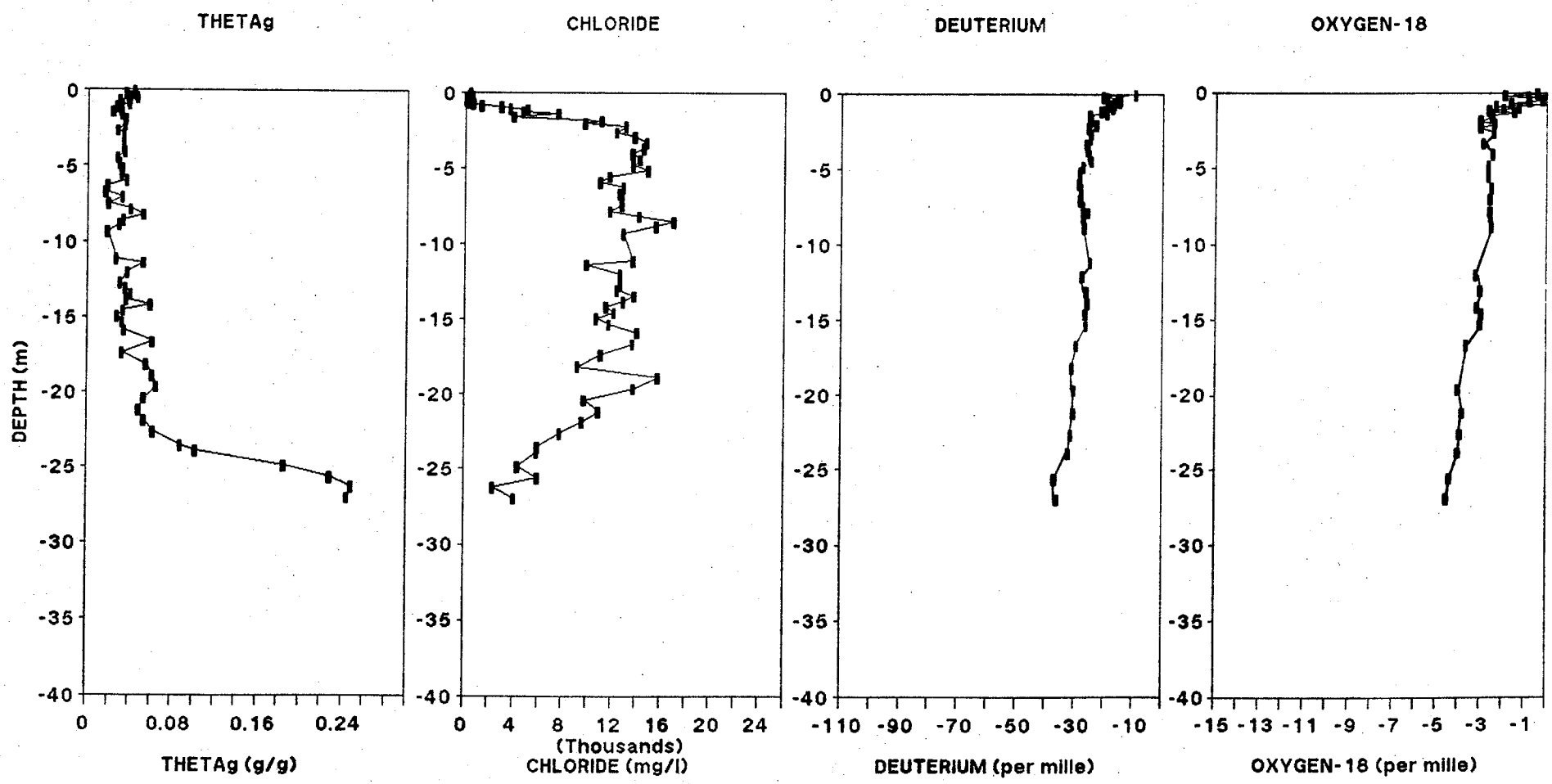


Figure 6 : Profiles for Mallee vegetated hole BVF02.

