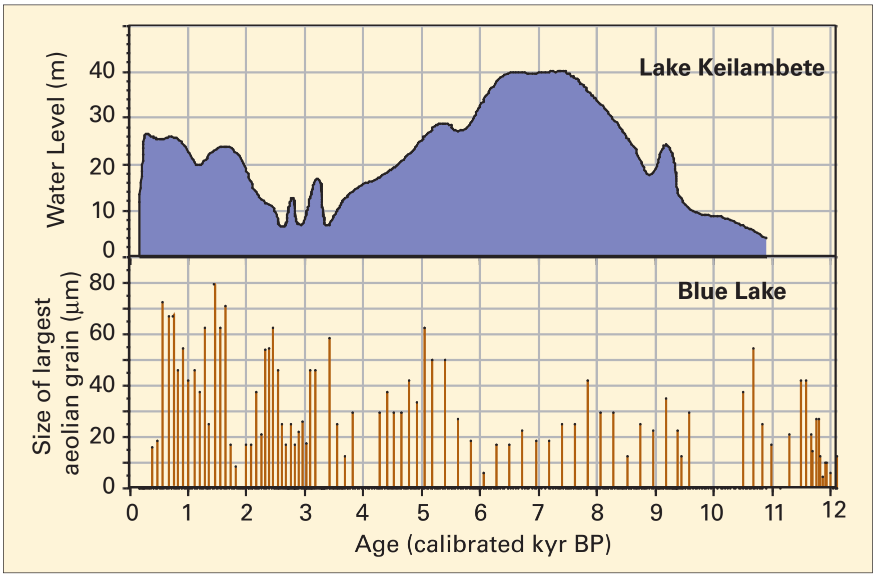

Fig. 2. Aeolian dust and lake level reconstruction from two lakes in southeastern Australia.

part of the core during the last 5 ky signifies a change in oceanic circulation in the region. At present, no pteridophytes grow in northern Australia. We therefore assume that the spores in the core originated in Indonesia or Papua New Guinea and that their presence indicates changes in the Leeuwin Current, which today travels poleward along the coast of Western Australia with an intensity significantly affected by ENSO signals (Pearce and Phillips, 1988).

Although suitable lakes for paleoclimatic reconstruction can be difficult to find, lake sediments can contribute to the understanding of climate change on shorter temporal scales. Stanley and De Deckker (in press) unravel a record of aeolian dust from the alpine Blue Lake in the Snowy Mountains of southeastern Australia and compare it to the well–documented record of lake-level changes from the crater in Lake Keilambete located to the southwest (map, Figure 2). Size analysis of the largest aeolian quartz grains found in a core from Blue Lake points to an intensification of winds or storm frequency over the last 5 ky, a period when lake levels in Lake Keilambete were both relatively low (Bowler, 1981) and variable.

The studies presented here indicate an onset of the Australian monsoon 14 thousand years ago. Furthermore, millennial scale variability in Australian climate is shown to have occurred subsequent to the Last Glacial Maximum.

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An 8,000 Year Multi–proxy Record from Lake Issyk–Kul, Kyrgyzstan

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Lake Issyk–Kul is a deep, closed–basin lake nestled at 1607 m asl in the Tien Shan mountains of Kyrgyzstan (42°30–43°20 N and 76°10–78°20 E) — a valuable site along the PAGES PEP II transect from which to extract paleoclimatic information. Its deep continental interior location offers a unique opportunity to study the paleoclimate history of a climatically sensitive “amplifier” lake situated in the heart of the Asian continent positioned relatively far from monsoonal influences to the south.

The lake resides in a semi–arid continental setting between two Alpine-glaciated mountain ranges (Figure 1). Local meteorological data suggest that moisture delivered to the basin (about 100–400 mm/yr) is mostly derived from the west. Approximately 10% of the 4.6 million inhabitants of Kyrgyzstan depend upon Issyk–Kul for their livelihood. Issyk–Kul has a long history of large-scale and ongoing lake–level changes. Since at least 1856 the basin has been closed and over the same period the level has declined about 12 meters (Semenov, 1858). Considerable present-day concern arises from the recognition that the lake level has declined about 3 meters since 1926.

