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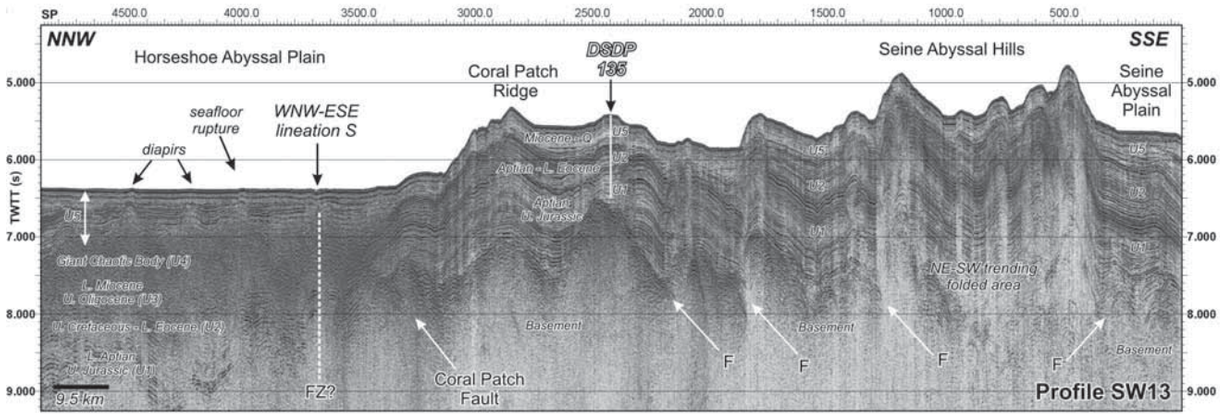

Fig 2: Interpretation of MCS profile SWIM-13 crossing the deformation area of the CPR.

NON-DESTRUCTIVE SCANNERS TO STUDY MARINE SEDIMENT

E. Piñero, A. Vizcaino, E. Gràcia, J.J. Dañobeitia

UTM: Unitat de Tecnologia Marina - CSIC, Centre Mediterrani d'Investigacions Marines i Ambientals, Pg. Marítim de la Barceloneta 37-49, 08003 Barcelona
e-mail: epinero@cmima.csic.es

Keywords: marine instrumentation, direct samples, core analyses methodology, half section analyses

1. Introduction

Marine geology constitutes a specific scientific field submitted to continuous advances. These advances are directly related to constant developments of new technology and instrumentation. New approaches of marine geological studies and technologies imply a potential increase in the number of analytical measures on the sediment. Thus, because the acquired amount of sample is very low, the main handicap of marine geologists is to apply the major number of analytical measurements on the same sediment sample. To avoid the fatal consequences generated by the irreparable lost of sediment by a single analysis, new non-destructive techniques have been developed and implemented in the last decade. Nowadays, interdisciplinar studies may be carried out based in a single sample to obtain a high resolution dataset keeping the stratigraphical order.

2. Methods and Instrumentation

Continuous non-destructive analyses can be applied during four different stages since the onboard sediment recovery, keeping the stratigraphical characteristics of the sediment. The four main stages are: (1) drilling, (2) whole-section core, (3) half-section core and (4) U-Channel.

During the first stage, drilling of the sediment deposits, a number of sensors are incorporated into the tube and are able to measure different physical properties (e.g. resistivity, porosity, density). Once the core is on board, the liners with sediment are usually divided in 1.5m sections for easy working.

The second stage starts with the cores onboard and liners with sediment divided into easy to work with 1.5m sections. Sediment sections are recorded and can be imaged using an Infra-Red camera, which is usually used in studies about temperature conditions of sediment. Furthermore, analyzing the whole section core using a Multi-Sensor Core Logger (MSCL) (Fig. 1), we can obtain in a single logging several physical properties of the sediment which include magnetic susceptibility, density, P-wave velocity, P-wave amplitude, impedance, fractional porosity, and electrical resistivity.

In the third stage, after core section splitting, new data can be acquired from the half section cores. Images on visible (Fig. 1), Infra-Red and X-Ray wavelengths of the sediment surface give information about the stratigraphic features and temperature of the record. Afterwards, the visible image can be processed obtaining RGB diagrams for spectral analyses. RGB diagrams together with the color parameters (lightness, a* and b*) obtained with the spectral photometer, allow us to characterize different sedimentary facies. In this stage, geochemical analyses can be applied on the sediment surface as the XRF scan. Using this method we obtain the chemical composition in relative values (cps) of each measurement in few seconds. The XRF scan can be run at resolution ranging from decimeters down to one millimeter.

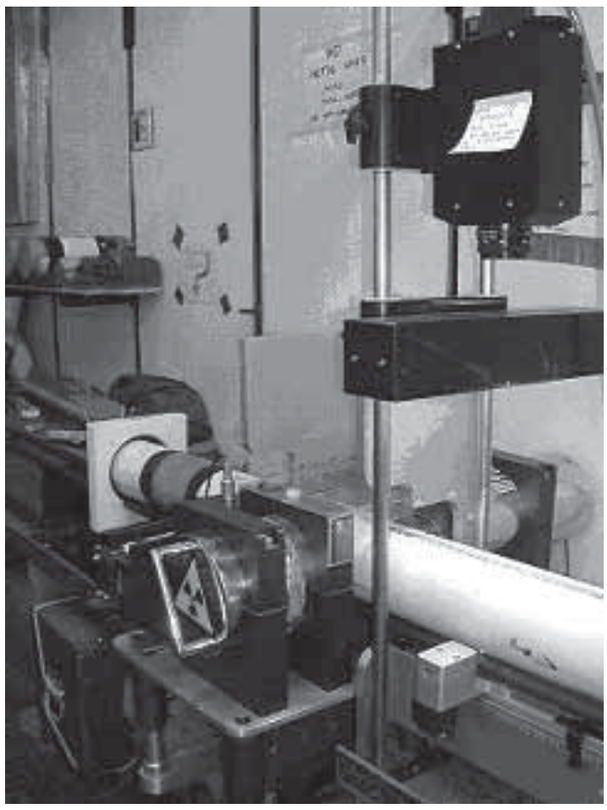

Figure 1: Multi-Sensor Core Logger of the Oregon State University, installed onboard the R/V Roger Revelle, showing the Gamma-Ray, electrical resistivity and Magnetic Susceptibility sensors. Also, a visible-image camera-scan device is shown.

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

A. Vizcaino(1), E. Piñero (1), E. Gràcia (1), C. Escutia (2), Jordi Garcia-Orellana (3), J. Dañobeitia (1)

1 UTM, Unitat de Tecnologia Marina - CSIC, Centre Mediterrani d'Investigacions Marines i Ambientals, Pg. Marítim de la Barceloneta 37-49, 08003 Barcelona
e-mail: alexis@cmima.csic.es
2 Instituto Andaluz de Ciencias de la Tierra, CSIC – Univ. Granada, Campus Fuentenueva, 18002 Granada, Spain.
3 Laboratori de Radioactivitat Ambiental, Facultat de Ciències, Universitat Autónoma de Barcelona, 08193 Bellaterra.

Keywords: Earthquake, SW Iberian Margin, turbidite, Synchroneity, interdisciplinary studie

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.