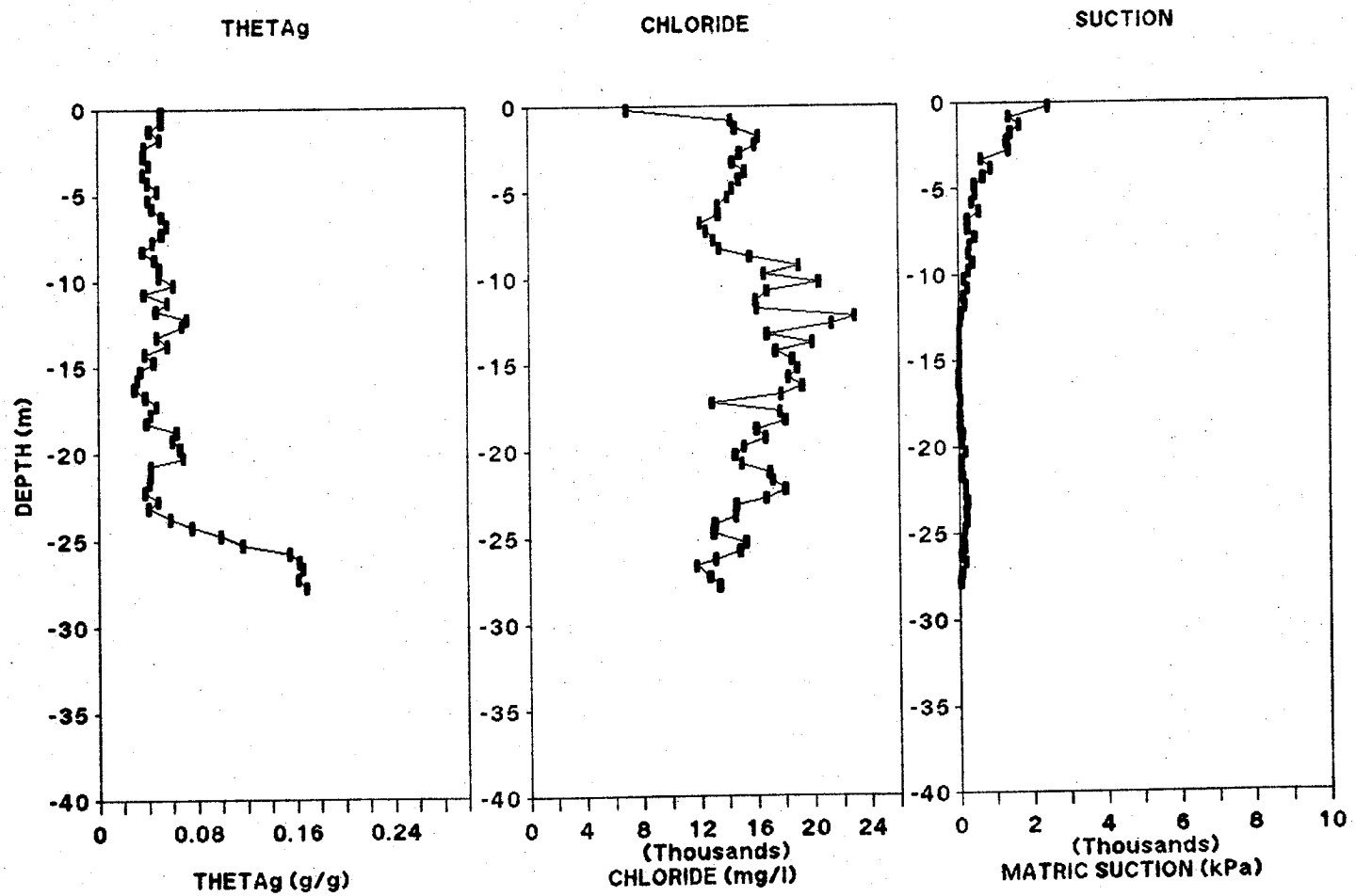


Figure 7 : Profiles of cleared hole BUF0 1.

