TRACE METALS CONTAMINATION IN SEDIMENTS FROM THE KISHON RIVER, ITS DRAINAGE BASIN AND ESTUARY, MEDITERRANEAN COAST OF ISRAEL

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The Kishon river, which empties into the Haifa Bay is regarded as the most polluted coastal river in Israel. The river runs through the largest industrial area in the country and is subjected to considerable inputs of organic and trace metal contaminants from oil refineries, petrochemical and fertilizer plants, a sewage treatment plant, intensive agriculture in the recharge area and other sources (COHEN *et al.*, 1993; KRUMGALZ *et al.*, 1990). Except during rainy winters (particularly such as 1991/92), the flow along the lower river system is dominated by the effluents from industries and the sewage treatment plant.

Surficial sediment samples (~ 3 cm top layer) from the Kishon river, its drainage basin (stream sediments), harbors and estuary were collected by grab or with a plastic scoop. Trace element concentrations in the samples were analyzed according to HERUT *et al.* (1993). The sampling was carried out once after the winter and again after the summer. The metal concentrations were normalized by Al as a conservative element in order to minimize grain size variations. Sediments from the upper river system and its drainage basin showed relatively low metal/Al ratios while high peaks of the polluted trace metals were recorded along the entire lower river system (Fig. 1). These normalized ratios decrease in the estuary sediments, from the Fishing Harbor seaward. For elements derived mainly from natural environment, such as Fe, Ce, Mn and Eu, no major differences were detected along the entire Kishon - Haifa Bay complex. Although contaminants are trapped in the sediments of the lower Kishon river system, river-borne contamination was also evident in the southern part of Haifa Bay deriving from bottom transport of sediment particles, suspended matter and disposal at sea of dredge spoils from the river harbors.

The interrelations between trace, minor and major elements in the Kishon system reveal the existance of two main situations : (1) during the winter, when relatively clean sediments from the drainage basin are contaminated in the lower river system by trace metals contained in industrial effluents, and close to the harbors area where the organic matter plays a major role in the accumulation of part of these metals; (2) during the summer, when due to low energy conditions, most trace metals sink directly and via scavenging by organic matter along the entire lower river system. Thus, the scavenging of trace metals from the Kishon waters seems to be controlled by two main factors : (a) the amount of organic matter input and (b) the hydrological regime of the river.

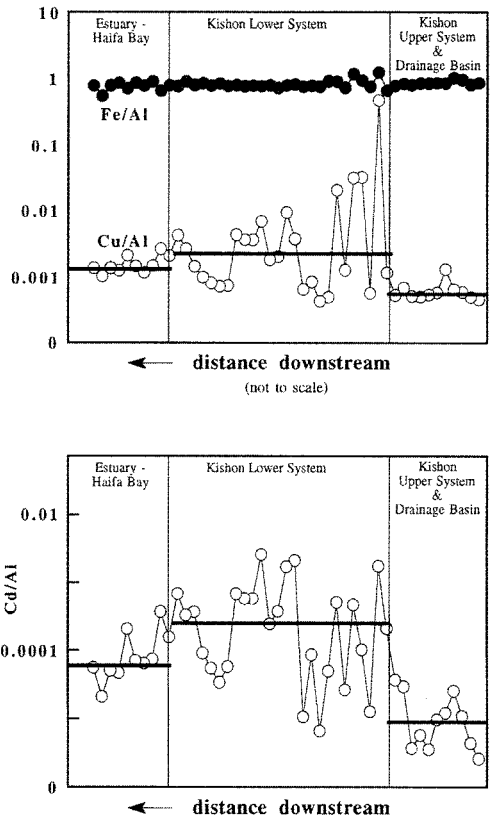

Fig. 1: Selected metals/Al ratios (wt./wt.) along the entire Kishon system. Horizontal lines represent the median values in each sub-system.

REFERENCES

COHEN Y., KRESS N. and HORNUNG H., 1993. Organic and trace metal pollution in the sediments of the Kishon river (Israel) and possible influence on the marine environment. *Wat. Sci. Tech.*, 27 : 439-447.

HERUT B., SHIRAV M., KRESS N., HORNUNG H., OLGA Y. and ILLANI S., 1993. Geochemistry of the Kishon Basin sediments, trace metals and organic matter behavior. IOLR Rep., H25/93, 70 pp.

KRUMGALZ B.S., FAINSHTEIN G., GORFUNKEL L. and NATHAN Y., 1990. Fluorite in recent sediments as a trap for trace metal contaminants in an estuarine environment. *Estuary Coastal and Shelf Sciences*, 30 : 1-15.