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ENVIRONMENT CANADA
CONSERVATION AND PROTECTION
ENVIRONMENTAL PROTECTION
PACIFIC AND YUKON REGION
NORTH VANCOUVER, B.C.

BASELINE MONITORING

SNIP PROJECT

- July 30, 1989 -

Data Report DR 91-02

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INTRODUCTION

The Snip project is located at the confluence of the Iskut River and Bronson Creek. The mine is situated at an elevation of 180 to 680 metres on the north-west side of the base of Johnny Mountain. The snip property is drained by Monsoon Creek which flow north towards the Iskut River. Dolly Varden char and cutthroat trout are present in Monsoon Lake. Sockeye are known to spawn at the mouth of Bronson Creek and in the side channels in front of the Bronson Creek airstrip. There is no suitable fish habitat upstream of the Cominco property since the creek is characterised by a single channel with fast flows, large boulders and cascading falls. Salmon utilise the lower 1 km of Sky Creek draining the west part of the property to the north west towards the Craig River. Small runs of chinook, pink and sockeye as well as cutthroat trout were identified (Figure 1).

The company is developing an underground mine. The gold and silver extraction will be performed by flotation. The tailings will be discharged in the tailings pond located in the headwaters of Monsoon Creek and Sky Creek.

Site Description

Station	Location	Remarks
1	Sky Creek at the mouth	Tea colour waters
2	Craig River downstream of Sky Creek	Influenced by glaciers
3	Monsoon Creek downstream	Tea colour waters
4	Bronson Creek upstream of Cominco camp	Influenced by glaciers

5	Iskut River upstream of Bronson Creek	Influenced by glaciers
6	Iskut River downstream of Monsoon Creek	Influenced by glaciers
7	Mine adit	Level 180
8	Mine adit	Level 300

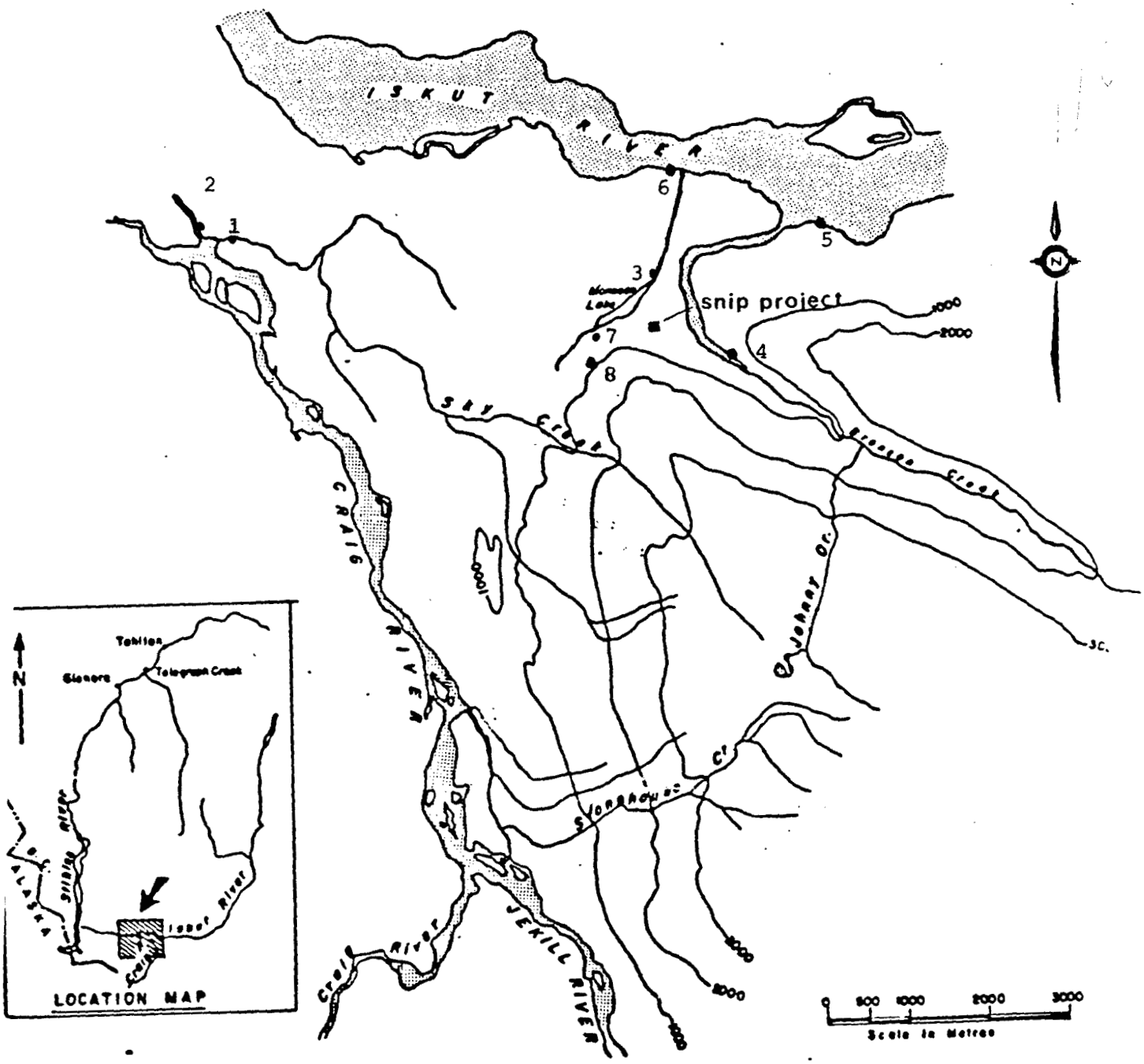


Figure 1 Snip Project - Sampling Sites

MATERIAL AND METHODS

The site was visited on July 30, 1989. No flow measurements were taken at the sites. Water chemistry and sediment samples were collected at the six receiving water stations but only water at the mine adit. The following chemical parameters were analysed: alkalinity, pH, conductivity, filterable residue, non filterable residue, and sulphate. These samples were kept cool with ice until analysed. Dissolved metals were filtered the same day through a 0.45 micron cellulose nitrate membrane filter. Total and dissolved metals were preserved with nitric acid (0.5 ml/100 ml of sample). All samples were collected with clean polyethylene bottles. The bottles for metal samples were previously acid washed. The hardness was determined from the dissolved metal sample.

Inductively Coupled Argon Plasma (ICAP) was used for the total and dissolved metal analysis and gave a reading of twenty-eight metals. For copper the samples were reanalysed with the graphite furnace when the values were below two times the detection limit on the ICAP procedure. For analytical method details refer to the Environment Canada Pacific Region Laboratory Manual (Anon, 1979).

Sediment samples were collected from the streambed, below the water level, with a clean acrylic corer. Four replicates were taken at each sites, except for stations 7 and 8. The samples were transferred into kraft bags and kept cool until analysed. The samples were air dried, sieved to <150 um, digested with aqua regia, and analysed for heavy metals using ICAP. A portion of the sediments were also ignited at 550° C in a muffle furnace. The loss of weight was reported as volatile residue and the remaining residue was reported as fixed residue.

