Suspended particulate matter as a marine pollutant vehicle
The Case Study of the Rasa River Estuary (Istra, Croatia)

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A major problem of coastal and marine pollution are land-based sources. Next to the hydraulic transport, the most important vehicle are suspended mineral particles. This study of the Rasa River estuary (Istra, Croatia) follows previous investigations of the Krka River, a typical karstic estuary (JURACIC and PRAVDIC, 1991), and of the much more important and larger Adige River mouth (BOLDRIN *et al.*, 1989). The Rasa River is more interesting due to a larger mineral particles load originating from clastic flysch rocks, to activities such as coal mining and burning in the nearby power plants, and because of port facilities and intensive agriculture in the upper reaches of the river.

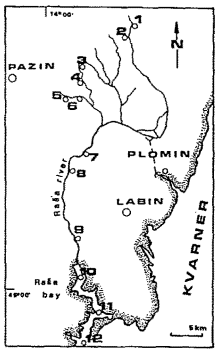

Figure: The Rasa River estuary sampling stations

The Rasa River is a comparatively small river, typically karstic and reflecting the seasonal variations of the Adriatic. Its mean flux in the upper part, at the sampling station (ST 7), measured in the span of some 15 years is 2.3 m^3/s (with a range from 0.1 to 43), whereas additional sources and bottom wells increase this mean flux to 12 m^3/s at the river mouth. The water samples taken in September 1991 had the following concentrations of particulates: 1.2 mg/dm^3 (ST 9 surface) and 29.2 mg/dm^3 (ST 9 near bottom, at -3 m); 17.0 mg/dm^3 (ST 10 surface) and 46.6 mg/dm^3 (ST 10 near bottom, -16 m).

The characterization of sediments included : organic matter estimation by oxidative stripping ; nitrogen adsorption BET specific surface area determination (SSA) ; and the determination of cation exchange capacity (CEC) using NH_4 exchange from 1 mol/dm^3 ammonium acetate and estimation by ammonia specific electrode. A review of results is given in the Table 1.

TABLE 1: ***Characteristics of samples***

	Sampling station	SSA m^2/g native	SSA m^2/g treated	CEC meqv/100g native	CEC meqv/100g treated	organic matter (%)	Pb (ppm)	Cd (ppm)
	2	16.1	10.9	19	20	3.0	59	6
I	3	14.8	14.6	54	57	3.2	93	9
	5	15.6	8.2	29	24	3.2	72	8
	4	24.0	26.5	78	103	5.0	118	12
	6	14.6	15.0	49	87	1.7	72	8
II	7	24.6	25.5	50	85	6.9	-	3
	8	32.6	30.5	74	86	7.5	115	16
	9	11.3	8.7	32	31	6.7	230	22
III	10	10.2	10.0	42	23	4.8	107	12
	11	14.0	13.3	26	35	5.4	132	12
IV		2.0		9				

Legend : I - source rocks (marls); II - river sediments; III - estuarine sediments (seawater influence); IV - coal particles extracted from sea sediment, sample 10.

The amount of organics is modest, the SSA rather high and there is little change observed on removing organics. This is indicative of particles where the mineral core is the dominant factor governing adsorption. The exchange capacities reflect the presence of carbonates.

Coal particles have been detected in marine sediments, originating from coal mines in the area. Such particles have been extracted mechanically from the sediments. These have very small surface areas, and very low CECs. These preliminary results indicate that most of the pollutant transport capacity will be due to clay minerals, and that the influence of coal particles might be minor.

The analysis on lead and cadmium bound to particles (ICP AES - Jobin Yvon P-50) show that these metals are progresively accumulated downstream, with the maximum at station 9, where the salt wedge is found at prevalent hydrologic conditions. Calculations show that Pb takes up less than 3% of the CEC of sediment particles.

REFERENCES

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