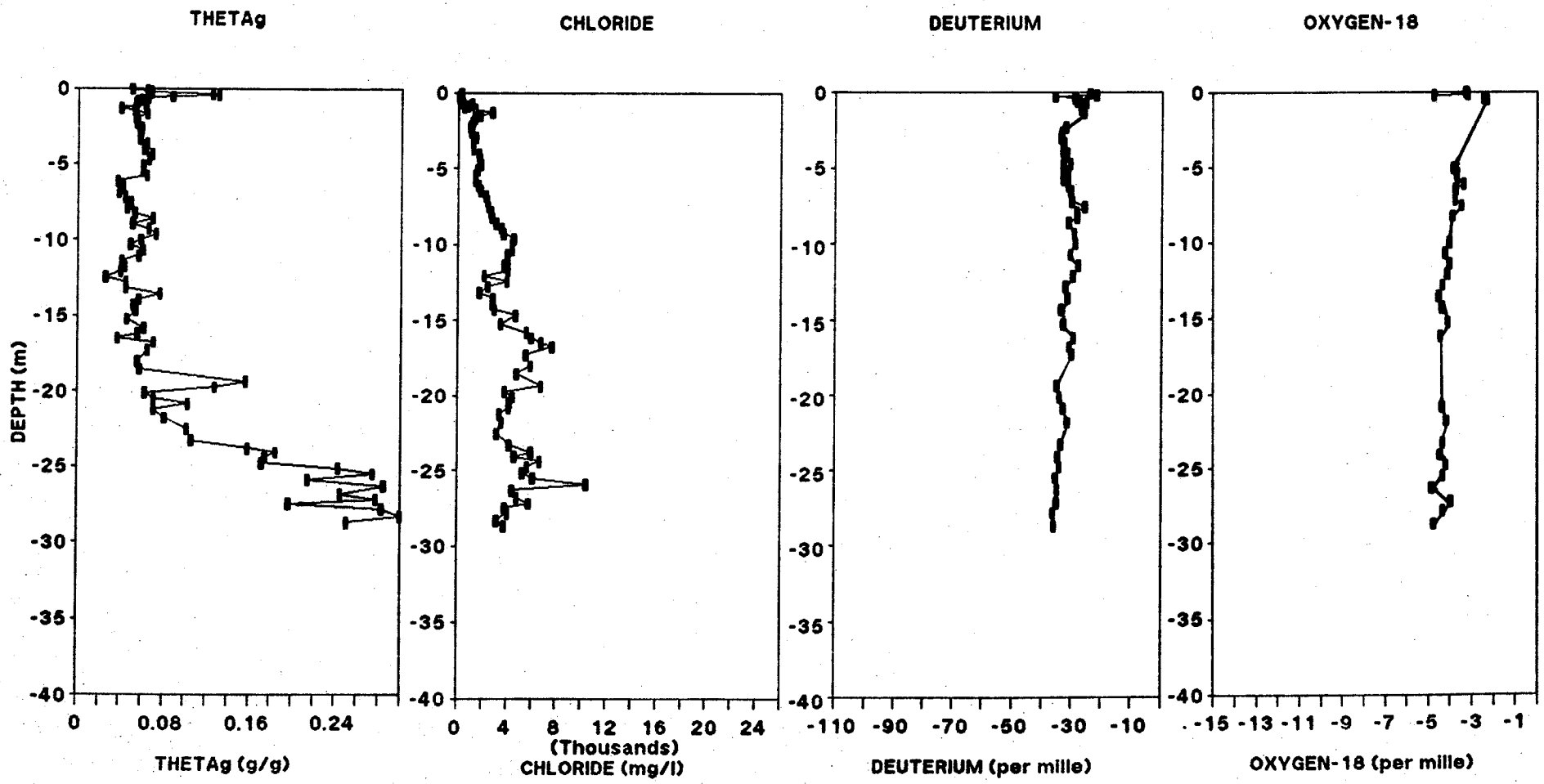


Figure 8 : Profiles of cleared hole BUF02.