RESULTS

The water metal results can be found in Table 1, while the other water quality results are found in Table 2. The sediment data are reported in Table 3.

Table 1

Metal Water Quality - Snip Project -
July 30, 1989

Station Number		TOTICP AG MG/L	DISICP AG MG/L	TOTICP AL MG/L	DISICP AL MG/L	TOTICP AS MG/L	DISICP AS MG/L	TOTICP BA MG/L	DISICP BA MG/L	TOTICP CA MG/L	DISICP CA MG/L	TOTICP CD MG/L	DISICP CD MG/L	TOTICP CO MG/L	DISICP CO MG/L	TOTICP CR MG/L	DISICP CR MG/L	TOTICP CU MG/L	TOTGF CU MG/L
	Repl.1	<.01	<.01	0.06	<.05	<.05	<.05	0.062	0.061	24.7	25.2	<.005	<.005	<.005	<.005	<.005	<.005	<.005	0.0008
	Repl.2	<.01	<.01	0.09	<.05	<.05	<.05	0.066	0.062	25.8	25.3	<.005	<.005	<.005	<.005	<.005	<.005	<.005	0.0010
1	Repl.3	<.01	<.01	0.09	<.05	<.05	<.05	0.061	0.061	24.8	25.2	0.007	<.005	<.005	<.005	<.005	<.005	<.005	0.0086
	Average	---	---	0.08	---	---	---	0.063	0.061	25.1	25.2	---	---	---	---	---	---	---	0.0035
	S.D.	---	---	0.02	---	---	---	0.003	0.001	0.6	0.1	---	---	---	---	---	---	---	0.0044
	Repl.1	<.01	<.01	4.44	0.08	<.05	<.05	0.082	0.013	9.7	7.6	0.006	<.005	<.005	<.005	<.005	<.005	<.005	0.0061
	Repl.2	<.01	<.01	5.08	0.06	<.05	<.05	0.092	0.014	10.0	7.7	<.005	<.005	<.005	<.005	<.005	<.005	<.005	0.0058
2	Repl.3	<.01	<.01	4.96	0.05	<.05	<.05	0.092	0.013	10.0	7.7	<.005	<.005	0.006	<.005	0.005	<.005	<.005	0.0069
	Average	---	---	4.83	0.06	---	---	0.089	0.013	9.9	7.7	---	---	---	---	---	---	---	0.0063
	S.D.	---	---	0.34	0.02	---	---	0.006	0.001	0.2	0.1	---	---	---	---	---	---	---	0.0006
	Repl.1	<.01	<.01	0.14	<.05	<.05	<.05	0.118	0.110	54.0	57.1	<.005	<.005	<.005	<.005	<.005	<.005	<.005	0.0031
	Repl.2	<.01	<.01	0.09	<.05	<.05	<.05	0.110	0.105	53.2	56.2	<.005	<.005	<.005	<.005	<.005	<.005	<.005	0.0029
3	Repl.3	<.01	<.01	<.05	<.05	<.05	<.05	0.117	0.105	55.9	55.7	<.005	<.005	<.005	<.005	<.005	<.005	<.005	0.0007
	Average	---	---	0.12	---	---	---	0.115	0.107	54.4	56.3	---	---	---	---	---	---	---	0.0022
	S.D.	---	---	0.04	---	---	---	0.004	0.003	1.4	0.7	---	---	---	---	---	---	---	0.0013
	Repl.1	<.01	<.01	4.53	0.07	<.05	<.05	0.114	0.028	16.2	14.2	<.005	<.005	<.005	<.005	0.008	<.005	0.018	0.0194
	Repl.2	0.02	<.01	6.08	0.07	<.05	<.05	0.138	0.028	17.1	14.2	<.005	<.005	<.005	<.005	0.010	<.005	0.028	---
4	Repl.3	<.01	<.01	6.02	0.07	<.05	<.05	0.134	0.028	17.0	14.5	<.005	<.005	<.005	<.005	<.005	<.005	0.022	---
	Average	---	---	5.54	0.07	---	---	0.129	0.028	16.8	14.3	---	---	---	---	0.009	---	0.023	---
	S.D.	---	---	0.88	0.00	---	---	0.013	0.000	0.5	0.2	---	---	---	---	0.001	---	0.005	---
	Repl.1	<.01	<.01	29.60	0.08	<.05	<.05	0.401	0.034	23.8	17.6	<.005	<.005	0.016	0.005	0.063	0.009	0.042	---
	Repl.2	<.01	<.01	30.90	<.05	<.05	<.05	0.423	0.032	24.8	17.1	<.005	<.005	0.025	0.006	0.067	0.008	0.044	---
5	Repl.3	<.01	<.01	29.20	0.09	<.05	<.05	0.401	0.032	24.0	16.9	<.005	<.005	0.029	<.005	0.066	<.005	0.044	---
	Average	---	---	29.90	0.09	---	---	0.408	0.033	24.2	17.2	---	---	0.023	0.006	0.065	0.009	0.043	---
	S.D.	---	---	0.89	0.01	---	---	0.013	0.001	0.5	0.4	---	---	0.007	0.001	0.002	0.001	0.001	---
	Repl.1	0.01	<.01	38.30	0.08	<.05	<.05	0.510	0.032	29.1	17.6	<.005	<.005	<.005	<.005	0.075	<.005	0.049	---
	Repl.2	<.01	<.01	36.60	0.07	<.05	<.05	0.481	0.035	27.8	17.9	<.005	<.005	<.005	<.005	0.072	<.005	0.044	---
6	Repl.3	<.01	<.01	37.40	0.08	<.05	<.05	0.502	0.036	28.2	17.7	<.005	<.005	<.005	<.005	0.070	<.005	0.045	---
	Average	---	---	37.43	0.08	---	---	0.498	0.034	28.4	17.7	---	---	---	---	0.072	---	0.046	---
	S.D.	---	---	0.85	0.01	---	---	0.015	0.002	0.7	0.2	---	---	---	---	0.003	---	0.003	---
7		<.01	<.01	6.22	<.05	<.05	<.05	0.137	0.053	77.2	65.2	<.005	<.005	0.020	<.005	0.009	<.005	0.112	---
8		<.01	<.01	16.80	<.05	<.05	<.05	0.455	0.100	83.5	53.0	<.005	<.005	0.030	<.005	0.012	<.005	0.113	---
blank		<.01	<.01	<.05	<.05	<.05	<.05	<.001	<.001	<.1	<.1	<.005	<.005	<.005	<.005	<.005	<.005	<.005	<.0006
blank		<.01	<.01	<.05	<.05	<.05	<.05	<.001	<.001	<.1	<.1	0.008	<.005	<.005	<.005	<.005	<.005	<.005	<.0006

Table 1 (cont.)

