

## ENVIRONMENTAL LEVELS OF AMERICIUM-241 IN TWO MEDITERRANEAN SEASTARS

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Previous works (GUARY, 1980) have clearly shown that the tissue distribution of <sup>241</sup>Am in seastars is strongly dependent on the uptake pathway. As was the case for plutonium (GUARY *et al.*, 1982), it is of interest to examine the distribution of fallout <sup>241</sup>Am in Mediterranean seastars in order to define the accumulation pathway of this radionuclide in natural environments, taking into account that these organisms, with few exceptions, have been found to contain the highest concentrations of transuranium elements among all marine invertebrates examined to date. Two asteroids collected off Monaco, *Coscinasterias tenuispina* and *Marthasterias glacialis*, were dissected and analysed for <sup>241</sup>Am by standard chemical extraction techniques and alpha-spectrometry (BALLESTRA, 1980). *C. tenuispina* (n > 100, 15 g average wet weight) was immature (gonad index = 1.3) and sexes were not visually identifiable. *M. glacialis* (n = 25, 50 g average wet weight) was mature and gonad index averaged 12 for males and 21 for females.

The results reported in Table 1 show the following:

i) the highest concentrations of <sup>241</sup>Am (C.F. =  $3 \times 10^4$ ) are found in the body wall which contains 84-94% of the total body burden of <sup>241</sup>Am in the two seastars.

ii) the internal organs (pyloric caeca, gut and gonads) are able to concentrate <sup>241</sup>Am to high levels ( $4 \times 10^3$  -  $2.9 \times 10^4$ ) although these tissues account for no more than a few per cent of the total americium body burden except gonads during the reproductive period, and particularly male gonads of *M. glacialis*. In the latter case, the fraction of total <sup>241</sup>Am fixed in gonads increases to 12% (C.F. =  $2.6 \times 10^4$ ).

These results confirm the very high americium concentrating ability of these marine invertebrates. If we compare these data with our previous results on plutonium accumulation in seastars (GUARY *et al.*, 1982), it appears that <sup>241</sup>Am is concentrated to a greater extent (10 times) than <sup>239+240</sup>Pu in the tissues of these asteroids. The greater bioavailability of Am could be due to a higher percentage of particulate <sup>241</sup>Am compared to plutonium in northwestern Mediterranean waters (HOLM *et al.*, 1980).

Our experimental radiotracer studies (not shown) have demonstrated that assimilation and input through the food chain can be substantial (GUARY, 1980); however, repetitive ingestion of this radionuclide results in increased <sup>241</sup>Am excretion rates which tend to limit the buildup of this radionuclide in seastar tissues. Furthermore, our radiotracer experiments have demonstrated that when asteroids are exposed to <sup>241</sup>Am in sea water, the resultant tissue distribution of <sup>241</sup>Am closely approximates that found in seastars contaminated in the natural environment (GUARY, 1980).

Thus, we conclude from these studies that in a natural environment, seastars mostly accumulate their americium body burden directly from water.

Table 1. Concentration and distribution of <sup>241</sup>Am in two Mediterranean seastars collected in Jan-Feb. 1978. 1s errors are based on propagated counting errors.

Tissue	Wet/dry weight ratio	<sup>241</sup> Am (mBq kg wet <sup>-1</sup> )	Total body burden <sup>241</sup> Am (%)	C.F. *
<i>Coscinasterias tenuispina</i>				
Body wall	3.8	63.6 ± 7.0	94.2	30 000
Pyloric caeca	4.1	27.4 ± 3.0	3.7	13 000
Gut	4.3	61.8 ± 11.8	1.9	29 000
Gonad	3.8	8.5 ± 3.7	0.2	4 000
Whole animal	-	59.9 ± 14.4	100	28 000
<i>Marthasterias glacialis</i>				
Body wall	3.3	62.9 ± 5.6	83.8 (♂) - 88.7 (♀)	30 000
Pyloric caeca	4.6	12.2 ± 1.5	3.4 (♂) - 4.1 (♀)	5 800
Gut	5.0	37.0 ± 3.7	0.7 (♂) - 0.8 (♀)	17 500
Male gonad	5.8	54.8 ± 2.6	12.1	26 000
Female gonad	5.2	13.7 ± 1.5	6.4	6 500
Whole animal **	-	55.5 (♂) - 44.4 (♀)	100	26 000 (♂) - 21 000 (♀)

\* Concentration factors (C.F.) were calculated using reported <sup>241</sup>Am concentrations in Mediterranean coastal sea water (2.1 μBq l<sup>-1</sup>) where the seastars were collected (FUKAI *et al.*, 1976).

\*\* Values for reconstituted animal are approximate because separate analyses for males (♂) and females (♀) were not performed for all organs.

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