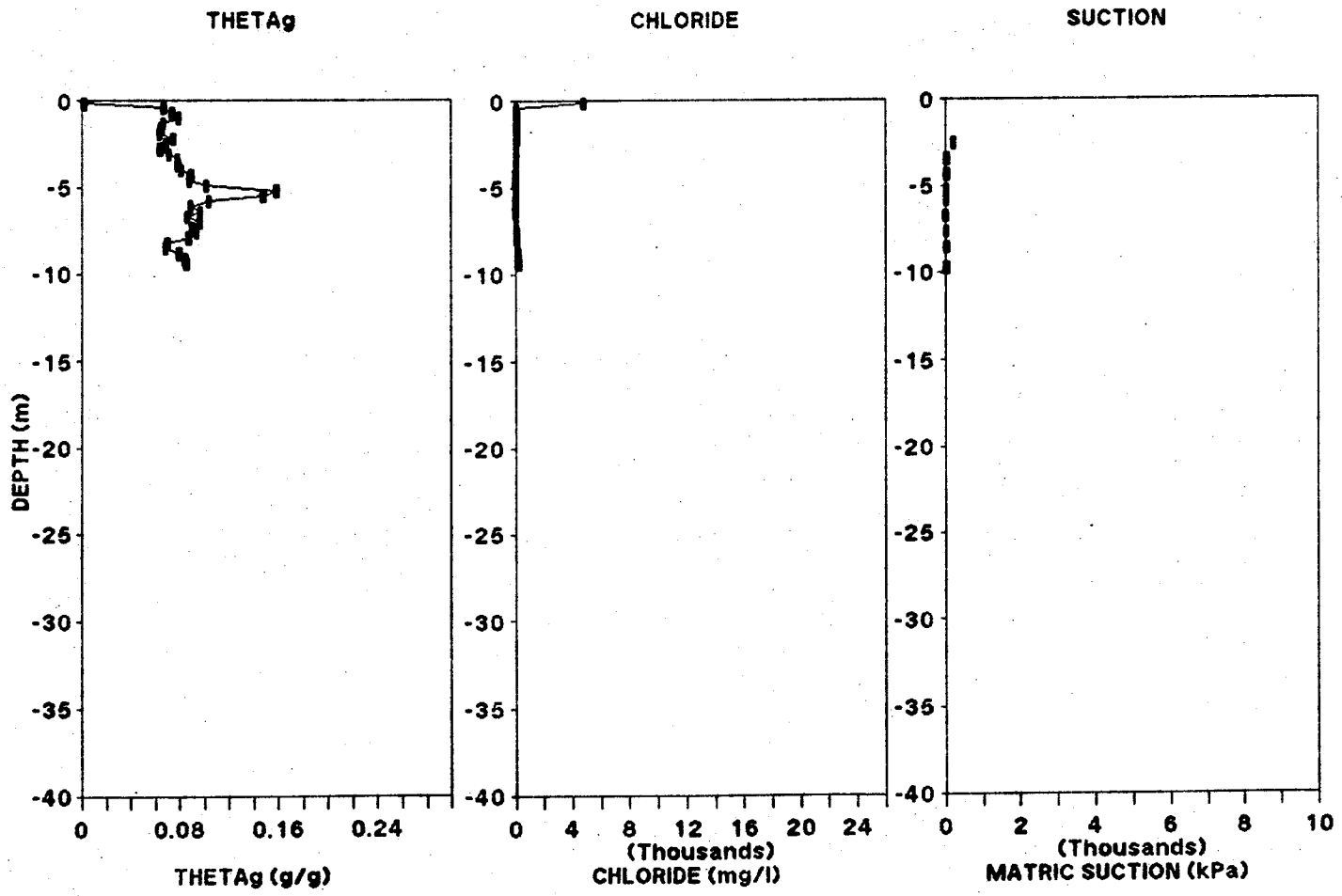


Figure 9 : Profiles of cleared hole BUF03.

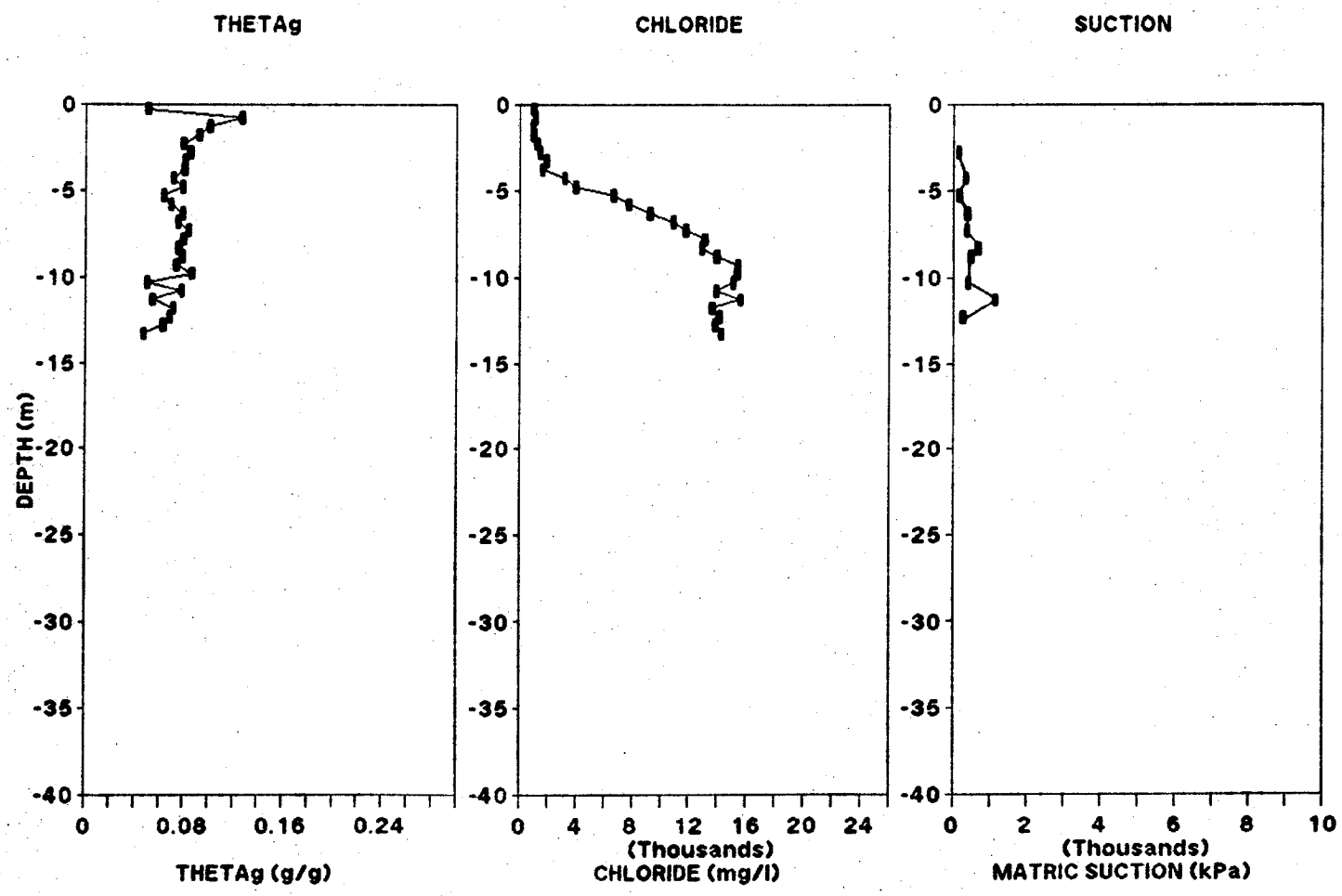


Figure 10 : Profiles for cleared hole BUF04.

