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OCEANOGRAPHIC STUDY OF THE THERMAIKOS GULF, GREECE

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The city of Thessaloniki with more than 1.000.000 inhabitants and the surrounding industrial area use Thessaloniki's and Thermaikos gulf as the final receivers for their liquid wastes.

Surface sea water from the Thermaikos gulf was sampled monthly during a period of one year (1985-1986) using polypropylene sampling bottles.

All reagents used were supra pure and supplied by Merck A.G. In Order to have a completed idea of the pollution degree of the examined area a big number of inorganic and organic compounds was studied:nutrients,pH, DO, BOD, turbidity, colour, suspended solids, anionic surfactants,heavy metals and organochlorine pesticides.

Results and Discussion

Concerning the heavy metals, in the examined areas their concentrations are relatively low and close to those found in literature for unpolluted and slightly polluted regions. High concentrations of heavy metals were observed near the harbor area and in the area where industrial sewages are discharged[1]. Concerning the other parameters for the organic pollution(BOD, DO,phenols, diesel)their concentratuons are in low levels and the same stands for the parametrs for the inorganic pollution.

Significant seasonal fluctuations of nutrients (phosphate, ammonium and nitrate) were observed. Significant increase of phosphate, nitrate and ammonium were observed at the beginning of winter and during spring because of the use of fertilizers.

From the analysed samples, lindane, pp DDT, parathion, dieldrin, endrin, Aldrin, chlordane, PCB were found in trace amounts.

Table 1. Chemical analysis in sea water samples in Thessaloniki gulf and Thermaikos gulf (Mean values).

	Sampling Stations						
Parameters	1	2	3	4	5	6	7
0_2 (mg/l)	8,55	7,18	7,35	8,1	7,6	7,28	6,33
Colour (mg Pt/l)	9,58	6,36	3,60	4,29	4,6	4,88	12,2
Suspended solids (mg/l)	0,069	0,093	0,048	0,042	0,051	0,079	0,086
Diesel (mg/l)	0,093	0,043	0,05	4,75	0,068	0,16	0,24
Detergents (mg/l)	0,025	0,023	0,032	0,018	0,025	0,045	0,059
BOD_5 (mg/l)	15,38	13,90	14,90	15,50	15,60	15,33	107,50
Phenols (mg/l)	0,063	0,059	0,056	0,066	0,063	0,063	0,064
Turbidity (FTU)	10,29	6,62	7,27	7,20	6,38	9,085	11,67
Ammonia (mg/l)	0,042	0,041	0,060	0,033	0,043	0,055	0,258
Nitrogen (Kjeldahl) (mg/l)	0,89	0,63	0,92	0,85	0,76	0,65	0,77
Nitrate NO_3^- (mg/l)	0,259	0,067	0,144	0,060	0,183	0,250	0,228
Phosphate PO_4^{3-} (mg/l)	0,117	0,121	0,114	0,115	0,128	0,173	0,235
Hg (µg/l)	0,20	0,16	0,21	0,21	0,21	0,15	0,26
Pb (µg/l)	43,75	30,50	25,00	33,75	31,75	21,25	38,75
Zn (µg/l)	161,25	283,75	20,35	164,00	221,25	250,75	218,25
Cr (µg/l)	17,75	19,25	18,75	18,25	19,75	18,75	19,25
Cu (µg/l)	79,50	83,25	153,75	117,0	123,75	119,25	112,5
Ni (µg/l)	30,25	34,75	46,75	13,75	24,00	32,50	53,75
Cd (µg/l)	6,20	7,35	6,10	6,425	6,55	6,60	7,15
Ag (µg/l)	n.d	n.d	n.d	n.d	n.d	n.d	n.d
Fe (µg/l)	536,25	522,25	660,00	591,25	606,75	573,25	931,25
CN^- (mg/l)	0	0	0	0	0	0	0

Table 2. Concentrations of toxic substances in Thessaloniki gulf and Thermaikos gulf (Mean values).

	Sampling Stations						
Parameters	1	2	3	4	5	6	7
Lindane (ng/l)	0,026	0,035	0,017	0,016	0,09	0,11	0,10
P P'DDT (ng/l)	0,37	0,57	1,2	1,3	1,2	1,22	1,6
Dieldrin (ng/l)	0,24	0,22	0,29	0,8	1,1	0,83	1,1
PCB (ng/l)	2,1	1,75	1,6	2,5	2,6	2,92	3,0
Polycyclic (PAH) (ng/l)							
Aromatic Hydrocarbons	24,0	13,0	17,0	37,0	47,0	61,2	61,5
$CL_2C{=}CCL_2$ (mg/l)	1,88	0,26	0,31	0,51	2,00	1,78	3,0
$CL_2C{=}CHCL$ (mg/l)	1,74	0,27	0,28	0,63	2,30	1,60	2,9
Parathion (ng/l)	0,745	0,562	0,925	0,517	0,652	0,617	0,965
Aldrin (ng/l)	0,345	0,18	0.23	0,313	0,136	0,150	0,483
Endrin (ng/l)	0,016	0,015	0,012	0,022	0,007	0,024	0,050
Chlordane (ng/l)	0,020	0,017	0,014	0,024	0,009	0,026	0,052

References

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COAL : A NEW MARINE POLLUTANT IN THE EASTERN MEDITERRANEAN ?

