# Th, U and Pu isotopes in the upper layer sediment of the Taranto Gulf (Ionian Sea)

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Résumé - La radioactivité d'echantillons de sediments du golfe de Tarente a été mesurée afin de déterminer les teneurs en Th, U et Pu. Les plages des variations trouvées, exprimées en µg/g de sediment sec sont les suivantes: 2 à 4,5 pour $^{238}U$; 3,3 à 7,5 pour $^{232}Th$; 0,3 à 2,25 x $10^{-4}$ pour $^{230}Th$ (Ionion). La concentration en $^{239}Pu$ (+ $^{240}Pu$) est 0,02 pCi/g de sediment sec. Le rapport d'activité $^{228}Th/^{232}Th$ n'est pas à l'equilibre; il est environ 0,9.

Text - Some results on the chemical and radiochemical analysis[(1, 2)] of Th, U and Pu isotopes contained in sediment surface layer samples are reported in this paper in the frame-work of a radioecological research in the Taranto Gulf environment[(x)]. The aim of the general work is at determining the radioactivity baseline level before the beginning of future controlled discharges of radioactive releases into the marine environment from the ITREC reprocessing plant of the CRN Trisaia.

Some basic information on the samples considered are reported in Table 1: samples "L" were collected by a sediment grab sampler in June 1974, samples "ST" were collected by a Phleger corer in July 1972.

The average values of the grain size distribution of dry sediment (expressed in %) are the following:

| | >250 µm | 250÷125 µm | 125÷62 µm | <62 µm |
|---|---|---|---|---|
| sample L | 27 | 57 | 15 | 1 |
| sample ST | 1 | 22 | 20 | 57 |

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Uranium ($^{238}U$) content (μg/g dry sediment) ranges from 2 to 4.5; Thorium ($^{232}Th$) content varies between 3.3 and 7.5 μg/g; Ionium ($^{230}Th$) ranges from 0.31 to $2.25.10^{-4}$ μg/g. These data are similar to those previously obtained in the Ligurian Sea[3]: 2.7 ppm U and 10.2 ppm for natural Th. Samples "L" present a $^{232}Th$ concentration lower than samples "ST" owing to a different sand and clay content.

Higher values of U and Th have been found in samples collected in the area from the mouth of the river Sinni toward South West (Trebisacce); bottom materials in the area near the coast show higher concentrations of typical heavy minerals such as zircon and epidote, as reported elsewhere[4].

It can be pointed out that higher concentrations of artificial radioactivity (from fallout) have also been found in sediments of this area[5].

Another thorium isotope, $^{228}Th$, has been determined through alpha spectrometry and the mean value of the activity ratio $^{228}Th/^{232}Th$ is about 0.9; the disequilibrium between these isotopes is evident.

Determination of plutonium isotopes (from fallout) has been carried out using $^{236}Pu$ as tracer, as previously described by Wong[2]: a preliminary datum obtained by analysing an electrodeposited source from a mixed sample (ST. 2/A and ST. 2/B) is 0.02 pCi $^{239}Pu$ ($+^{240}Pu$) per g of dry sediment.

TABLE 1

| sample | collection area | depth (m) | thickness of sediment layer (cm) |
|---|---|---|---|
| L.0 ) L.1 ) L.2 ) | in front of Sinni river mouth, near pipe-line outlet | 10-12 | 1.5-2 |
| ST. 2/A ) ST. 2/B ) | offshore Sinni river mouth (right and left) | 50-200 | 6 |
| ST. 3 | central area | 500 | 6 |
| ST. E | in front of Metaponto (North-East) | 50-200 | 6 |
| ST. 0 | in front of Trebisacce (South-West) | 50-200 | 6 |

Bibliography

1. Triulzi C. (1973) - Analyses of U and Th in marine sediment samples by different methods - Thalassia Jugoslavica, 9 (1/2), 119-125.

2. Wong K. M. (1971) - Radiochemical determination of plutonium in sea water, sediments and marine organisms - Anal. Chim. Acta, 56, 355-364.

3. Cerrai E., Schreiber B., Triulzi C. (1966) - Ra, Io, Th and U in some coastal sediment samples of the Ligurian Sea - Energia Nucleare, 13 (12), 680-686.

4. Brondi A., Ferretti O., Anselmi B. (1974) - Deriva delle sabbie del litorale Nord-Occidentale del Golfo di Taranto - Rend. Soc. Ital. Min. Petr., 30 (1), 111-140.

5. Triulzi C., Mezzadri M. G., Giacoletto C. (1972) - Radioattività dei sedimenti del Golfo di Taranto (1969) - Giorn. Fis. Sanit. Radioprot., 16 (2), 101-108.

6. Mangia A., Mezzadri M.G., Triulzi C. - Th, U and Pu isotopes in the upper layer sediment of the Taranto Gulf (Ionian Sea).

## Discussion

Guegueniat P. (France) : Do you think that the high content of iron in sediment (6%) has any influence on the uptake of radionuclides ? Russian works show a correlation between content of iron in sediments and uptake of protactinium and thorium.

Triulzi C. : As for the correlation between the elements of interest with others or with ionic groups (e.g. $CO_3^{--}$), I think this could be taken into consideration in a future work. For the time being, we are engaged in finishing the collection of all our experimental data.

Ünlü Y. (Turkey) : What type of plant do you have on the coast of Sinni river ?

Triulzi C. : The plant is called ITREC, that is plant for the fuel element reprocessing, which is now at a pilot-plant stage. It is located in an area (CRN, Trisaia) about 5 Km from the coast line. In the future this area might store also radioactive wastes of various origin.

Livingston H.D. (USA) : Have you measured the ratio $^{238}Pu/^{239,240}Pu$ in your sediment samples yet ?

Triulzi C. : Pu isotopes and consequently their ratios for all sediment samples considered have not yet been measured. For the time being we have just obtained the availability of electrodeposited sources derived by radiochemical separation.

Dejak C. (Italy) : What is the predominant water circulation in the Taranto Gulf near the Sinni river estuary ?

Triulzi C. : The oceanographic research carried out by Bernhard et al. did not show any evidence of a preferential circulation in one sense or another: however, some indications of seasonal type have been noticed.