First results on the fine-grained deposits of the Galician margin through grain size analyses, radiographic and radionuclides profiles.

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Introduction

This study concerns the data obtained by University of Bordeaux 1 on samples collected during The *GAMINEX* cruise which took place in July 1998 on the Galician and Northern-Portuguese margins in collaboration with Instituto Hidrografico and Universidad do Algarve. This campaign had for objectives to sample the fine-grained deposits of the Iberian margin to study the on-going sedimentological processes. Moreover the *CD110* cruise (December 1997) allows us to obtain other samples.

The proposed study aims to understand the first steps of sedimentation by the means of detailed studies of surficial sediments collected with box-corers. It will be focused on the seabed interface to establish, on a sedimentological point of view, the on going sedimentological processes induced by the hydrodynamic conditions. This will enable us to establish the budget of the current sedimentation on the shelf and the upper part of the margin. Therefore special attention is done to the fine-grained deposits.

In this first step only the sampling of the Galician margin has been taken in account.

Sampling grid has been governed by previous surveys and results obtained by Rey Salgado (1993) who established a sedimentological map of the Galician margin. So we focused the sampling on the fine-grained deposits of the shelf which are the best records for the on going processes and in addition, inside the main rias to use of references on the potential continental supplies.

Methods

10 box cores and 5 gravity cores were collected for this study in the different muddy areas (Figure 1).

Presently, all the cores have been radiographied and sampled each centimetre. Grain size distribution and carbonate contents have been done and radionuclide profiles realised on the box cores. Moreover samples have been split with our Portuguese partners for fuller analyses.

The grain-size analysis was realised using a MALVERN 3600 E micro-granulometric diffractometer laser. The POC amounts in sediment and water samples were determined using the STRICKLAND and PARSONS' method (1972) as adapted by ETCHEBER (1981). Its content was measured with a LECO CS-125 equipment. The $CaCO_3$ content was determined by a gasometric method showing a fairly low $CaCO_3$ relative variation (<2%) in duplicate measurements.

