

Distribution of Cesium-137 in the Mediterranean Sea
A Preliminary Report

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Abstract

Preliminary observations made on the distribution of cesium-137 in the Mediterranean are presented and discussed. The vertical distribution of cesium-137 in different areas of the Mediterranean seems to be primarily correlated with the hydrographical conditions prevailing in specific areas.

Resumé

Des mesures préliminaires concernant la distribution du césium-137 en Mer Méditerranée sont présentées et discutées. La distribution verticale du césium-137 dans différentes zones de la Mer Méditerranée semble être liée principalement avec les conditions hydrographiques régnant dans les zones considérées.

Little is known about the general pattern of the distribution of cesium-137 in the Mediterranean, although a small number of measurements has already been carried out in some local areas. During several cruises conducted in 1975-77 a number of large volume seawater samples (≈ 200 litres) were collected from various basins of the Mediterranean for measurement of radionuclides. Based on the results of these measurements, preliminary observations made on the distribution of cesium-137 are presented here.

Measurements of cesium-137 were carried out by a standard procedure adopted in our laboratory for routine use. Briefly, cesium-137 is absorbed on ammonium phosphomolybdate (AMP) at pH ≈ 1.5 with added stable cesium carrier, followed by dissolution of AMP with NaOH solution and ion-exchange separation of cesium from potassium and rubidium; finally cesium-137 with

cesium carrier is precipitated as chloroplatinate and beta-counted. The chemical yield is determined by weighing cesium chloroplatinate.

The results of the measurements show that the levels of cesium-137 at the surface layer of the Mediterranean are normally in a range of 80-150 fCi $^{137}\text{Cs}/\text{l}$, which are similar to those found in other oceans. No systematic trend for variation of the surface levels of cesium-137 depending on different Mediterranean basins has been found, but it is necessary to take into account that the data for the eastern part of the Mediterranean and those for the Adriatic are still missing. Since the input of the soluble fraction of cesium-137 from Mediterranean rivers does not exceed 60 fCi $^{137}\text{Cs}/\text{l}$, the level of cesium-137 in the Mediterranean as a whole, is likely to be controlled exclusively by fallout delivery rather than input through rivers.

The vertical distribution of cesium-137 in a profile shows definite dependency on the location. In general, a profile shows a subsurface maximum of cesium-137 at an upper depth (50-250m), which then sharply decreases to a depth around 1000m. The maximum ^{137}Cs concentrations for the off-Monaco, Tyrrhenian and Ionian profiles are respectively 90, 137 and 182 fCi $^{137}\text{Cs}/\text{l}$. The maximum ^{137}Cs concentration for these profiles appears respectively at 50, 250 and 100m. The gradient of concentration decrease between the maximum layer and 1000m is steepest in the Ionian profile and least steep in the off-Monaco profile. The less steep gradient of the ^{137}Cs decrease for the off-Monaco profile is considered to reflect the effect of the intermittent winter sinking of the surface water mass, which has been known to take place in the neighbouring area. On the other hand, the steeper decrease for the Ionian profile when compared to the other profiles indicates that the downward transport of the upper water mass is much slower in the Ionian basin. Thus, it seems reasonable to consider that the vertical distribution of cesium-137 in different areas of the Mediterranean may be primarily correlated with the hydrographical structure and movement of the water masses which prevail in these specific areas.

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*"Distribution of Cesium-137 in the Mediterranean Sea.
A preliminary report"*

Paper presented by R. Fukai (IAEA, Monaco Pt.)

Discussion

M. BILINSKI: Did you measure the distribution of solid particles with the depth? It seems to me that Coulter Counter method could give a useful information about the size and distribution of the particles. Also, adsorption isotherms of Pu and Am in sea water should be determined. Different adsorption properties of both elements could explain their very different behaviour.

R. FUKAI: No, we did not, so that our data represent those for unfiltered water. I agree that the measurements on the particulate fraction are very important. Our intention in the future is to try to filter large volume of sea water in depth in order to obtain sufficient amounts of particulate matter for analysis.

G. LAPICQUE: Do you start by filtering your samples, or do they include particles and small size living matters?

R. FUKAI: As I said, we did not filter the water samples for measurements. We estimate, however, that only 5-10% of total ^{137}Cs concentration is contained in the particulate fraction.

