

Leachable and Total Heavy Metals in Muddy and Sandy Sediment Collected from Suez Gulf

Amany El-Sikaily, Azza Khaled, Ahmed El Nemr

**National Institute of Oceanography and Fisheries
Alexandria**

Introduction



Heavy metals enter the aquatic environment through the earth crust which has led to steady state background level in aquatic environment.




In addition to the geological weathering, human activities have also introduced large quantities of heavy metals to localized area.



Pollution by heavy metals is considered a serious problem in our environment due to their toxicity, persistence and bioaccumulation and contrary to most pollutants, they do not undergo biodegradation.


Followed

-  **Bottom sediments which act as a reservoir for pollutants can absorb heavy metals to level many times higher than their concentrations in the water column, have an adverse effect on the biota.**

Aim of the Work

 Determination the total and labile heavy metals in:

- 1- Total surface sediment.
- 2- Mud and Sand fractions.

 Compare the concentrations levels of heavy metals bound to fine fraction (<0.063 mm) and sand fraction (0.063- 0.2 mm)

 Compare the concentration levels by the Effect Range Low (ERL) and the Effect Range Median (ERM).

 Study the pollution level of this area based on the Index of geoaccumulation

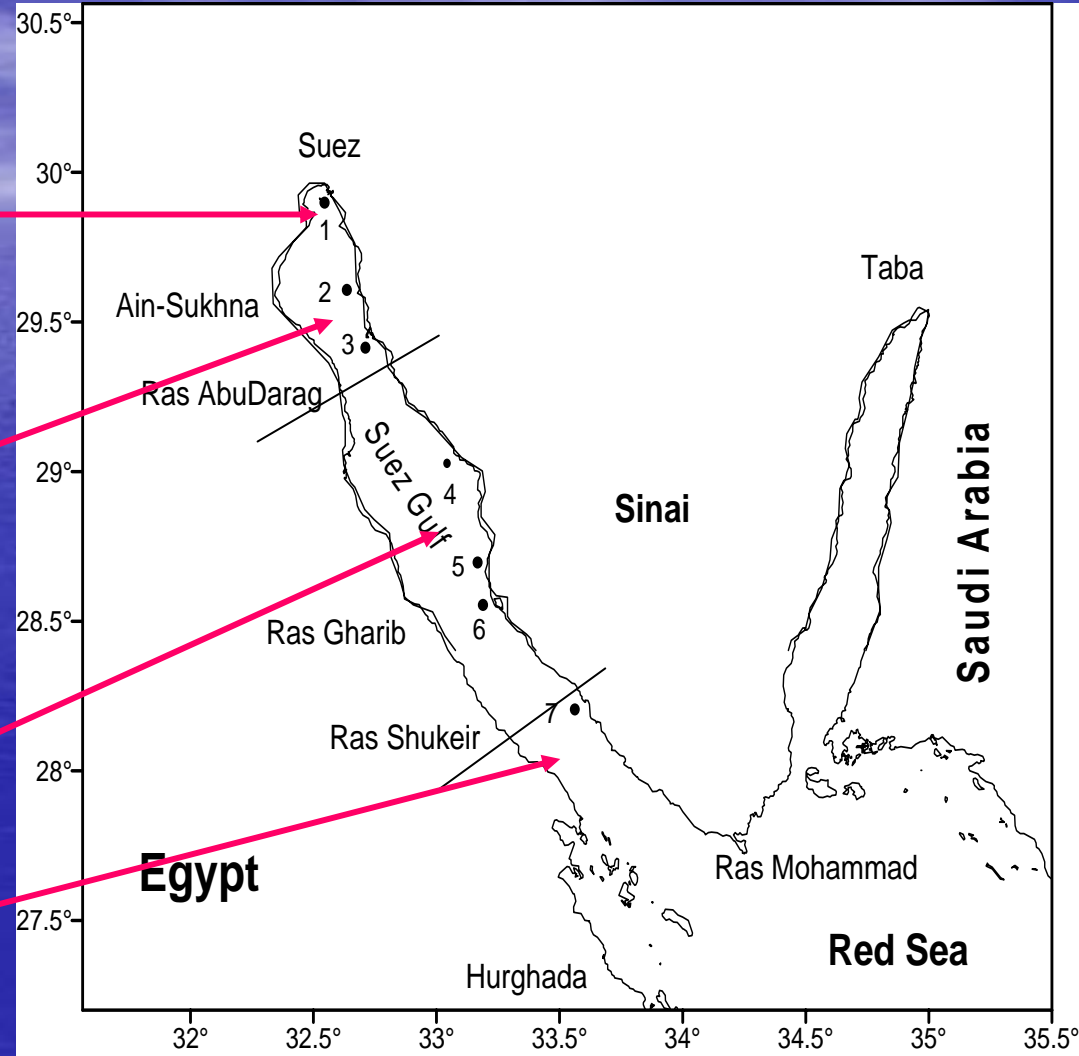
Area of Study

El-Nasr Petroleum Company
Suez Petroleum Company
Suez sewage
Suez Electric Station
Cement Factory
Adabia Port
Military Port

New Port (Ain Sukhna)
French Electric Station
Tourism(Ras Sadr) : Sewage

Oil Fields

El-Tur, Safaga, hurghada
Tourism : Sewage



Materials and Methods



Surface sediment samples (<5 cm) were collected from seven sites and dried in the oven.



