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A step towards the identification of eolian input in the 51 ka BP sediment record of Laguna Potrok Aike in southeastern Patagonia

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During the past decade there was ongoing discussion about the impact of dust in the southern hemisphere. Fingerprint analyses of the dust components detected in Antarctic ice cores revealed Southern South America (SSA) with its extended dry areas as the major source for dust in the higher latitudes of the southern hemisphere. Dust is mostly related to strength and direction of the wind systems and thus to paleoclimatic changes. SSA is mainly influenced by the Southern Hemisphere Westerlies (SHW) that shift in latitudinal position between glacial and interglacial times, thus influencing the amount of dust that is mobilized. Our study site Laguna Potrok Aike is a lake situated in the middle of the source area of dust and thus offers the unique opportunity to investigate a dust record that allows a better understanding of the migration of the SHW and the associated paleoclimatic changes. In this lake, a lacustrine deep drilling campaign (PASADO) was carried out in 2008. The cores recoverd during the PASADO deep drilling hold a paleoclimatic record of the past ~51 ka. Magnetic susceptibility was used in marine cores to trace eolian input and the same approach was proposed for Laguna Potrok Aike. However, this lake is situated in a large volcanic field, and grains carrying magnetic susceptibility presumeably are not exclusively of eolian origin. It is thus questionable whether magnetic susceptibility can be used without any constraint as a measure for eolian input in this terrestrial record. We are thus attempting to characterize the specific fingerprint of eolian material in order to distinguish it from e.g. riverine material.

In a first step, 76 samples representative of all different lithologies encountered in the sediment sequence were taken from the 106 m long PASADO Site 2 composite profile. On fresh samples, magnetic susceptibility was measured and the element composition was determined by XRF-scanning. After freeze drying, physical, chemical and mineralogical sediment properties were determined. Each sample was then separated into six grainsize classes by sieve and sedimentation techniques, and the same parameters were then determined for each fraction separately. SEM techniques were used to verify the eolian origin of grains. The aim of this approach is to isolate the fingerprint of the eolian sediment fraction in terms of their grain size, physical and chemical composition. A first evaluation of the dataset indicates that the magnetic susceptibility signal of the original, wet samples is not solely representing the grain size of the sediments as is often the case. For instance, samples with high sand percentages show average susceptibility values and low total Fe counts. However, considering only the silt fraction of these samples, high values of magnetic susceptibility and high Fe counts are observed. Hence, unmixing of the signal stored in the sedimentary record of Laguna Potrok Aike with tools of multivariate statistics is a necesseary step to characterize the eolian fraction. The 51 ka BP sediment record of Laguna Potrok Aike can then be used to arrive at a reconstruction of dust availability in the high latitude source areas of the southern hemisphere.