

## Heavy Metal Concentrations in selected marine species from Milos Island (Aegean Sea)

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### Introduction

A considerable amount of work deals with the problem of the accumulation of heavy metals by the marine biota (Howard & Brown, 1987; Santoro & Koepp 1986). During an oceanographic survey in Milos island (Aegean Sea) in October 1988, specimens of *Paracentrotus lividus*, *Patella aspera*, *Cystoseira* sp. and *Padina pavonica* were collected from different areas in the island in order to determine heavy metal contamination, in an area where natural mineral resources and the establishment of a big electricity plant could alter the environmental background.

### Materials and Methods

Samples were collected from five stations along the coast line of Milos Island by SCUBA diving. Metal bioaccumulation was determined using the soft tissues for *P. aspera*, the gonads for *P. lividus* and the leaves in plants. Heavy metal concentrations were determined by air-acetylene flame (UNEP 1982) using a VARIAN AA157 Atomic Absorption Spectrophotometer. Statistical analysis include one-way ANOVA and the LSR test.

Table 1. Mean values (avg) and Standard Deviation values (std) of bioaccumulation of the six metals at the 5 stations in the four species. sp1: *P. lividus*, sp2: *P. aspera*, sp3: *Cystoseira* sp. sp4: *P. pavonica*.

METAL	STATION 1				STATION 2			STATION 3				
	sp1	sp2	sp3	sp4	sp1	sp2	sp3	sp1	sp2	sp3	sp4	
Ni	avg	9.30	28.60	21.90	28.40	8.74	26.90	17.60	14.10	25.50	10.20	27.30
	std	5.58	14.69	6.33	8.32	5.25	12.66	4.99	19.37	38.54	7.37	2.54
Cu	avg	4.00	10.10	5.20	5.90	4.29	7.60	4.20	6.30	12.00	4.60	6.70
	std	1.40	2.30	1.70	2.60	2.10	2.68	1.04	3.30	4.30	0.40	0.80
Cd	avg	2.40	8.30	2.40	3.20	2.49	3.70	1.80	3.00	7.90	3.50	3.10
	std	0.80	2.30	0.70	0.90	0.90	1.50	0.10	1.70	2.20	0.90	0.40
Mn	avg	2.20	16.30	27.20	46.50	10.75	32.10	61.70	2.40	6.30	18.60	75.20
	std	1.04	11.80	35.70	5.20	9.70	44.50	24.20	0.80	2.50	3.00	18.90
Cr	avg	3.10	6.17	2.10	4.40	2.48	5.12	2.50	3.60	15.30	1.60	4.10
	std	1.90	4.60	2.20	1.50	1.20	2.30	2.30	2.80	31.30	0.80	1.50
Zn	avg	123.60	56.50	24.40	21.80	120.02	31.85	25.90	117.60	42.60	47.30	30.10
	std	69.30	36.90	8.10	12.30	67.80	18.00	7.50	22.50	5.40	10.60	2.60

  

METAL	STATION 4				STATION 5				
	sp1	sp2	sp3	sp4	sp1	sp2	sp3	sp4	
Ni	avg	7.10	19.10	8.90	19.00	34.90	16.00	17.70	22.00
	std	2.34	13.04	5.91	9.19	19.37	11.80	5.30	6.90
Cu	avg	3.70	12.30	3.60	6.70	5.50	7.90	4.10	5.30
	std	0.70	3.70	0.50	0.40	2.80	2.80	3.30	1.00
Cd	avg	1.90	11.40	2.20	3.20	3.40	5.00	1.60	2.70
	std	0.20	3.90	0.20	0.30	1.20	1.70	0.70	0.30
Mn	avg	1.20	11.30	16.70	74.00	6.30	23.00	65.40	121.30
	std	0.30	3.50	1.80	25.80	4.00	22.80	68.40	9.60
Cr	avg	1.90	5.80	1.50	3.50	18.20	5.20	5.30	4.10
	std	1.40	4.20	1.10	1.20	14.70	4.50	3.60	1.00
Zn	avg	75.80	50.90	22.00	37.30	127.30	43.20	59.10	32.20
	std	41.10	8.70	3.90	4.40	102.70	11.80	41.80	4.80

Table 2. F-ratio (F) and significance level (p) in the four species for the six metals

METAL	<i>P. lividus</i>		<i>P. aspera</i>		<i>Cystoseira</i> sp.		<i>P. pavonica</i>	
	F	P	F	P	F	P	F	P
Ni	8.64	<0.001	0.85	0.498	7.97	0.0001	3.32	0.03
Cu	2.72	0.038	5.74	0.006	1.17	0.336	1.63	0.199
Cd	2.78	0.035	18.17	<0.001	10.92	<0.001	0.99	0.408
Mn	8.53	<0.001	2.27	0.072	3.86	0.008	31.33	<0.001
Zn	0.66	0.619	2.71	0.038	6.64	0.0003	7.32	0.0006
Cr	11.79	<0.001	1.13	0.349	-	-	0.85	0.477

### Results and Discussion

Out of the total 226 samples, 66 belong to sea urchins, 66 to limpets and 103 to the two species of algae. The mean concentration values are shown in Table 1. The concentrations of Ni, Cu, Cd, Cr and Zn in *P. pavonica* show a lot of comparability with the concentrations found in the leaves of *Cystoseira* sp. (Table 1). In addition, results show that metal concentrations in *P. aspera* are higher than those in *P. lividus*. This is particularly emphasized for the determined concentrations of Cd. The explanation for this could be found in the physiology of these two organisms. The limpet is a herbivorous animal and a good indicator species for Cd contamination and usually contain high concentrations of metals under natural conditions, particularly in the visceral mass (Bryan 1976). One-way ANOVA revealed that there are no significant differences in metal content for *P. pavonica* between the various stations (Table 2). On the contrary the ANOVA test regarding the concentrations of Ni, Cu, Cd and Cr for *P. lividus* demonstrates differences between two groups of stations, 3 and 5 in the first group and all the other stations in the second group of stations. The differences of the natural environment should be responsible for that rather than contamination areas. In this respect the observed differences in the levels of contamination in the metal concentrations should be due to natural environmental factors like sediments and/or mineral dissemination.

In conclusion, the concentration ranges found in the above mentioned species are comparable with other areas in the Aegean sea (Voutsinou-Taliadouri, 1982; Vasilikiotis et al, 1983; Catsiki, unpublished results) which are considered as clean waters.

### References

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