Grain Size Analysis was carried out using mechanical shaker (sieve meshes from 2, 1, 0, 0.5, 0.2, 0.125 and 0.063 mm)



Total heavy metals were carried out by digestion of 0.2g of dry sediment by a mixture of HNO₃, HF and HClO₄ (3:2:1v/v)



Leachable heavy metals were carried out by shaken of 0.5 g of dry sediment with an excess of 40 ml of 1N HCl at room temperature for two hours, then centrifuging at 5000 rpm for 3 minutes

Results and Discussion

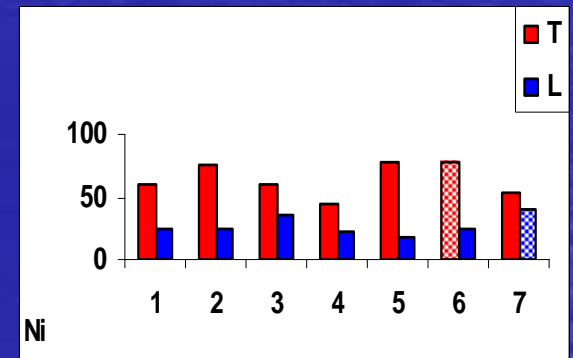
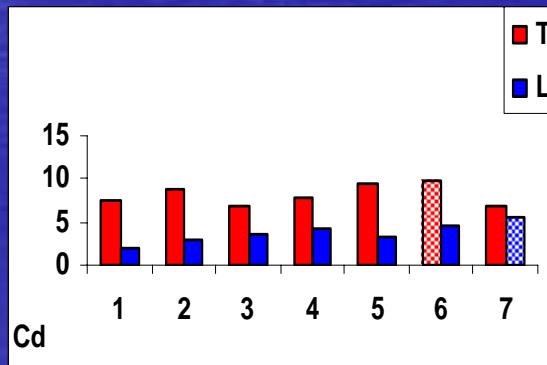
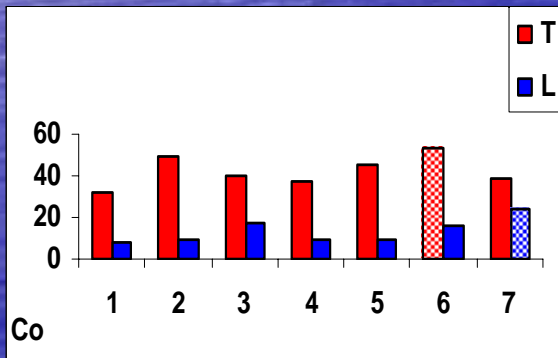
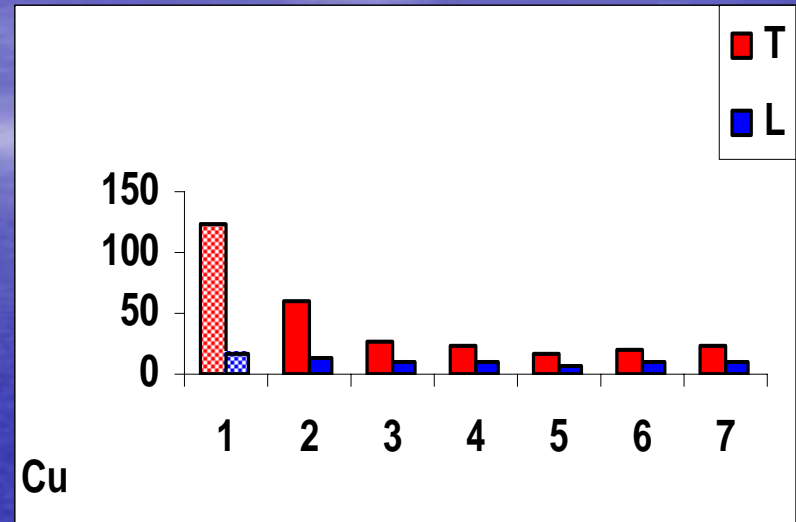
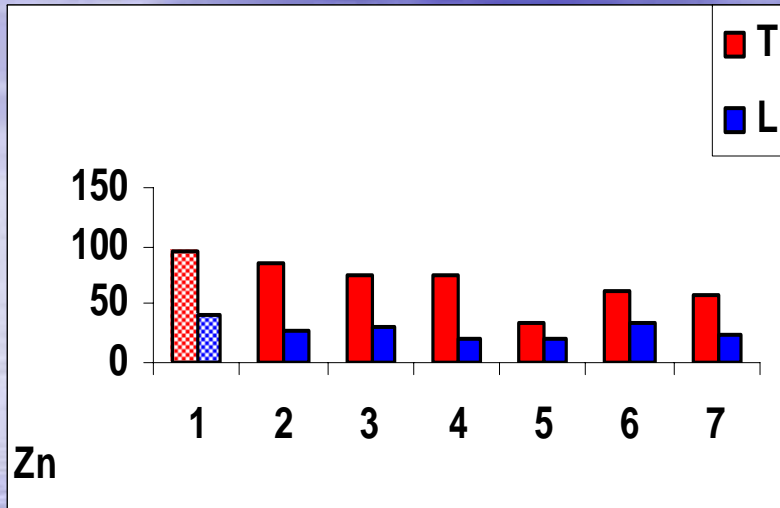