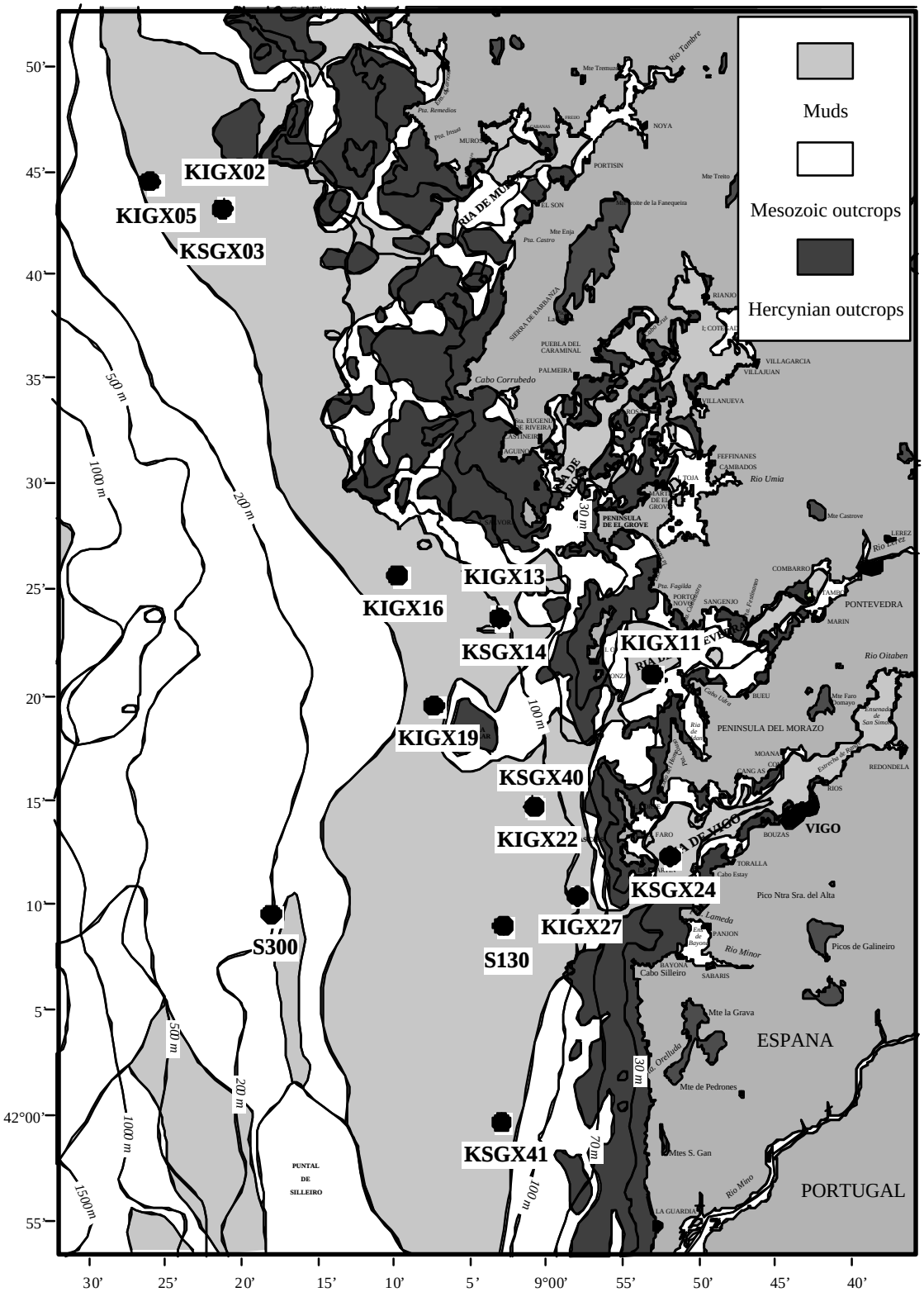
For spectrometry gamma HR, ^{210}Pb (46.5 Kev) measurements were done on dried bulk sediment samples, using a high-resolution gamma-spectrometer with a semi-planar detector (Intertechnique EGSP 2200-25-R). ^{210}Pb excess have been calculated from: ^{210}Pb total - ^{226}Ra (^{226}Ra is counted from its daughters; ^{214}Bi and ^{214}Pb) The sample (6 to 10 g) is counted during 10 to 20 hours.

Radiography of surficial cores were performed with SCOPIX made up of a classical X-ray equipment coupled with a new equipment of radioscopy developed by the CEGELEC Company (France) and connected to a computer for data acquisition and processing using two specific software (Acquisition and Analysis).

According to the different tasks in connection with our partners we have measured the POC content and the carbonate content in sediment samples (**Tasks II.2.2** and **III.2.2**). Moreover we have split the samples with partners in charge of geochemical analysis.

For the main task in our charge (**Task III.1.3**) presented here, we have worked presently on box cores and 2 gravity cores.

