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POLLUTANTS IN SEDUNEBTS OFF PALOS VERDES

To improve the body of data on trace contaminants in surface sediments near Los Angeles County Sanitation Districts' outfall system, the Coastal Water Project participated in a survey of this area in 1975. Concentrations of eight metals, DDT, and PCB in the surface sediments at 44 stations off Palos Verdes Peninsula were determined and are reported here.

The samples were obtained during the County Sanitation Districts' regular benthic monitoring survey in September 1975. Four Shipek grab samples were taken at each of the stations shown on Figure 1. A sample 5 cm deep was taken from each grab with a hand-held corer, and excess pore water was removed with a mechanical squeezer; the sample was then place in a precleaned container and frozen until analysis.

In the laboratory, samples to be analyzed for the non-volatile metals (silver, cadmium, chromium, copper, nickel, lead, and zinc) were dried, powdered, digested using a hot nitric acid method, and aspirated into the air-acetylene flame of a Varian-Techtron atomic absorption spectrophotometer (Model AA-6) equipped with a premix burner. Blanks were prepared with the same reagents and processed using the same procedures. The total mercury concentrations in the top 1 cm of sediment in each sample were determined using a cold vapor technique described by Eganhouse (1975). Chlorinated hydrocarbon analyses were performed by Theadore Heesen in the Project's trace organics laboratory, using the methods described in Young et al. (1976).

The variability of our measurements of metals concentrations in the sediments of this region was examined. Four individual samples obtained at each of three stations (Stations 6C, 7C, and 9C; Figure 1) were analyzed separately, and the coefficients of variation (CV's) of these measurements were determined (Table 1). The CV's for the seven metals analyzed in these sediments typically range from 10 to 50 percent. To determine how much of this rather large variability is due to analytical precision, we per-formed analyses on sediments from three other stations known from previous work to represent a wide range of metals contamination. Samples from each of these stations were processed according to the usual procedure and mixed mechanically for several minutes to achieve homogeneity. Then six 1.0-gm aliquots were taken from each station homogenate and analyzed individually; the resulting mean concentrations and their CV's are presented in Table 2. All but 3 of the 21 CV's, which primarily reflect analytic rather than sampling variability, range from 2 to 10 percent, less than one-fourth the CV values for the mean concentrations obtained through analyses of individual replicate grabs. Therefore, it appears that the procedure of compositing sediment samples from several grabs per station before analysis (in lieu of analyzing each individually, which often is impractical) reduces the effect of "on-station" variability and thus yields a better estimate of the true station metal concentration than a single grab.

Figures 2 and 3 Illustrate trace constituent concentration contours determined in this survey. The contours for the various substances are remarkably similar, suggesting that similar processes are governing the distribution of these trace contaminants following discharge.

To evaluate the degree to which submarine discharges have altered conditions around outfalls, it is necessary to determine corresponding baseline values. In Table 3, we have listed ranges of metals concentrations determined in three independent investigations conducted in different regions of the Bight. The first set of values (reported in Galloway (1972) and Coastal Water Research Project (1973) are based on measurements of subsurface sediments (20 to 30 cm deep) from numerous cores taken around the five major out-fall systems. The second set of data was obtained from the surface layer (0 to 5 cm) of box cores collected in 1974 around Santa Catalina Island (Chen and Lu 1974). The third set of ranges are from the surface layer data (0 to 5 cm) of Bruland et al. (1974) for vertical profiles of metals in box core sediments taken in the remote and anaerobic Santa Barbara and Soledad Basins. In spite of the differences between these sampling sites, the ranges of these baseline concentrations are generally quite similar. The highest values for most of these metals are about an order of magnitude lower than concentrations in outfall sediments in the area extending 5 km to the northwest of the JWPCP outfalls (Figure 2).

During the coming year, we will be conducting studies that should enhance our understanding of the processes that determine the fate of wastewater particulates and their associated chemical constituents in the marine environment.

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Table 1. Means (mg/dry kg) and coefficients of variation (in parentheses) of concentrations of metals in four replicate grab samples of surface sediments collected from each of three stations off the Palos Verdes Peninsula.