Grain Size Analysis :

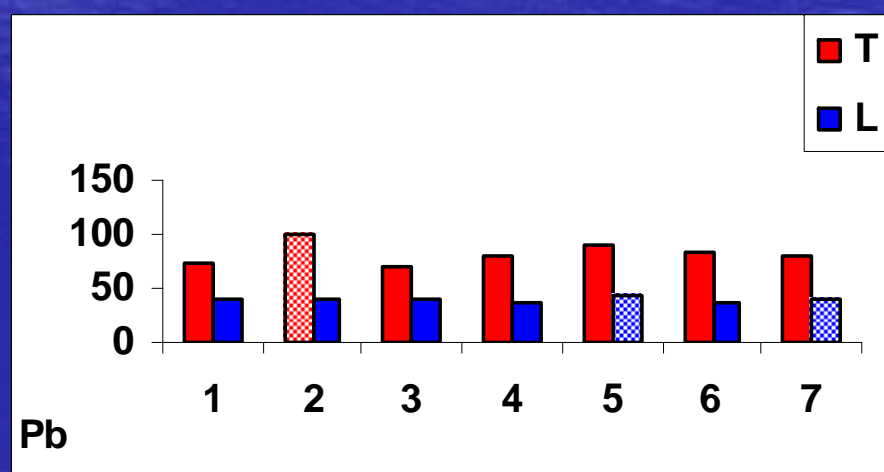
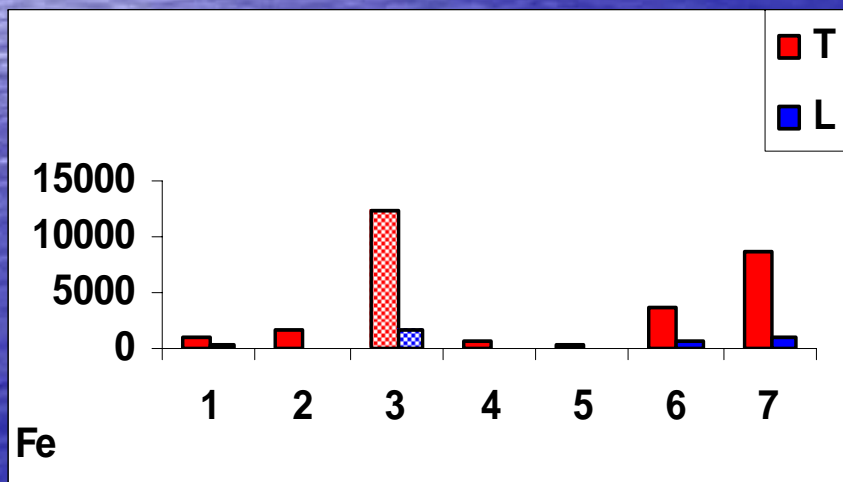
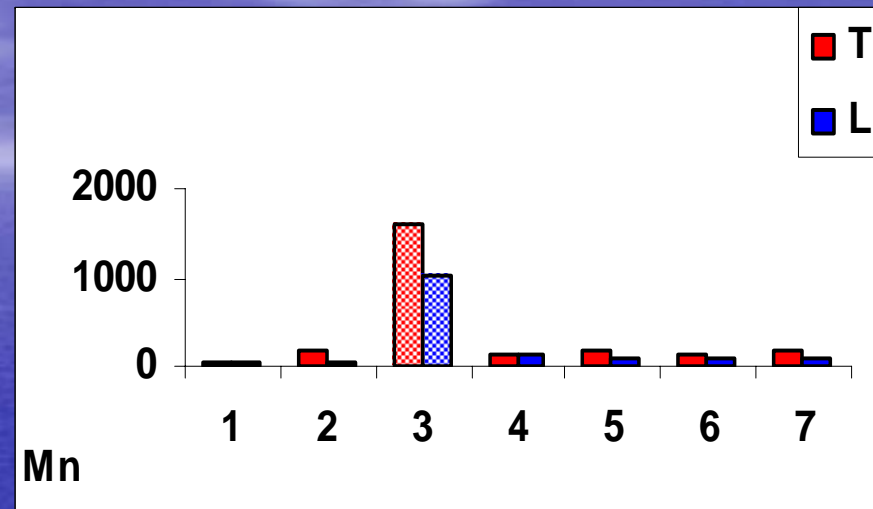
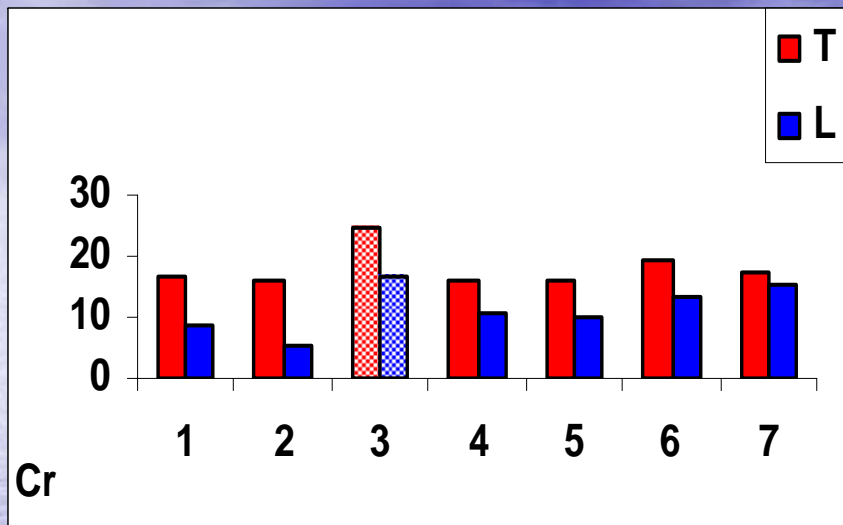
Station number	Sand %	Mud %
1	86.68	12.66
2	98.61	1.25
3	82.73	15.28
4	96.50	2.35
5	98.20	1.50
6	53.89	44.91
7	33.50	64.76