Metal Water Quality - Snip Project -
July 30, 1989

Station Number		DISICP CU MG/L	DISGF CU MG/L	TOTICP FE MG/L	DISICP FE MG/L	TOTICP K MG/L	DISICP K MG/L	TOTICP MG MG/L	DISICP MG MG/L	TOTICP MN MG/L	DISICP MN MG/L	TOTICP MO MG/L	DISICP MO MG/L	TOTICP NA MG/L	DISICP NA MG/L	TOTICP NI MG/L	DISICP NI MG/L	TOTICP P MG/L	DISICP P MG/L
	Repl.1	<.005	<.0005	1.52	0.732	<2	<2	2.5	2.5	0.327	0.326	<.01	<.01	2.4	2.3	<.02	<.02	<.1	<.1
	Repl.2	<.005	<.0005	1.69	0.743	<2	<2	2.7	2.5	0.343	0.327	<.01	<.01	2.4	2.3	<.02	<.02	<.1	<.1
1	Repl.3	<.005	<.0005	1.55	0.803	<2	3	2.5	2.5	0.327	0.325	<.01	<.01	2.3	2.3	<.02	<.02	<.1	<.1
	Average	---	---	1.59	0.759	---	---	2.6	2.5	0.332	0.326	---	---	2.4	2.3	---	---	---	---
	S.D.	---	---	0.09	0.038	---	---	0.1	0.0	0.009	0.001	---	---	0.1	0.0	---	---	---	---
	Repl.1	<.005	<.0005	4.16	0.061	<2	<2	2.9	0.4	0.111	0.021	<.01	<.01	1.1	0.3	<.02	<.02	<.1	<.1
	Repl.2	<.005	<.0005	4.67	0.065	<2	<2	3.1	0.4	0.121	0.021	<.01	<.01	1.2	0.3	<.02	<.02	0.1	<.1
2	Repl.3	<.005	<.0005	4.64	0.053	<2	<2	3.1	0.4	0.120	0.021	<.01	<.01	1.4	0.3	<.02	<.02	0.2	<.1
	Average	---	---	4.49	0.060	---	---	3.0	0.4	0.117	0.021	---	---	1.2	0.3	---	---	0.2	---
	S.D.	---	---	0.29	0.006	---	---	0.1	0.0	0.006	0.000	---	---	0.2	0.0	---	---	0.1	---
	Repl.1	<.005	<.0005	1.13	0.103	4	6	5.1	5.1	0.532	0.288	<.01	<.01	3.3	3.3	<.02	<.02	<.1	<.1
	Repl.2	<.005	<.0005	0.85	0.094	4	6	5.0	4.9	0.394	0.291	<.01	<.01	3.1	3.1	<.02	<.02	<.1	<.1
3	Repl.3	<.005	<.0005	0.80	0.096	3	6	5.3	4.9	0.399	0.284	<.01	<.01	3.3	3.1	<.02	<.02	<.1	<.1
	Average	---	---	0.93	0.098	4	6	5.1	5.0	0.442	0.288	---	---	3.2	3.2	---	---	---	---
	S.D.	---	---	0.18	0.005	1	0	0.2	0.1	0.078	0.004	---	---	0.1	0.1	---	---	---	---
	Repl.1	<.005	<.0005	5.71	0.032	<2	<2	3.1	1.1	0.253	0.051	<.01	<.01	1.0	0.5	<.02	<.02	0.2	<.1
	Repl.2	<.005	<.0005	6.90	0.017	<2	<2	3.5	1.1	0.276	0.050	<.01	<.01	1.4	0.5	<.02	<.02	0.2	<.1
4	Repl.3	<.005	<.0005	6.71	0.019	<2	<2	3.4	1.2	0.273	0.052	<.01	<.01	1.3	0.5	<.02	<.02	0.2	<.1
	Average	---	---	6.44	0.023	---	---	3.3	1.1	0.267	0.051	---	---	1.2	0.5	---	---	0.2	---
	S.D.	---	---	0.64	0.008	---	---	0.2	0.1	0.013	0.001	---	---	0.2	0.0	---	---	0.0	---
	Repl.1	<.005	<.0005	32.90	0.015	5	2	13.0	2.1	0.767	0.015	<.01	<.01	3.2	0.8	0.06	<.02	0.6	<.1
	Repl.2	<.005	<.0005	34.80	0.013	6	3	13.7	2.0	0.804	0.012	<.01	<.01	3.4	0.7	0.06	<.02	0.6	<.1
5	Repl.3	<.005	<.0005	33.10	0.024	6	<2	13.1	2.0	0.772	0.014	<.01	<.01	3.2	0.8	0.06	<.02	0.6	<.1
	Average	---	---	33.60	0.017	6	3	13.3	2.0	0.781	0.014	---	---	3.3	0.8	0.06	---	0.6	---
	S.D.	---	---	1.04	0.006	1	1	0.4	0.1	0.020	0.002	---	---	0.1	0.1	0.00	---	0.0	---
	Repl.1	<.005	<.0005	40.80	0.012	8	<2	17.3	2.1	1.080	0.010	<.01	<.01	3.7	0.9	0.07	<.02	0.8	<.1
	Repl.2	<.005	<.0005	38.60	0.015	6	<2	16.4	2.3	1.030	0.010	<.01	<.01	3.8	0.9	0.06	<.02	0.8	<.1
6	Repl.3	<.005	<.0005	39.80	0.029	5	<2	16.8	2.3	1.040	0.009	<.01	<.01	3.9	0.9	0.06	<.02	0.8	<.1
	Average	---	---	39.73	0.019	6	---	16.8	2.2	1.050	0.010	---	---	3.8	0.9	0.06	---	0.8	---
	S.D.	---	---	1.10	0.009	2	---	0.5	0.1	0.026	0.001	---	---	0.1	0.0	0.01	---	0.0	---
7		<.005	<.0005	20.20	<.005	9	7	14.0	10.2	0.527	0.077	0.02	0.03	8.4	8.7	<.02	<.02	0.4	<.1
8		<.005	<.0005	31.00	0.015	13	7	17.8	9.0	0.908	0.068	0.04	0.03	7.6	4.9	<.02	<.02	0.9	<.1
blank		<.005	<.0005	<.005	<.005	<2	<2	<.1	<.1	<.001	<.001	<.01	<.01	<.1	<.1	<.02	<.02	<.1	<.1
blank		<.005	<.0005	<.005	<.005	<2	<2	<.1	<.1	<.001	<.001	<.01	<.01	<.1	<.1	<.02	<.02	<.1	<.1

Table 1 (cont.)