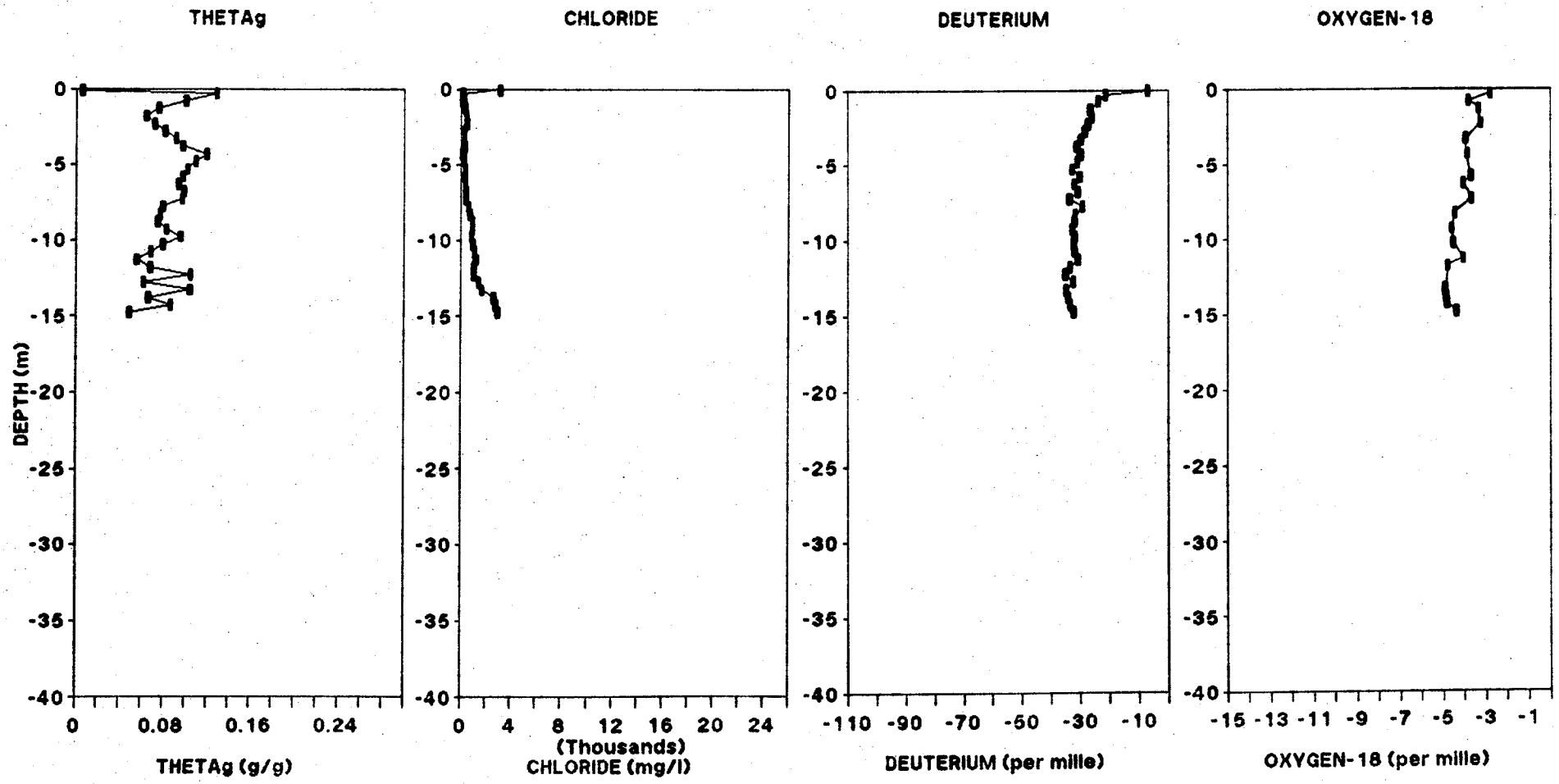
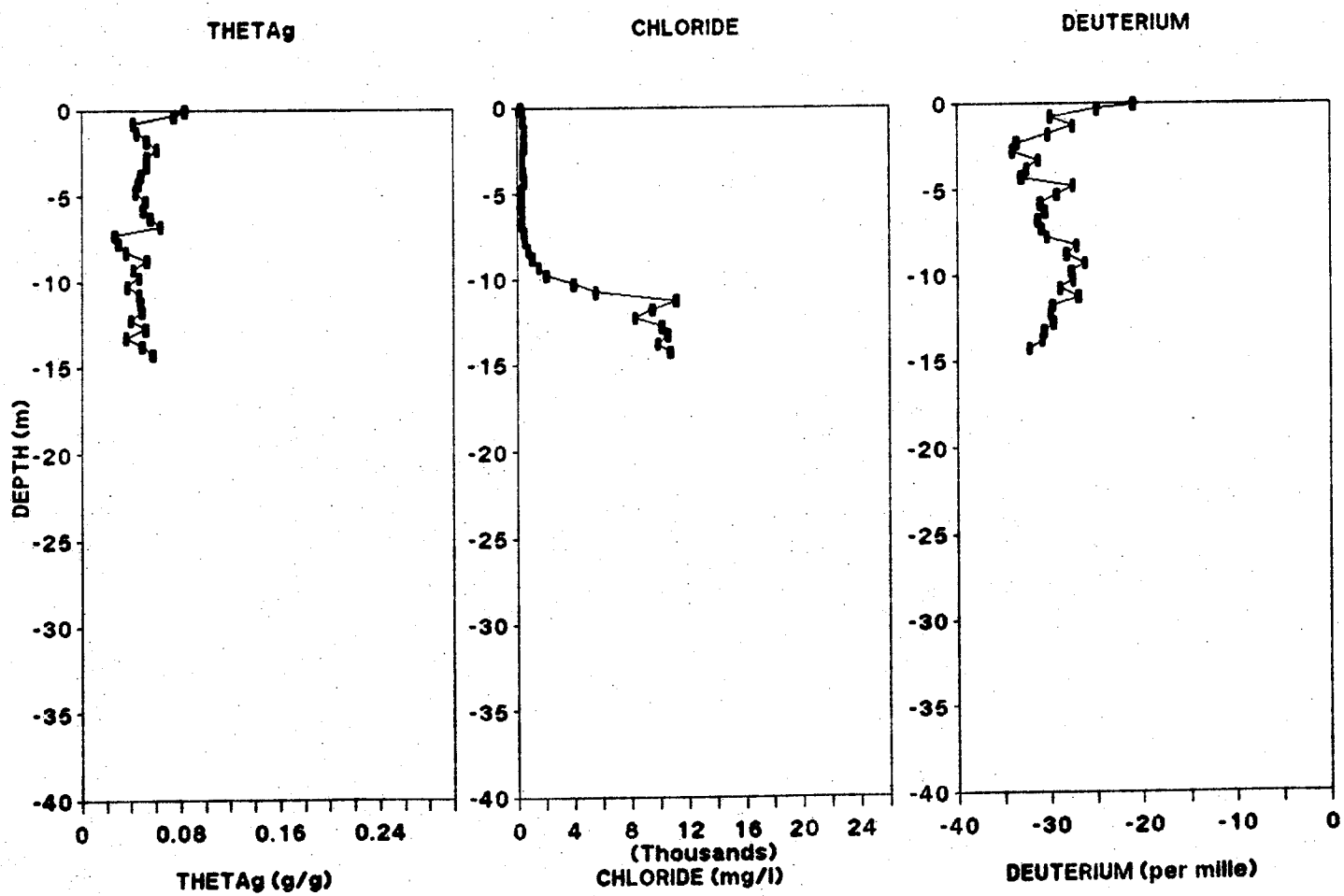