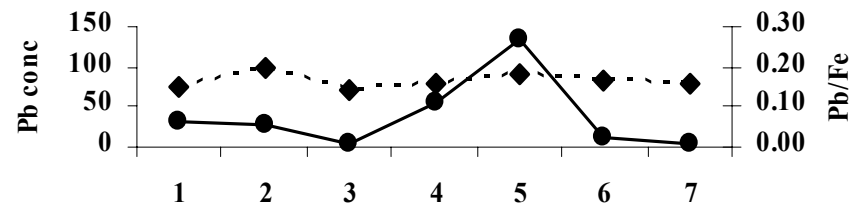
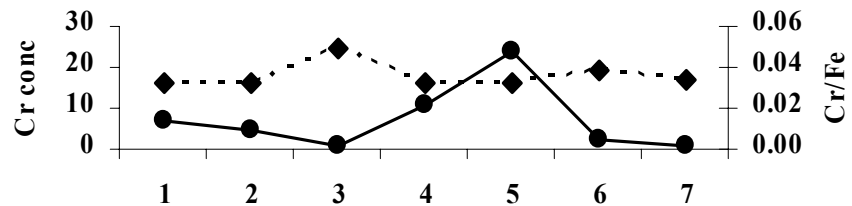
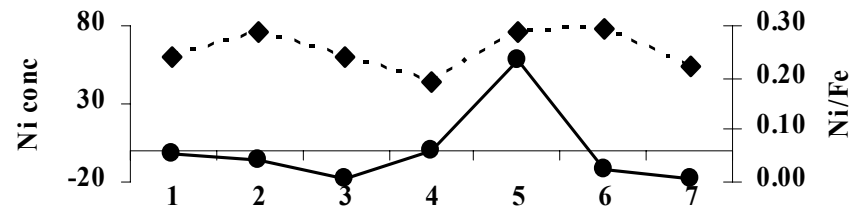
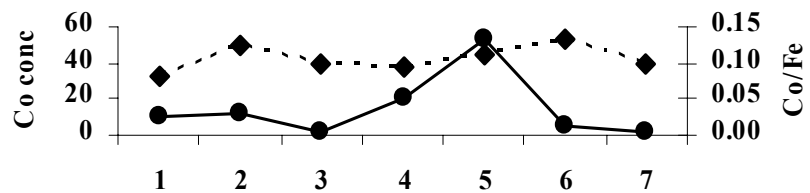
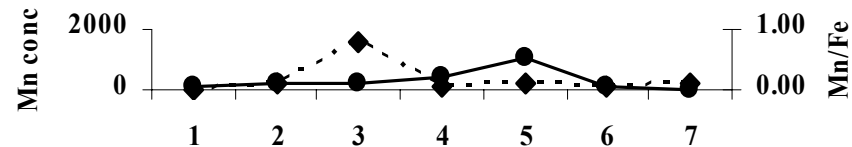
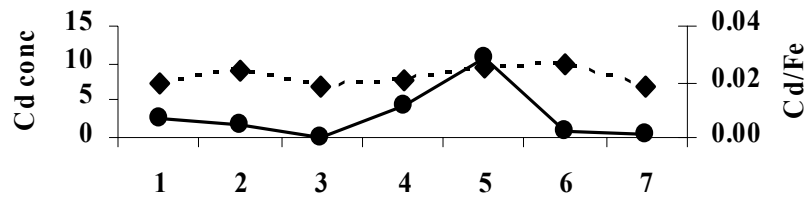
Total and Leachable heavy metals in sediments

