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Tracing acidification induced by Deccan volcanism

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The Deccan Volcanic Province (DVP) is constituted by three major phases of eruptions, for which the most voluminous - the Deccan Phase-2 – encompassed the Cretaceous-Paleogene (KT) boundary and has been pointed as the main contributor of the KT mass extinction. However, the mechanisms (including acidification) by which the massive Deccan Phase eruptions contributed to the end-Cretaceous global changes and to the controversial KT mass extinction are still poorly constrained. Here we identify the regional climate and environmental effects of the Deccan eruptions by studying the magnetic and mineral assemblages preserved in the lacustrine and continental intertrappeans sediments from the western Maharashtra Deccan Volcanic Provinces (DVP). To achieve this objective, we applied rock magnetic techniques coupled to scanning electron microscopy and diffuse reflectance spectrophotometry to samples collected in three different stratigraphic sections. Our results show that the main magnetic carriers of the Deccan lacustrine and continental sediments are represented by allogenic (detrital) magnetite and hematite inherited from the weathering of the surrounding underlying basaltic bedrocks. Iron sulphides (pyrrhotite or greigite) are accessorily observed. Interestingly, the Podgawan deposits show peculiar and very distinct magnetic and mineralogical signatures, including iron oxide reductive dissolution and widespread crystallisation of iron vanadates, that we interpreted as the effect of Deccan induced acidification.

Keywords: Deccan Volcanic Province, intertrappean continental sediments, environmental magnetism

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