Figure 11 : Profiles for cleared hole BUF05.



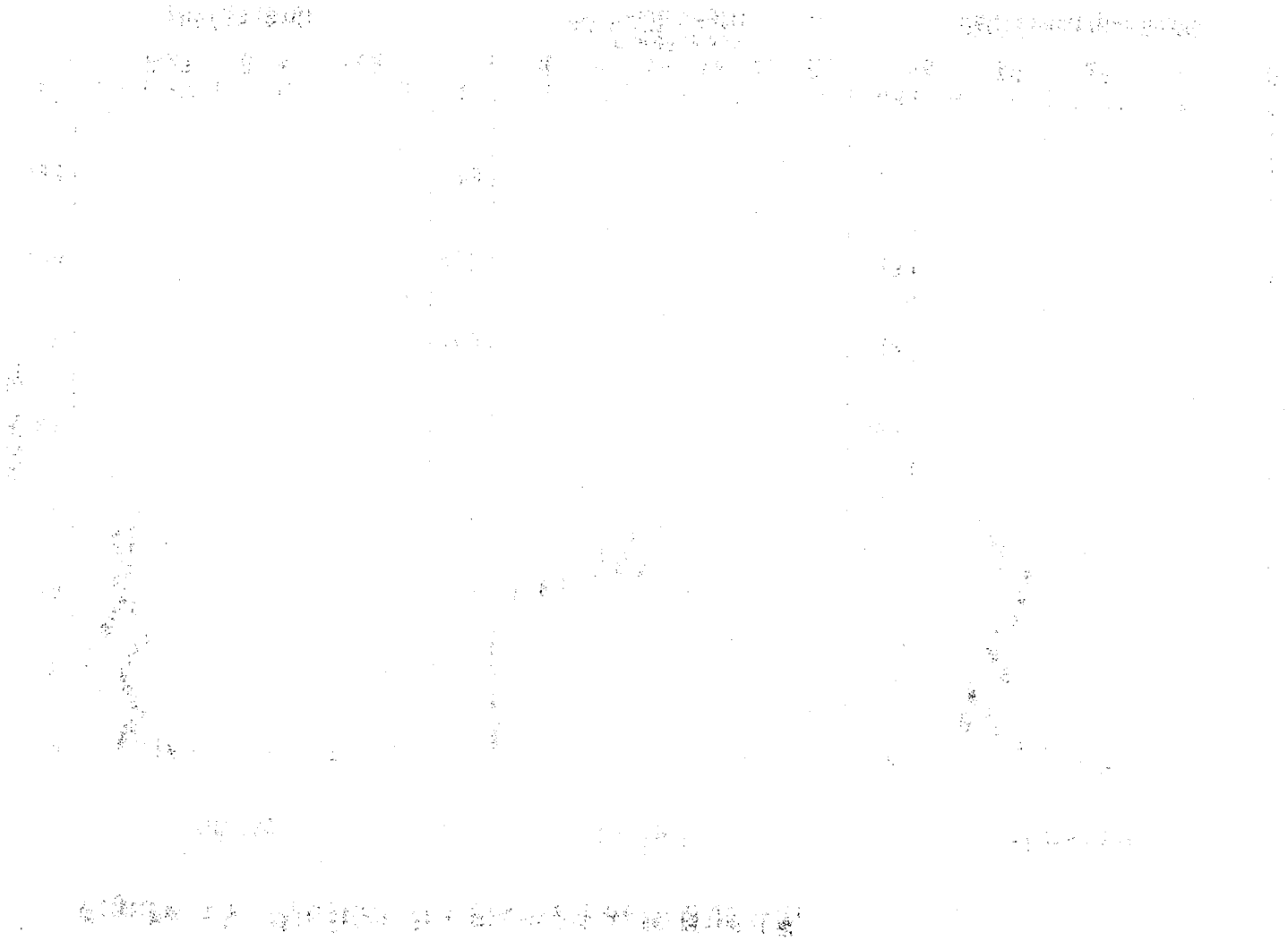


Figure 12 : Profiles for cleared hole BUF06.