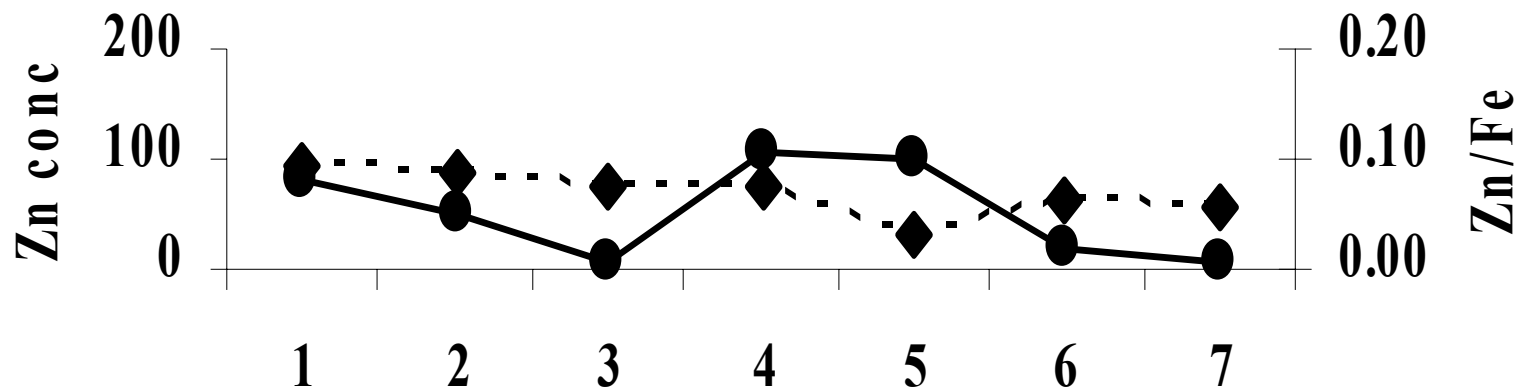
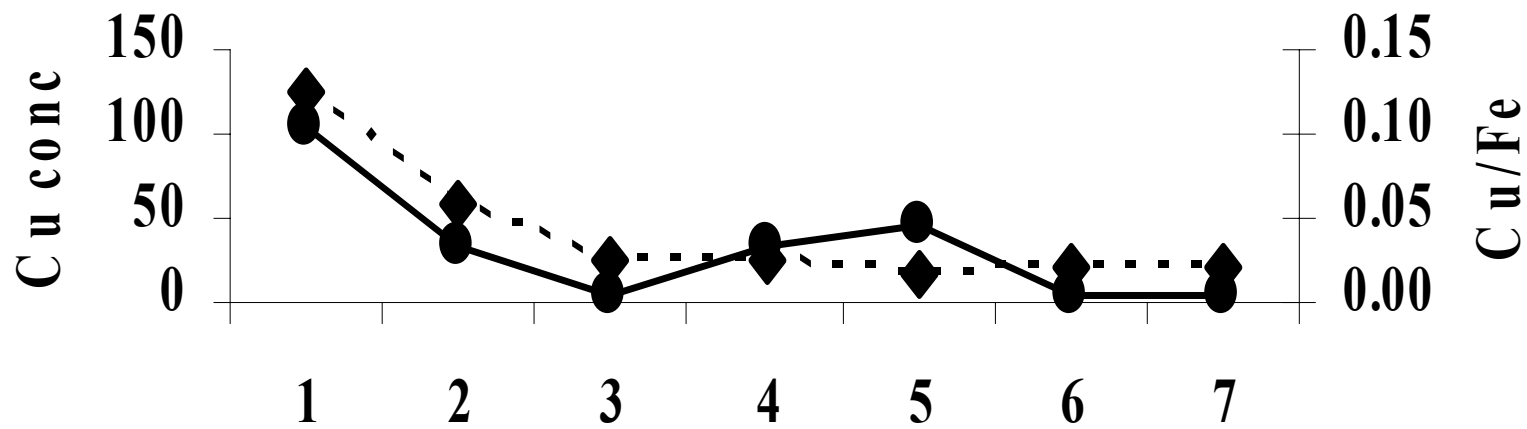