Little was known of Lake Issyk-Kul prior to the mid–1990’s (Rasmussen and Romanovsky, 1995). Our goal over the past 4 years has been to reconstruct the Late Quaternary history of Lake Issyk–Kul. Initial results of this continuing project are reported here.

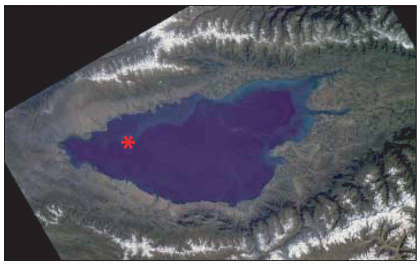

Fig. 1. Aerial view of Lake Issyk–Kul from the space shuttle (STS047–077–082, Sept. 1992) showing its position amidst Alpine–glaciated highlands of the Tien Shan. The Asterisk indicates the west–central location of core IK97–10P in 230 m water depth.

We recovered eleven piston cores from Lake Issyk–Kul in 1997. IK97–10P was selected for detailed analyses of AMS–radiocarbon age (larger ostracodes), grain size (bulk, and also carbonate-free detrital mud fraction only), sand–fraction

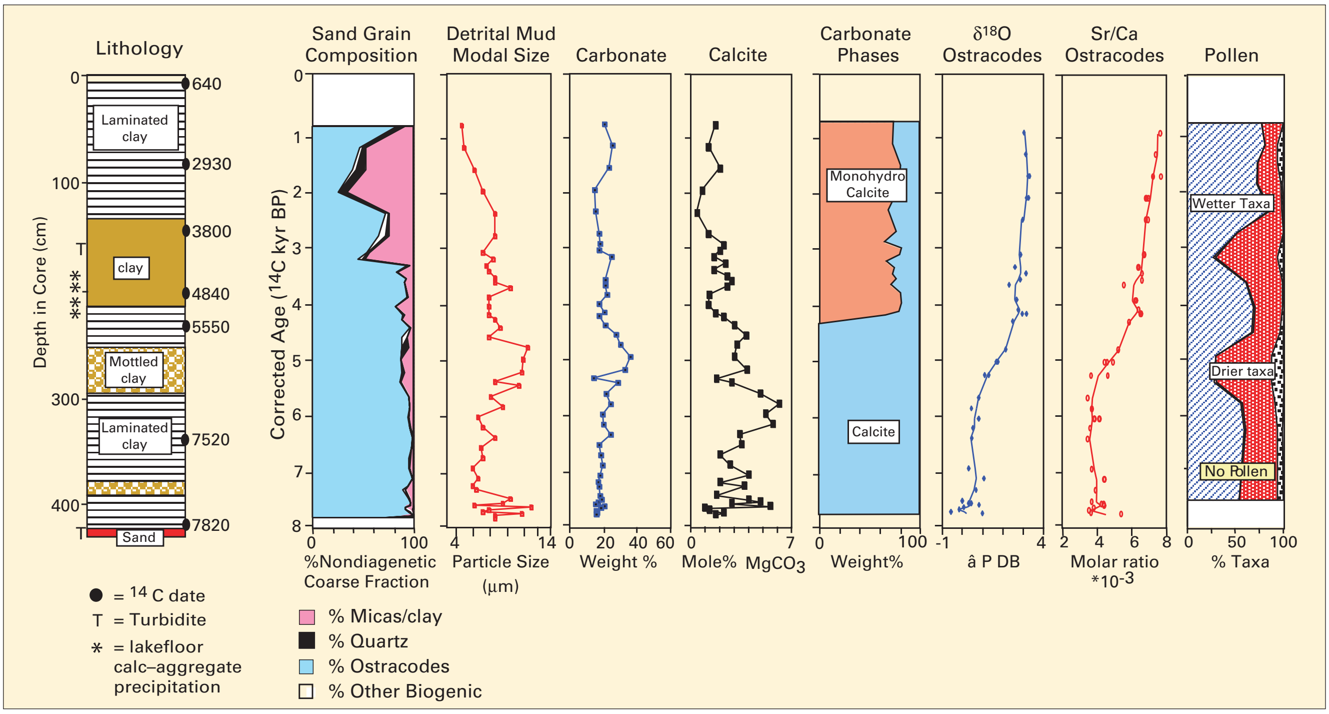

Fig. 2. Sedimentological, geochemical and palynological trends within core IK97–10P. High lake level, great distance from core to shore, and significant river inflow is interpreted from 7.8–7.5 ky — a time of highly depleted $\delta^{18}O$ values, low Sr/Ca ratios, and great variations in detrital mud particle size and Mole% $MgCO_3$. The lake was likely open, exiting westward. From 7.5-6.0 ky increases begin in detrital mud size suggesting some decrease in core-to-shore distance, the accumulation rate falls markedly (nearly 5-fold) suggesting decreasing river inflow, and Mole% $MgCO_3$ begins to increase. Conditions were apparently still open and fresh, since $\delta^{18}O$ maintains a relatively constant and depleted value near 0.5‰. Between 6.0 and 4.8 ky great and relatively rapid changes occur in our proxies which suggest a climatically–induced mid–Holocene regression, basin closure, and increased salinity. By 4.0 ky mica/quartz abundance in the minor sand–fraction has stabilized at a somewhat higher level, detrital mud particle size, %carbonate, and Mole% $MgCO_3$ have all decreased to pre–regression levels, and the rate of change in $\delta^{18}O$ and Sr/Ca values decreases. Flooding of a portion of the cobble-strewn shelf by saline waters ca. 4.3 ky seems likely, as recorded in the export of microbialitic monohydrocalcite