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A new potential marine and coastal pollutant, coal, was introduced into the coastal waters of Israel with the activation of the power plant at Hadera, Israel. The annual consumption of this power plant is 3.3 million m^3 coal, the expected coal consumption of a new power station which is now under construction in Ashkelon is 2.5 million m^3, and many industries in Israel are now undergoing conversion to coal. It is expected that the national consumption of coal in the year 2000 will be 13 million m^3. All this coal is shipped to Israel by sea and some of it will fall to the seabed during unloading, hence the threat to the marine and coastal environment.

The purpose of this work was to monitor the coal falling onto the seabed in the vicinity of the coal terminal in Hadera, and to determine the direction and rate of its dispersal with special attention to the threat of coastal pollution by coal. To this end, the seabed was sampled at stations located in the vicinity of the coal terminal (some as far as 5 km from it) using a grab sampler. The coal quantity in these samples determined the degree of pollution of the seabed. In addition, beach surveys were conducted along the shores of the power plant to determine if and where coal has landed on the beach. During the three and a half years of monitoring (January 1982 - June 1985), eight sampling trips were carried out.

The first sampling was carried out in a temporary unloading zone which was about 2 km north of the present terminal. The other seven sampling trips were carried out near the coal terminal, but with time the sampling area was increased to cover also the temporary unloading zone and even beyond it.

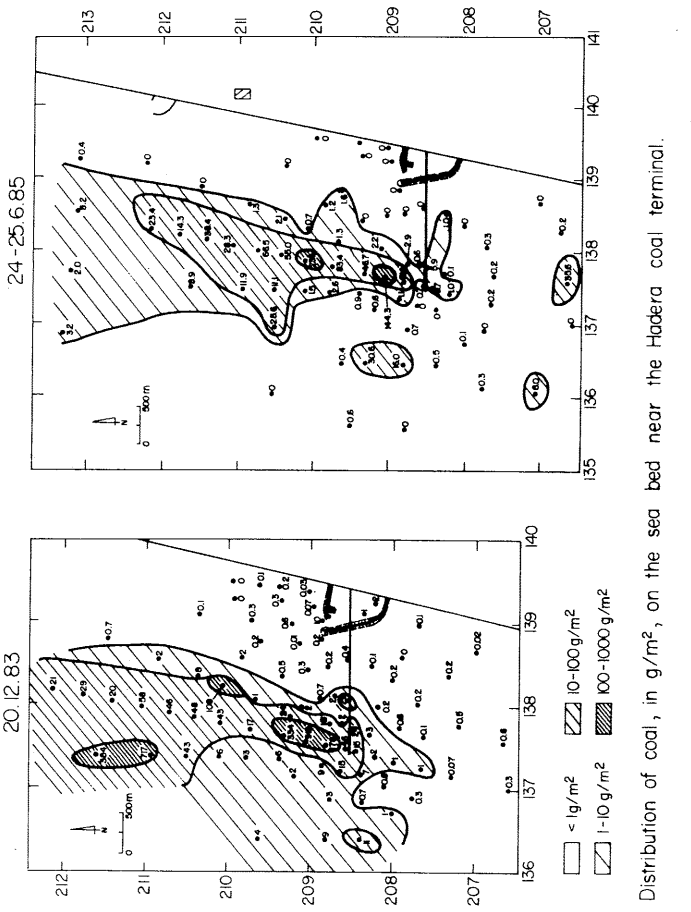
The results showed that coal is found in significantly larger quantities in stations located north of the terminal than to its south. At stations which are located close to the beach, coal is found in small quantities or not at all. Large quantities of coal were found in the area where temporary unloading took place in 1981. On the beach, coal was not found until October 1983, which was about two years after coal unloading had started. In October 1983 coal was found on the beach north of the the power plant. Only a few grains of coal were found at that time at two locations, 100 m and 2500 m north of the power plant. Following that event and until the end of this study, in September 1985, coal was not found on the beach.

This study reached the following conclusions, after close to four years of monitoring and unloading of almost 7 million m^3 of coal:

a. The coal falling at the Hadera coal terminal drifts northward more than 5 km away.

b. The primitive unloading methods which took place before the coal terminal was completed caused a lot of coal to fall out, so that a high coal concentration is still located on the seabed in the area of temporary unloading four years after unloading has ceased.

c. Until the end of this monitoring, there were no signs of a coal pollution threat to the beaches in the vicinity of the Hadera coal terminal.



Distribution of coal, in g/m², on the sea bed near the Hadera coal terminal.