	Station 6C		Station 7C		Station 9C	
Silver	14	(44%)	15	(53%)	12	(19%)
Cadmium	45	(44%)	80	(17%)	22	(15%)
Chromium	1,090	(23%)	1,290	(12%)	640	(16%)
Copper	655	(19%)	775	(8%)	38	(12%)
Nickel	79	(13%)	85	(4%)	58	(9%)
Lead	435	(23%)	500	(27%)	255	(12%)
Zinc	1,900	(34%)	2,620	(17%)	820	(6%)

Table 2. Means (mg/dry kg) and coefficients of variation (in parentheses) of concentrations of metals in six aliquots of composite sediment samples from each of three stations off the Palos Verdes Peninsula.*

	Station 10A		Station 1B		Station 7C	
Silver	0.59	(34%)	2.4	(8%)	20	(3%)
Cadmium	2.1	(21%)	3.6	(32%)	60	(2%)
Chromium	77	(9%)	185	(5%)	1,170	(10%)
Copper	45	(2%)	78	(4%)	810	(2%)
Nickel	25	(6%)	22	(5%)	80	(2%)
Lead	15	(10%)	50	(7%)	540	(6%)
Zinc	120	(4%)	210	(5%)	2,720	(3%)

*Metals contamination at these stations is known to be highest at Station 7C and lowest at Station 10A.

Table 3. Estimated baseline concentrations (mg/dry kg) of trace metals in sediments in the Southern California Bight calculated in three independent studies.

	Coastal Water Project Estimates[1]	Chen and Lu Data[2]	Bruland et al. Data[3]
Silver	0.6–1.5	–	1.5–2.0
Cadmium	0.2–0.5	1.4–2.1	1.0–2.0
Chromium	34–62	26–60	90–150
Copper	13–21	11–18	28–35
Mercury	0.02–0.05	0.04–0.09	–
Nickel	9.4–17	42–62	22–50
Lead	6.2–12	20–78	5–30
Zinc	54–75	32–65	85–100

1. From Galloway 1972 and Coastal Water Research Project 1973.
2. From Chen and Lu 1974.
3. From Bruland et al. 1974.

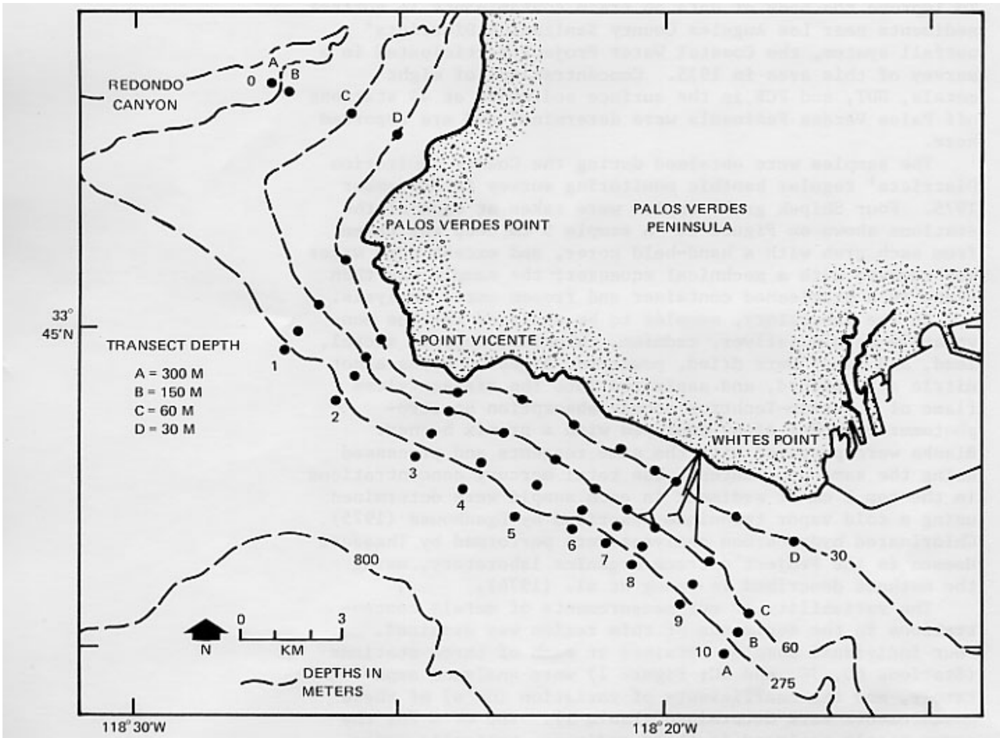

Figure 1. Sediment stations used in the Los Angeles County Sanitation Districts' benthic monitoring program in the vicinity of the Joint Water Pollution Control Plant (JWPCP) outfall system.

