Geophysical Research Abstracts
Vol. 20, EGU2018-1430, 2018
EGU General Assembly 2018

Magnetic and mercury anomalies at the Paleocene-Eocene Thermal Maximum (PETM): environmental acidification and the role of volcanism

Mariana Andrade (1), Eric Font (1,2), Thierry Adatte (3), Hassan Khozyem (3,4), and Alexandra Abrajevitch (5)

(1) DEGGE, Faculty of Sciences, University of Lisbon, Lisbon, Portugal, (2) IDL, Faculty of Sciences, University of Lisbon, Lisbon, Portugal, (3) Institute of Earth Sciences (ISTE), University of Lausanne, 1015 Lausanne, Switzerland, (4) Department of Geology, Faculty of Sciences, Aswan University, Aswan, Egypt, (5) Department of Earth Sciences, Faculty of Sciences, Ehime University, Matsuyama, Japan

The Paleocene-Eocene Thermal Maximum (PETM, ≈55.8±0.2 Ma) is marked by a global change in carbon cycle and rapid warming and is considered as an analogue for anthropogenic climate changes. The cause and timing of the PETM have hitherto remained under debate. Common explanations are the North Atlantic Igneous Province volcanism (NAIP) and/or to the massive dissociation of methane hydrates, leading to global warming, ocean acidification and mass extinction. In addition, the identification of the PETM boundary in the geological record is hampered by the lack of carbonate, making hard the identification of the carbon isotopic excursion typical of that event. Here we propose to apply and test environmental magnetic methods coupled to mercury analyses on the Dababiya section, Egypt, the global stratotype section and point of the Paleocene-Eocene boundary, in order to provide new benchmarks to identify the PETM event in the sedimentary record, and to unravel the cause of the associated environmental changes. Our magnetic results show that magnetic susceptibility is nearly cyclical along the entire section, suggesting that is mostly controlled by the balance between carbonate productivity and detrital input, in turn controlled by climate parameters (eustatism and Milankovitch cycles). However, the interval of carbonate dissolution corresponding to the PETM boundary is characterized by an acyclical, abrupt and positive shift in magnetic susceptibility, indicative of a higher relative abundance of ferromagnetic particles, which is not controlled by Milankovitch cycles. Unmixed isothermal remanent magnetization curves indicate the presence of three components in the whole Dababiya section, except in the PETM dissolution interval, where four components are identified. Component 1 and 2 correspond to (detrital) magnetite, component 3 to hematite and component 4 to goethite. Goethite is interpreted as the post-depositional oxidation of pyrite. Goethite is much less abundant in the PETM dissolution interval, suggesting than more oxic conditions inhibited the formation of pyrite at this time. Hematite is only identified in the dissolution interval, comforting the hypothesis of more oxic (and acidic?) conditions at the PETM event. The PETM dissolution interval is also characterized by significant Hg enrichments. This Hg enrichment is not linked to clays or total organic carbon contents, and suggests that Hg anomaly resulted from higher atmospheric Hg input into the marine realm, rather than organic matter scavenging and/or increased run-off. Our rock magnetic investigation thus provides new benchmarks to better identify the PETM event in the geological record. In addition, the presence of several peaks of mercury coincident with the PETM interval supports the role of volcanism (North Atlantic Igneous Province) to initiate the concomitant warming and sea-level rise characterizing the PETM.