Metal Water Quality - Snip Project -
July 30, 1989

Station Number		TOTICP PB MG/L	DISICP PB MG/L	TOTICP SB MG/L	DISICP SB MG/L	TOTICP SE MG/L	DISICP SE MG/L	TOTICP SI MG/L	DISICP SI MG/L	TOTICP SN MG/L	DISICP SN MG/L	TOTICP SR MG/L	DISICP SR MG/L	TOTICP TI MG/L	DISICP TI MG/L	TOTICP V MG/L	DISICP V MG/L	TOTICP ZN MG/L	DISICP ZN MG/L
	Repl.1	<.05	<.05	<.05	<.05	<.05	<.05	3.16	3.26	<.05	<.05	0.110	0.111	0.009	<.002	<.01	<.01	0.004	<.002
	Repl.2	<.05	<.05	<.05	<.05	<.05	<.05	3.35	3.25	<.05	<.05	0.116	0.112	0.013	<.002	<.01	<.01	0.006	<.002
1	Repl.3	<.05	<.05	<.05	<.05	<.05	<.05	3.14	3.23	<.05	<.05	0.108	0.111	0.010	<.002	<.01	<.01	0.008	<.002
	Average	---	---	---	---	---	---	3.22	3.25	---	---	0.111	0.111	0.011	---	---	---	0.006	---
	S.D.	---	---	---	---	---	---	0.12	0.02	---	---	0.004	0.001	0.002	---	---	---	0.002	---
	Repl.1	<.05	<.05	<.05	<.05	<.05	<.05	8.81	0.73	<.05	<.05	0.053	0.027	0.331	0.002	<.01	<.01	0.041	<.002
	Repl.2	<.05	<.05	<.05	<.05	<.05	<.05	10.40	0.74	<.05	<.05	0.058	0.028	0.377	0.002	<.01	<.01	0.032	<.002
2	Repl.3	<.05	<.05	<.05	<.05	<.05	<.05	10.20	0.72	<.05	<.05	0.058	0.027	0.373	<.002	0.02	<.01	0.010	<.002
	Average	---	---	---	---	---	---	9.80	0.73	---	---	0.056	0.027	0.360	0.002	---	---	0.028	---
	S.D.	---	---	---	---	---	---	0.87	0.01	---	---	0.003	0.001	0.025	0.000	---	---	0.016	---
	Repl.1	<.05	<.05	<.05	<.05	<.05	<.05	2.34	2.33	<.05	<.05	0.486	0.496	0.009	<.002	<.01	<.01	0.029	<.002
	Repl.2	<.05	<.05	<.05	<.05	<.05	<.05	2.20	2.28	<.05	<.05	0.470	0.475	0.006	<.002	<.01	<.01	0.006	<.002
3	Repl.3	<.05	<.05	<.05	<.05	<.05	<.05	2.25	2.26	<.05	<.05	0.504	0.474	0.008	<.002	<.01	<.01	<.002	<.002
	Average	---	---	---	---	---	---	2.26	2.29	---	---	0.487	0.482	0.008	---	---	---	0.018	---
	S.D.	---	---	---	---	---	---	0.07	0.04	---	---	0.017	0.012	0.002	---	---	---	0.016	---
	Repl.1	<.05	<.05	<.05	<.05	<.05	<.05	7.17	0.69	<.05	<.05	0.097	0.076	0.302	<.002	0.02	<.01	0.036	<.002
	Repl.2	<.05	<.05	<.05	<.05	<.05	<.05	10.10	0.68	<.05	<.05	0.109	0.076	0.371	<.002	0.02	<.01	0.047	<.002
4	Repl.3	<.05	<.05	<.05	<.05	<.05	<.05	9.91	0.69	<.05	<.05	0.110	0.078	0.374	<.002	0.01	<.01	0.069	<.002
	Average	---	---	---	---	---	---	9.06	0.69	---	---	0.105	0.077	0.349	---	0.02	---	0.051	---
	S.D.	---	---	---	---	---	---	1.64	0.01	---	---	0.007	0.001	0.041	---	0.01	---	0.017	---
	Repl.1	<.05	0.06	<.05	<.05	<.05	0.07	42.10	0.93	<.05	0.05	0.159	0.096	0.774	<.002	0.09	0.01	0.106	<.002
	Repl.2	<.05	0.06	<.05	<.05	<.05	<.05	43.90	0.89	<.05	<.05	0.167	0.092	0.801	<.002	0.09	0.02	0.139	<.002
5	Repl.3	<.05	<.05	<.05	<.05	<.05	<.05	41.60	0.89	<.05	<.05	0.160	0.093	0.746	<.002	0.09	<.01	0.099	<.002
	Average	---	0.06	---	---	---	---	42.53	0.90	---	---	0.162	0.094	0.774	---	0.09	0.02	0.115	---
	S.D.	---	0.00	---	---	---	---	1.21	0.02	---	---	0.004	0.002	0.028	---	0.00	0.01	0.021	---
	Repl.1	<.05	<.05	<.05	<.05	<.05	<.05	51.90	0.91	<.05	<.05	0.186	0.097	1.240	<.002	0.12	<.01	0.132	<.002
	Repl.2	0.05	<.05	<.05	<.05	<.05	<.05	49.50	0.96	<.05	<.05	0.178	0.107	1.100	<.002	0.11	<.01	0.150	<.002
6	Repl.3	<.05	<.05	<.05	<.05	<.05	<.05	50.20	0.97	<.05	<.05	0.183	0.105	1.100	<.002	0.11	<.01	0.123	<.002
	Average	---	---	---	---	---	---	50.53	0.95	---	---	0.182	0.103	1.147	---	0.11	---	0.135	---
	S.D.	---	---	---	---	---	---	1.23	0.03	---	---	0.004	0.005	0.081	---	0.01	---	0.014	---
7		0.07	<.05	<.05	<.05	<.05	<.05	14.40	4.89	<.05	<.05	1.370	1.400	0.579	<.002	0.03	<.01	0.233	0.008
8		0.06	<.05	<.05	<.05	<.05	0.07	31.30	4.39	<.05	<.05	1.020	0.804	1.500	<.002	0.08	<.01	0.393	<.002
blank		<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.001	<.001	0.005	<.002	<.01	<.01	0.016	<.002
blank		<.05	<.05	<.05	<.05	0.22	<.05	<.05	<.05	<.05	<.05	<.001	<.001	0.004	<.002	<.01	<.01	<.002	<.002

