Sediment reworking rates, multitracer approach

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Sampling.

We took part in the CD105, PE109 and CD110 cruises for sampling sediment cores at the interface with surrounding sea-water. During CD105, we sampled 7 box cores at depths between 1100 and 2900 meters for short half-lived nuclides investigation. 3 Kasten cores obtained by Cambridge University were sampled for the determination of long term processes such as sedimentation rates and sedimentary component fluxes.

During PE109 together with large volume water sampling in the water column and nepheloid layer we obtained surface sediments as 6 multicorer tubes and 6 boxcore subcores by 200 to 2960 meter depth for short half-lived nuclides investigations.

Unfortunately the sea was too strong during CD110 cruise to allow sediment sampling and we only got large sea-water samples.

Laboratories.

Sediment cores were sliced at 0.5 and 1cm intervals, dried at 60° and conditioned in sealed tubes ready for direct gamma counting in high efficiency well-type Ge detectors.

Very short half lived nuclides determination: $^{234}Th_{xs}$ ($T_{1/2}$=24d) and $^{228}Th_{xs}$ ($T_{1/2}$=1.8y) are only present in freshly deposited sediment. They will be used for 3 purposes: - to check for a good recovery of the uppermost sediment layer, - to study the sediment mixing rate and - to link sediment trap material data to those of deposited sediments. Radionuclide contents of this particular layer was measured on 4 cores from CD110 cruise and 9 from PE109 less than two month after coring. With this first run, we were able to measure $^{234}Th_{xs,}$ $^{228}Th_{xs}$ and $^{210}Pb_{xs}$.

Short half-lived nuclides determination: $^{226/228}Ra$, $^{210}Pb_{ex}$, ^{137}Cs are used in order to establish short term mass accumulation and mixing rates in surface sediments. Measurements are conducted in the underground laboratory of Modane by non destructive gamma spectrometry using 2 high efficiency well type germanium detectors. 4 to 10 grams of dry sediment are measured during 2 days and their activities compared with a standard. At different depths across the Iberian margin, density and mineralogical composition of the sediment are highly variable, therefore variations in the self absorption process for low energy gamma emitters like ^{210}Pb(46keV) become important and must be controlled in order to be able to give precise data. We selected 8 samples in cores with variable composition and measured ^{210}Po by radiochemical method followed by alpha spectrometry. By comparing alpha and gamma spectrometry results on ^{210}Po/Pb, we will be able to correct the efficiency of our gamma detectors for low energy gamma rays in various samples. For the other radionuclides, with gamma rays of high energy, the sample composition do not affect the counting efficiency.

Results.

Very short half-lived nuclides: $^{234}Th_{xs}$ and $^{228}Th_{xs}$ activities at the top (0.5cm) of 13 cores are reported on the map. Most cores contain ^{234}Th and ^{228}Th in excess which proves a good recovery of the sea-water sediment interface layer sampled with multicorers as well as with box corers. Only 2 cores, number 1 and 15, do not display $^{234,228}Th_{xs}$ at the top. The cores were sampled in the channel between the Galice bank and the Iberian shelf where strong bottom currents may prevent particles deposition. We will confirm this hypothesis next year by measuring the same nuclides on multicores that will be taken during summer 98 cruise in the same area.

Short half-lived nuclides: we measured ^{210}Pb, $^{226-228}$Ra, ^{137}Cs,^{228}Th and ^{40}K profiles with depth in 9 sediment cores

Potassium content is mainly governed by the mineralogical composition of the sediment. In all studied cores K content is constant with depth which means a quite homogeneous composition of the sediment in the cores. Potassium content varies from 0.5% for deep cores to 2.8% for shelf cores.
Radium isotope activities increase from the surface to 15cm depth in most cores as a result of their diffusive behaviour from the sediment to bottom sea water.
^{210}Pbxs profiles display 2 different behaviour :
(1) for low water depth cores (fig1) a mixed layer of about 11cm overlaying an exponential decay interpreted in term of ages of the sediment.
(2) for deep water cores(fig 2): a mixed layer of 4 to 7 cm and, deeper, a different mixing process. Before to give final interpretation of such profiles we must measure additional intermediate levels in every cores.
^{137}Cs profiles (fig1 and 2) confirm short-half live nuclide penetration in the sedimentary column.

Long-term accumulation rates.

Radiochemical study of long core OMEXII 5K is in progress. 10 samples between 4 and 300cm depth were analysed for ^{230}Th, ^{231}Pa, $^{234-238}$U and ^{232}Th. Thorium content is proportional to the non carbonated fraction (R^2=0.95) while U content is very poorly correlated. We found enrichments in authigenic uranium as high as 3ppm at the end of the glacial stage just before the Holocene This enrichment may be due as in Thomson et al. (EPSL, *98*,1990, pp222-232) to a decrease in sediment accumulation rate at the end of the last glacial stage. Indeed ^{230}Th normalised sediment fluxes decrease by more than a factor of 2 between stage 2 and the Holocene.

Map 1. Surficial very short half lived nuclides (^{234}Thxs, italic underlined ; ^{228}Thxs, italic) activities for CD105 and PE109 OMEX cruises. Numbers of the stations are given in normal characters.

