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Tittel

Brief Summary of the Preliminary Results from the Bruvann Samples collected for GeoNickel and Interpretations of the Arnes

Forfatter

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Dato År

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Bedrift (Oppdragsgiver og/eller oppdragstaker)

Outokumpu Research for Nikkel og Olivin A/S

Kommune

Ballangen

Fylke

Nordland

Bergdistrikt

1: 50 000 kartblad

13311

1: 250 000 kartblad

Narvik

Fagområde

Mineralogi
Analyser

Dokument type

Forekomster (forekomst, gruvefelt, undersøkelsesfelt)

Bruvannsfeltet
Råna
Arnesfjellet

Råstoffgruppe

Malm/metall

Råstofftype

Ni, Cu

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

Beskriver en studie av 238 prøver fra 5 borhull. Totale bergartsanalyser er gjennomført. Petrografiske undersøkelser vil følge.

Lister opp en rekke generelle mineralogiske resultat i Bruvannsfeltet. Plasserer de ulike typer mineralisering til aktuell sulfid-fase.

Det gis en konklusjon på resultatene av Arnes-malmleting i 1996.

Vedlagt analyseskjema og forskjellige grafer.

Brief Summary of the Preliminary results from the Bruvann samples collected for GeoNickel and interpretations of the Arnes

Pertti Lamberg

Following gives a short summary of the results from the GeoNickel study concerning Bruvann. For the study a total of 238 samples were collected from five different drill holes. At this stage of the study only whole rock chemical composition of the samples (analysed by XRF) has been available. Study will continue by petrographical and mineralogical investigations.

The main study results from Bruvann are listed below.

- Bruvann is layered in structure
- Two megacyclic units have been distinguished (classification differs from the one of Barnes so, that cyclic units form two megacyclic units, and Barnes put each cyclic unit as megacyclic one)
- Megacyclic unit one (MCU I) consists of several cyclic units each starting with bottom olivine cumulate (oC), followed by orthopyroxene cumulate (bC) and then plagioclase orthopyroxene cumulate (pbC).
 - * At least eight cyclic units have been identified in MCU I
 - * Cyclic units are up to 100 m in thickness
 - * MCU I is ca. 375 m in thickness
 - * MgO content of olivine cumulate is up to 40 wt. %
 - * Thickest olivine cumulates are 140 m in thickness
- Megacyclic unit two (MCU II) consist of several cyclic units each starting with bottom olivine cumulate (oC) followed by clinopyroxene-orthopyroxene cumulate (abC), clinopyroxene cumulate (apC) and plagioclase cumulate (pC).
 - * At least eight cyclic units have been identified in MCU II, as well
 - * Cyclic units are thinner than in MCU I, up to 50 m in thickness.
 - * MCU II is at least 300 m in thickness.
 - * MgO content of olivine cumulate (oC) is up to 35 wt. %.
 - * Thickest olivine cumulates are only 30 m thick.
- Ores occur in MCU I 100 m-300 m from the basal contact
 - * Two type of ores can be distinguished semi massive - massive one and disseminated one
 - 1. Semi-massive - massive ore
 - Host rock is orthopyroxene or orthopyroxene-plagioclase cumulate
 - Ni and Cu contents of the sulfide phase are low (<5 and <1.5, respectively)
 - They contain small amount of graphite
 - They contain anomalous high contents of V, Mn, C, and P
 - Inclusions of gneissic rocks locate close to them
 - 2. Disseminated ore
 - Host rock is olivine cumulate (mainly oMC)
 - Ni and Cu contents of the sulfide phase are high (>5 and >1.5, respectively).

- They are hosted by thickest and most primitive olivine cumulates of MCU I
- Thick orthopyroxene cumulates occur adjacent to them. These orthopyroxene cumulates are rich in V
- Olivine cumulate hosting the ore is slightly richer in Mn than other olivine cumulates
- * In some locations at least, disseminated ores exist on the extensions of massive ores.
- * Features listed above indicate, that the assimilation and melting of graphite schist has played a major role in ore formation process, both in massive and disseminated ores.

Exploration target Arnes was mapped and sampled during summer 1996. On the basis of this and lithogeochemistry of some 90 samples, following conclusions can be drawn from Arnes.

- Arnes is layered in structure
- Arnes consists of at least five cyclic units most of them being like cyclic units of MCU I in Bruvann, i.e. starting with oC and followed by bC and in some cyclic units also by pbC
- The olivine cumulates highest in MgO are even more primitive than the olivine cumulates of Bruvann (MgO is up to 43 compared to 41 in Bruvann)
- Arnes contains clinopyroxene-orthopyroxene cumulates (less than 10% plagioclase), which lack in Bruvann
- There exists several evidences of black schist contamination in Arnes:
 - * Presence of xenoliths
 - * Presence of graphite in cumulates
 - * Presence of partially melted mixture rocks
- Graphite schist in the west side of Arnes is sulfur bearing (one sample contained 4.0% S)
- Graphite schist comes in contact with Arnes cumulates in west side of the block (most probably contact is tectonic, however)
- Structural interpretation of the Arnes based on mapping and geophysical measurements tells, that the basal contact locates in north and layering is dipping ca. 60 degrees to north.
- The most critical places in Arnes are locating in zone, which is locating roughly in a polygon: (3400E, 3800N); (4000E, 3600N); (4000E, 3300N); (3400E, 3400N) and which is furthermore characterized by
 - * Presence of xenoliths
 - * Presence of graphite in cumulates
 - * Presence of sulfide dissemination
 - * Anomalous high V contents
 - * Clinopyroxene-orthopyroxene cumulates next to the most primitive and thick olivine cumulate
 - * Weak conductor in helicopter geophysical measurements

Drilling is recommended to the above described most critical location of Arnes target.

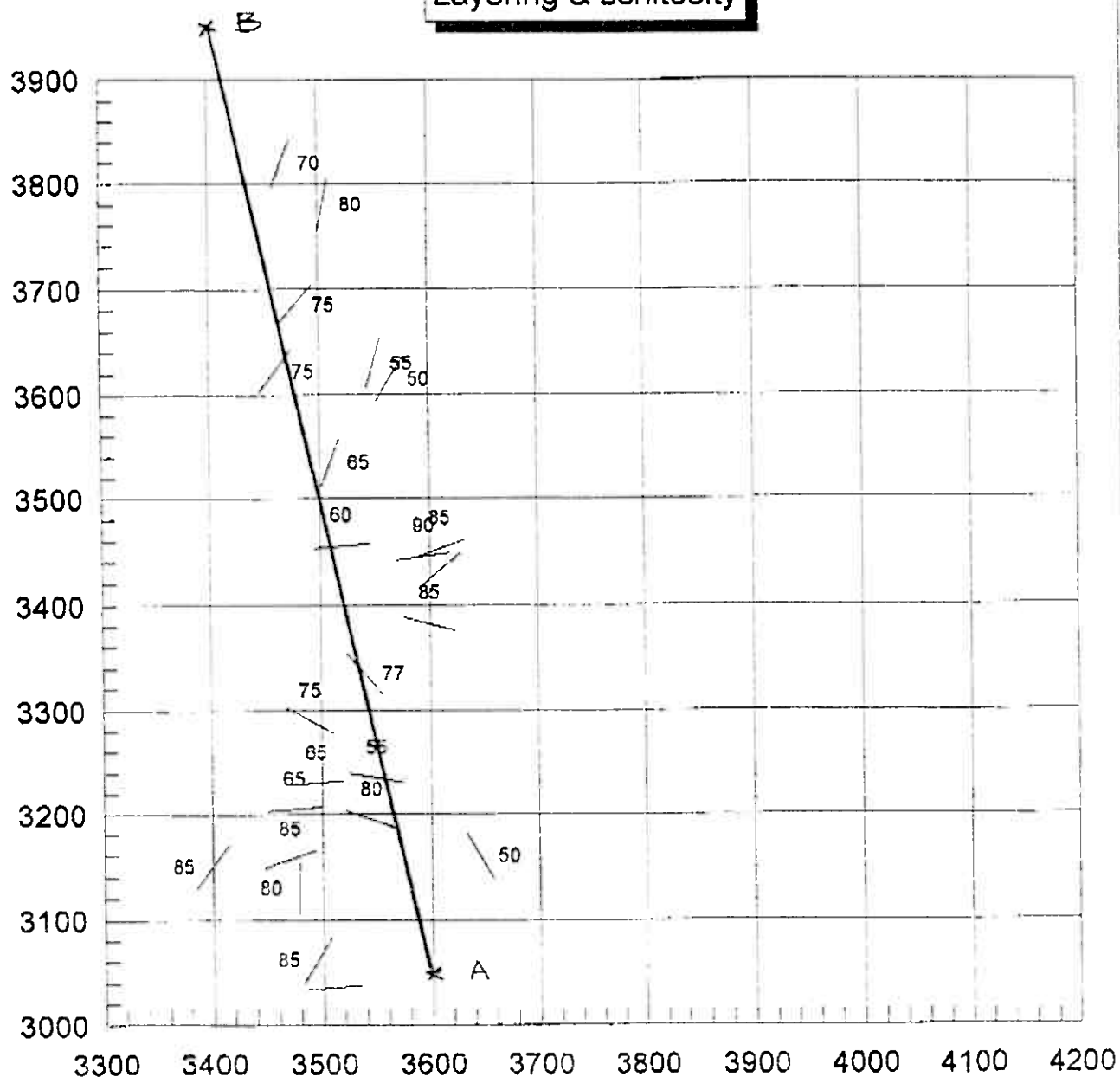
10/15/96

A { 3600
3050

B { 3400
3950

Arnes

Layering & schistosity



LAYERING AND PROJECTION LINE, IN PROFILE
FIGS DISTANCE SHOWN AS METRES (NEGATIVE)
FROM A TO B. NOTE THAT LAYERING IS
NOT PERPENDICULAR TO PROFILE LINE A→B,