Table 2

Water Quality - Snip Project -
July 30, 1989

Station Number		ALK MG/L	PH REL.U.	DISICP HC MG/L	DISICP HT MG/L	COND UMHO/C	FR MG/L	NFR MG/L	SO4 MG/L
	Repl.1	68.2	8.2	73.0	75.0	143	95	<5	8
	Repl.2	67.7	8.2	73.3	75.3	143	100	<5	7
1	Repl.3	68.2	8.2	72.9	75.0	143	100	6	7
	Average	68.0	8.2	73.1	75.1	143	98	---	7
	S.D.	0.3	0.0	0.2	0.2	0	3	---	1
	Repl.1	20.9	7.7	20.6	21.2	45	30	91	3
	Repl.2	20.9	7.7	20.8	21.3	45	30	64	3
2	Repl.3	20.9	7.7	20.8	21.3	45	30	93	3
	Average	20.9	7.7	20.7	21.3	45	30	83	3
	S.D.	0.0	0.0	0.1	0.1	0	0	16	0
	Repl.1	119.0	8.4	163.0	165.0	285	200	<5	37
	Repl.2	119.0	8.4	160.0	162.0	255	207	<5	41
3	Repl.3	119.0	8.4	159.0	161.0	255	210	<5	41
	Average	119.0	8.4	160.7	162.7	265	206	---	40
	S.D.	0.0	0.0	2.1	2.1	17	5	---	2
	Repl.1	26.9	7.9	40.1	40.7	90	50	109	15
	Repl.2	27.4	7.9	40.2	40.8	88	50	109	16
4	Repl.3	27.4	7.9	41.0	41.7	90	50	110	16
	Average	27.2	7.9	40.4	41.1	89	50	109	16
	S.D.	0.3	0.0	0.5	0.6	1	0	1	1
	Repl.1	42.3	8.1	52.7	53.4	98	80	590	13
	Repl.2	41.8	8.1	51.0	51.2	100	80	580	13
5	Repl.3	41.8	8.1	50.5	51.2	98	80	600	12
	Average	42.0	8.1	51.4	51.9	99	80	590	13
	S.D.	0.3	0.0	1.2	1.3	1	0	10	1
	Repl.1	44.3	8.1	52.6	53.2	98	90	730	14
	Repl.2	44.3	8.1	54.0	54.6	103	100	690	14
6	Repl.3	44.8	8.1	53.7	54.3	103	90	720	14
	Average	44.5	8.1	53.4	54.0	101	93	713	14
	S.D.	0.3	0.0	0.7	0.7	3	6	21	0
	7	134	8.3	205	207	375	250	140	70
	8	135	8.3	169	171	320	240	580	58
Blank		1.5	5.4	<.4	0.5	1	<5	<5	<1
Blank		1.5	5.8	<.4	<.4	1	<5	<5	<1

Table 3

Sediment Quality - Snip Project -
July 30, 1989

Station Number		AG UG/G	AL UG/G	AS UG/G	BA UG/G	BE UG/G	CA UG/G	CD UG/G	CO UG/G	CR UG/G	CU UG/G	FE UG/G	HG UG/G	K UG/G	MG UG/G
	Repl.1	<2	12300	<8	173	0.3	10600	<.8	<20	18.3	25.8	37100	<.008	2900	8520
	Repl.2	<2	8140	<8	100	<.2	7420	<.8	<20	21.5	17.7	52100	0.009	1000	5410
1	Repl.3	<2	13100	<8	175	0.3	15500	<.8	<20	18.9	18.0	37300	<.008	3100	10800
	Repl.4	<2	12700	<8	178	0.3	14400	<.8	<20	19.6	19.9	39600	0.010	3100	10200
	Average	---	11560	---	156	0.3	11980	---	---	19.6	20.4	41525	0.010	2525	8733
	S.D.	---	2303	---	38	0.0	3694	---	---	1.4	3.8	7141	0.001	1021	2416
	Repl.1	<2	12800	<8	149	0.3	19300	<.8	<20	15.0	9.7	30800	0.009	3000	13100
	Repl.2	<2	14100	<8	162	0.3	21600	<.8	<20	15.0	13.0	31200	<.008	3400	15900
2	Repl.3	<2	12100	<8	146	0.3	18900	<.8	<20	16.9	14.0	40200	<.008	3000	12700
	Repl.4	<2	10700	<8	138	0.2	15400	<.8	<20	21.1	15.0	59600	0.010	2600	10400
	Average	---	12425	---	149	0.3	18800	---	---	17.0	12.9	40450	0.010	3000	13025
	S.D.	---	1417	---	10	0.0	2560	---	---	2.9	2.3	13484	0.001	327	2256
	Repl.1	<2	18600	49	469	0.3	9960	2.0	<20	34.5	161.0	65200	0.020	5200	10500
	Repl.2	<2	17100	74	645	0.3	12400	2.5	<20	35.1	227.0	85900	0.010	5200	9770
3	Repl.3	<2	17400	48	466	0.3	9870	1.8	<20	34.4	165.0	65500	0.018	5100	9840
	Repl.4	<2	16100	86	782	0.3	13100	2.1	<20	34.5	330.0	101000	<.008	4900	9000
	Average	---	17300	64	591	0.3	11333	2.1	---	34.6	220.8	79400	0.016	5100	9778
	S.D.	---	1030	19	153	0.0	1662	0.3	---	0.3	78.9	17356	0.005	141	614
	Repl.1	<2	15300	58	215	0.2	22000	2.0	<20	23.2	229.0	80700	0.009	6000	7910
	Repl.2	<2	14400	140	179	<.2	19900	1.7	20	21.2	294.0	117000	<.008	5400	7320
4	Repl.3	<2	16300	51	208	0.2	22000	2.4	<20	23.7	179.0	74800	<.008	6200	8000
	Repl.4	<2	15500	120	198	0.2	19700	1.9	20	23.5	291.0	109000	<.008	5800	7810
	Average	---	15375	92	200	0.2	20900	2.0	20	22.9	248.3	95375	---	5850	7760
	S.D.	---	780	44	16	0.0	1273	0.3	0	1.2	55.0	20752	---	342	303
	Repl.1	<2	16600	30	247	0.3	13300	1.0	<20	30.6	131.0	57000	0.010	4400	10600
	Repl.2	<2	17000	65	272	0.3	14400	1.6	<20	33.2	200.0	73100	0.010	5500	10500
5	Repl.3	<2	17000	53	276	0.3	14200	2.3	<20	30.5	207.0	71500	0.010	5800	9940
	Repl.4	<2	14800	29	249	0.3	15900	1.0	<20	26.2	126.0	53300	0.009	4500	9190
	Average	---	16350	44	261	0.3	14450	1.5	---	30.1	166.0	63725	0.010	5050	10058
	S.D.	---	1050	18	15	0.0	1079	0.6	---	2.9	43.4	10037	0.001	705	647
	Repl.1	<2	18500	23	290	0.4	13100	<.8	<20	45.9	62.3	59100	0.020	2700	12300
	Repl.2	<2	17700	47	300	0.4	13400	<.8	<20	48.0	85.9	67900	0.026	2100	12400
6	Repl.3	<2	17700	47	267	0.4	13500	<.8	<20	47.6	84.3	66500	0.026	2400	12500
	Repl.4	<2	18100	21	308	0.4	13000	<.8	<20	47.5	79.9	65400	0.042	2200	12800
	Average	---	18000	35	291	0.4	13250	---	---	47.3	78.1	64725	0.029	2350	12500
	S.D.	---	383	14	18	0.0	238	---	---	0.9	10.8	3887	0.009	265	216
NBS1646	25	<2	20300	<8	41.8	0.8	4290	<.8	<20	45.0	10	28300	0.058	4600	8910
NBS1646	26	<2	19800	<8	40.2	0.8	4180	<.8	<20	44.3	11	27600	0.068	4800	8720
NBS1646	27	<2	19200	<8	39.6	0.8	4130	<.8	<20	43.6	10	27400	0.073	4700	8610
NBS1645	28	<2	6000	71	50.1	0.6	29600	9.8	40	28900	120	104000	0.921	600	7000
NBS1645	29	<2	5900	65	51.6	0.6	29800	9.0	40	28500	113	102000	0.816	800	7130
NBS1645	30	<2	6060	71	51.4	0.6	29900	9.4	40	29500	118	107000	0.881	600	7130

Table 3 (cont.)

