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Environmental magnetism study of Lake Cadagno, Switzerland

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Climate affects the mineralogy and grain size of sediments deposited in lakes. These properties are reflected in the sediment magnetic properties and can be characterized using magnetic methods. As part of the Cadagno-Project, which recovered several gravity and piston cores spanning the entire lake history from the deglacial to the present from the deepest part of permanently stratified Lake Cadagno, which is due to its peculiar water column chemistry considered an early Earth ocean analogue, our study aims to define changes in climate conditions during sedimentation. Here, we present a rock magnetic dataset (low-field magnetic susceptibility and its temperature dependence, anhysteretic and isothermal remanent magnetization (ARM, IRM), acquired in various fields, AF demagnetization, and hysteresis loops) that helps characterize the concentration, mineralogy, and grain size of magnetic carriers, and their variability with depth. Susceptibility, ARM, and IRM were measured on core sediments down to a depth of 886 cm below the lake bottom, providing a high-resolution record of the sedimentary environment of Lake Cadagno over the last 11,000 years. In addition to these depth profiles, detailed rock magnetic experiments were conducted at specific depths. The cores consist of pelagic sediments, flood turbidites, and late glacial sediments. In order to determine the characteristics of the background sedimentation, only turbidite-free intervals were included in this study. The depth profiles of susceptibility, ARM and IRM have approximately similar variations with depth. They show distinct peaks at the upper parts of the pelagic sediments (156-158 cm below the lake bottom, 1280-1320 cal. Yr Bp) and of the late glacial sediments (826-844 cm below the lake bottom), which can be interpreted as increased concentration of ferromagnetic minerals or as a change in the magnetic mineralogy, in addition to decreasing trend in the background. Several intervals within the pelagic sediments are dominated by low-coercivity minerals (<10 mT), while higher coercivity grains (10–100 mT) contribute significantly at (150-170, 418-448 and 719-735 cm below the lake bottom). Magnetic grain size was analyzed using a Day plot, and shows that single domain magnetite dominates at (844 cm) below the lake bottom, indicating the presence of magnetotactic bacteria, which are believed to dwell mainly in the oxic–anoxic interface where chemical gradients are high. These results provide important constraints on the environmental conditions and climate change recorded by the magnetic minerals in Lake Cadagno.