DETERMINATION OF TRACE ELEMENTS IN THE MEDUSAE *AURELIA AURITA* and *PELAGIA NOCTILUCA* FROM SARONICOS GULF, BY INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS.

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Abstract:
Instrumental Neutron Activation Analysis and γ-spectrometry were used for the determination of the trace elements Se,Cr,Ag,Cs,Sc,Rd,Fe,Zn, and Co in the Medusae Aurelia aurita and Pelagia noctiluca, both collected from the Saronicos Gulf. Mean trace element levels (μg/g d.w., whole body) and corresponding concentration factors (in parenthesis) calculated on a w.w. basis for these two jellyfish species were as follows : Se 0.18 (23), Cr 2.26 (282), Ag 0,025 (3), Cs 0,013 (1.7), Sc 0.0008 (0.10), Rb 3.39 (422), Fe 12.1 (1507), Zn 16.5 (2067) and Co 0.14 (17) for A.aurita and Se 2.0 (250), Cr 2.98 (372), Ag 0.078 (10), Cs 0.020 (2.5), Sc 0.019 (2.4), Rb 3.27 (407) Fe 113.8 (14227), Zn 71.0 (8900), and Co 0.08 (10) for P.noctiluca.

Résumé :
Les méthodes de radioactivation neutronique et de spectromètrie-gamma ont été utilisées pour la détermination des éléments en trace, Se, Cr, Ag, Cs, Sc, Rb, Fe, Zn et Co, dans les Méduses Aurelia aurita et Pelagia noctiluca qui ont été récoltées dans le golfe de Saronicos. Les concentrations en éléments déterminées dans les deux espèces exprimées en valeurs moyennes, (μg/g de poids sec) pour l'ensemble du corps et les facteurs de concentration (entre parenthèses) calculés sur la base du poids humide, sont les suivants : Se 0.18 (23), Cr 2.26 (282), Ag 0.025 (3), Cs 0.013 (1.7), Sc 0.0008 (0.10), Rb 3.39 (422), Fe 12.1 (1507), Zn 16.5 (2067) et Co 0.14 (17) pour A. aurita, et Se 2.0 (250), Cr 2.98 (372), Ag 0.078 (10), Cs 0.020 (2.5), Sc 0.019 (2.4), Rb 3.27 (407), Fe 113.8 (14227), Zn 71.0 (8900) et Co 0.08 (10) pour P. noctiluca.

Last decade an augmented bloom of jellyfish was observed in Mediterranean, including coastal areas of Greece. The swarming of jellyfish and its impact on human activities create significant economic and health problems. By clogging fishing nets for instance, sorting of the catch becomes difficult and sometimes pactically impossible. More important, jellyfish act as potential predators on fish larvae as well as food competitors of larval fish and of plankton-feeding adult species. When abundant, they can clog and damage power plant sea water intake cooling systems (1). Finally, they also present a health hazard since

fishermen and swimmers are frequently injured by contact with jellyfish stings.

Knowledge of the elemental composition of jellyfish could be of importance in understanding their ecology, their increasing populations and their role in marine pollution, if any, as a contributing factor to their development and distribution. In this regard, an attempt was made to determine the concentrations of the trace elements Se,Cr,Ag,Cs,Sc,Rb Fe,Zn and Co in *Aurelia aurita* and *Pelagia noctiluca*. Both species were collected from the Saronicos Gulf. The trace elements studied, are in the majority important pollutants of the marine environment and also possess corresponding fission and/or neutron induced radionuclides.

Instrumental Neutron Activation Analysis and gamma spectometry were applied for the determination of the above elements in the "whole body" of the species studied. Results are shown in Table 1.

All trace elements under study were detected in both species. Significant (p 0.001) differences in trace element levels between *A. aurita* and *P.noctiluca* were observed for Se,Ag,Sc,Fe and Zn, their values being higher in *P.noctiluca*. Concentration factors of Se,Sc,Fe and Zn were substantially higher in *P.noctiluca* as compared to those in *A.aurita*. Mean values reported by Tomic et al.(2) for *P.noctiluca* were

TABLE 1.

TRACE ELEMENT CONTENT (µg/g d.w., whole body) AND CONCENTRATION FACTORS (based on w.w.) OF *AURELIA AURITA* AND *PELAGIA NOCTILUCA*

ELEMENT	SE	CR	AG	CS	SC	RB	FE	ZN	CO
AURELIA AURITA	0.18	2.26	0.025	0.013	0.0008	3.39	12.1	16.5	0.14
(N = 11)	(0.10)	(1.90)	(0.018)	(0.003)	(0.0004)	(0.49)	(5.7)	(5.0)	(0.20)
CONCENTRATION FACTOR	23	282	3	1.7	0.10	422	1507	2067	17
PELAGIA NOCTILUCA	2.0*	2.98	0.078*	0.020*	0.019*	3.27	113.8*	71.0*	0.08
(N = 6)	(0.7)	(1.31)	(0.020)	(0.008)	(0.007)	(0.57)	(57.3)	(30.2)	(0.04)
CONCENTRATION FACTOR	250	372	10	2.5	2.4	407	14 227	8 900	10

Values indicate means plus SD (in parentheses).* The difference between the same element concentrations is significant (p 0.001, "t" test).

(in µg/g d.w.) Se 180, Cr 31, Rb 127, Fe 185, and Zn 52. With the possible exception of Fe and Zn all other trace element levels are not

in agreement with those reported here, possibly because of the different habitat of *P.noctiluca* of the two sampling areas (Adriatic and Saronicos Gulf).

References

1. Moller, H. (1983). Effects of jellyfish predation on fishes. Workshop on jellyfish blooms in the Mediterranean Sea. Mediterranean Action Plan, UNEP.Athens.
2. Tomic, S., J., Makjanic, I., Orlic and V.Valkovic (1983) Analysis of trace elements in jullyfish by XRF. Workshop on jellyfish blooms in the Mediterranean Sea. Mediterranean Action Plan, UNEP.Athens.

Discussion

L. MUSANI-MARAZOVIC: You have also analysed the concentration of trace elements in seawater. Is there any accummulation of these elements by Aurelia or Pelagia?

C. PAPADOPOULOU: We do have data on the content of these elements in seawater, and the concentration factors for Fe and Zn are high in Pelagia.

A. BOLOGA: Have you also data on the elemental composition of marine seaweeds using instrumental neutron activation analysis?

C. PAPADOPOULOU: No, unfortunately we don't have yet any data for seaweeds.

P. GERMAIN: Did you measure any lanthanides in biological material by neutron activation?

C. PAPADOPOULOU: No, we did not measure lanthanides.

N. FISHER: Do you have any reason to suspect that these low metal concentrations in your animals have any influence on their ecology or behaviour? It is not entirely clear to me why you are going to so much trouble to obtain all these metal values in medusae.

C. PAPADOPOULOU: Information on the elemental composition of different species of medusae could be of importance for understanding their ecology and role in the transfer of certain pollutants or radionuclides from the plankton through the food chain.

E. PAPATHANASSION: For the sake of completeness I think that you should also include the results of the trace metal analyses of zooplankton. The wet weight-dry weight relationship for every size class is $\simeq$ 4% for Aurelia aurita.

C. PAPADOPOULOU: We will present separately the data we have on the trace element concentration in other plankton. We also found the same wet weight-dry weight ratio for Aurelia.

T. VUCETIC: Do you know anything about the "Hormesis" effect (at low level radiation) on fertility and fecundity of jellyfish?

C. PAPADOPOULOU: No I don't, I'm sorry.