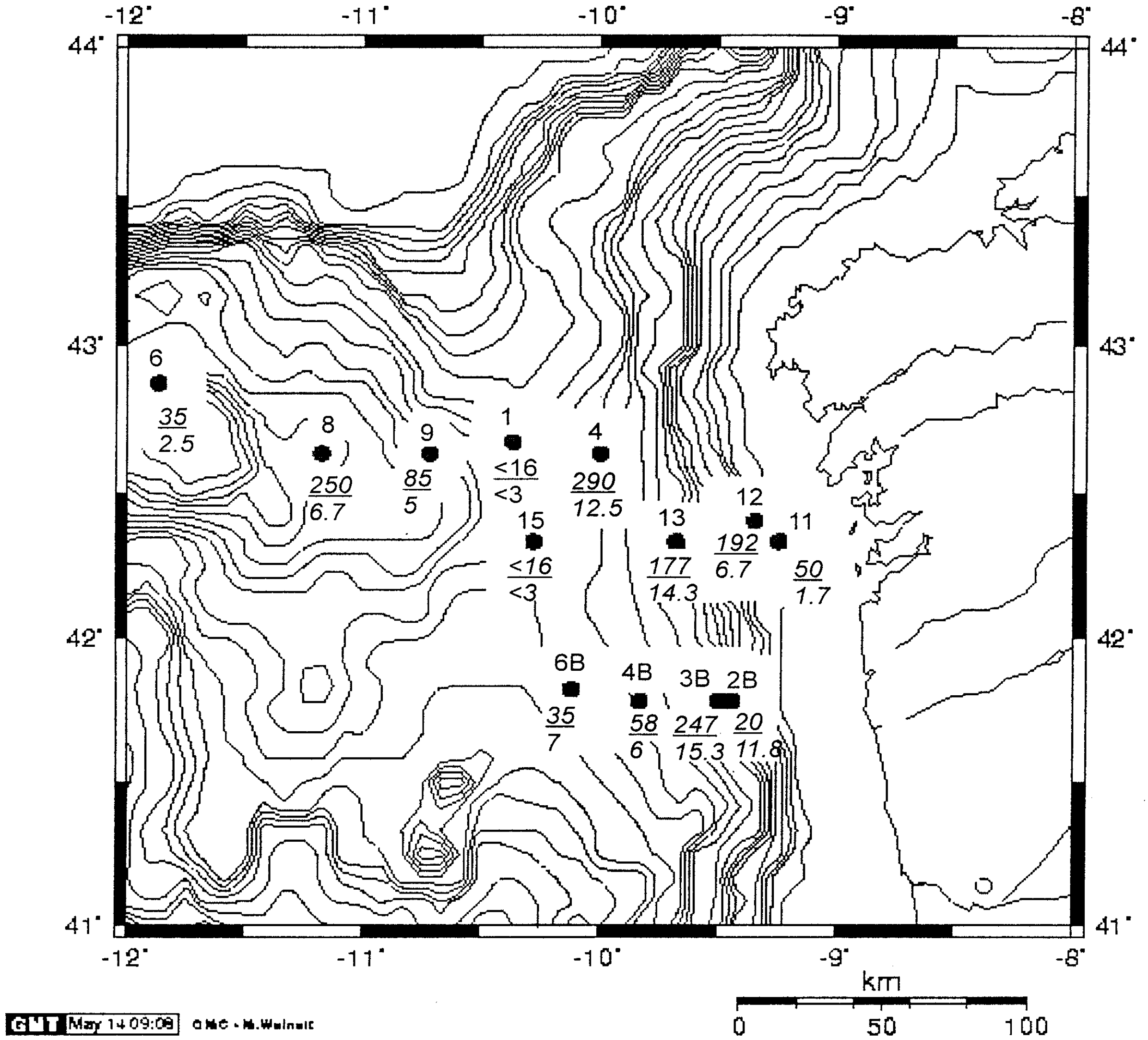

Figure 1

OMEX II - PELAGIA 109 - Du 15/07 au

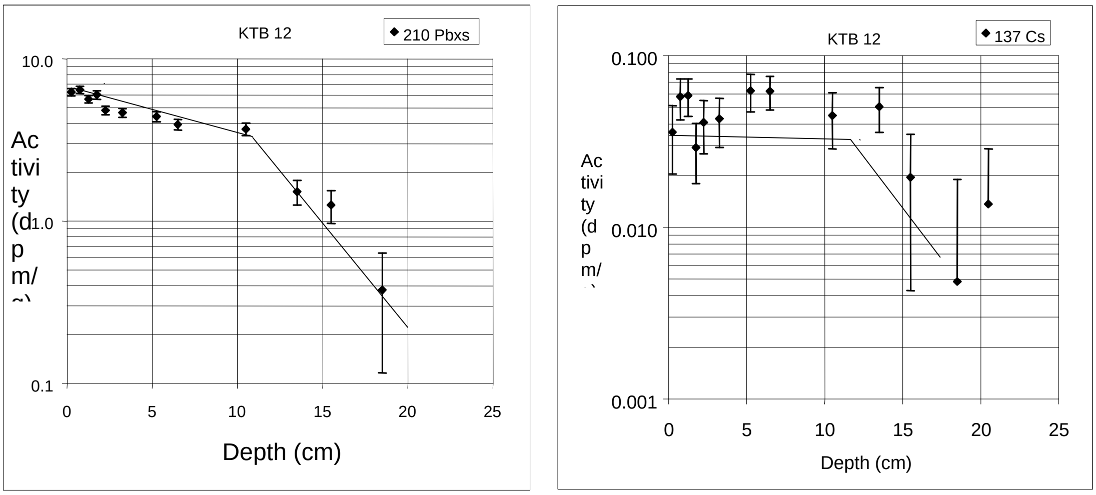

Figure 2

OMEX II - PELAGIA 109 - Du 15/07 au