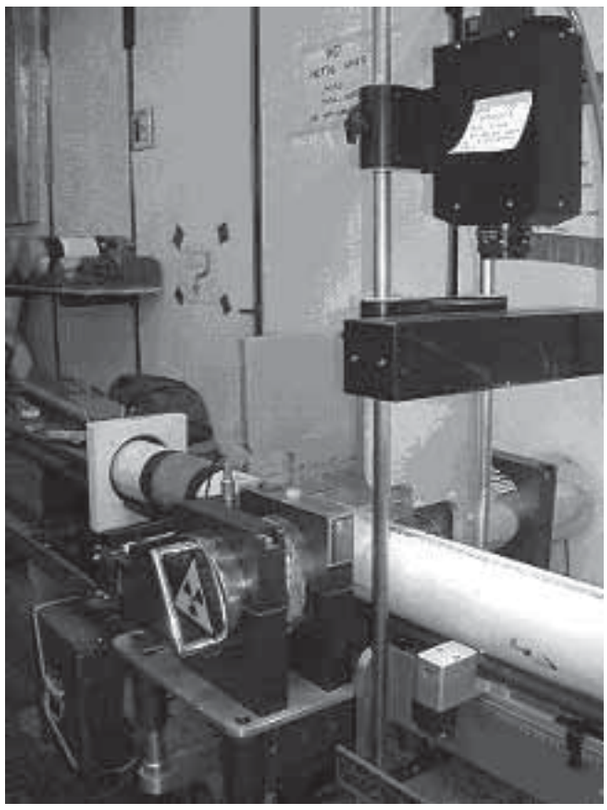

Figure 1: Multi-Sensor Core Logger of the Oregon State University, installed onboard the R/V Roger Revelle, showing the Gamma-Ray, electrical resistivity and Magnetic Susceptibility sensors. Also, a visible-image camera-scan device is shown.

Using a XRF scan we are able to know easily the abundance in our cores of some of the major chemical elements. This kind of data is usually used to study sediment source in paleoceanography, marine paleoseismology and paleoclimatology. Also, a MSCL can be applied on the splitted sections to obtain the physical parameters already explained.

During the final stage, using a U-Channel container (2 cm x 2 cm x length of the section) on the splitted cores, the central part of the section is sampled along the axis because it is usually the least disturbed sediment. Thus, sediment in U-Channels preserves the stratigraphical order. On the U-Channels we can apply different analytical procedures such as environmental magnetics, 3D X-ray, geochemistry, magnetic susceptibility, etc. Environmental magnetic measures the IRM, ARM and NRM with the objectives of investigating the secular timing, the change in the Earth magnetic field, magnetic characteristics of the sediment as mineral composition and grainsize.

3. Conclusions

Following the four stages of the proposed methodology, a number of different non-destructive techniques can be carried out in the same sediment samples giving a complete high-resolution dataset for complementary scientific disciplines saving time and money. After applying all these techniques we have completely preserved the sample to do another group of analyses.

4. Acknowledgements

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AN APPLICATION OF NON-DESTRUCTIVE MEASUREMENTS IN MARINE GEOLOGY: TURBIDITE PALEOSEISMOLOGY

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1. Introduction

Two of the most common methods in marine geology are sidescan sonar and seismics which are indirect methods to study the seafloor and underlain formations. For this reason the interpretation of the data depends largely on the scientist's experience. However, only direct methods give us a real ground-truthing of the offshore settings. Notwithstanding acquisition of direct samples is full of difficulties in terms of marine technology for sediment recovery, economic costs of the acquisition and analyses of the samples, and analytical timing and scheduling.

With the aim to optimize as much as possible the available resources in marine sciences, marine geological technology has input a number of continuous and non-destructive methods to study the sediment in few and unique sediment samples obtained from sea floor. Different scientific disciplines can be interested in investigations on a limited set of sediment samples obtained from a specific region. In interdisciplinary studies, the high cost, or sometimes the impossibility to take repeatedly the same sample from the ocean, increases the importance to preserve the small amount of sediment to carry out different analytical measures. An example of the interdisciplinary study applied on a single sedimentary data is turbidite paleoseismology which uses the non-destructive methodology of different specific sciences (i. eg.

Geochemistry, Sedimentology, Environmental magnetic). In order to investigate how often large seismic events occur and the fault source responsible for the shake, turbidite paleoseismology applies Multi-Sensor Core Logger, XRF scan, and magnetometer measurements. In order to study large historical European earthquakes such as the Lisbon Earthquake, we test for the first time the "turbidite paleoseismology" approach of Adams [1] in the Holocene record of a low convergence rate margin like SW Iberia.