followed



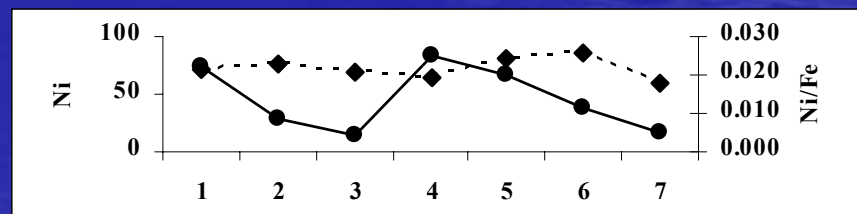
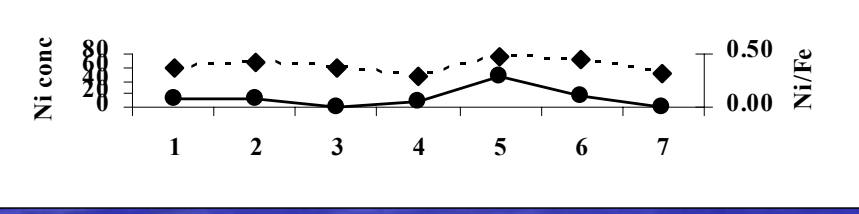
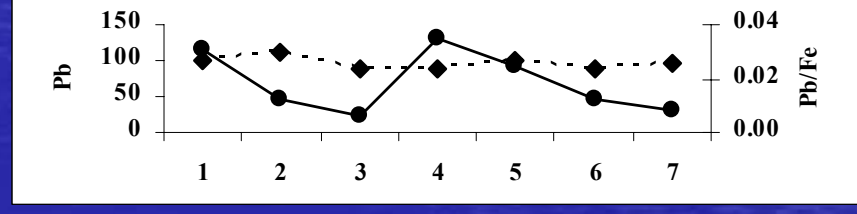
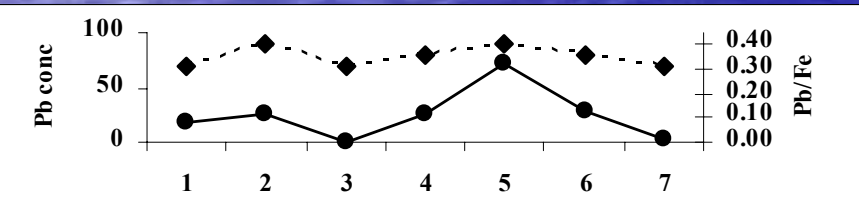
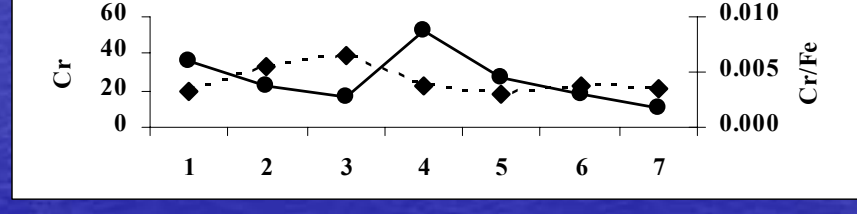
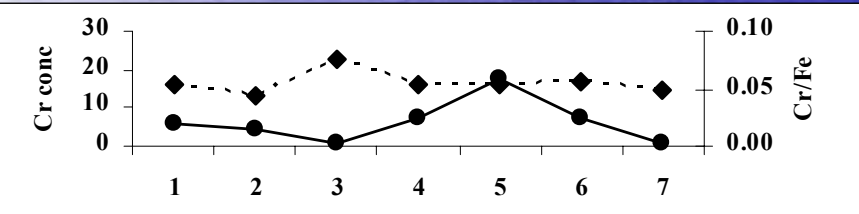
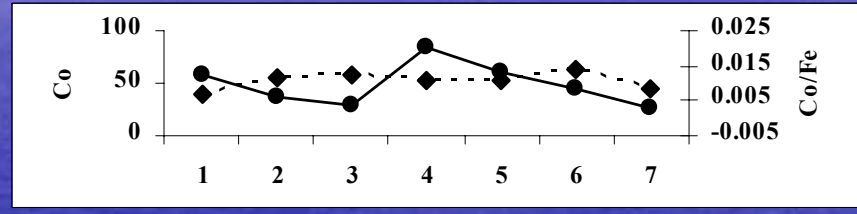
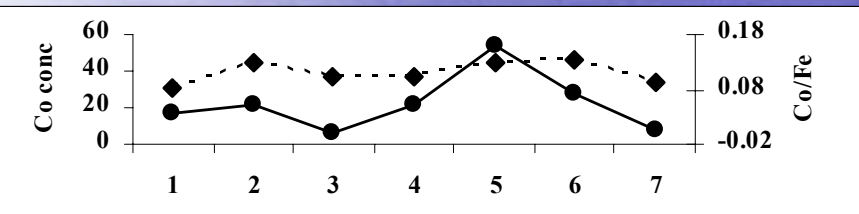
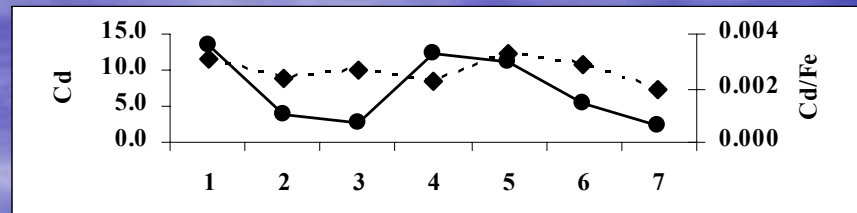
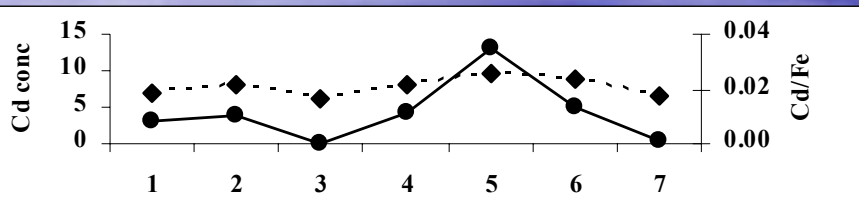
- **Metal concentrations have often been related to the grain size effect. To composite this natural variability, metal concentrations were normalized.**
- **This procedure can be done by calculating the ratio of natural concentrations to that of a normalizing factor whose concentration is not affected by anthropogenic processes (Metal/Fe)**





