MAIN RADIONUCLIDES OF CESIUM, PLUTONIUM AND STRONTIUM IN THE NORTHERN ADRIATIC SEA (1990 - 92)

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Temporal trends of radiocesium isotopes were presented in the past in papers (TRIULZI *et al.*, 1992; 1994) that dealt mostly with the influence of the Chernobyl accident on the eastern Mediterranean Sea. In this work investigations were extended to other important radionuclides such as plutonium and strontium isotopes (DESIDERI *et al.*, 1994) that contribute together with Cs-137 to the radiocontamination of the Mediterranean area because of their long environmental persistency.

Although the distribution of Sr-90, Cs-137, Pu-238 and Pu-239+240 was obtained in different ecosystem components such as seawater, pelagic and benthic organisms and sediments, major emphasis was put on the detection of the above-cited nuclides in sediment samples, due to the importance of the sediment compartment as the final point of pollution accumulation.

For this reason, samples of sediment from different strata (mostly 0-3 cm and 12-15 cm) were collected from sampling stations along transects off the main Adriatic cities during May 1990 (NONNIS MARZANO and TRIULZI, 1994). A complete mapping of radionuclide concentrations has therefore been obtained for an area located between the Gulf of Trieste and Ancona.

Samples of sediment and macrofauna were also collected in the Sacca di Goro, a salt marsh environment of the Po river delta, with the aim of comparing the marine and estuarine biogeochemical behaviour of the radionuclides. For this reason two stations were chosen inside the Sacca, a central station influenced by the tidal current and river-sea exchanges, and a recovered one with slow hydrological motion (BONDAVALLI *et al.*, 1994).

Concentrations of Sr-90 and Pu-239+240 in benthic marine organisms were generally very low, and in particular for the Pu-239+240 very close to the limits of detection. Concentrations of Sr-90 ranged between <0.5 and 1.7 Bq/kg dry while values of Pu-239+240 were variable between <0.003 and 0.093 Bq/kg dry.

However as reported above, special emphasis was put on the distribution of these isotopes in the sediment layer where concentrations were more readily detectable. In fact, concentrations of Sr-90 in the open sea sediments ranged between 1.5 and 6.44 Bq/kg dry for the surface strata and between <1.5 and 2.13 Bq/kg dry for the underlying layers. Lower concentrations were detected for the plutonium isotopes with values of Pu-239+240 in the ranges 0.21-1.23 Bq/kg dry and 0.08-1.47 Bq/kg dry for the top and underlying strata, respectively. Mean concentrations of Pu-238 were around 0.03 Bq/kg dry for both strata.

Results obtained from samples collected in the two stations of the Sacca di Goro were lower than those determined in the open sea area. Sr-90 concentrations were in the range 1.9-2.8 Bq/kg dry, Pu-238 was below the detection limits (<0.1 Bq/kg dry) and Pu-239+240 was in the range 0.05-0.15 Bq/kg dry. Nevertheless concentrations of Cs-137 and Cs-134 were much higher in this estuarine environment compared to the ones detected in the open Adriatic Sea.

Pu-238/Pu-239+240 ratios varied between 0.02 and 0.06 whereas Sr-90/Pu-239+240 ratios were in the range 5-26. These values were in good agreement with data reported by PENTREATH (1987) for the marine environment in the preChernobyl period. It is well known that the Chernobyl event has scarcely affected the Sr-90 and Pu-239+240 levels already present in the environment. In fact, fallout depositions of these isotopes during the Chernobyl period were negligible in comparison to the levels of radiocesium.

On the other hand, the Cs-137/Sr-90 ratios varied between 1 and 4 in the marine environment and were around 25 in the salt marsh. The Cs-137/Pu-239+240 ratios ranged from 5-25 in the open sea and between 466 and 600 in the Sacca di Goro. The estuarine environment therefore appeared to be a strong accumulating area of Cs-137 whereas concentrations of Sr-90 and plutonium isotopes were lower than levels detected in the Adriatic.

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