Geophysical Research Abstracts
Vol. 17, EGU2015-6433, 2015
EGU General Assembly 2015
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Magnetic study of turbidites

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Turbidites induce sedimentary reworking and re-deposition caused by tsunami, earthquake, volcanic processes, and other catastrophic events. They result from rapid depositional processes and are thus considered not being pertinent for comparison with pelagic sediments. Turbidites are evidently ruled out from paleomagnetic records dealing with time-series. Consequently, no attention has ever been paid to the magnetization of turbidites which is fully justified if the high level of turbulence governing the depositional processes influences the acquisition of magnetization. In certain conditions like channeled turbidity currents, levees of sediment are generated and then associated with relatively calm although very fast redeposition processes. Such conditions will thus govern the subsequent acquisition of magnetization through mechanical lock-in of the magnetic grains. This situation is actually quite similar to what happens during the experiences of artificial redeposition that are conducted in laboratory. Therefore, combining laboratory experiments and studies of natural turbidites could reveal important information on the processes involved in the acquisition of magnetization, especially if the comparison with the overlying hemipelagic sediments does not show any striking difference.
We will present the results of magnetic measurements performed on four different and relatively recent turbidites. We selected different origins associated either with spillover of channeled turbidity currents or with co-seismic faulting. Each event is characterized by a different thickness (ten to few tens of cm), lithology and mean granulometry (few tens of μm to hundreds of μm). We have carried out measurements of magnetic susceptibility, magnetic remanence, anisotropy of magnetic susceptibility (AMS) and we also scrutinize the evolution of various rock magnetic parameters (ARM, IRM, S ratio, magnetic grain sizes, hysteresis parameters...). The magnetic characteristics of the turbiditic levels have been compared with those of the surrounding hemipelagic sediments. In all cases, the magnetization of remanence reflect the expected field direction at the site location without significant change in direction inside the turbiditic levels. This is an indication that magnetization acquisition likely obeys the same rules as for slowly deposited hemipelagic sediments. As expected there is a grain size grading with relatively coarse sediment at the bottom and fine-grained sediment at the top, similarly to what is observed with laboratory redeposited sediments and thus further justify the comparison. Surprisingly, in most cases the magnetic grain sizes follow a similar pattern, which would imply that magnetic grains were not clustered inside sedimentary particles, otherwise we would expect a different relationship.