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Dynamic history of sediment deposition in Laguna Potrok Aike, Argentina

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During austral spring 2008, a total of 510 m of lacustrine sediments were recovered from the maar lake Laguna Potrok Aike (52°S, 70°W; 116 m above sea level; diameter: 3.5 km, water depth: 100 m) in southern Patagonia, Argentina, in the framework of the ICDP project PASADO (Potrok Aike Maar Lake Sediment Archive Drilling Project). Quadruplicate and triplicate cores down to a maximum depth of 101.5 m below lake floor were taken at two drill sites located approximately 700 m apart in the central profundal plain of the lake. Total core recovery was 94.4%.

Embedded in the sandstone rocks of the surrounding Santa Cruz Formation, a funnel-shaped structure originating from phreatomagmatic maar explosions is revealed by seismic refraction data. The funnel is filled by lacustrine sediments of up to 370 m thickness with seismic velocities of 1500 to 2350 m/s. These are underlain by a unit of probably volcanoclastic material (seismic velocities >2400 m/s). The lacustrine sediments are stratified in the uppermost part and show a highly dynamic development of the lake: on top of pelagic sediments, a distinct desiccation horizon is found associated with sand dunes in the eastern part of the lake basin. A series of paleo-shorelines overlays the desiccation horizon and documents the history of lake level rise in the newly formed lake. While this new lake was established in the eastern and central part of the lake, the western part was filled by stacked coarse-grained, delta-type sediments. These quite likely derive from the only inlet that is sporadically active at present.

Seismic findings are currently verified by the analyses of a 106.08 m long composite profile created by splicing of the three drilled cores of Site 2. A first age model dates the entire drilled section to approximately 56,000 cal. BP. The core is characterized by contrasting lithologies downcore especially in the Pleistocene part of the record. Approximately 54% of the record consists of redeposited material, with increasing percentage downcore likely representing the delta-type sediments detected in the seismic profiles. A dramatic shift in all proxies occurs at around 15,6000 cal. BP, where a distinct layer of approximately 1 m thickness and fundamentally different geochemical composition is found, immediately above a 1 cm tephra layer that can be tied to an eruption of the Reclus volcano. The sediments below this distinct layer are carbonate-free and dominated by clastic input of fluvial and eolian origin and a high proportion of redeposited material. The sediments above this distinct layer, in turn, originate from a lake system characterized by authigenic carbonate precipitation in the uppermost 19 m of the record with calcite contents of as much as 35%, lower percentages of redeposition, and lake level variations between +21 and -35 m with respect to present day lake level.