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Pretty Metal: Understanding Prehistoric African Climate and Dust Transport

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Dust in Earth's atmosphere figures prominently in studies of climate, human respiratory health, and biogeochemical cycles of the world's oceans. In this study, we provide a record of ancient eolian material transport by tracing the elements found within the VM 30-40 marine core to their origin on the North African continent. By tracing the elements to their sources, we are able to understand the direction and perhaps the strength of ancient monsoonal winds, and reconstruct North African climate changes over the last ~260,000 years. Marine core VM 30-40 was analyzed using scanning X-ray fluorescence (XRF) using an Itrax core scanner (Cox Analytics) and interpreted using QSpec software (Cox Analytics). From the XRF data, we focus on elements that appear to be indicative of material carried off the African continent as part of dust-cloud transport. The elements being, Fe, Si, K, Ti, Ca, Sr, and Mn, which probably derive from minerals found in bedrock, soils, and areas covered by regolith. We compare our findings to published geochemical data from potential source areas (Scheuvens et al., 2013). Current results from the spectral analysis of XRF data show that orbital precession changes (~20 kyr) can be found throughout the core from the Fe abundance. This agrees with previous work on the core that studied the freshwater diatom Melosira (Pokras and Mix, 1987). From plotting the data, Fe is shown to linearly increase with Ti, Si, and K, indicating that they are derived from the same source and/or their abundance in the core is controlled by the same variable. Also, bivariate plots of the elements suggest that there are three geographic sources of dust. These areas may correspond to foothills of the Atlas Mountains, Southern Algeria and Northern Mali, and Western Chad in North Africa. Further work will be done in order to understand which minerals are carrying the Fe, with a focus on magnetic minerals, such as hematite and magnetite, and assess their ability to reveal climate.

D. Scheuvens et al., 2013. Earth-Science Reviews 116, 170-194

E.M. Pokras and A.C. Mix, 1987. Nature 326, 486-487

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