Geophysical Research Abstracts, Vol. 7, 09717, 2005
SRef-ID: 1607-7962/gra/EGU05-A-09717

Magnetic properties of methane related concretions of the Gulf of Cádiz

J.J. Villalain, (1) M.P. Mata (2); C. Taberner (3); L. Somoza, (4); V. Díaz del Río (5)

(1) Dpt. Física. Univ. Burgos. E. Politécnica Superior. Avda. Cantabria S/N. 09006 Burgos. Spain. (2) Dpt. Geología. CC. Mar y Ambientales. Univ. Cádiz. 11510 Puerto Real, Cádiz, Spain (3) Inst. Jaume Almera, CSIC, 08028 Barcelona, Spain (4) IGME. Rios Rosas, 23, 28003 Madrid, Spain. (5). Instituto Español de Oceanografía, 29640. Fuengirola, Málaga, Spain.

Carbonate concretions and crusts were discovered around seafloor seep areas in the Gulf of Cádiz at around 1000 m depth. The vast number of the total dredged concretions collected by different European cruises in the last years, and the considerable extent of the area affected by the methane seeping, makes the Gulf of Cádiz an excellent laboratory for the study of seeping fluids and fluid flow in a continental margin. Although previous microbiological and stable isotopic studies have shown that most of these concretions were formed through the massive release of methane to the ocean floor and its anaerobic oxidation by methane oxidizing microbes, not much is known about the path followed by the fluids in a local or in a regional scale.

Samples of this study were dredged during Anastasya 2000 and 2001 cruises in the Gulf of Cádiz and come from 3 methane related mounds: Ibérico, Cornide and Fila de Hormigas. The concretions have different shapes and sizes: irregular to nodular and visibly tubular shapes with one to more central conduits. All the conduits are always less than 7 cm in diameter. Sizes of the fragments are up to 80 cm in length. The tubular concretions have been previously named as chimneys, by comparing external features with those present in chimneys from hydrothermal environments. A recent and alternative explanation for these structures is as cemented sediments around burrows and bioturbations in a rich methane environment.

This study is included in the framework of a collaborative project by European groups where a whole geochemical characterization is made. One of the main goals to achieve is to understand the growing mechanism of these structures and the characterization

of the path of the methane fluid. In this study, a mineralogical and preliminary rock magnetic analysis in selected tubular samples has been performed in order to see how the carbonates form inside the sediments. The magnetic anisotropy of the sample will give an approximation of how the sediment has been affected by a focused or by a diffuse fluid flow. The mineralogy has been determined by XRD, optical microscopy and SEM study. The rock magnetic analysis, made on subsampled tubular concretions, include thermal and alternating field demagnetization of the Natural Remanent Magnetization (NRM), Isotermal Remanent Magnetization (IRM), and subsequent thermal demagnetization of three IRM components and measurement of anisotropy of magnetic susceptibility.

Hand sample observations show that the outer walls of the studied samples show differences being from black to red stained and light brown. Authigenic carbonated minerals are dolomite, high magnesium calcite and calcite. The general texture of the authigenic carbonates is fine grained (micrite). Framboidal pyrite fills foramminifera test in some samples. Regarding detrital minerals, samples from Ibérico and Cornide sites show higher clay mineral content than Fila de Hormigas site showing Fila de Hormigas a higher content, up to 40%, of coarse detrital quartz. Samples from Ibérico and Fila de Hormigas sites show dominant coercivity phases with the magnetite being the main magnetic mineral. However they also present an appreciable contribution of hematite in the magnetization. Although no significant hematites content has been detected in these samples by XRD, hematites has been detected in SEM images as an oxidation product of pyrite filling foramminifera test. The occasional presence of goethite and pirrotite is also detectable. The minor goethite component, not detected in XRD analysis, can be present at the brownish to black film that occurs in the outer walls of many of the samples. On the other hand, in samples of Cornide site, both hematite and/or magnetite have been detected as ferromagnetic components.

Anisotropy of susceptibility analysis has been made in well oriented subsamples of a thick walled tubular sample from Cornide site. The analysis indicate a distinctive and characteristic primary sedimentary magnetic fabric: a) minimum susceptibility axis clustered in the direction of the tubular structure axis and b) the susceptibility ellipsoid of individual samples shows an oblate shape with foliation plane perpendicular to the axis of the tube. With these preliminary results, a focused fluid flow that interacted with the magnetic minerals of this sample is no probable, and therefore, the conduit of the tubular structures would not act channeling the methane rich fluids. From the magnetic fabric orientation results, the most plausible situation would be an unaltered sedimentary fabric where methane flow would diffuse without reorienting the magnetic minerals. If a larger number of samples give similar results, it would mean that the precipitation of the carbonates was under diffused fluid flows regimes that did not

disturb the sedimentary fabric. Although more samples need to be studied, the previous results show a potential and alternative way to study how the components of the sediments can be affected by the fluid flow in a methane rich environments.

Aknowledgments: Projects EUROMARGINS 01-LEC-EMA06F, Spanish MEC Project REN2002-11668-E/MAR