No	X	Y	Z	L	RockTyp	SiO2	TiO2	Al2O3	Cr2O3	V2O3	FeO	MnO	MgO	CaO	Rb2O	SrO	BaO	Na2O	K2O
347	3035	3510	360	-35.6128	NO	50.5	0.236	19.0	0.1360	0.0408	6.130	0.110	11.70	9.47	0.0007	0.0252	0.007	1.39	0.15
343	3155	3482	322	-128.097	PRD	39.6	0.027	3.2	0.0310	0.0077	14.400	0.170	37.90	1.36	0.0010	0.0013	0.002	0.21	0.09
62	3205	3475	300	-178.425	PRD,PX	40.6	0.069	2.3	0.4030	0.0155	12.800	0.174	39.90	1.34	0.0001	0.0018	0.004	0.11	0.02
78	3235	3550	305	-191.441	PX	52.4	0.243	4.7	0.4140	0.0563	9.470	0.173	27.20	2.33	0.0010	0.0022	0.005	0.30	0.13
335	3290	3490	260	-258.147	PX	50.9	0.217	4.6	0.3930	0.0616	10.300	0.181	27.60	2.19	0.0007	0.0015	0.002	0.17	0.03
314	3382	3600	295	-324.094	NO	52.9	0.296	4.1	0.3870	0.0608	10.200	0.188	26.60	1.91	0.0011	0.0016	0.005	0.23	0.18
338	3422	3582	275	-367.046	PRD	38.9	0.041	1.4	0.4600	0.0186	14.900	0.190	40.70	1.01	0.0005	0.0007	0.003	0.01	0.01
337	3432	3610	285	-370.734	PRD, PX	45.0	0.075	12.0	0.2490	0.0195	8.800	0.127	25.60	5.21	0.0005	0.0162	0.003	1.07	0.08
337	3432	3610	285	-370.734	PRD, PX	44.9	0.124	2.2	0.3930	0.0335	12.600	0.176	35.60	1.07	0.0008	0.0009	0.003	0.06	0.01
312	3445	3595	275	-386.679	PRD	44.0	0.118	2.2	0.3080	0.0371	14.200	0.191	33.90	1.32	0.0009	0.0012	0.003	0.08	0.02
304	3455	3520	240	-412.71	PRD	38.9	0.043	0.8	0.4000	0.0056	13.800	0.172	42.20	0.82	0.0010	0.0003	0.002	0.00	0.01
339	3475	3570	255	-421.387	PRD	39.2	0.038	1.8	0.3510	0.0063	13.400	0.171	40.70	1.21	0.0006	0.0015	0.000	0.07	0.01
68	3495	3520	230	-451.758	PRD	44.1	0.122	1.5	0.3340	0.0247	11.400	0.172	37.30	1.58	0.0004	0.0000	0.004	0.08	0.03
69	3500	3547	240	-450.781	PRD	49.0	0.267	2.7	0.5020	0.1020	9.130	0.127	20.60	11.30	0.0005	0.0013	0.002	0.21	0.01
67	3535	3510	210	-492.974	PRD	49.8	0.267	2.9	0.3990	0.0867	9.080	0.136	22.70	9.05	0.0008	0.0014	0.003	0.23	0.02
67	3535	3510	210	-492.974	PRD	50.2	0.291	2.6	0.3500	0.1100	7.830	0.147	20.00	12.80	0.0004	0.0008	0.004	0.19	0.02
67	3535	3510	210	-492.974	PRD	50.4	0.303	2.7	0.3630	0.1130	7.560	0.147	19.60	13.40	0.0006	0.0018	0.003	0.20	0.02
282	3575	3517	195	-530.503	PX	52.2	0.188	2.2	0.3070	0.0645	11.300	0.189	28.20	1.91	0.0007	0.0001	0.004	0.00	0.02
286	3615	3565	190	-559.138	PX/PRD	50.0	0.283	2.6	0.3970	0.1200	7.480	0.134	19.60	13.70	0.0008	0.0011	0.003	0.19	0.02
286	3615	3565	190	-559.138	PX/PRD	50.7	0.280	2.6	0.3980	0.1150	8.010	0.154	20.60	12.80	0.0002	0.0009	0.000	0.20	0.01
332	3622	3460	150	-588.749	PRD	41.7	0.116	4.3	0.3830	0.0234	12.500	0.157	33.70	3.65	0.0006	0.0048	0.003	0.40	0.03
65	3635	3472	150	-598.837	PX	48.2	0.321	3.9	0.3510	0.0967	9.700	0.150	19.30	11.30	0.0009	0.0028	0.001	0.32	0.04
348	3685	3479	130	-646.127	PX	53.0	0.245	7.8	0.3620	0.0429	8.200	0.161	23.10	3.90	0.0004	0.0080	0.006	0.72	0.13
51	3737	3455	110	-702.095	NO	51.0	0.200	17.8	0.1040	0.0514	4.350	0.093	10.90	13.10	0.0009	0.0233	0.003	1.36	0.13
53	3745	3460	110	-708.82	PX	50.9	0.414	5.0	0.2910	0.0943	8.420	0.163	18.30	11.50	0.0006	0.0032	0.004	0.47	0.10
55	3780	3505	110	-733.225	PRD	41.2	0.177	6.4	0.2560	0.0199	14.900	0.162	29.00	3.59	0.0010	0.0085	0.006	0.56	0.10
56	3780	3515	110	-731.056	PRD	42.4	0.201	4.8	0.2210	0.0198	12.200	0.168	33.20	3.20	0.0013	0.0064	0.005	0.63	0.18
154	3820	3467	80	-780.516	PX	53.2	0.330	7.2	0.4420	0.0367	8.450	0.166	23.00	4.05	0.0011	0.0070	0.004	0.87	0.14
153	3845	3455	60	-807.524	PRD	41.9	0.227	6.0	0.3420	0.0111	11.300	0.158	33.20	3.04	0.0011	0.0077	0.006	0.86	0.18
349	3862	3432	45	-829.108	PX	52.4	0.306	6.4	0.3830	0.0376	8.590	0.165	23.30	4.00	0.0036	0.0046	0.009	0.62	0.88
354				-900		47.4	0.139	19.6	0.1130	0.0326	7.540	0.093	10.10	9.41	0.0004	0.0248	0.002	1.20	0.07
334			380	-1000	BS	64.8	0.564	11.6	0.0113	0.0156	6.790	0.046	3.39	4.78	0.0090	0.0186	0.053	1.04	2.11