GAMINEX 98 - Location map



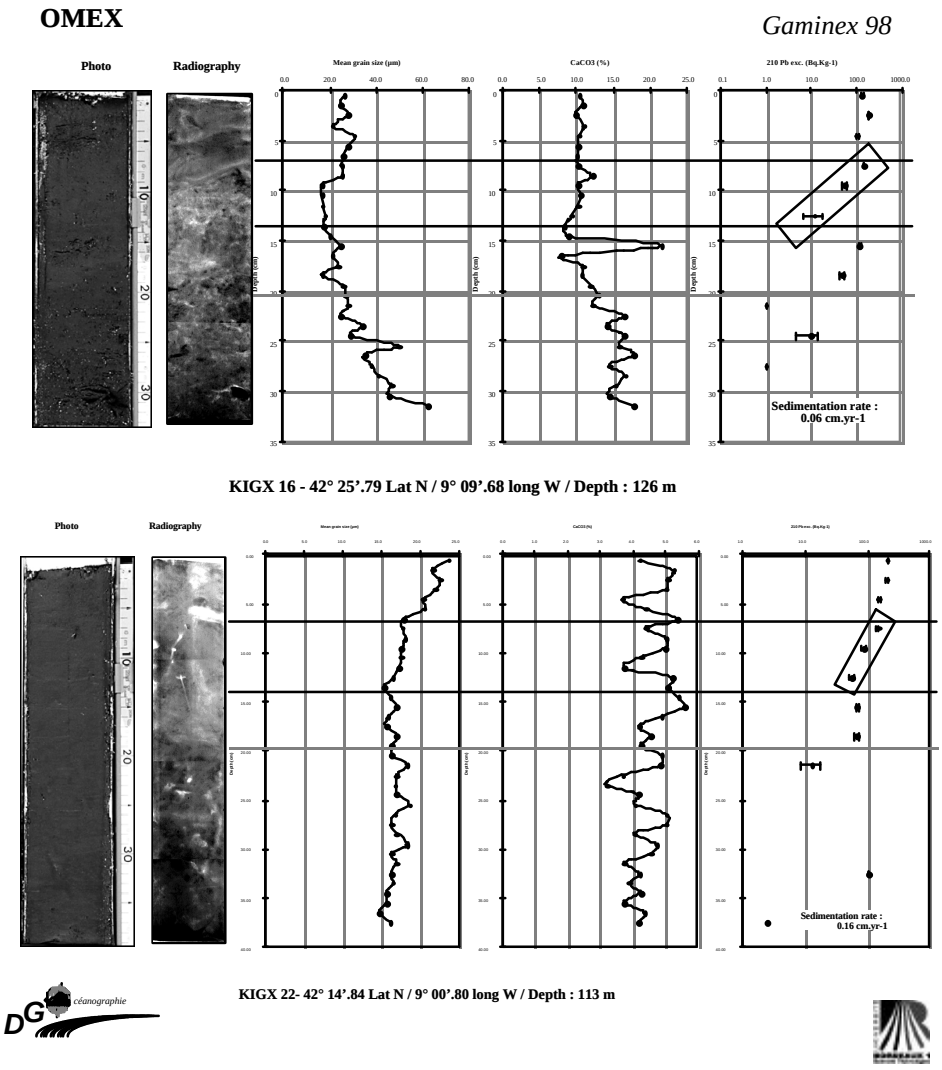
Box-Cores

Results obtained on 2 box-cores are presented (Figure 2) as example of differences observed between a northern (KI GX 16) and a southern (KI GX 22) area of the Galician shelf. Estimates of sedimentation rates are based upon knowledge of sedimentary parameters (grain-size distribution, carbonate content) and radiography interpretation. This approach helps us to choice the levels of reference (frame) for this calculation.

Thus on KI GX 16, the surficial mixing layer, marked by a constancy of the ^{210}Pb exc., has a thickness of 7 cm and we can observe 2 contacts of dynamical origin. Thus it be can notify that this mixed layer do not show any biological forms but laminae composed of medium silts. Estimates of the sedimentation rate (0.06 cm yr^{-1}) has been established below this mixing layer between 7 and 13 cm. Following the coarsing-up basal sequence one can note a quite similar sequence (16-22 cm) where the sedimentation rate should be around 0.03 cm yr^{-1}.

On KI GX 22, evidences of reworking by biota are more obvious on radiography, dynamical contacts are poorly marked. Grain-size distribution does not show high vertical variation.

Comparison between KI GX 16 and KI GX 22 shows that vertical grain-size variations are opposite. They are finning-up in KI GX 16 and slightly coarsing-up in the surficial levels of KI GX 22. Carbonate contents are lower in KI GX 22 (4 to 5%) than in KI GX 16 (10 to 20%), at least, sedimentation rates are three times higher in the southern area (KI GX 22).