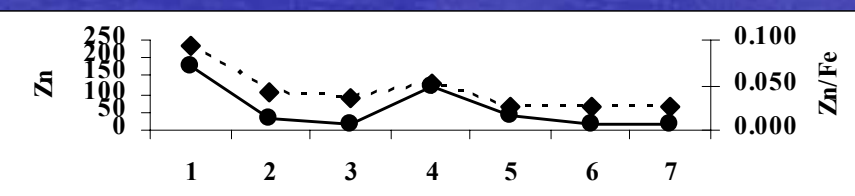
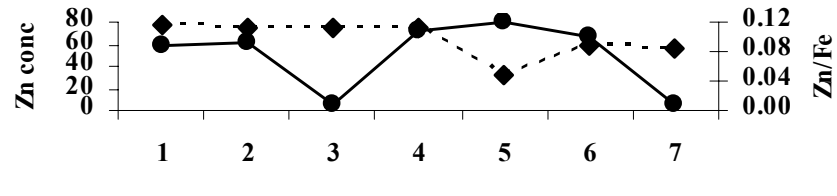
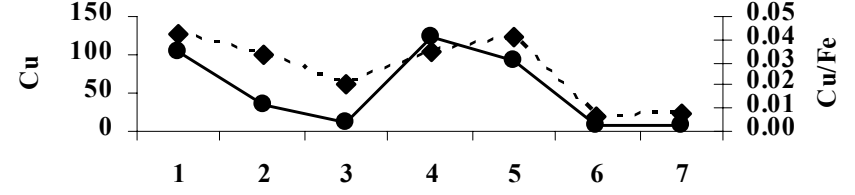
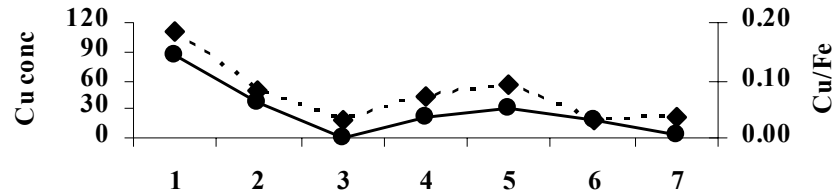


Heavy metals in Sand and Mud fractions



Sand fraction

Mud fraction



Sand fraction

Mud fraction



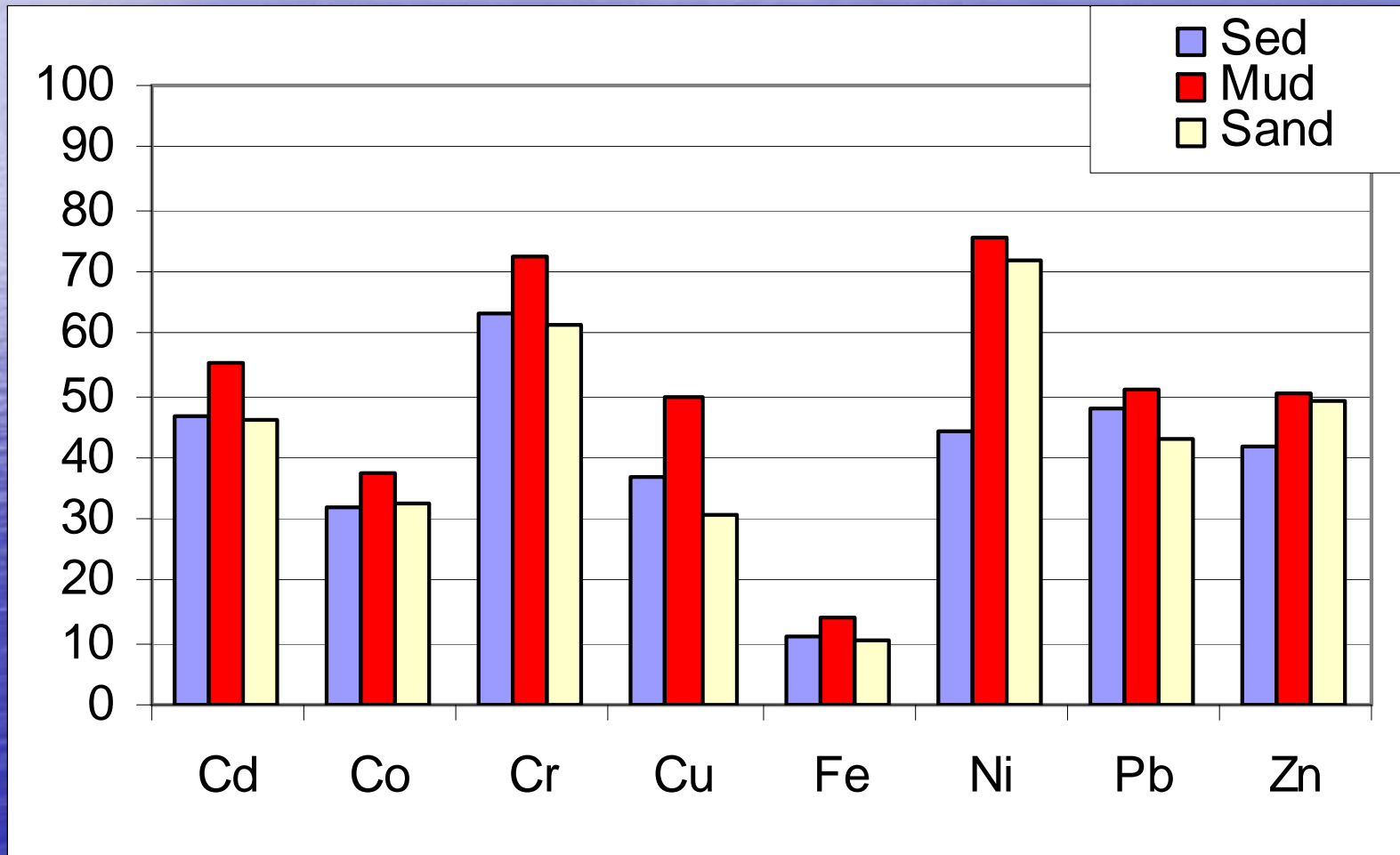
To compare heavy metals bound to mud fraction (<0.063mm) to that in sand fraction (0.063-0.2mm)