Sediment Quality - Snip Project -
July 30, 1989

Station Number		MN UG/G	MO UG/G	NA UG/G	NI UG/G	P UG/G	PB UG/G	SI UG/G	SN UG/G	SR UG/G	TI UG/G	V UG/G	ZN UG/G	SFR MG/KG	SVR MG/KG
	Repl.1	418	<2	370	10	1300	10	581	<8	51.5	1380	82	80.9	979000	20800
	Repl.2	320	<2	280	9	1400	<8	427	<8	42.5	1000	130	65.2	986000	14200
1	Repl.3	436	<2	380	10	1400	10	724	<8	55.1	1340	80	82.8	976000	23600
	Repl.4	470	<2	400	10	1300	10	739	<8	54.8	1270	81	109.0	974000	26100
	Average	411	---	358	10	1350	10	618	---	51.0	1248	93	84.5	978750	21175
	S.D.	64	---	53	1	58	0	146	---	5.9	171	25	18.2	5252	5129
	Repl.1	363	<2	420	10	1500	9	663	<8	56.7	1220	78	57.5	985000	15300
	Repl.2	399	<2	470	10	1500	10	724	<8	60.6	1320	81	66.2	983000	16800
2	Repl.3	366	<2	460	10	1500	10	645	<8	54.6	1200	100	63.9	984000	15800
	Repl.4	381	<2	380	10	1600	10	601	<8	52.1	1140	150	64.8	984000	15900
	Average	377	---	433	10	1525	10	658	---	56.0	1220	102	63.1	984000	15950
	S.D.	17	---	41	0	50	1	51	---	3.6	75	33	3.9	816	624
	Repl.1	3060	10	540	33	1670	71	827	<8	89.8	1370	90	329.0	956000	43600
	Repl.2	9380	20	700	47	1700	66	1110	<8	113.0	1330	93	436.0	953000	47200
3	Repl.3	5320	10	510	34	1650	72	797	<8	90.0	1260	84	340.0	965000	34500
	Repl.4	9820	25	560	47	1600	37	1180	<8	131.0	1250	87	479.0	941000	58800
	Average	6895	16	578	40	1655	62	979	---	106.0	1303	89	396.0	953750	46025
	S.D.	3262	7	84	8	42	17	195	---	19.9	57	4	73.3	9912	10055
	Repl.1	915	7	640	39	1400	80	595	<8	90.7	1070	79	366.0	960000	40400
	Repl.2	874	7	560	52	1500	96	725	<8	80.4	1020	84	394.0	935000	64600
4	Repl.3	952	4	670	36	1400	53	596	<8	90.4	1090	78	352.0	960000	40000
	Repl.4	954	7	630	52	1400	150	648	<8	83.1	1120	87	428.0	943000	57100
	Average	924	6	625	45	1425	95	641	---	86.2	1075	82	385.0	949500	50525
	S.D.	38	2	47	8	50	41	61	---	5.2	42	4	33.6	12557	12310
	Repl.1	937	4	490	32	1300	45	762	<8	67.7	1130	83	232.0	979000	21400
	Repl.2	1000	7	540	38	1500	56	801	<8	75.6	1260	94	277.0	974000	26400
5	Repl.3	964	6	570	33	1600	54	807	<8	78.4	1240	88	348.0	975000	25000
	Repl.4	886	4	460	30	1400	48	694	<8	69.9	1040	75	259.0	980000	20300
	Average	947	5	515	33	1450	51	766	---	72.9	1168	85	279.0	977000	23275
	S.D.	48	2	49	3	129	5	52	---	5.0	102	8	49.6	2944	2893
	Repl.1	830	3	480	44	1200	39	651	<8	64.8	1220	110	203.0	977000	23500
	Repl.2	830	4	410	48	1100	31	716	<8	58.6	1230	120	167.0	973000	26700
6	Repl.3	815	3	590	50	1200	29	756	<8	61.3	1170	110	247.0	976000	23500
	Repl.4	816	5	480	50	1200	34	768	<8	59.6	1190	120	208.0	974000	25700
	Average	823	4	490	48	1175	33	723	---	61.1	1203	115	206.3	975000	24850
	S.D.	8	1	74	3	50	4	53	---	2.7	28	6	32.7	1826	1611
NBS1646	25	267	<2	11000	25	510	24	980	<8	31.7	617	53	120.0	---	---
NBS1646	26	260	<2	10700	24	500	25	900	<8	31.1	606	52	117.0	---	---
NBS1646	27	256	<2	10500	24	490	25	887	<8	30.6	588	52	113.0	---	---
NBS1645	28	775	18	1100	37	450	722	667	393	797.0	192	24	1770.0	---	---
NBS1645	29	775	17	1100	38	450	725	740	405	813.0	189	24	1760.0	---	---
NBS1645	30	795	19	1100	40	450	728	743	414	821.0	198	25	1790.0	---	---

Sky Creek site (station 1) is characterised by relatively low aluminum, copper, iron, manganese, lead, and zinc sediment concentrations in comparison with the other sites in this survey. This is a reflection of good water quality with low metal content with good buffering capacity and hardness.

The Craig River site (station 2) downstream of Sky Creek, shows sediment content low in aluminum, copper, iron, mercury, manganese, lead, and zinc. Calcium content is high with 18.8 mg/g. High aluminum and iron content in the water did not reveal significant difference between station 1 and 2 in the sediment content. High variability in total zinc concentration was noticed although the metal could not be detected in the dissolved form. Craig River had a lower alkalinity, hardness, pH and filterable residue, although high non filterable residue was encountered (83 mg/l).

The Monsoon Creek site (station 3) sediment content showed detectable arsenic with an average of 64 ug/g as well as cadmium with an average of 2.1 ug/g. Significantly higher aluminum, copper, iron, lead, manganese, and zinc sediment content than station 1 was found in these two creeks with tea colour water. However the organic content of the station 3 sediments was 4.6% compared to 1.9%. No significant difference could be detected between the two stations with any of the metals. Station 3 showed higher alkalinity (119 mg/l) and hardness (160 mg/l) levels than any other stations in the survey. It could be suggested that the amount of organic content detected in the sediment and the high carbonates as shown in the water hardness, were promoting the precipitation of the metals into the sediments and controlling the amount of metal present in the waters. Sulphate levels were the highest of the receiving water stations surveyed with 40 mg/l.

