with the reconstructed biomes, show that during intervals characterised by forest/woodland biomes the catchment was more stable, there was less erosion of mineral materials and the lake was more productive. In contrast, during intervals dominated by steppe biomes the lake was less productive and the catchment was less stable.

The pollen data have been further utilized to quantitatively reconstruct paleoclimatic conditions using the pollen–climate response surfaces technique. These reconstructions indicate that moisture availability was reduced during cold and warm steppe periods compared to forested periods, with wooded steppe periods being intermediate. For most of the last glacial the reconstructed mean temperature of the coldest month was ca. 12°C less than the present day, with minimum reconstructed values more than 20°C less than present day values. During the early Weichselian forested intervals, the reconstructed coldest month temperature was close to that of the Holocene. Of particular interest in the reconstructed values of the annual temperature sum above 5°C is the reduction during pollen assemblage zone 19b compared to the preceding subzone. This most probably reflects the decreased summer insolation at that time.

Investigations of rates of paleovegetation change show both this, and the underlying environmental changes, were often rapid: for example, increases/decreases of >20% in the total pollen of woody taxa occur in a mean interval of 142±21 yr, whilst increases/decreases of ≥10°C in reconstructed temperature of the coldest month occur in a mean interval of 153±54 yr. Given the average temporal resolution of the pollen data (pre-Holocene: 193±157 yr) these must be regarded as minimum estimates of the actual rates of change.

In the last 101 ka of the GISP2 ice-core record 22 interstadial events have been identified. When the GISP2 record, plotted on the Meese et al. (1994) timescale, is compared with the Monticchio record plotted on its independent timescale, the ice-core interstadials correlate with environmental changes seen in the Monticchio record. Prior to 65 ka, however, the Monticchio record shows greater detail than the ice-core data, pro-

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A 800,000 Year Long Record from Owens Lake, California

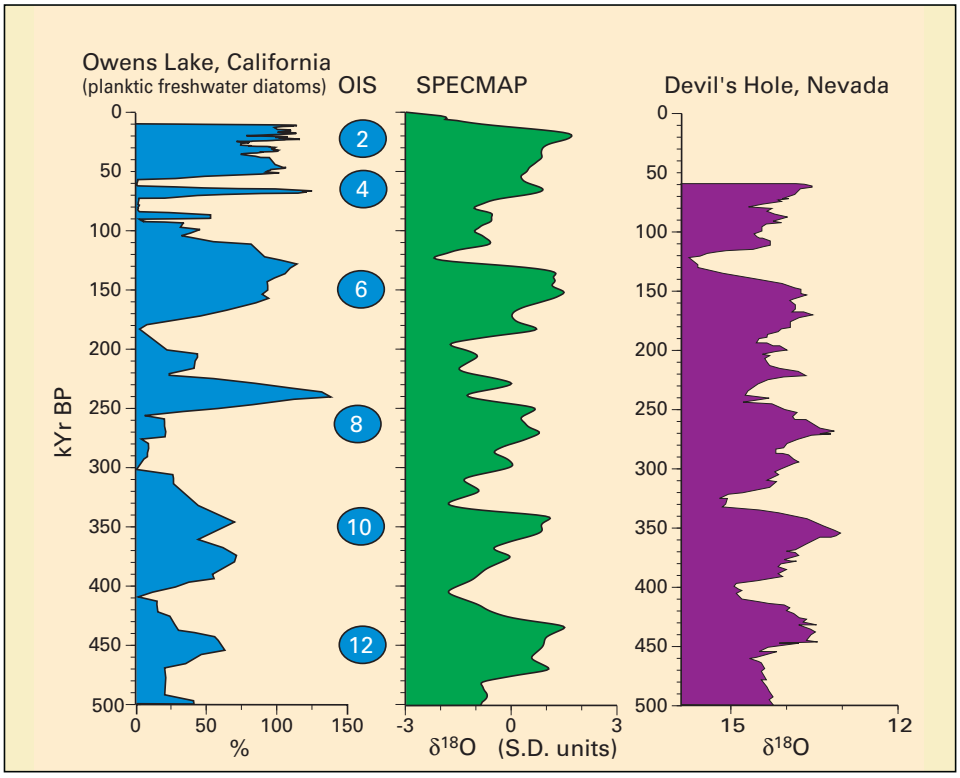

Figure 8: Owens Lake compared to SPECMAP and Devil's hole records

A 323-m (~800 ka) core of lake deposits beneath Owens Lake playa, Inyo County, California contains a nearly continuous paleolimnological record based on diatom assemblages. The core chronology is anchored by the Brunhes/Matuyama boundary and the Bishop ash near the base of the record and by radiocarbon dates near the top. A tentative chronology based on mass accumulation rates appears to reliably date some volcanic ashes of known age and allows this record to be correlated with marine and terrestrial records of climate change (Smith and Bischoff, 1997).

Throughout the past 500 kyr of its history, Owens Lake was characterized by planktic freshwater diatoms, indicating a positive hydrologic input from the Owens River and overflow of the Owens basin to lake systems downstream. Saline diatoms or sediments barren of diatoms occur in the intervals where freshwater planktic diatoms are less common or absent.

According to the Owens Lake chronology, even-numbered isotope stages of SPECMAP, representing glacial conditions, approximately match episodes where freshwater planktic diatoms dominate. The match probably indicates abundant precipitation in the Sierra Nevada in response to a southward shift of storm tracks originating in the North Pacific around the Aleutian Low which was forced to the south by the expanding Laurentide ice sheet.

The correspondence of the freshwater, planktic diatom peaks at Owens Lake to wet climates indicated by isotopes in the independently dated spring-deposited carbonate at Devils Hole, Nevada (Coplen et al., 1994) is less convincing, perhaps as a result of inadequate chronological control of the Owens Lake record. Nevertheless, the strong, approximately 100 kyr pulses indicating cool and wet climates in all these records suggests a common cause related to global climate change. When the chronology becomes independently verified or corrected, the Owens Lake lacustrine diatom record will be important for investigating the relation of lake levels and alpine glaciation in western North America to continental glaciation and global atmospheric circulation.

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