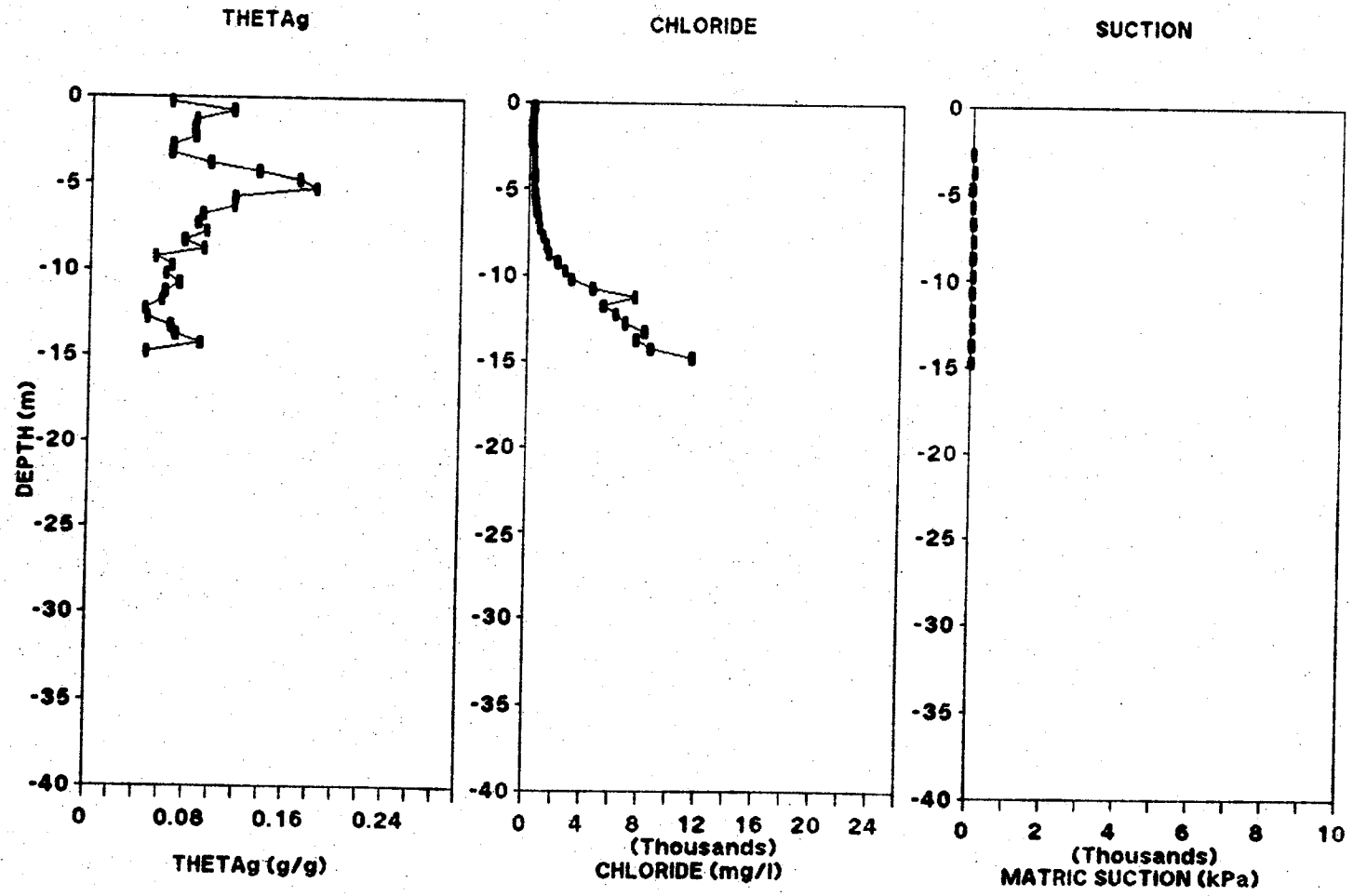


Figure 13 : Profiles for cleared hole BUF07.