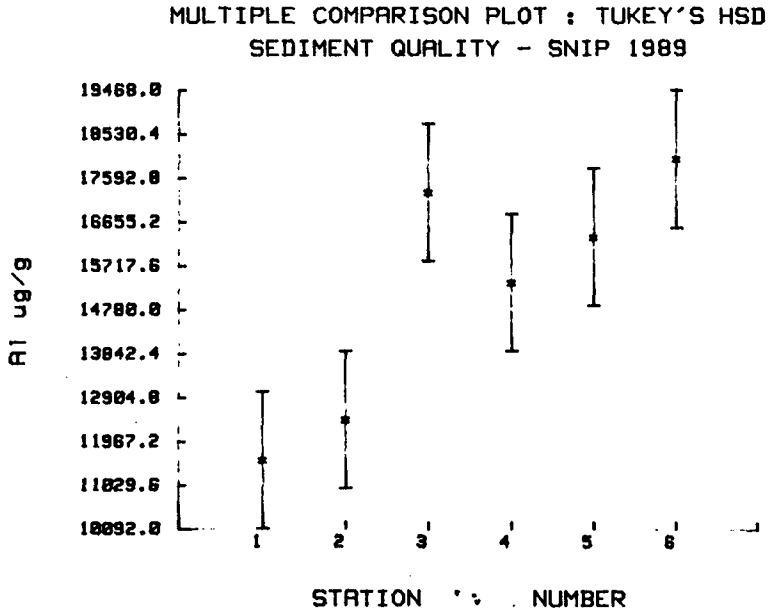
The Bronson Creek site (station 4) upstream of the Cominco camp is located about 3 km from the mouth of the creek. The area is influenced by the Bronson Glacier, Johnny Creek (receiving Skyline mine discharge) and natural acid rock drainage generated from the canyon walls in the lower part

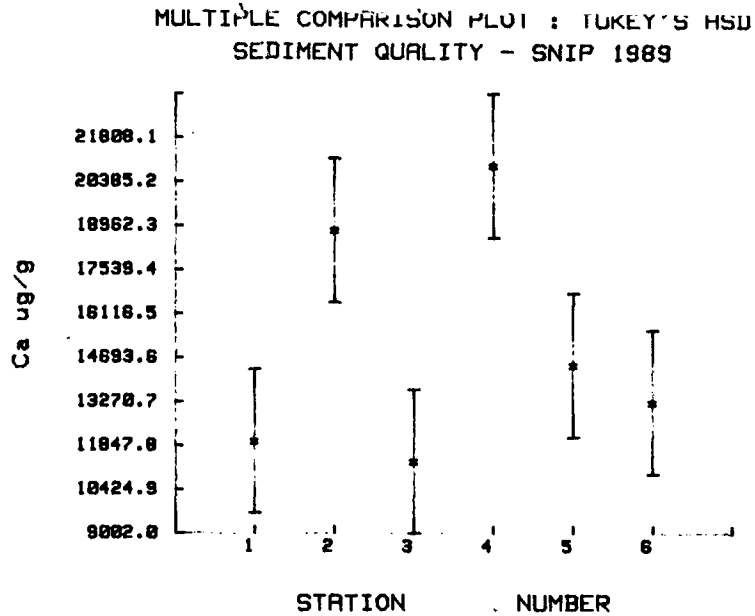
of the system. Sediment content showed detectable values for arsenic with an average of 92 ug/g and cadmium with an average value of 2.0 ug/g. High sediment values were found for most contaminants described in Figure 2 except for mercury and manganese, however no significant differences could be detected between the station 3 and 4 except for calcium. The high calcium content at station 4 could be attributed to the effect of liming the mine effluent at Skyline mmine. The loss on ignition represents the highest percentage composition of the station surveyed with an average of 5.1%. Water quality showed high total copper values with 23 ug/l but no detectable dissolved copper with the graphite furnace.

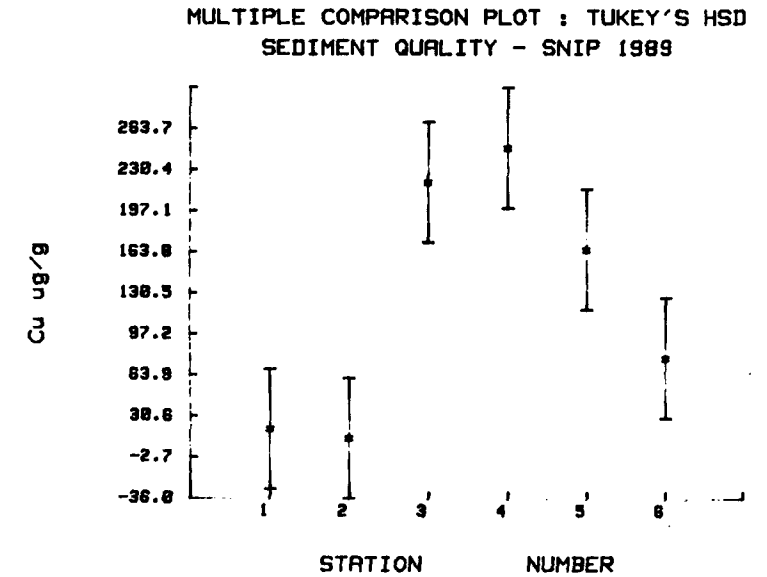
The Iskut River site upstream of the Bronson Creek (station 5) showed detectable levels of arsenic (44 ug/g) and cadmium (1.5 ug/g) in the sediments. Sediment content was low for calcium, mercury, and manganese. Aluminum, copper, concentrations were not significantly different than station 4. However iron, lead and zinc were significantly different than station 4. The water quality at station 5 is dominated by the high suspended solids content which was as an average 590 mg/l. Total metals were generally high for many contaminants such as aluminum, copper, and zinc however the dissolved fraction was close to or below the detection limit.

The Iskut River site downstream of Bronson Creek (station 6) showed generally lower contaminant levels in the sediments except for aluminum, and mercury. In the case of mercury, the average concentration at that site was 29 ng/g which was significantly different than any other site. The mercury concentration is not uncommon, however no explanation could be given for the sudden increase in concentration. The water quality at station 6 is dominated by the high non filteralble residue (713 mg/l). The dissolved metal fraction showed values close to or below the detection limit compared to total metal, especially for aluminum, copper and zinc.

Mine water collected at the level 180 (station 7) and 300 (station 8) showed high total copper levels (0.112 and 0.113 mg/l), and zinc (0.233 and 0.393 mg/l). The dissolved metal content for these two metals was below the detection limit.







