PUZZLING ASPECTS OF DEEP-SEA SEDIMENTS MAGNETISATION FROM LABORATORY REDEPOSITION EXPERIMENTS

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Acquisition of detrital and/or post-detrital magnetisation (DRM and pDRM) of sediments depends on many factors linked to sediment properties and to the depositional process. Despite the large differences between the timing of natural and artificial deposition in laboratory it is possible to constrain some critical parameters by simple experiments.

The present study, which involves laboratory redeposition of carbonate-rich and carbonate poor natural marine sediments preserved in piston cores, is aimed at:

- constraining the variability in the response curves of the magnetisation to the applied field
- determining the importance and consequences of post-detrital reorientation in different environments

In order to meet these goals we used samples with gelatine, which mechanically locks all grains shortly after deposition by cooling down to 3 °C, and samples without gelatine. Mechanical orientation of magnetic grains was preserved by the gelatine while in samples without gelatine a large part remained free to rotate within the sediment or at the interface with water, because remanence was measured in zero field. A direct consequence is that the DRM of the gelled samples was 2 to 4 times stronger than for the samples without gelatine. The magnetisation intensities derived from the laboratory experiments have been compared to those that were initially measured in natural sediments after normalising the magnetisation by the concentration of magnetic material (using either ARM or susceptibility). The values obtained without gelatine match those of the natural sediment. Therefore, either the part of magnetisation that was not locked-in is associated with unstable magnetic carriers or the same grains were also mechanically free to rotate during the initial measurements of the natural remanent magnetisation (NRM) of the sediment in zero field.

Alternating field demagnetisation curves of the DRMs obtained for samples with and without gelatine are quite different. Without gelatine, the median destructive field (MDF) is below 5 mT, but when using gel the MDF is about 30 mT. Grains with stronger remanent coercive forces are still in suspension and contribute only to the total remanence if they are completely mechanically fixed.

In comparison to nature, a gelled sample would correspond to a certain depth where the sediment is almost dewatered and consolidated and where the sediment matrix does not allow anymore particle rotations. Concerning our studied sediments, this means that 25 to 50 % of the total remanence would be blocked immediately during sediment deposition in case of no bioturbation) and that the remainder would be locked-in between sediment deposition and sediment consolidation. In dependence of magnetic grain sizes, or the size of sediment particles, carrying remanence carriers, delayed remanence acquisition may be not an unimportant factor in certain deep-sea sediments.