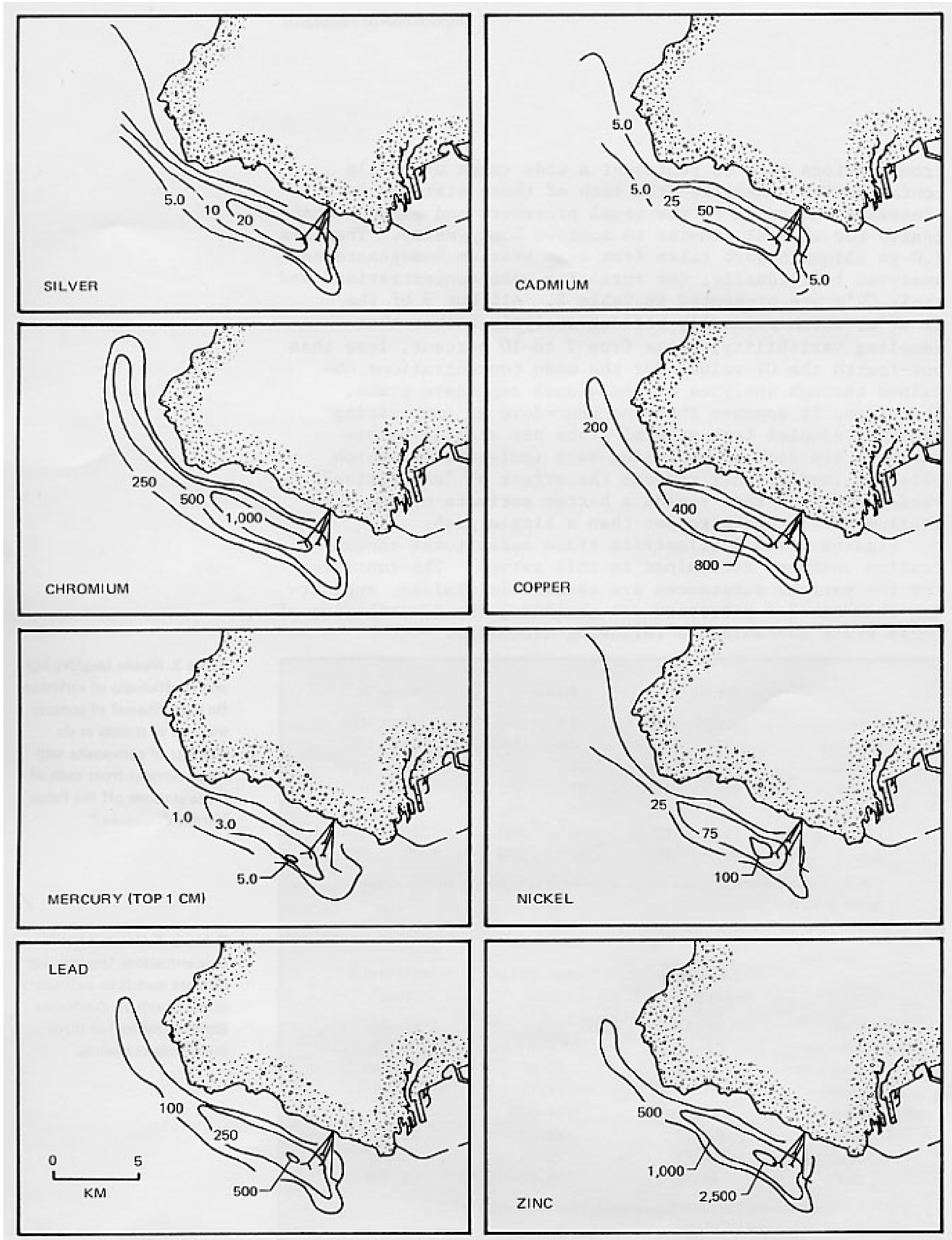

Figure 2. Concentrations isopleths (mg/dry kg) of trace metals in the top 5 cm of sediments off the Palos Verdes Peninsula, 1975.

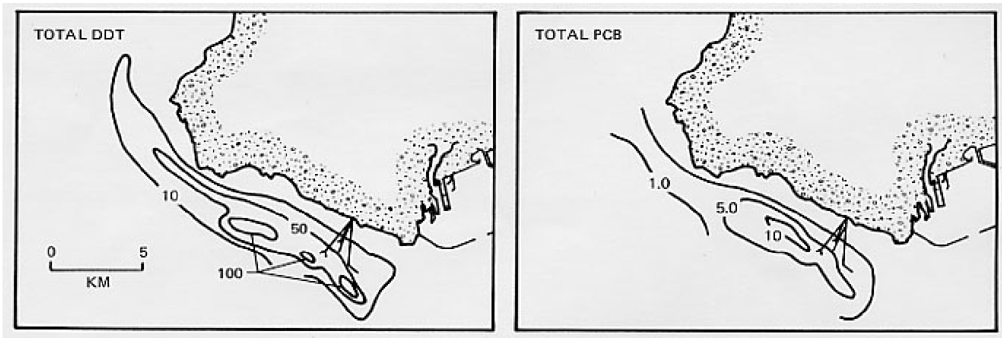

Figure 3. Concentrations isopleths (mg/dry kg) of total DDT and total PCB in the top 5 cm of sediments off Palos Verdes Peninsula, 1975.