No	X	Y	Z	L	RockTyp	ZrO2	P2O5	CO2	OxSu	Cu	Ni	Co	Zn	Pb	Ag	S	As	Sb
347	3035	3510	360	-35.6128	NO	0.000	0.007	1.0	99.3	0.002	0.007	0.010	0.004	0.000	0.000	0.188	0.002	0.000
343	3155	3482	322	-128.097	PRD	0.000	0.012	0.6	97.6	0.014	0.097	0.017	0.009	0.001	0.000	0.402	0.005	0.000
62	3205	3475	300	-178.425	PRD, PX	0.000	0.011	0.5	98.2	0.009	0.087	0.014	0.009	0.001	0.000	0.243	0.001	0.000
78	3235	3550	305	-191.441	PX	0.000	0.006	0.3	97.7	0.007	0.037	0.008	0.006	0.001	0.000	0.279	0.002	0.000
335	3290	3490	260	-258.147	PX	0.000	0.005	0.3	97.0	0.005	0.014	0.016	0.008	0.001	0.000	0.274	0.001	0.000
314	3382	3600	295	-324.094	NO	0.000	0.018	0.4	97.6	0.012	0.055	0.013	0.007	0.001	0.000	0.369	0.001	0.000
338	3422	3582	275	-367.046	PRD	0.000	0.011	0.2	98.3	0.017	0.283	0.017	0.009	0.000	0.000	0.448	0.001	0.000
337	3432	3610	285	-370.734	PRD, PX	0.000	0.005	0.4	98.7	0.011	0.112	0.010	0.007	0.000	0.000	0.274	0.001	0.000
337	3432	3610	285	-370.734	PRD, PX	0.000	0.007	0.6	97.9	0.036	0.209	0.013	0.008	0.001	0.000	0.550	0.011	0.000
312	3445	3595	275	-386.679	PRD	0.000	0.004	0.2	97.6	0.055	0.302	0.020	0.008	0.002	0.000	1.270	0.005	0.000
304	3455	3520	240	-412.71	PRD	0.000	0.018	0.6	97.6	0.027	0.171	0.018	0.008	0.002	0.000	0.466	0.001	0.000
339	3475	3570	255	-421.387	PRD	0.000	0.013	0.6	97.6	0.019	0.121	0.023	0.008	0.001	0.000	0.312	0.002	0.000
68	3495	3520	230	-451.758	PRD	0.000	0.017	0.7	97.3	0.023	0.139	0.017	0.006	0.000	0.000	0.365	0.001	0.000
69	3500	3547	240	-450.781	PRD	0.000	0.007	1.3	98.0	0.040	0.121	0.023	0.003	0.000	0.000	2.750	0.001	0.000
67	3535	3510	210	-492.974	PRD	0.000	0.004	1.8	96.3	0.028	0.122	0.020	0.003	0.001	0.000	1.830	0.001	0.000
67	3535	3510	210	-492.974	PRD	0.000	0.004	2.5	96.1	0.013	0.032	0.015	0.004	0.001	0.000	1.480	0.001	0.000
67	3535	3510	210	-492.974	PRD	0.000	0.006	2.6	96.1	0.012	0.017	0.016	0.003	0.000	0.000	1.200	0.001	0.000
282	3575	3517	195	-530.503	PX	0.000	0.007	0.7	97.2	0.007	0.036	0.017	0.006	0.000	0.000	0.951	0.002	0.000
286	3615	3565	190	-559.138	PX/PRD	0.000	0.002	1.1	95.4	0.011	0.024	0.014	0.003	0.001	0.000	1.020	0.001	0.000
286	3615	3565	190	-559.138	PX/PRD	0.000	0.002	1.0	96.8	0.009	0.023	0.012	0.004	0.000	0.000	1.230	0.001	0.000
332	3622	3460	150	-588.749	PRD	0.000	0.012	0.8	98.2	0.028	0.142	0.018	0.007	0.000	0.000	1.390	0.001	0.000
65	3635	3472	150	-598.837	PX	0.000	0.008	1.4	95.5	0.039	0.083	0.020	0.003	0.000	0.000	2.430	0.002	0.000
348	3685	3479	130	-646.127	PX	0.000	0.012	0.4	97.9	0.009	0.050	0.017	0.005	0.002	0.000	0.111	0.005	0.000
51	3737	3455	110	-702.095	NO	0.000	0.018	0.1	99.2	0.004	0.010	0.005	0.002	0.001	0.000	0.198	0.001	0.000
53	3745	3460	110	-708.82	PX	0.001	0.017	0.3	96.1	0.009	0.017	0.010	0.004	0.001	0.000	0.262	0.001	0.000
55	3780	3505	110	-733.225	PRD	0.000	0.022	0.6	98.3	0.087	0.333	0.023	0.008	0.001	0.000	2.170	0.003	0.000
56	3780	3515	110	-731.056	PRD	0.000	0.035	0.2	98.0	0.037	0.226	0.014	0.007	0.002	0.000	0.619	0.001	0.000
154	3820	3467	80	-780.516	PX	0.000	0.049	0.4	98.2	0.010	0.042	0.013	0.006	0.000	0.000	0.170	0.002	0.000
153	3845	3455	60	-807.524	PRD	0.000	0.031	0.4	97.9	0.026	0.137	0.015	0.007	0.001	0.000	0.437	0.002	0.000
349	3862	3432	45	-829.108	PX	0.000	0.022	0.3	97.3	0.003	0.049	0.008	0.006	0.002	0.000	0.065	0.010	0.000
354				-900		0.000	0.005	5.4	97.9	0.028	0.042	0.012	0.004	0.001	0.000	1.060	0.001	0.000
334			380	-1000	BS	0.021	0.094	6.5	99.2	0.005	0.008	0.000	0.008	0.002	0.000	4.060	0.002	0.000

No	X	Y	Z	L	RockTyp	Bi	Te	Y	Nb	Mo	Sn	W	Cl	Th	U	Cs	La
347	3035	3510	360	-35.6128	NO		0.002	0.000	0.0006	0.0004	0.001	0.000	0.007	0.0000	0.0005	0.001	0.002
343	3155	3482	322	-128.097	PRD		0.001	0.000	0.0006	0.0016	0.001	0.000	0.008	0.0000	0.0005	0.002	0.000
62	3205	3475	300	-178.425	PRD,PX		0.001	0.000	0.0000	0.0013	0.001	0.000	0.005	0.0000	0.0013	0.002	0.003
78	3235	3550	305	-191.441	PX		0.001	0.000	0.0002	0.0011	0.000	0.000	0.007	0.0000	0.0010	0.000	0.000
335	3290	3490	260	-258.147	PX		0.001	0.000	0.0000	0.0015	0.002	0.000	0.008	0.0000	0.0004	0.002	0.000
314	3382	3600	295	-324.094	NO		0.001	0.000	0.0003	0.0015	0.000	0.000	0.003	0.0000	0.0011	0.001	0.002
338	3422	3582	275	-367.046	PRD		0.001	0.000	0.0000	0.0017	0.001	0.000	0.013	0.0000	0.0003	0.001	0.001
337	3432	3610	285	-370.734	PRD,PX		0.001	0.000	0.0000	0.0015	0.000	0.000	0.015	0.0000	0.0007	0.000	0.000
337	3432	3610	285	-370.734	PRD,PX		0.002	0.000	0.0000	0.0016	0.001	0.000	0.005	0.0000	0.0003	0.000	0.001
312	3445	3595	275	-386.679	PRD		0.002	0.000	0.0000	0.0013	0.000	0.000	0.004	0.0000	0.0003	0.002	0.002
304	3455	3520	240	-412.71	PRD		0.001	0.000	0.0000	0.0012	0.000	0.000	0.001	0.0000	0.0002	0.002	0.002
339	3475	3570	255	-421.387	PRD		0.001	0.000	0.0000	0.0014	0.000	0.000	0.004	0.0000	0.0011	0.003	0.002
68	3495	3520	230	-451.758	PRD		0.001	0.000	0.0000	0.0015	0.001	0.001	0.006	0.0000	0.0003	0.002	0.002
69	3500	3547	240	-450.781	PRD		0.001	0.000	0.0007	0.0013	0.001	0.000	0.004	0.0000	0.0007	0.000	0.001
67	3535	3510	210	-492.974	PRD		0.000	0.000	0.0001	0.0015	0.000	0.000	0.001	0.0000	0.0001	0.002	0.003
67	3535	3510	210	-492.974	PRD		0.001	0.000	0.0005	0.0013	0.000	0.000	0.002	0.0000	0.0009	0.000	0.002
67	3535	3510	210	-492.974	PRD		0.001	0.000	0.0004	0.0013	0.000	0.000	0.001	0.0000	0.0004	0.001	0.001
282	3575	3517	195	-530.503	PX		0.001	0.000	0.0000	0.0015	0.000	0.000	0.005	0.0000	0.0008	0.001	0.001
286	3615	3565	190	-559.138	PX/PRD		0.001	0.000	0.0007	0.0012	0.002	0.000	0.009	0.0000	0.0009	0.001	0.002
286	3615	3565	190	-559.138	PX/PRD		0.001	0.000	0.0004	0.0015	0.000	0.000	0.001	0.0000	0.0005	0.000	0.000
332	3622	3460	150	-588.749	PRD		0.001	0.000	0.0000	0.0014	0.000	0.000	0.001	0.0000	0.0005	0.000	0.000
65	3635	3472	150	-598.837	PX		0.001	0.000	0.0005	0.0014	0.000	0.000	0.005	0.0000	0.0000	0.001	0.000
348	3685	3479	130	-646.127	PX		0.000	0.000	0.0000	0.0015	0.000	0.000	0.004	0.0000	0.0006	0.000	0.003
51	3737	3455	110	-702.095	NO		0.001	0.000	0.0003	0.0009	0.000	0.000	0.003	0.0000	0.0009	0.001	0.002
53	3745	3460	110	-708.82	PX		0.001	0.000	0.0007	0.0015	0.000	0.000	0.008	0.0000	0.0012	0.003	0.002
55	3780	3505	110	-733.225	PRD		0.000	0.000	0.0000	0.0011	0.000	0.000	0.005	0.0000	0.0008	0.000	0.000
56	3780	3515	110	-731.056	PRD		0.001	0.000	0.0004	0.0009	0.000	0.000	0.004	0.0000	0.0003	0.000	0.001
154	3820	3467	80	-780.516	PX		0.001	0.000	0.0001	0.0016	0.000	0.000	0.009	0.0000	0.0002	0.000	0.003
153	3845	3455	60	-807.524	PRD		0.001	0.000	0.0004	0.0016	0.000	0.000	0.005	0.0000	0.0006	0.001	0.000
349	3862	3432	45	-829.108	PX		0.001	0.000	0.0001	0.0017	0.000	0.000	0.004	0.0000	0.0011	0.002	0.001
354				-900			0.001	0.000	0.0002	0.0017	0.000	0.000	0.001	0.0000	0.0010	0.002	0.000
334			380	-1000	BS		0.002	0.000	0.0027	0.0023	0.0002	0.001	0.021	0.0005	0.0011	0.000	0.003

