



Magnetic susceptibility and rock magnetic properties in recent carbonate mounds – Challenger Mound, Porcupine Seabight (SW of Ireland) as specific case study

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Sub-recent cold-water carbonate mounds localized in deeper slope settings on the continental margins can not be any longer neglected in the study of carbonate systems. They clearly play a major role in the dynamics of mixed siliciclastic-carbonate and/or carbonate-dominated continental slopes. During IODP Expedition Leg 307 aboard the R/V Joides Resolution, a recent carbonate mound, Challenger mound (Porcupine Seabight, SW of Ireland), was drilled for the first time in history (Expedition Scientists, 2006). The Challenger mound sediments can be described as a facies of cold-water coral fragments and other biogenic fragments embedded in an alternating biogenous (carbonate-rich) to terrigenous (siliciclastic) matrix (Exp. 307 Scientists, 2006; Foubert & Henriët, 2009). This study highlights how Challenger mound act as a palaeo- and rock magnetic recorder (Foubert & Henriët, 2009). An overview will be given of the relevance and the use of magnetic properties in the sediments of recent carbonate mounds. Palaeomagnetic and rock magnetic measurements were partly carried out aboard the R/V JOIDES Resolution during IODP Expedition Leg 307 and in the palaeomagnetic labs of the Geophysical Centre of Dourbes (KMI, Belgium). Shipboard analyses comprised measurements of the natural remanent magnetization (NRM) before and after alternating-field (AF) demagnetization (long-core cryogenic magnetometer (2G Enterprises model 760-R)) and low-field magnetic susceptibility measurements (k) (Bartington Model MS-2 meter) on whole-round sections. Discrete samples (7 cm³) were taken on the working halves of each core-section to calibrate and evaluate shipboard measurements. Remanence measurements and AF demagnetizations were performed on each of the cubes with a cryogenic magnetometer (2G Enterprises model 760-R) installed at the Geophysical Centre of Dourbes (KMI, Belgium). Low-field magnetic susceptibilities (k) and the anisotropy of magnetic susceptibility (AMS) were measured with a KLY-3S Kappabridge. A thermomagnetization experiment was carried out on oven-dried powders of two discrete samples. The interpretation of inclination records and palaeointensity records allowed building up a magnetostratigraphic framework for the mound records. A four-phase general evolution model for Challenger mound and his surrounding environment could be proposed. The interplay between terrigenous sedimentation (with the supply of paramagnetic Fe-rich clay minerals (mainly illite and chlorite), diamagnetic quartz and ferrimagnetic magnetite), biogenic sedimentation (diamagnetic calcium carbonate) and diagenesis (dissolution of ferrimagnetic magnetite and formation of paramagnetic pyrite) controls the susceptibility records. The anisotropy in magnetic susceptibility suggested that the sediments in the mound might be deposited by northward directed currents ensuing alongslope transport of sediments. Tuning the susceptibility records to standard oxygen isotopic records, made it possible to define a stacked susceptibility record calibrated in age for the mound sediments (SUSMOUND). Spectral analysis of the susceptibility records and the tuned records revealed some spectral characteristics of Milankovitch cyclicity between the mound base (~2.50 to 2.70 Ma) and a major hiatus present around 25.00 mbsf (~1.67 Ma), suggesting climatic forcing.

EXPEDITION 307 SCIENTISTS, 2006. Expedition 307 summary. In Ferdelman, T.G., Kano, A., Williams, T., Henriët, J.-P., and the Expedition 307 Scientists, 2006. *Proc. IODP, 307*: Washington, DC (Integrated Ocean Drilling Program Management International, Inc.).

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Devonian magnetic susceptibility studies in Poland: current state of knowledge and future studies

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So far, there are two published papers dealing with MS of Devonian and its stratigraphical and palaeoenvironmental applications in the area of Poland. Both studies concern southern Holy Cross Mts., key area of stratigraphic and facies studies of the epicontinental basin of southern Poland. Most extensively studied is the Kowala section, which comprises Upper Devonian reef-slope to marly shelf-basinal succession. MS in Kowala section was studied in detail in two intervals: Frasnian/Famennian boundary (Devleeschouwer, in Racki et al. 2002) and Lower/Middle Frasnian boundary (Nawrocki et al. 2008). The latter boundary was also studied in the Wietrzna section which is developed in a more proximal reef-slope facies. MS changes at the Lower/Middle Frasnian boundary, related to variations of detrital input into the basin, were interpreted as a result of Eovariscan tectonic activity in the Saxo-Thuringian zone and Mid-German Crystalline High. Interpretation of MS variations at the Frasnian/Famennian boundary is ambiguous since transgressive/regressive trend postulated by MS curve was not supported by microfacies study. However, only short F/F boundary interval was studied (ca. 7 m). However the eustatic signal might be biased by well documented synsedimentary tectonics. An unrecognized contribution of secondary magnetite might also affect the MS signal. Southern part of HCM was affected by Late Variscan (mostly Early Permian) remagnetization. Its intensity is stronger in the areas more thermally altered (CAI indexes 2 to 3). Moreover, Devonian rocks are locally intensively impregnated with secondary hematite, which originated most probably due to multi-stage hydrothermal activity (Lewandowski 1999) and weathering in the Late Permian/Early Triassic.

Northern part of the HCM, where Late Variscan “magnetite-related” remagnetization event was hitherto not documented, offers good possibilities of correlation of Eifelian/Givetian sections. Preliminary results indicate, that MS is nicely linked with depositional rhythms expressed as shallowing upwards, shallow subtidal to intertidal carbonate cycles

Ongoing project aims to construct reference MS curves for the Devonian in several tectonostratigraphic units of Poland, basing on borehole data. These comprise boreholes from the Brunovistulicum cover: Goczałkowice IG 1 (Lower Devonian – Lower Tournaisian) and Trojanowice 2 (Eifelian – Givetian) and from the Holy Cross Mts: Kowala 1 (Lower Devonian – Famennian) and Janczyce IG 1 (Emsian – Famennian). Another small project in the Pommeranian region is focused on the MS variations and correlations at the Devonian/Carboniferous boundary.

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