

VANADIUM CONCENTRATION FACTORS IN ECHINODERM SPECIES
FROM SARONICOS GULF

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Les facteurs de concentration de vanadium par quelques échinodermes collectionnés dans le Golfe Saronique ont été déterminés après avoir dosé le vanadium par activation neutronique. Les valeurs obtenues indiquent une accumulation de vanadium très importante dans certaines espèces. Ainsi ces organismes pourraient être utilisés en tant que indicateurs biologiques étant donné que le vanadium présente beaucoup d'intérêt du point de vue de la pollution et éventuellement de la radioécologie, puisqu'il est remplacé dans certains cas par le niobium.

The increase of the radioactive wastes discharges into the marine environment necessitates the extension of our knowledge on the characterization of the marine species as concentrators for certain specific radionuclides. This can be achieved by studying the concentration factors of the elements in the marine organisms. The concentration factors express the transfer of the trace elements from the sea water in the biota and then to the man through the food chain.

The marine invertebrates accumulate trace metals in a range, up to 10^6 , depending on the species and the metal involved. They also possess an intermediate position in the radiosensitivity scale. Among them the echinoderms present variations in their elemental composition and the peculiarity to highly concentrate vanadium in Holothuria species.

Radioactive isotopes of vanadium are normally not existing in the nuclear wastes. However vanadium could be an element of radioecological interest since it can be replaced, in certain species, by niobium (as has been reported for certain ascidians) which is present in the nuclear waste discharges, mainly by the radionuclide ^{95}Nb . This fact and the significance of vanadium as biologically important and pollutant element led us to determine the concentration factors of vanadium in the whole bodies of the following echinoderm species collected from the north-east Saronicos Gulf (salinity: 38‰, temperature 14°C): *Ophioderma longicanda*, *Echinaster sepositus*, *Marthasterias glacialis*, *Sphaerechinus granularis*, *Paracentrotus lividus* and *Arbacia lixula*. Neutron activation combined with a fast radiochemical separation by solvent extraction was used for determining vanadium (^{52}V , $T_{1/2}$: 3.8 min) in the

above organisms. The vanadium concentration factors (K) were calculated by analysing sea water from the same area and the values, respectively to the species above, were found as follows: 1.1×10^4 , 6.8×10^2 , 7.3×10^2 , 5×10^3 , 2×10^2 and 5.5×10^2 , expressed in fresh weight. These values show a high accumulation of vanadium in all species and especially in *Ophioderma longicanda* ($K=10^4$). Bibliographic data on the values of vanadium concentration factors related to these organisms are rather lacking. However the vanadium content in *Asterias glacialis* and *Paracentrotus lividus*, reported by Vinogradov, is approximately the same when compared with the vanadium content found in the corresponding species from Saronicos Gulf. From the results presented above it should be pointed out that apart from *Holothuria*, *Ophioderma longicanda* is another echinoderm species accumulating vanadium in high levels. This fact suggests a differentiation among the echinoderm species belonging to different classes, as it has been found in *Tunicates*, as far as it concerns the concentration of vanadium. Thus *Ophioderma longicanda* and *Spaerechinus granularis* could be used in certain cases as indicators for marine radioactive and industrial pollution, since they cover many of the characteristics defined for the suitability of an indicator organism.