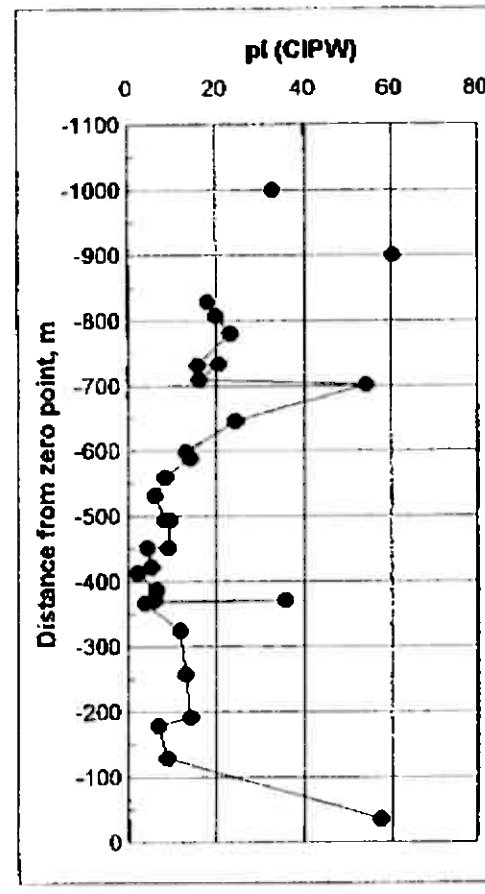
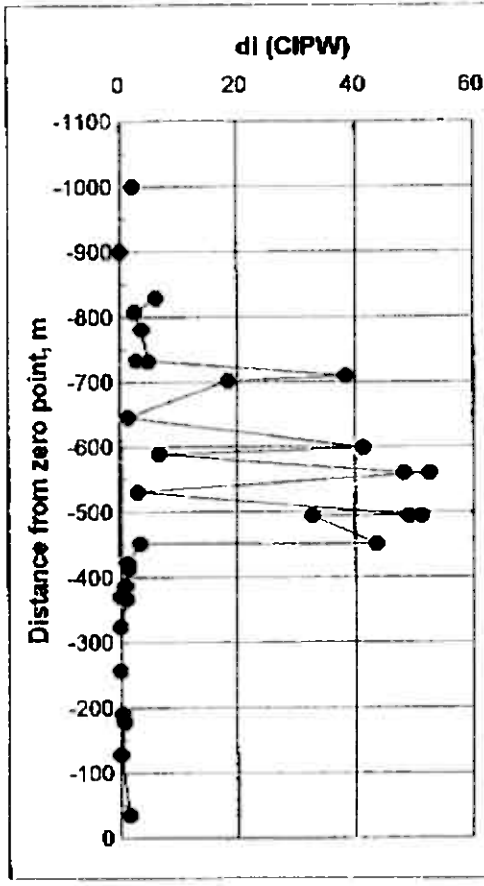
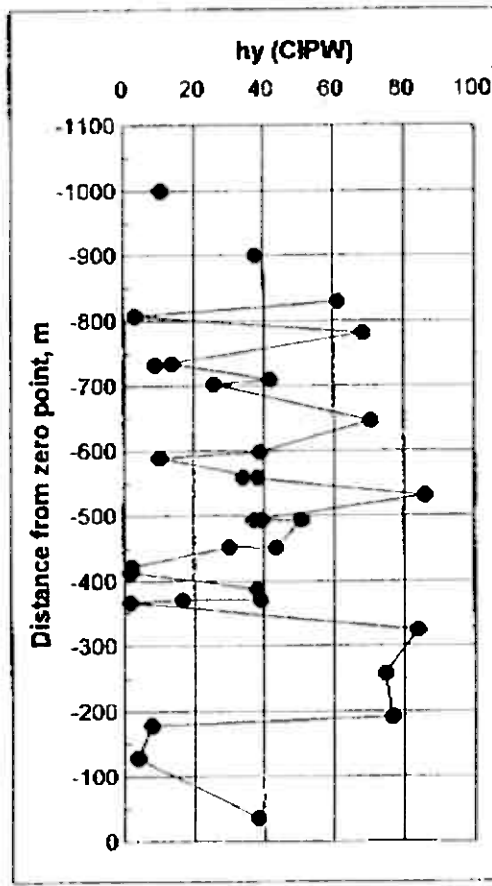
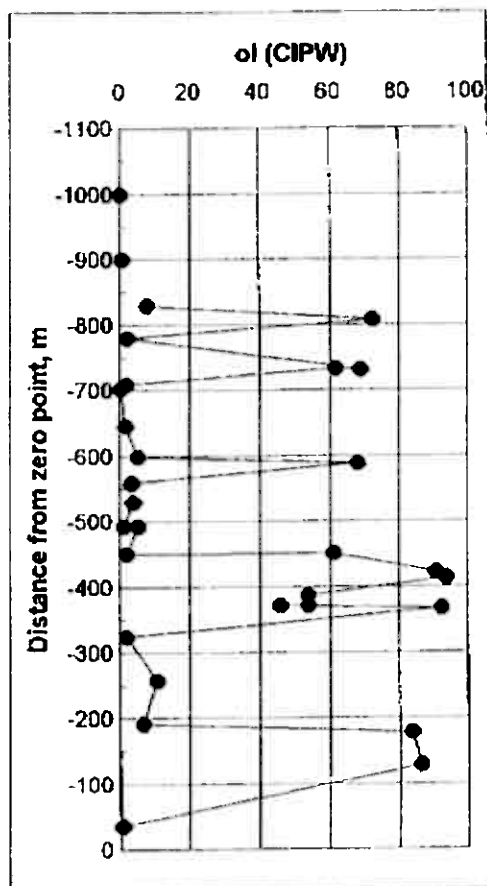
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62	3205	3475	300	-178.425	PRD,PX	0.001	0.000
78	3235	3550	305	-191.441	PX	0.002	0.000
335	3290	3490	260	-258.147	PX	0.001	0.000
314	3382	3600	295	-324.094	NO	0.002	0.001
338	3422	3582	275	-367.046	PRD	0.002	0.001
337	3432	3610	285	-370.734	PRD, PX	0.001	0.000
337	3432	3610	285	-370.734	PRD, PX	0.003	0.001
312	3445	3595	275	-386.679	PRD	0.000	0.001
304	3455	3520	240	-412.71	PRD	0.002	0.000
339	3475	3570	255	-421.387	PRD	0.002	0.000
68	3495	3520	230	-451.758	PRD	0.001	0.000
69	3500	3547	240	-450.781	PRD	0.001	0.001
67	3535	3510	210	-492.974	PRD	0.002	0.000
67	3535	3510	210	-492.974	PRD	0.002	0.000
67	3535	3510	210	-492.974	PRD	0.001	0.000
282	3575	3517	195	-530.503	PX	0.001	0.000
286	3615	3565	190	-559.138	PX/PRD	0.000	0.000
286	3615	3565	190	-559.138	PX/PRD	0.001	0.000
332	3622	3460	150	-588.749	PRD	0.002	0.000
65	3635	3472	150	-598.837	PX	0.001	0.001
348	3685	3479	130	-646.127	PX	0.001	0.001
51	3737	3455	110	-702.095	NO	0.001	0.000
53	3745	3460	110	-708.82	PX	0.001	0.001
55	3780	3505	110	-733.225	PRD	0.001	0.000
56	3780	3515	110	-731.056	PRD	0.003	0.002
154	3820	3467	80	-780.516	PX	0.002	0.000
153	3845	3455	60	-807.524	PRD	0.001	0.001
349	3862	3432	45	-829.108	PX	0.000	0.000
354				-900		0.001	0.001
334			380	-1000	BS	0.009	0.001