2. Turbidite palesoseismology in the SW Iberian Margin

The first step in the study of Turbidite paleoseismology in the SW Iberian Margin (Fig. 1) is to characterize turbidites found on four sediment piston cores collected on the Infante D. Henrique Basin, the Tagus and Horseshoe Abyssal Plains, 4 gravity cores in Marquês de Pombal fault area and 6 multicores located widespread in the region. With this aim, the half-section cores were submitted to Multi-Sensor Core Logger analyses at 2 cm resolution obtaining magnetic susceptibility, density, P-wave velocity, P-wave amplitude, impedance, fractional porosity, and electrical resistivity. These physical parameters together with the visual description, texture characterization and lightness give an accurate idea of the sediment facies. In order to investigate the sediment source area, XRF scan on the half-section cores have been carried out. The possibility to geochemically scan the sediment allowed us to get a high resolution dataset of 2cm.

We have established an age model for every single core using radiocarbon ages and environmental magnetics during the Holocene (last 11,500 years). The magnetic measurements of IRM, ARM and NRM on u-channels, also at 2cm resolution, allow us to investigate secular ages related to variations in the Earth magnetic field. Once the sediment characterized, we established a regional correlation of all turbidite events integrating results from a local study at the Marquês de Pombal fault area [2][3] taking into account both sediment facies study and chemical composition. Afterwards we were able to discuss the seismic origin of the turbidites and to suggest a correlation of turbidite events with past historical earthquakes and tsunami deposits from the Gulf of Cadiz. Finally we established a recurrence interval for large earthquakes during the Holocene period to highlight the relevance of the turbidite record as paleoseismic indicator in a low-convergence rate margin as SW Portugal.

3. Conclusions

Turbidite paleoseismology has been successfully applied in several active margins with short recurrence interval of large earthquakes, such as Oregon, San Andreas, and Taiwan. W Iberian Margin is the first study area in a slow-convergence margin. Using the high resolution dataset from the sediment cores we have been able to identify synchronous events in different abyssal plains and slope basins in a 300 Km wide area. The most likely mechanism to explain the turbidite event synchroneity in a slow convergence margin with moderate seismic activity during the Holocene period is the earthquake triggering of mass transport deposits. In the SW Iberian Margin we have found 13 turbidite events with a time recurrence interval of 1,500 years.

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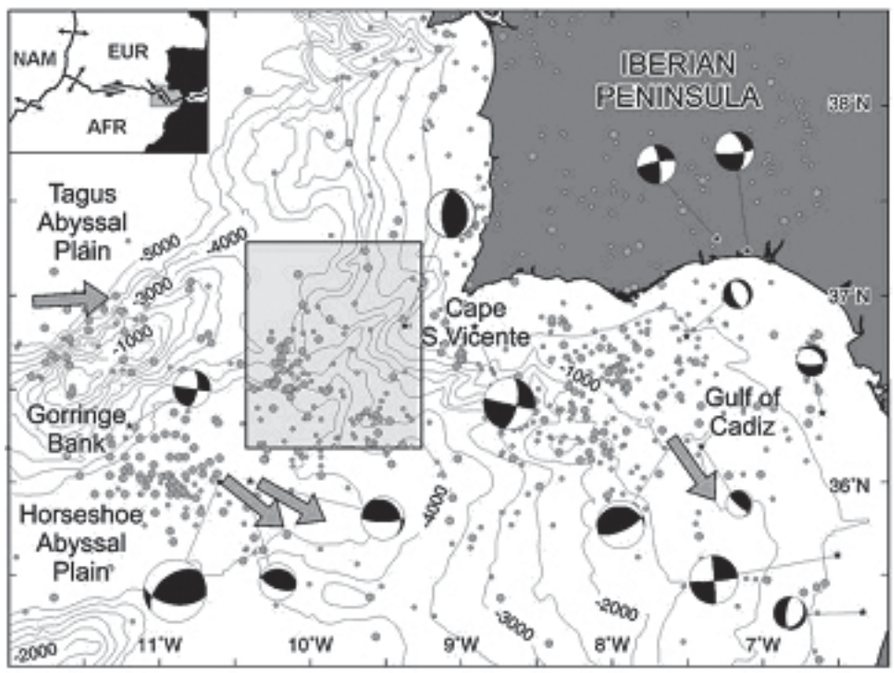

Figure.1: Bathymetric map of the Gulf of Cadiz with 250 m contour interval. Seismicity from the "Instituto Geográfico Nacional" catalog for the period between 1965 and 2000 is depicted [I.G.N., 1999]. Small grey dots are epicentres of earthquakes for 2.5 <mb <3.5, and large grey dots for earthquakes of mb >3.5 and focal mechanisms