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Heavy Metals in Sediments from İzmir Bay, Turkey

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İzmir Bay is located in the eastern part of the Aegean Sea, lying between latitudes 38°20′ and 38°42′ and longitudes 26°25′ and 27°10′. The port of İzmir city and several industries are located in the Inner Bay. Untreated or partially treated industrial and domestic wastewaters are discharged directly or carried by several streams into the Bay. İzmir, with a population of over 1.5 million, is one of the fastest growing cities in Turkey. The main sources of pollution in İzmir Bay include domestic and industrial wastes; rainfall and associated pollutants from run-off; shipping; and agricultural sources.

From the topographic and hydrographic points of view, the Bay is divided into inner and outer regions. Its average depth is about 20–25 m. The inner Bay, which is shallower, reaches a maximum depth of about 20 m and exhibits a limited water exchange with the outer Bay. Both the port area and the central part of the inner Bay are dredged to improve navigation. Pollution by nutrients is a problem, and red tide occurrences are reported to have increased in frequency in recent years (Kocataş *et al.*, 1988).

Surveys were carried out in 1989 and 1990 to measure the concentrations of selected trace elements in surface sediments of the Bay. Sediment samples were collected at 11 sampling stations using a Van-Veen grab (Fig. 1). All samples were stored in clean polyethylene bags. In the laboratory, samples were oven-dried at 40°C, ground in an agate mortar and wet-digested in teflon flasks using concentrated nitric acid. Blank digestions were also carried out. Trace metals from each subsample were extracted according to the method of Sinex *et al.* (1980). The acid extracts were filtered, made up to a fixed volume, and placed in acid-washed polyethylene sample bottles. The metal extracts were analysed by atomic absorption spectrophotometry using a Pye Unicam SP9 Model. Chromium, copper and lead were determined by direct aspiration using an air acetylene flame, while mercury was analysed by the cold vapour technique. The accuracy of the method was established using reference sediment material, from the International Atomic Energy Agency laboratory in Monaco, coded SD-N-1/2. The analysis of reference material gave the following results:

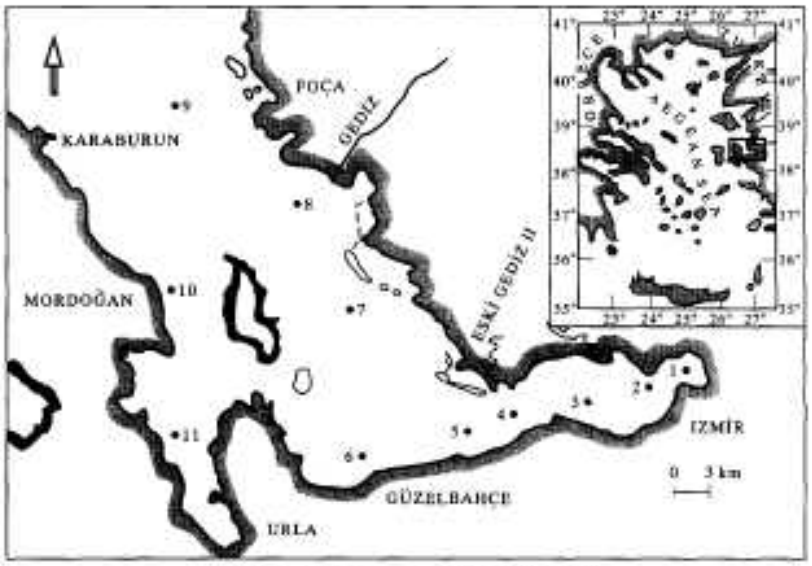


Fig. 1 Sampling stations in the İzmir Bay, Turkey.

	Pb	Cr	Cu
Mean conc. ($\mu g\,g^{-1}$)	120	149	72
Lab. results ($\mu g\,g^{-1}$)	114	145	76

The concentrations of heavy metals in surface sediments from İzmir Bay are summarized in Table 1. The highest levels of chromium, copper, lead and mercury were found in the sediments close to the city, reflecting the intensity of anthropogenic inputs in the inner Bay. Mercury levels were greater than those reported by Balci *et al.* (1990) for sediments of İzmir Bay. Stations 10 and 11 in the outer Bay can be considered to reflect background levels of metals.

By comparison with published data from other Mediterranean coastal areas (e.g. see Voutsinou, 1982; Whitehead *et al.*, 1986), the metal concentrations reported here for the inner Bay are indicative of a polluted environment. Further monitoring would appear to be required to establish the temporal trends in sediment contamination as development of the area continues.

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TABLE 1

Concentrations of trace elements ($\mu g\,g^{-1}$, wet wt) in sediments from İzmir Bay.

Site no.		Hg	Cr	Cu	Pb
1	R	0.31–1.30	238–457	60–67	92–140
	M	0.55	345	94	116
	N	5	5	4	2
2	R	0.06–0.51	213–465	27–59	73–92
	M	0.20	382	44	83
	N	6	5	4	2
3	R	0.12–0.23	139–285	29–41	48–60
	M	0.16	217	36	57
	N	6	5	4	4
4	R	0.06–0.16	77–101	23–24	52–55
	M	0.10	86	24	54
	N	6	6	2	2
5	R	0.08–0.26	77–86	22–27	53–59
	M	0.13	82	25	55
	N	6	6	2	2
6	R	0.05–0.16	74–87	16–34	39–42
	M	0.11	85	25	53
	N	7	5	4	4
7	R	0.08–0.10	82–87	15–37	47–55
	M	0.08	85	26	51
	N	6	4	3	2
8	R	0.07–0.11	75–101	28–33	48–60
	M	0.09	87	31	54
	N	6	5	2	2
9	R	0.10–0.16	62–75	19–37	48–50
	M	0.12	68	23	49
	N	6	2	3	2
10	R	0.12–0.17	24–31		
	M	0.14	28	14	
	N	5	3	1	
11	R	0.04–0.09	22–34		
	M	0.06	27	11	
	N	5	3	1	

R: Range. N: Number of samples. M: Average.