from the shallows, detrital mud particle size decreasing to its minimum, and the greatest abundance of alluvial-source materials (mica/quartz) appearing in the limited sand fraction. A relatively high position for the still–closed lake is also supported by increased abundance of wetter (mesophytic and hydrophytic) taxa in pollen identified from the upper core. The slight increasing trend in $\delta^{18}O$ and Sr/Ca values (4.0–0.9 ky) likely reflects continued evaporative maturation of generally closed–basin lake waters similar to those found today.

constituents, %carbonate, carbonate mineralogy, stable isotope and trace element content of ostracode shells, and variations in pollen (Figure 2). This record extends from 0.64 ky at the core top (incomplete recovery) to nearly 8 ky near at its base. Sediments consist of terrigenous muds and silts along with endogenic calcite and ostracodes, as well as bacterially-induced monohydrocalcite material exported from shallow–shelf microbialite reefs (Rasmussen et al., 1996, 2000). Coeval shifts in sedimentary, geochemical, and palynological data suggest a period of generally fresh, open–basin conditions with high freshwater input from 7.8 to 6.0 ky followed by a major regressive episode and increasing salinity from 6.0 to 4.3 ky. Conditions similar to modern have existed from 4.3 to 0.9 ky (Figure 2) — a generally closed–basin, with brackish waters flooded over the shallow, cobble–strewn shelf, experiencing transient open-basin episodes.

Comparisons with other lakes suggest some similarities across the region, although more work clearly needs to be done. The record from Lake Bangong, 950 km to the south of Issyk–Kul, indicates wetter conditions between 9.6 and 6.3 ky, and increased aridity after 6.3 ky (Gasse et al., 1996). Initiation of more arid conditions occurs at 6 ky in Lake Manas 700km to the east (Rhodes et al., 1996). Lake Qinghai, 1900 km to the southeast, appears to generally experience evaporative concentration between 8.5 and 3 ky, although shorter periods of inferred lake-level rise occur within that time span (Lister et al., 1991).

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