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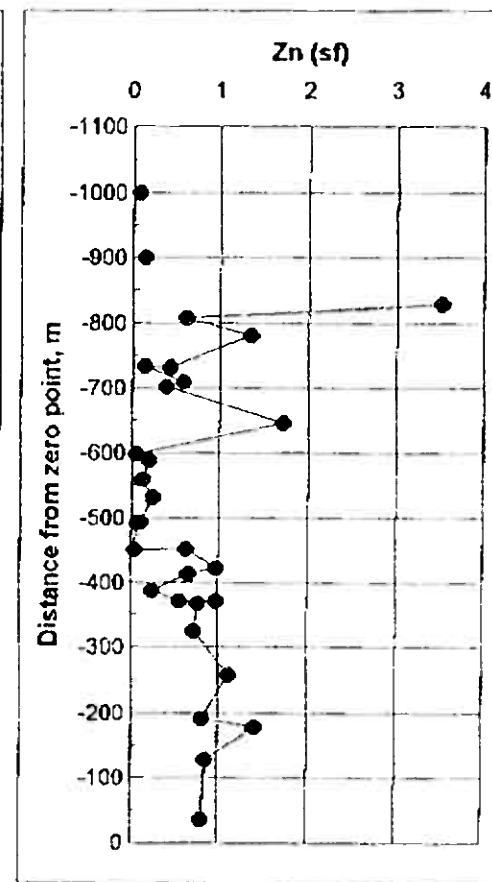
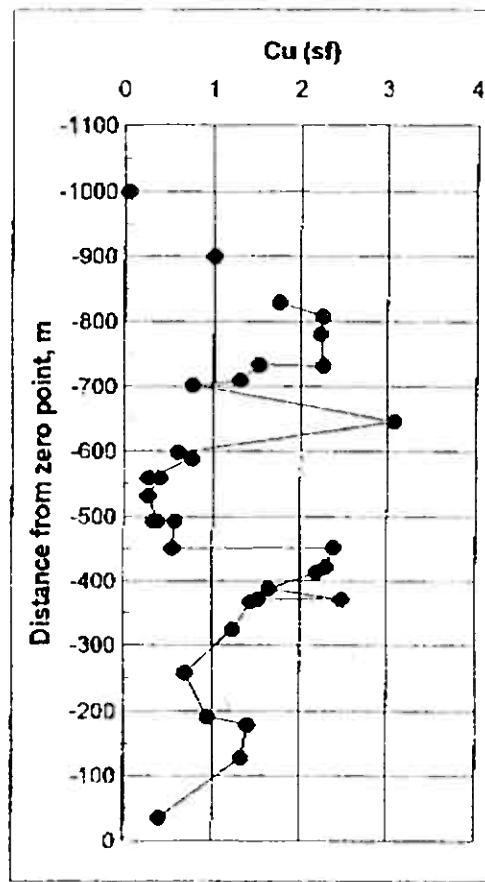
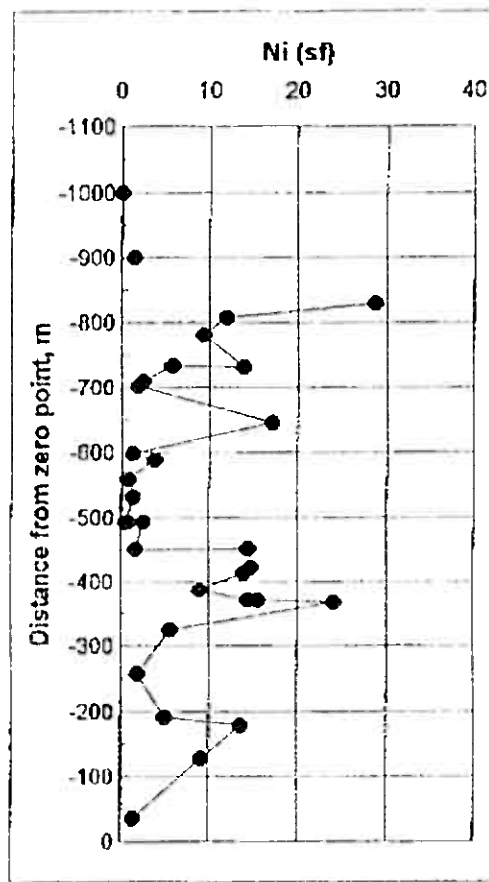
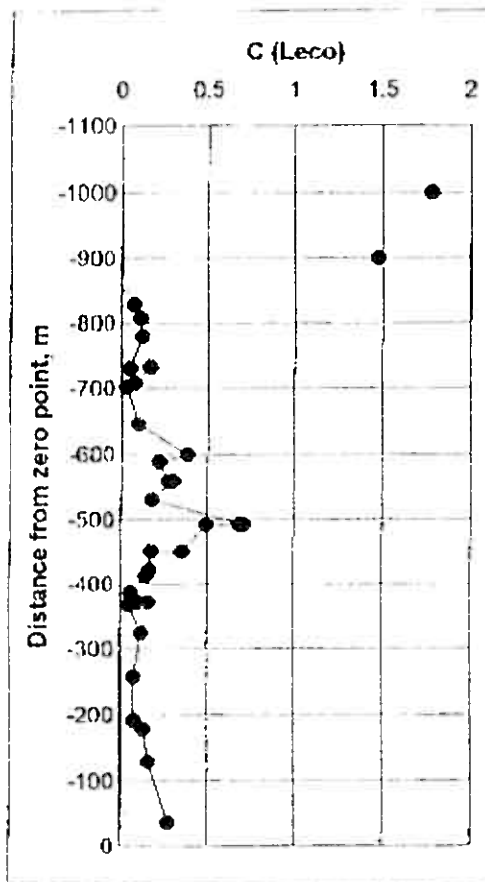
P. Lamberg, GAL

