

Linkages between paleomagnetism, solar activity and cosmogenic radionuclides: Insights from sedimentary record of Lago Cardiel

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Paleomagnetic analyses of sedimentary cores provide a powerful tool for high-resolution stratigraphic correlation, however, the database of high-resolution sedimentary paleomagnetic records, including paleointensity data, for the last 10 kyr is sparse, particularly for the southern hemisphere. We have generated high-resolution records of paleomagnetic directional secular variation (PSV) and relative paleointensity (RPI) from three long piston cores from Lago Cardiel, southern Argentina (CAR 99-7P, CAR 99-9P, and CAR 99-10P) covering the last ~16 kyr. A single-component low-coercivity magnetization carried by magnetite, and homogeneity in magnetic concentration, allows the reconstruction of well-defined PSV and RPI records. Comparison with two other Argentinean lacustrine PSV records from Lake Escondido and El Trébol revealed comparable features. The Holocene RPI records from Lago Cardiel include a broad low around 7-5 ka and a high around 2 ka, followed by a decrease comparable to published archeomagnetic records from the northern hemisphere, implying that the RPI records from Lago Cardiel are strongly influenced by the main axial dipole field. Holocene geomagnetic field intensity has been implicated as a potential driver for climate (and regime) change in the Middle East and elsewhere, through the links between field intensity and cosmic ray flux, and cosmic ray flux and low cloud formation. In order to test the former linkage, the RPI records from Lago Cardiel were band pass filtered and subsequently compared with the identically treated radiocarbon production record. The remarkable similarity between both records points towards a link between cosmogenic radionuclide production rate and geomagnetic paleointensity on millennial or even shorter timescales. With a sampling resolution of less than two years, the late Holocene RPI record of core CAR 99-10P can be directly compared with the radiocarbon production rate. Both records show similar characteristics with a dominant periodicity around the ~ 205 yr de Vries cycle. As the de Vries cycle is considered of solar origin, this implies a climatic contamination of the RPI record from this core in spite of its similarity with RPI and archaeomagnetic records from the northern hemisphere.