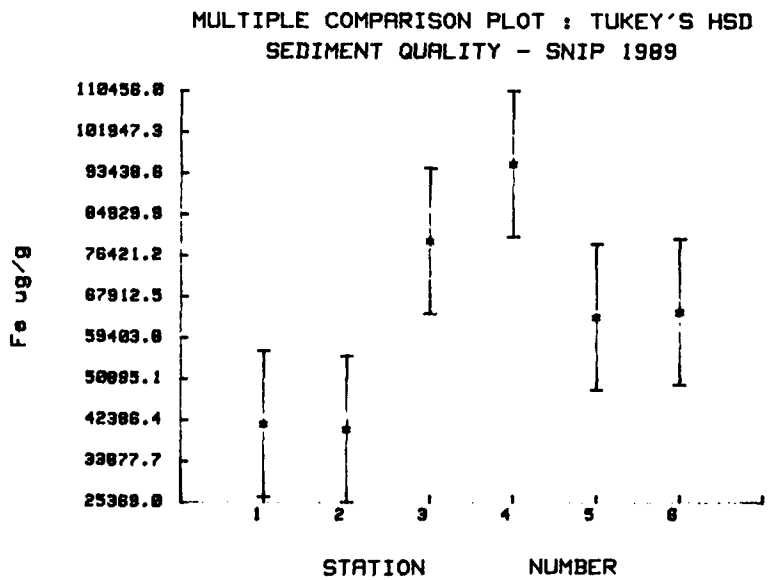
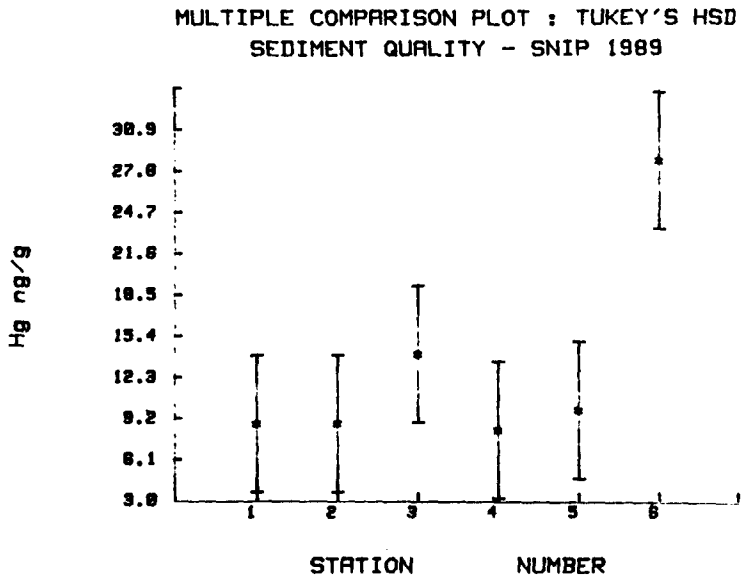
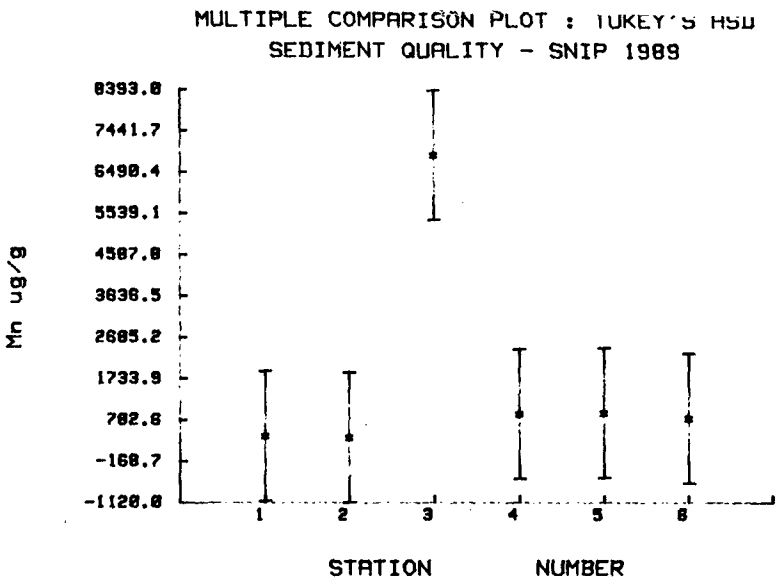
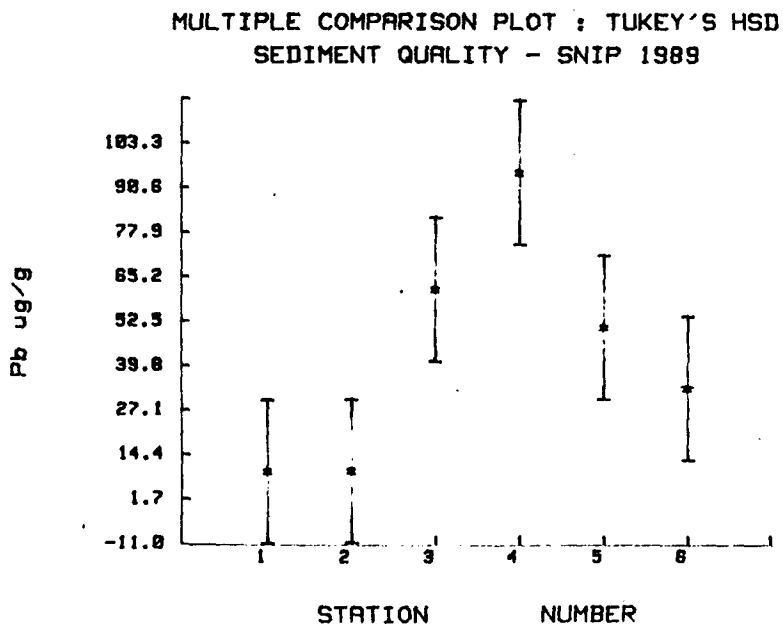


Figure 2 - Sediment Multiple Comparison Plot SNIP 1989 - Al, Ca, Cu, Fe.







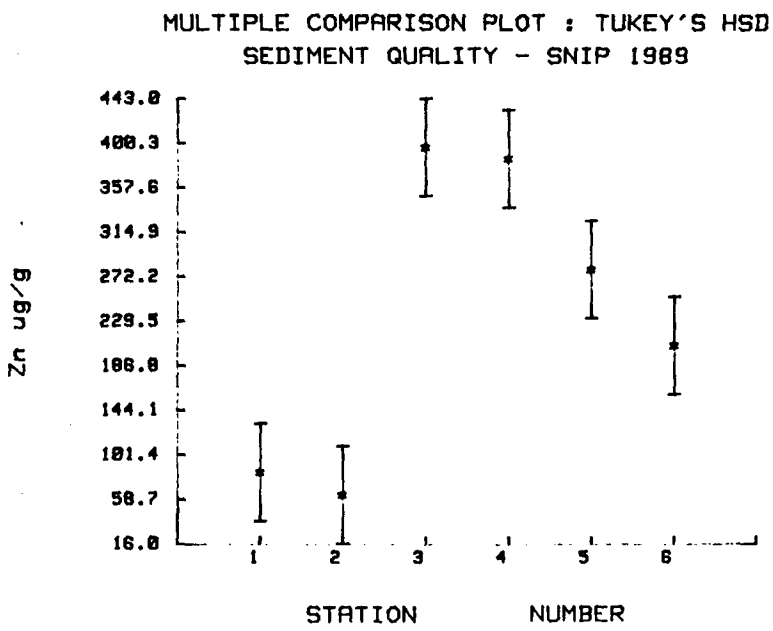


Figure 2 - Sediment Multiple Comparison Plot SNIP 1989 - Hg, Mn, Pb, Zn.

REFERENCE

Anonymous. 1979. Laboratory Manual. Department of the Environmental Protection Service. Department of Fisheries and Oceans (Pacific Region).