Station number	Cd	Co	Cr	Cu	Fe	Mn	Ni	Pb	Zn
Total fraction									
1	1.69	1.33	1.20	1.13	3.73	1.84	1.23	1.43	3.03
2	1.13	1.25	2.57	2.05	10.81	11.97	1.13	1.22	1.35
3	1.59	1.60	1.73	3.09	1.20	1.27	1.15	1.29	1.16
4	1.07	1.40	1.40	2.43	3.73	1.70	1.42	1.11	1.70
5	1.28	1.15	1.16	2.29	14.53	2.53	1.06	1.11	1.93
6	1.18	1.35	1.36	1.14	11.29	3.21	1.19	1.13	1.11
7	1.15	1.32	1.41	1.16	1.67	1.28	1.18	1.39	1.17
Labile fraction									
1	1.97	1.58	1.75	4.91	11.50	2.77	1.25	1.70	3.43
2	1.67	2.00	3.09	4.79	15.17	12.57	1.49	1.35	2.30
3	1.76	1.70	1.20	1.32	1.39	1.50	1.24	1.17	1.26
4	1.25	1.54	1.60	4.77	3.52	1.61	1.52	1.08	2.16
5	1.90	2.00	1.56	9.67	10.13	2.38	1.83	1.26	1.77
6	1.15	1.40	2.01	1.27	12.98	3.38	1.58	1.27	1.19
7	1.33	1.22	1.59	1.52	1.42	1.08	1.32	1.17	0.98

Classification of sediments by heavy metal concentrations in the muddy fractions (<63µm) according to the background classification system from the Hong Kong environmental protection department (EPD, 1992).

	Cr	Ni	Pb	Zn	Cu	Cd
Station 1	16.08	72.60	99.79	231.02	25.71	11.67
Station 2	12.86	77.14	89.81	75.51	12.85	9.02
Station 3	22.74	68.06	89.81	74.48	10.00	7.26
Station 4	16.08	40.84	89.81	75.17	10.00	8.49
Station 5	16.08	81.67	99.79	33.10	14.28	12.20
Station 6	22.51	86.21	79.83	64.48	18.57	10.61
Station 7	20.67	49.91	96.85	64.14	22.85	7.43
uncontaminated	<25	<15	<25	<70	<10	<0.1
low contaminated	25-50	15-35	25-65	70-150	10-54	0.1-1.0
Moderately contaminated	50-80	35-40	65-75	150-200	55-64	1.0-1.5
highly contaminated	>80	>40	>75	>200	>64	>1.5

Percentage of leachable heavy metals in Total sediments, Mud and Sand fractions



Comparison of metal levels with ERL and ERM

To assess the metal pollution risk of heavy metals in aquatic organisms, the concentrations of the metal in sediment were compared with ERL and ERM.

Metal	Guidelines ($\mu\text{g/g}$)		Percent incidence of effect		
	ERL	ERM	< ERL	ERL-ERM	> ERM
Cd	1.2	9.6	6.6	36.6	65.7
Cr	81	370	2.9	21.1	95.0
Cu	34	270	9.4	29.1	83.7
Pb	46.7	218	8.3	35.8	90.2
Ni	20.9	51.6	1.9	16.7	16.9
Zn	150	410	6.1	47.0	69.8

Metal	Station number						
	1	2	3	4	5	6	7
Cd	7.45	8.80	6.70	7.89	9.56	9.91	6.79
Cr	16.38	16.07	24.81	16.08	16.07	19.00	17.10
Cu	123.07	58.42	26.00	24.80	15.89	18.99	22.02
Ni	60.32	75.02	59.17	44.86	76.97	77.84	53.10
Pb	73.13	99.81	71.48	79.28	89.67	83.35	80.72
Zn	95.30	84.92	74.84	75.73	33.46	60.92	58.85

