

ALLOGENIC URANIUM IN IONIAN-SEA SAPROPELS

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Uranium- and thorium-isotope analyses on quaternary sediments from the Ionian-Sea show the allogenic origin of Uranium in the sapropel-layers C,D,E and F.

L'analyse des isotopes du U et du Th effectuée sur sédiments quaternaires (Mer Ionienne) indique que l'Uranium dans les couches sapropéliques C,D,E et F est d'origine allogène.

α -spectrometric U- and Th-analyses were carried out in order to estimate the age of sapropel-layers of the Eastern Mediterranean and to establish the distribution of U and Th in these sediments. Preliminary results show that in sapropels C,D,E and F from cores 22M48, 22M50, 22M45 and 17M21 (Ionian Sea) U was incorporated in a manner different from what is normally assumed for anaerobic sediments.

Anaerobic sediments with high organic matter (C_{org}) content are enriched in U (up to 500 ppm (1)), whereas in aerobic sediments the U-content is similar to the average for sedimentary rocks (1-3 ppm). This enrichment generally is ascribed to authigenic U-deposition from sea-water. U dissolved in sea-water is not in radioactive equilibrium with its daughters (Act. ratio U^{234}/U^{238} (=AU) = 1,15; $Th^{230}/U^{234} \leq 5 \cdot 10^{-4}$ (2)). Thus, dating of U-enriched anaerobic sediments is possible because after U-deposition, Th^{230} grows into equilibrium with U^{234} , while the U^{234} -excess decays with the halflife of U^{234} ($T_{1/2}^{234} : 75.000y.$; $U^{234} : 250.000y.$).

The investigated sapropels are up to 15 times enriched in U (fig.1: 22M48). In layers A and B the AU exceeds unity indicating the presence of authigenic U. Assuming the detritic component to be 1-3 ppm, the age of layer B can be estimated to be between 40.000 and 60.000 years.

The process of authigenic U-deposition, however, cannot be responsible for the U-enrichment in layers C, D, E and F as the lower age-limit for U (apparent age $\geq 700.000y.$) is in obvious contradiction with results of paleomagnetic and paleontologic datings (F: $\approx 200.000y.$ (3)) and, moreover, as from U-data would result an extremely low upper-limit for the average sedimentation rate (4 mm/1000y.). The high U-content here is caused by supply of "old" U-rich allogenic material in which U is in radioactive equilibrium. In layer C (22M48) the allogenic component exceeds 80 %.

The observed radioactive equilibrium of Ra^{226} with Th^{230} indicates that no appreciable diffusion of the easily-mobile Ra from this reducing environment takes place. It suggests a particular stable incorporation of Radium.

The fact that in the sapropels under study a large amount of the U is of allogenic origin and that a broad correlation between the U- and the C_{org} -content was found, finally suggests the terrigenous origin also of the organic matter.

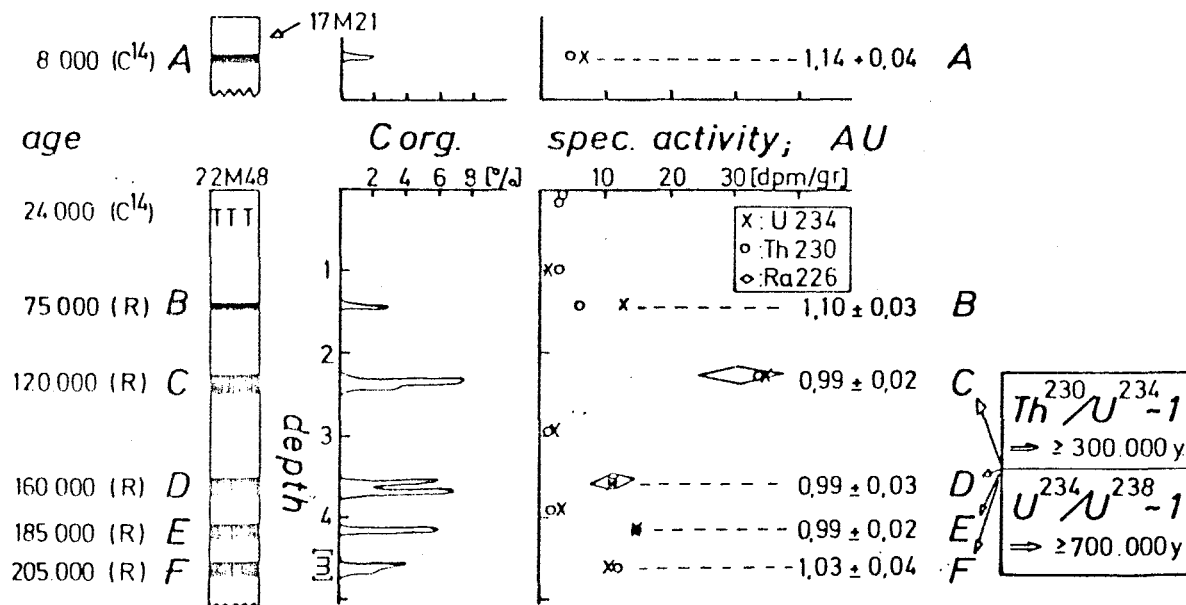


Fig. 1: U^{234} , Th^{230} , Ra^{226} and C_{org} -Distribution in cores 22M48 and 17M21 (layer A) from the Ionian-Sea. AU= Activity-ratio U^{234}/U^{238} . (1 dpm/o U^{238} = 1.36 ppm Uranium.). C^{14} , paleomagnetic and paleontologic (R) ages, on the left side, are from Ryan.

- 1) Veeh H.H., 1967, Deposition of U from the Ocean, Earth Planet. Sci. Lett., 3, 145-150
- 2) Moore W.S. a. Sackett W.M., 1964, U- and Th-Series Inequilibrium in Sea-Water, J. Geophys. Res., 69, 4293
- 3) Ryan W.F.B., 1972, Stratigraphy of Late Quaternary Sediments in the Eastern Mediterranean, in Stanley D.J. (ed.): The Mediterranean Sea.

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Discussion

Livingston H.D. (USA) : Do you have any idea about the source and transport mechanism of the allogenic U in your sediment samples - with the U isotopes in equilibrium ?

Mangini A. : No. I want to ask Geologists this question and see if their idea of how sapropels were formed fits allogenic uranium.

Got H. (France) : Le ^{232}Th est essentiellement d'origine détritique et lié à la matière organique. Avez-vous mesuré ce radioisotope afin de différencier les veines détritiques dans les niveaux sapropéliques ?

Mangini A. : The ^{232}Th values (ppm) for the studied Ionian-Sea cores lie between 4.7 and 7.2. They are mainly depending on the CaCO_3 content. Higher CaCO_3 values mean lower ^{232}Th content.