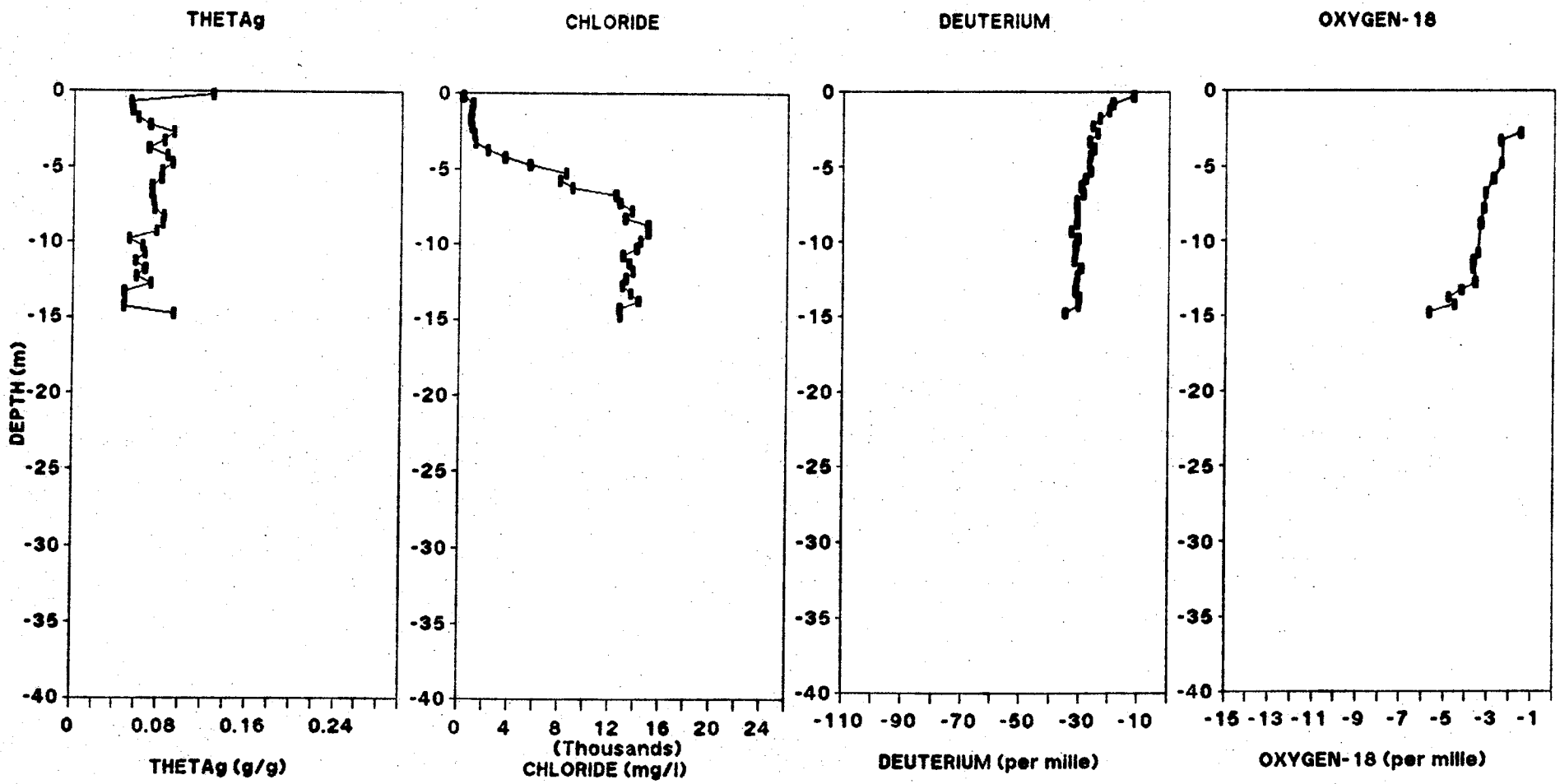


Figure 14 : Profiles for cleared hole BUF 12.