Gravity Cores

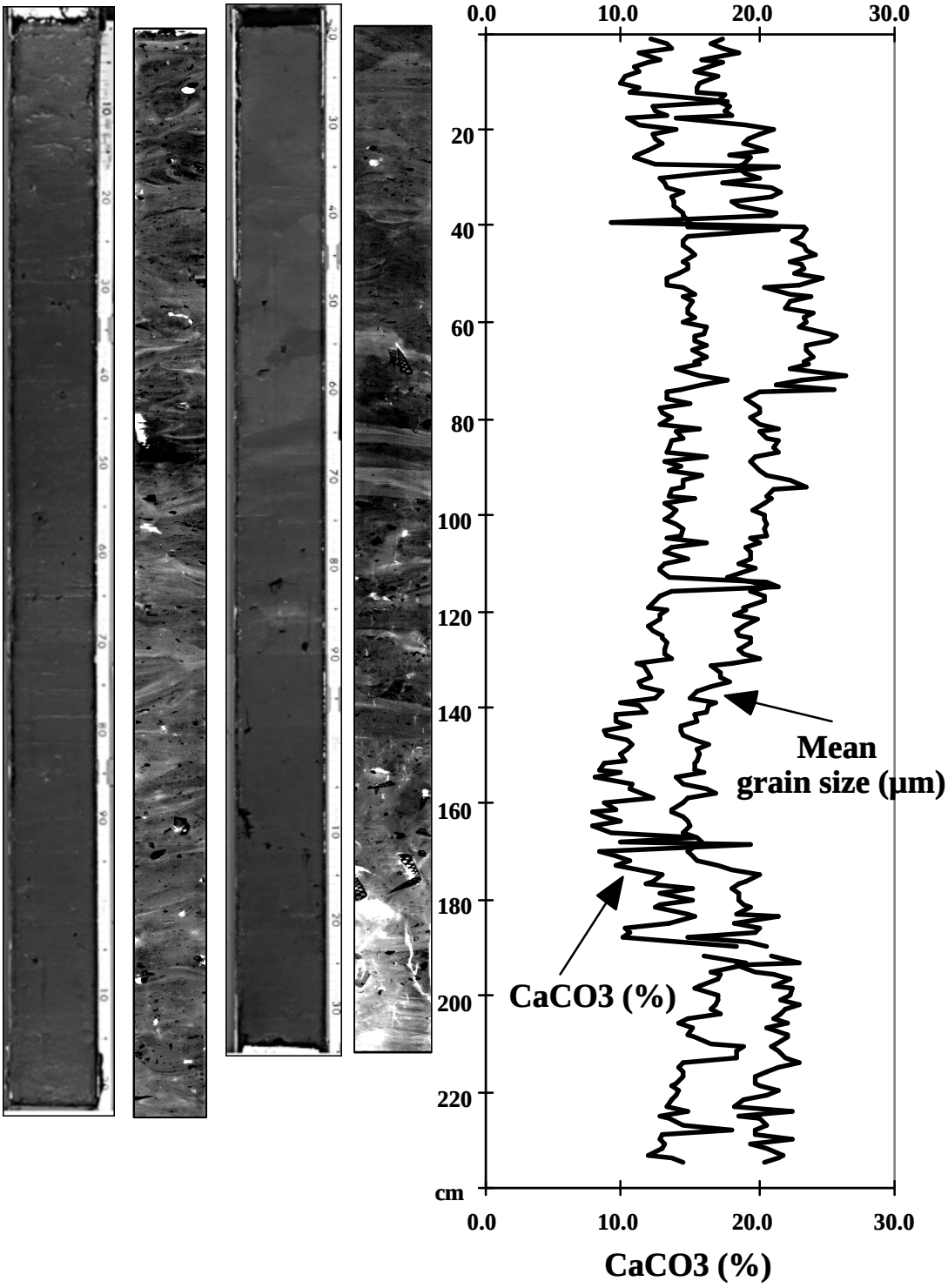
Preliminary results obtained on 2 gravity cores are presented.
KS GX 24 has been collected in the outlet of the Vigo ria and KS GX 40 on the middle shelf (115-m depth) practically at a mean latitude between the 2 large rias of Galicia (Vigo and Pontevedra).
The following information can be underline:
There is a similar pattern in the vertical distribution of the grain size and of carbonate content distribution in these 2 cores, the sedimentological record of the 2 m long KS GX 24 seems to represent an enlarging of the upper 90 cm of the KS GX 40 recording.
One can note the very good relationship between mean grain size and carbonate content in the 2 cores. Despite differences between absolute values of these parameters themselves in the 2 sites, one can propound that there is evidences on an hand, of time variations in the sedimentary processes and on an other hand, of close relations between the continental supply and the sedimentation recording in this part of the Galician margin.