Ames: Western profile

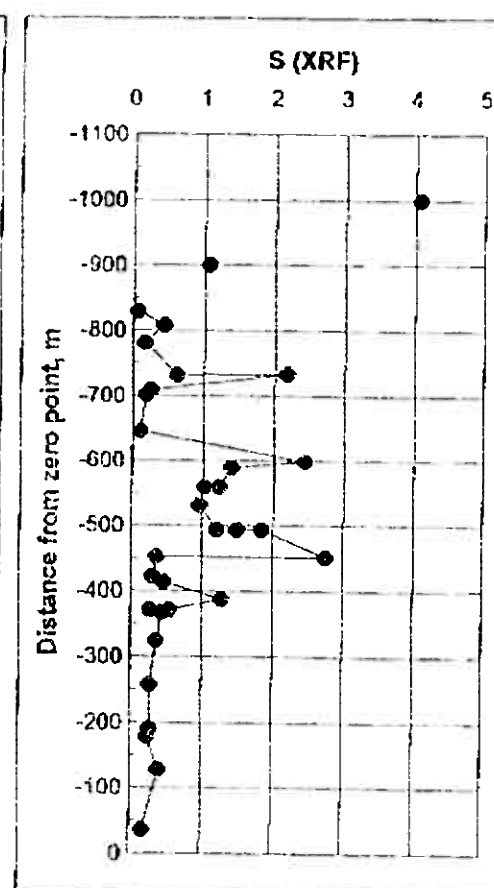
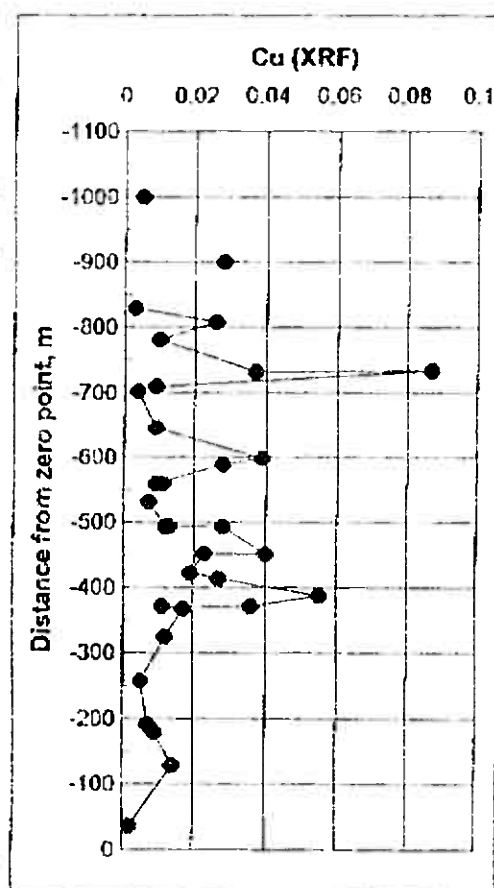
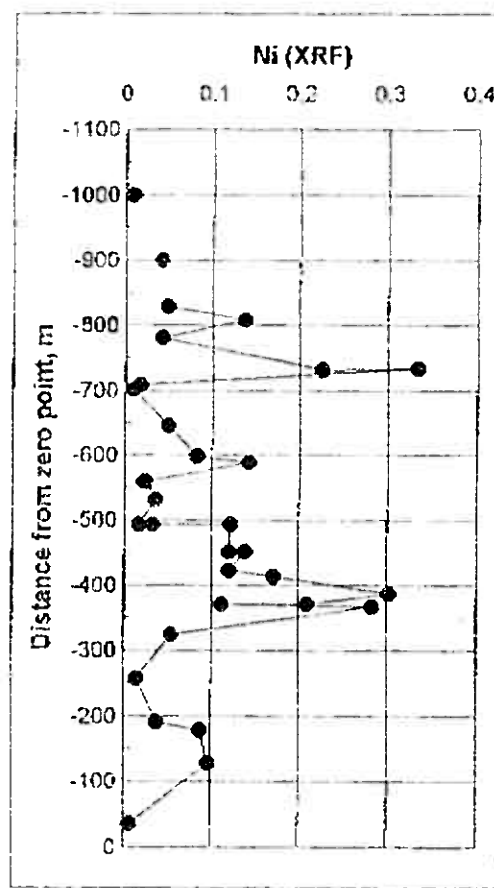
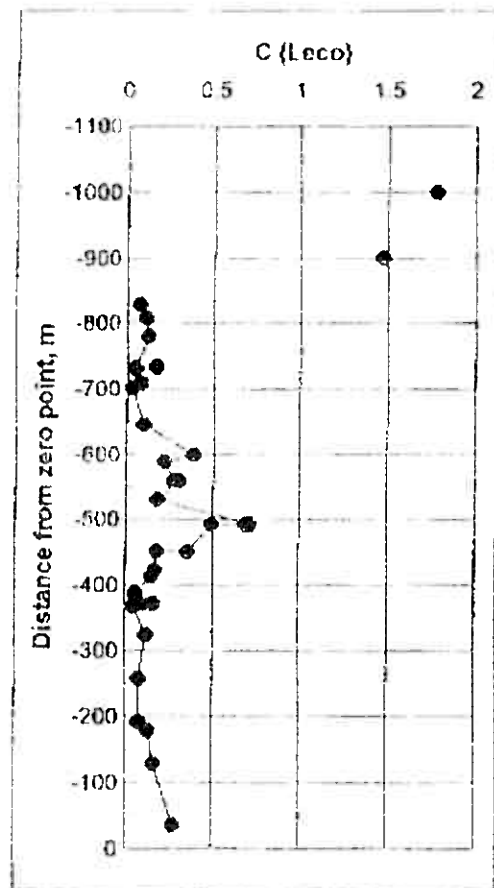
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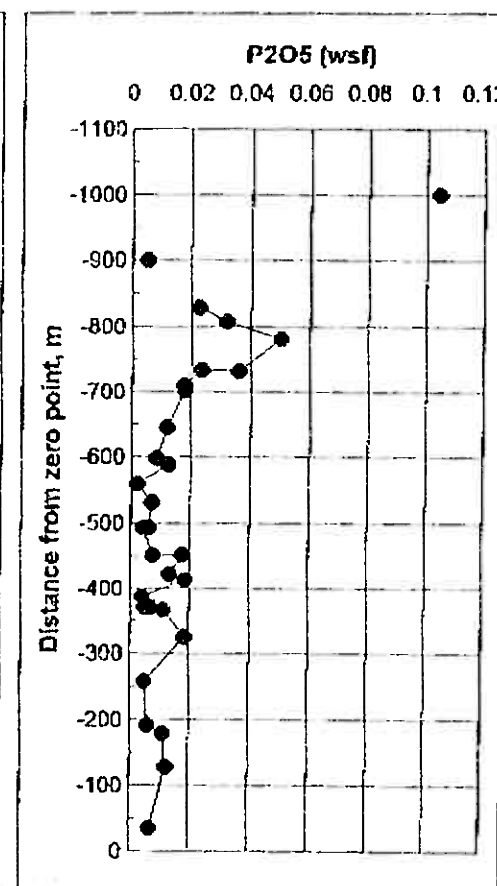
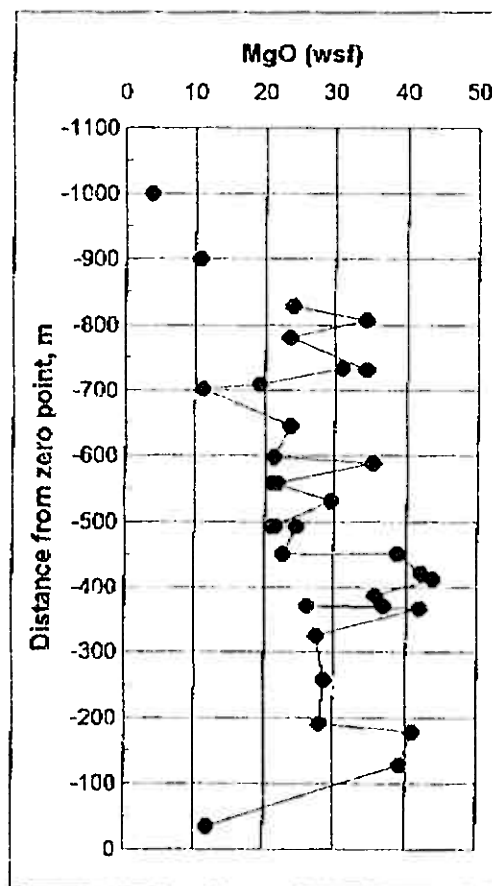
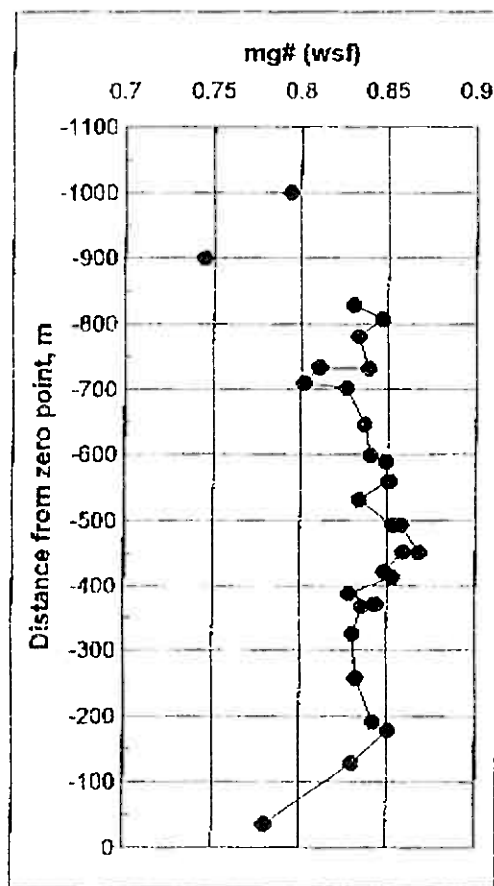
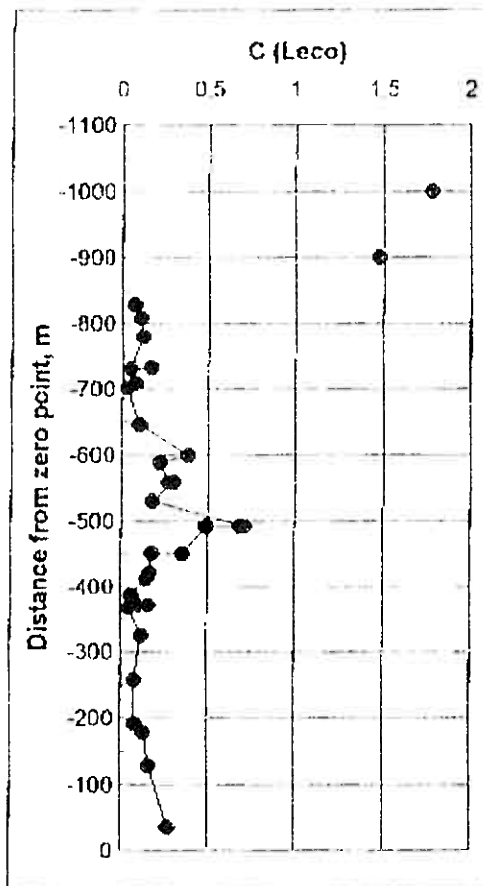


