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Pleistocene advances and retreats of ice flow across the shelf of the Ross Sea, Antarctica

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Over the past three million years, Earth's climate oscillated numerous times between cooler glacial periods with enhanced terrestrial ice volume and warmer interglacial periods with reduced terrestrial ice volume. The periodicities of these oscillations are closely linked to variations in Earth's orbital parameters. The behavior of the Pleistocene Antarctic Ice Sheets is poorly known at the orbital time-scale because of scarcity of continuous sedimentary records. Here, we present environmental magnetic property cycles in a continuous Pleistocene deep-sea (upper slope) sedimentary record (Eltanin 27-21 core), from the Ross Sea sector (69.03°S 179.83°E). Magnetic terrigenous materials from the continent transported to the edge of the Ross Sea shelf by glaciers, and beyond by currents, derived from a single source system. Magnetostratigraphy of Jovane et al. (2008) demonstrates that the cyclical pattern of the amount of magnetic terrigenous materials in the sedimentary record is linked to orbital periodicities. We tuned the magnetic property cycles to the dominant short-term eccentricity (100-kyr) and obliquity (41-kyr) periodicities. The Eltanin 27-21 magnetic and global deep-sea stable isotope (and by inference sea level) records show a strong climate coupling in the last 2.5 Myrs. The glacial-interglacial cycles of advance and retreat of the ice streams transitioned from dominantly 41-kyr to 100-kyr periodicities during the mid-Pleistocene (1.25 to 0.7 Myrs ago). Rapid reductions in the environmental magnetic record during deglaciations indicate retreats of the ice streams during periods of global warming when CO_2 levels were on the rise.