^{210}Pb Results

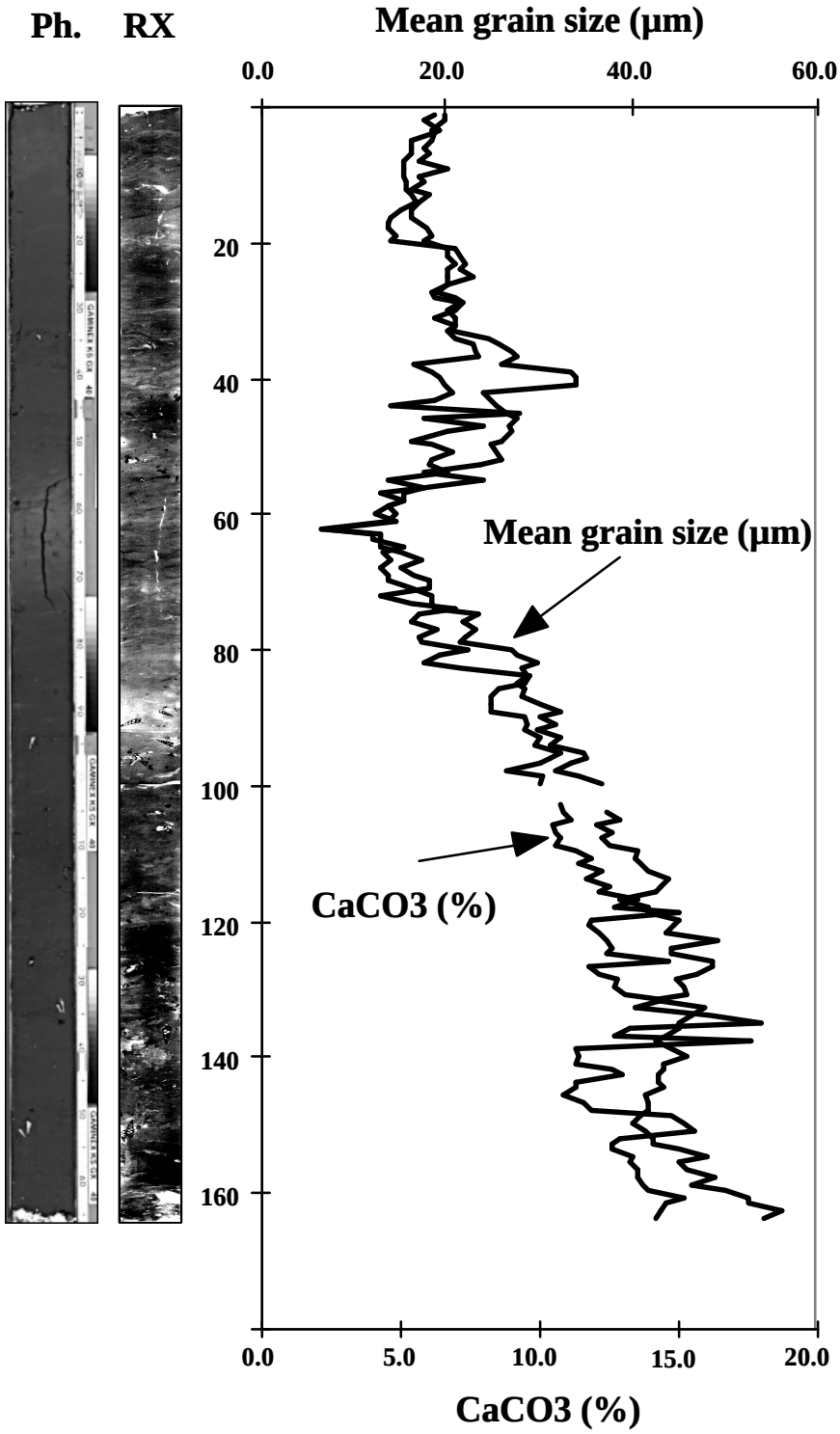
The results of ^{210}Pb excess always show a mixing surficial layer with a thickness ranging from 4 to more than 9 cm. Under this layer, sedimentation rates are measured, they vary from 0.03 to 0.19 cm yr^{-1} (except near the shelf-break where it is higher: 0.34 cm yr^{-1} at S 300). As for sedimentological results, we can note that higher sedimentation rates are measured in the southern area of the margin in front of Pontevedra and Vigo rias, at the opposite the lower ones are found in the northern area The mixing rates (corrected or not with sedimentation rate value) vary from 10^{-5} to 10^{-8} cm^2 s^{-1}. The comparison of theses data with sedimentological results and principally with X Ray imagery can easily explain the distribution of ^{210}Pb excess in the cores. The mixing zone obtained with ^{210}Pb excess profiles could correspond either to a biological effect with burrows and mottled sediment or to a physical process with sedimentary structures such as laminae and erosive contacts.