ARNES #5



4



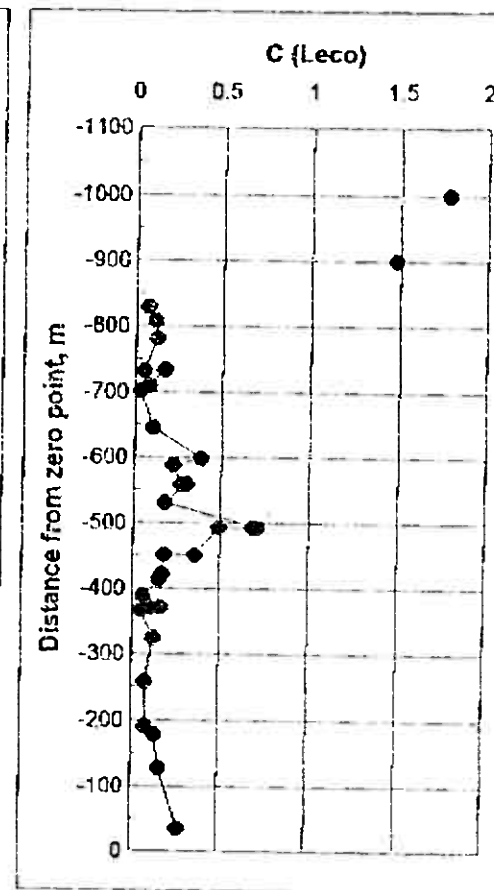
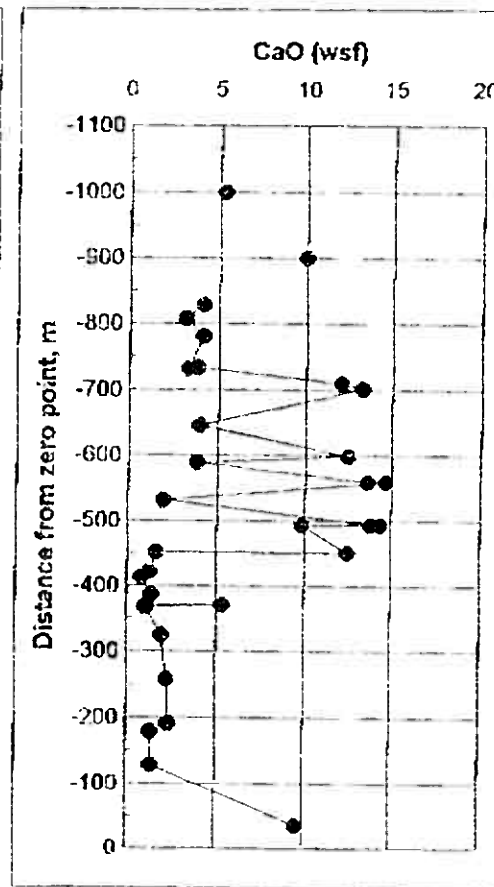
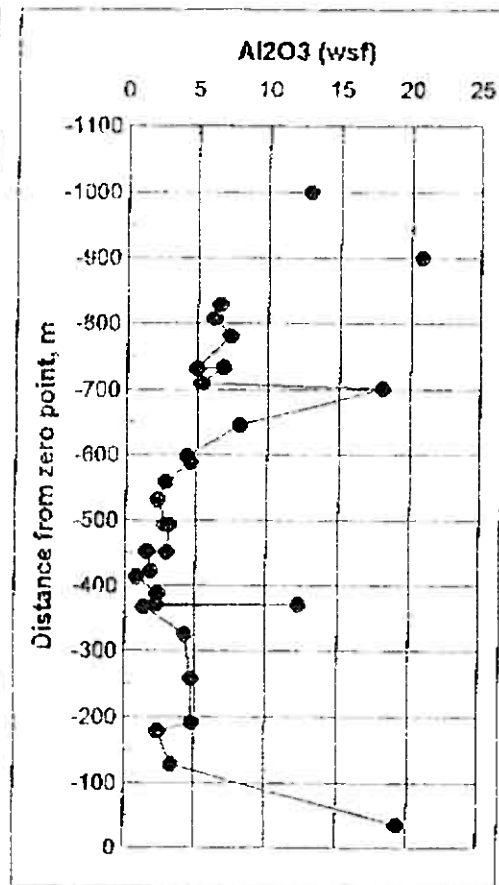
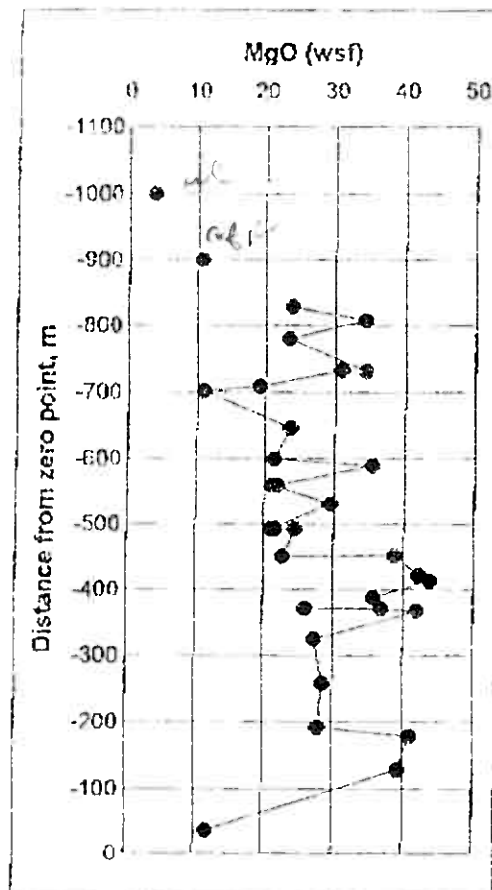


