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Environmental magnetic changes in the Southwestern South Atlantic for the Last Glacial: evidence from magnetotactic bacterial production

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Magnetotactic bacteria (MTB) intracellularly biomineralize magnetite of an ideal grain size (single domain, SD) for recording stable palaeomagnetic signals. Magnetofossils (when found in the sedimentary record) can contribute to the natural remanent magnetization (NRM) of sediments, given its origin and distinctive significance, we refer to as a biodepositional remanent magnetization (BDRM). However, the abundance of magnetofossils in sediments can also be used as a proxy for palaeoproductivity changes because organic carbon supply to the seafloor may control the abundance population of magnetotactic bacteria. We conducted an environmental magnetic study of a deep-sea sediment core (44 to 7 ka) from SE South American continental margin (29.22°S, 47.28°W, water depth 1514 m) to better constrain climatic and oceanographic, particularly ocean productivity variations. Environmental magnetic parameter (χ, ARM, SIRM, and their ratios) shows significant variations during last glacial, mainly after 30 ka. IRM acquisition curves were fitted with six components using CLG functions. The component 1 is detrital magnetite, components 2 and 3 are low-coercivity magnetofossils (biogenic soft, BS) and high-coercivity magnetofossils (biogenic hard, BH), respectively, and components 4 to 6 represent the high-coercivity mineral, probably hematite. The magnetic mineral assemblage is dominated by magnetite magnetofossils (approximately 60%). First Order Reversal Curve (FORC) distributions for representative samples show sharply peaked vertical contribution, and characterized by coercivity distributions that peak approximately at 25 mT. These distributions indicate the predominance of non-interacting magnetite particles within a narrow SD grain-size range. In this studied core, the contribution of magnetofossils suggests a period of high nutrient availability, including iron, that is an important limiting factor for magnetotactic bacterial metabolism. Iron fertilization in the photic zone increase primary productivity. Future multiproxy work is needed to test for links between climatic changes and the organisms that biomineralized these magnetofossils.