N°Core	Depth m		Sedimentation rates cm.yr^{-1}	Mixing rates cm^2.s^{-1}	Surficial mixing layer cm
KI 02	127		0.15	4.10^{-7}	5
KI 05	141		0.17	8.10^{-7}	7
KI 11	49		0.18	9.10^{-6}	9
KI 13	101		0.18	5.10^{-5}	6
KI 16	126	total	0.08	1.10^{-5}	5
		7-13 cm	0.06	1.10^{-5}	5
		16-22 cm	0.03	1.10^{-5}	5
		24 cm-bottom	0.04	1.10^{-5}	5
KI 19	133		0.08	2.10^{-7}	5
KI 22	113	total	0.15	2.10^{-7}	5
		7-13 cm	0.16	2.10^{-7}	5
		15-25 cm	0.06	2.10^{-7}	5
		25 cm-bottom	0.11	2.10^{-7}	5
KI 27	99		0.19	2.10^{-7}	3
S 130	132		0.13	2.10^{-8}	4
S 300	213		0.34	6 to 7.10^{-6}	9

KSGX 24
42° 12’.48 Lat N / 8° 51’.90 long W / Depth : 39 m



KSGX 40
42° 14'.98 Lat N / 9° 01'.01 long W / Depth : 115 m



Conclusion

It has been shown that 2 areas could be distinguished on the Galician shelf:
southward to the latitude of Pontevedra ria, fine deposits of the shelf present the fingerprints of a continental origin (ria), sediments are finer with a main mode between 0-15 μm and a second one around 30 μm and sedimentation rates are higher. Carbonate contents very high in the rias themselves decrease on the middle shelf and increase again close to the shelf break.
Northward, sediments are coarser with worse sorting, carbonate contents are higher on the middle shelf. It seems that continental supplies are and have been weaker in this part of the margin. Presence of several rocky outcrops could enhance the hydrodynamical agents and hinder the fine-grained sedimentation. Moreover they could be sources of a local coarser fraction.
The results of ^{210}Pb excess always show a mixing surficial layer with a thickness ranging from 4 to more than 9 cm. Under this layer, sedimentation rates are measured, they vary from 0.03 to 0.19 cm yr^{-1} (except near the shelf-break where it is higher: 0.34 cm yr^{-1} at S 300). As for sedimentological results, we can note that higher sedimentation rates are measured in the southern area of the margin in front of Pontevedra and Vigo rias, at the opposite the lower ones are found in the northern area. The mixing rates (corrected or not with sedimentation rate value) vary from 10^{-5} to 10^{-8} cm^2 s^{-1}. The comparison of theses data with sedimentological results and principally with X-Ray imagery can easily explain the distribution of ^{210}Pb excess in the cores. The mixing zone obtained with ^{210}Pb excess profiles could correspond either to a biological effect with burrows and mottled sediment or to a physical process with sedimentary structures such as laminae and erosive contacts.