



High resolution analysis of northern Patagonia lake sediments

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Sediment cores covering the period from the last glacial maximum through the Holocene to the present have been collected from sites in the Chacabuco valley, southern Chile (around 47°08'S, 72°25'W, to the east of the North Patagonian Icecap). Cores were taken from five lakes and one recently dried lake bed. Short cores (0.2 to 0.5m), covering approximately the last two hundred years, were taken from all the lakes. Additionally, long sequences were obtained from one of the lakes and from the dried lake bed, the latter sequence extending back to the last glacial maximum as indicated by thick clay at the base. Each of the lakes are small-medium sized and are open systems situated at 300-1000m above sea level.

The shorter cores comprise predominantly clastic gyttja but show a number of distinct changes in colour and chemical composition that suggest major environmental changes over the period of sediment accumulation. This is also reflected in variations in the loss on ignition of samples from the cores and in elemental profiles produced by scanning the cores with the Itrax micro-XRF corescanner at 200µm resolution.

The long sequence from the dried lake bed has very low organic content glacial clay at the base, interpreted as last glacial maximum basal clay following determination in the field that this layer exceeded 2m in thickness. Similar sediments occur within a stratigraphically discrete section of approximately 14cm and may relate to a stadial event. The latter section also shows a drop in organic content and appears to be glacial clay incorporating some coarse sandy components indicative of detrital input from the catchment. The second long sequence, from a carbonate lake, includes two mineral layers indicating increased detrital input from the catchment. The deeper and thicker of these layers appears similar to the 14cm layer in the first long sequence, while the upper layer comprises a fine grain size indicative of rock flour and hence also of glacial activity in the catchment. Variation of elemental composition of these 'glacial' layers is also clear from the Itrax data. It therefore appears that there have been significant deglaciation events in the catchment since the last glacial maximum.

Many cores contain tephra layers, identified both visually and from the Itrax scans. Some of these have been confirmed as volcanic ash from the 1991 eruption of Mt Hudson, which at 45°54'S, 72°58'W is the southern-most volcano in the Chilean Andes and only 140km from the study area. Further work is underway to confirm and identify the source and age of other suspected tephra layers.

Sediment accumulation rates in the upper parts of the cores are of the order of 1mm/yr (as determined by lead-210, caesium-137 dating and the 1991 Hudson tephra). Given XRF scan resolutions of up to 200µm there is thus the potential for investigation of sub-annual variability. Funding has been obtained to determine carbon-14 dates for the lower parts of the longer cores.

The reproducibility and accuracy of the Itrax data has been validated using conventional WD-XRF spectrometry and the work presented will also include geochemical interpretation of the XRF data and comparison with recorded and proxy-inferred climate data for the region.