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Mineral Magnetic and Microscopic Characterisation of Magnetic Particles in Pelagic Sediments: Examples from the Equatorial Atlantic

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A correct interpretation of the information contained in the NRM of rocks crucially depends on a proper identification of the minerals carrying the magnetisation. The most meaningful paleomagnetic and -environmental information is often carried by submicron magnetic particles from various sources. They are not straightforward to identify since they are so small and occur in low concentration. This study aims at a detailed identification and characterisation of magnetic micro- and nanoparticles in oxic/suboxic sediments. The study area in the Equatorial Atlantic comprises three sites along a W-E transect. Magnetic particles come from varying sources: continental eolian dust, fluvial discharge, and submarine weathered basalts. Authigenic sources for magnetic particle input constitute the biogenic formation of magnetosomes and the (inorganic) recrystallisation of previous iron sulphides. Bulk sediments, magnetic extracts and heavy liquid separates were scrutinised by various rock magnetic techniques. The extracts were analysed by analytic SEM and TEM to supplement the magnetic information. Novel techniques, such as electron backscatter diffraction, were applied to characterise the particles in great detail. The outcome testifies to the complexity of the magnetic inventory and displays potential diagenetic mineral alterations. Seeming inconsistencies in bulk magnetic signals could be clarified using the EM techniques for grain size and mineralogical analysis. By this means, the amounts of individual magnetic components can be (semi-)quantified allowing for better budget calculations. The detailed knowledge of the mineral inventory and its specific properties helps to distinguish between primary and secondary magnetic components of different origins, which is of key importance in paleomagnetism. They provide useful proxy parameters (for transport mechanisms, source areas, or sedimentary processes) in similar environmental settings from the Equatorial and subtropical South Atlantic.