ARNES

P. Lamberg, GAI

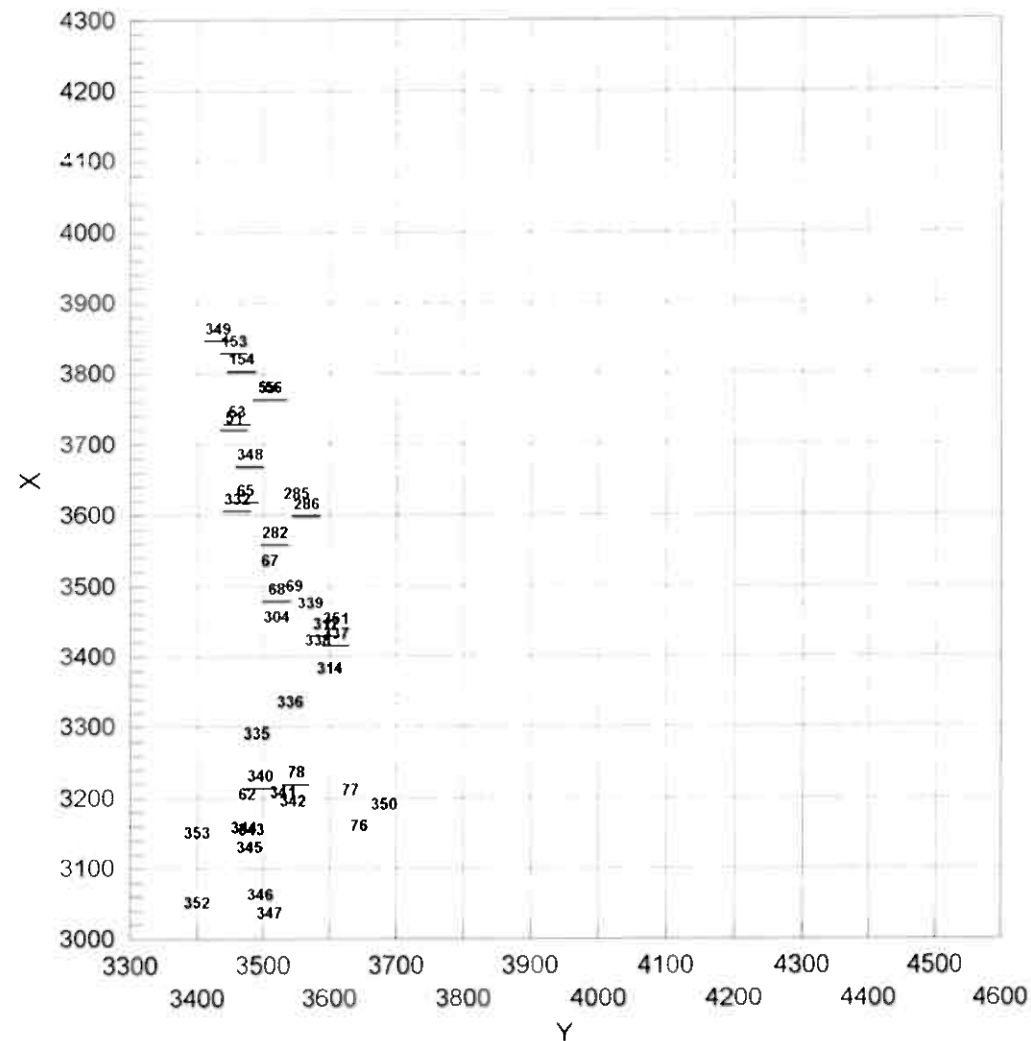
Western profile

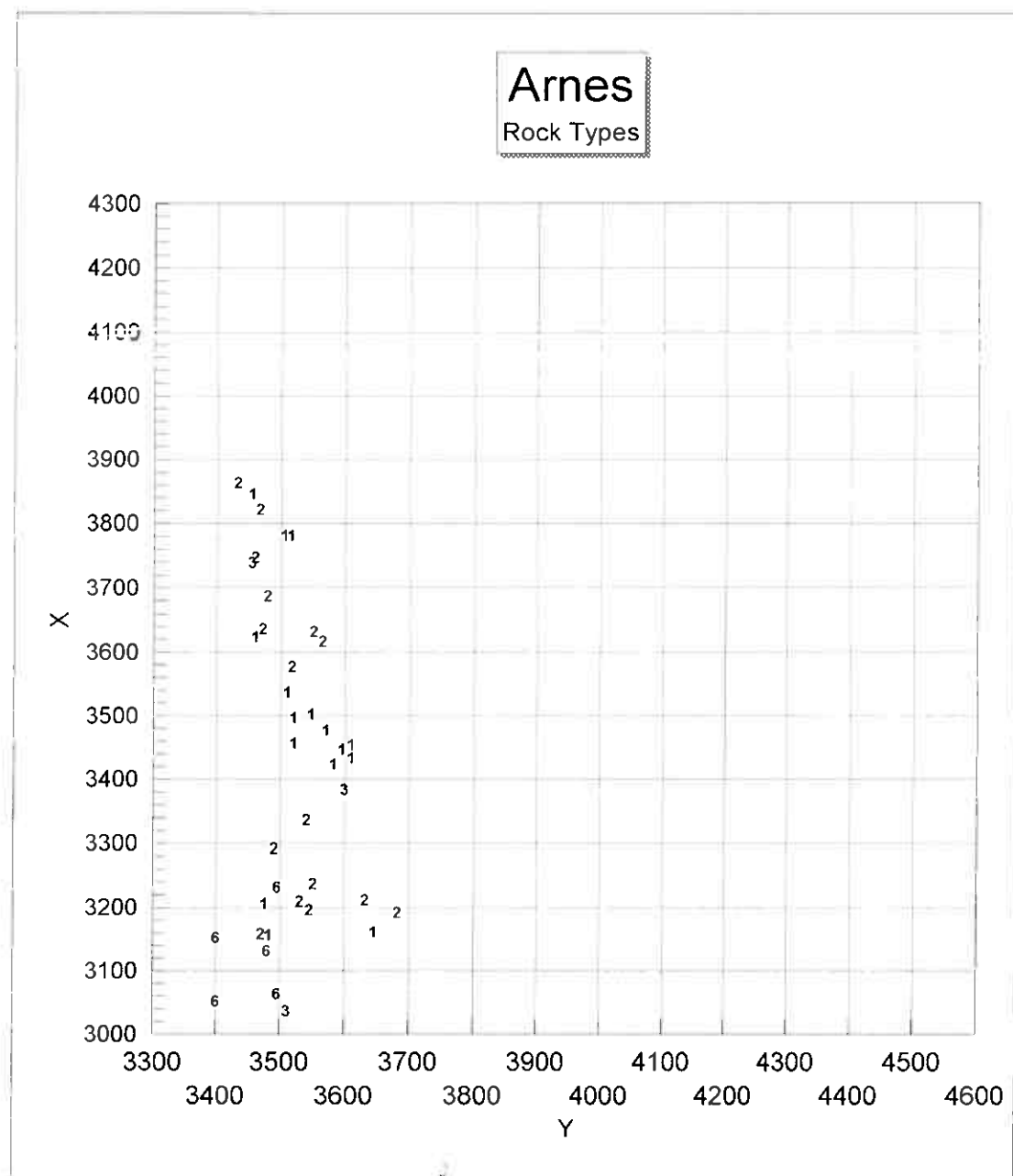
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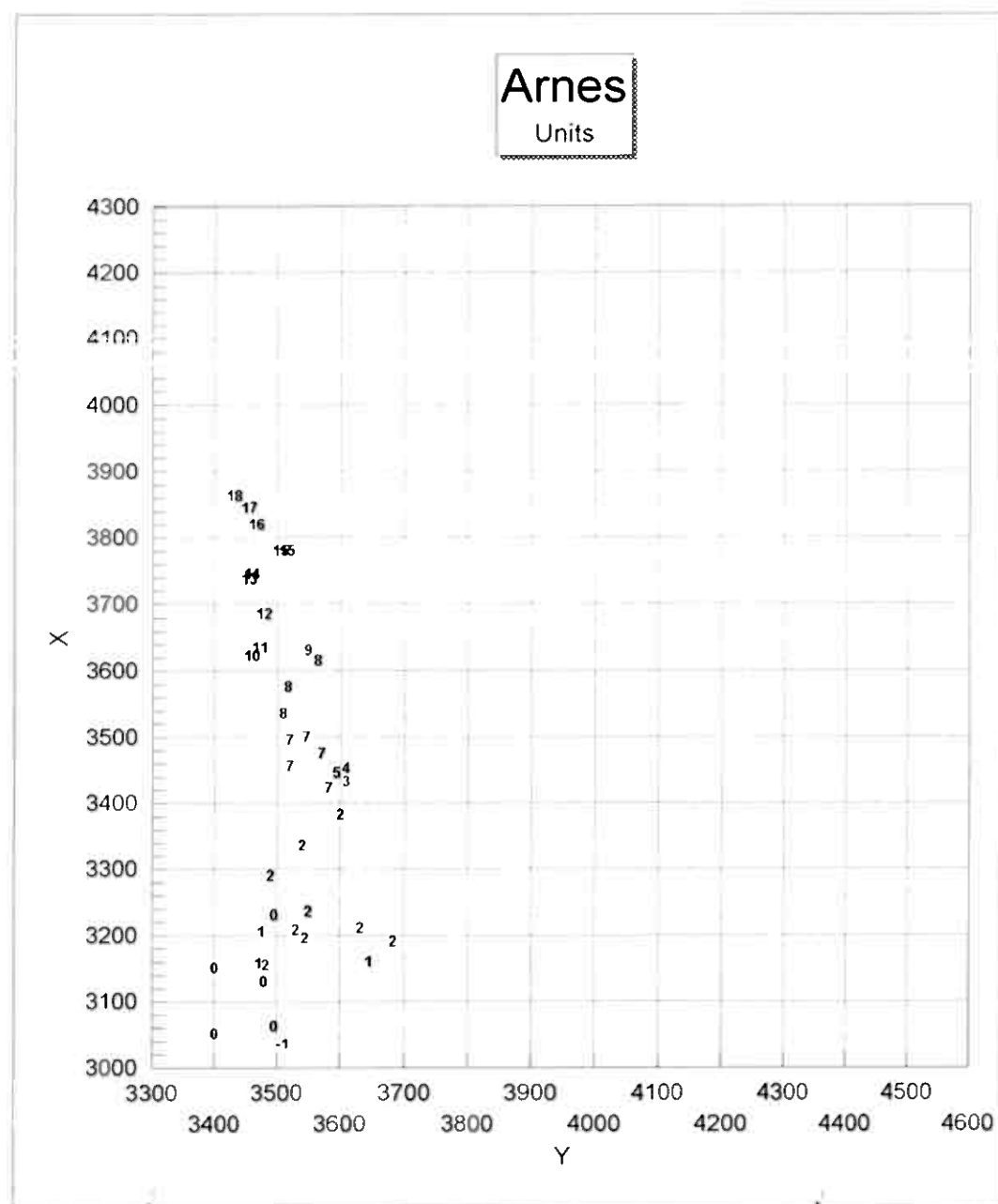


Arnes

Observation No underlined where samples







Arnes

Layering & schistosity

