Geophysical Research Abstracts
Vol. 18, EGU2016-6712-1, 2016
EGU General Assembly 2016

Insights into MIS 3 and 4 climate in the Alps from the Baumkirchen paleo-lake site: Results of pollen analysis

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The well-known Baumkirchen site of western Austria has recently been the focus of a renewed research effort. New drilling has greatly extended the length of the known lacustrine sequence to over 250 m. Luminescence dating has corroborated the late MIS 3 radiocarbon dates for the upper part of the sequence and revealed two lake phases: the upper extending from late MIS 3 back to mid MIS 3, and the lower covering late MIS 4 or early MIS 3 back possibly as far as MIS 5a. X-ray fluorescence core scanning analysis confirmed the presence of two phases which have different geochemical signals, and provided a chemistry-based stratigraphy in the visually monotonous sediments. In these uniform sediments, the only clear indication of climatic conditions from the sediments themselves is a short sequence of ice-rafted debris corresponding to the end of MIS 4. However, given their age and location within the Alps, these sediments provide an important archive of Alpine climate in the last glacial cycle. We present new results from pollen analysis and discuss them in the context of previously reported findings. Due to high sedimentation rates, pollen counts were very low. However, two stadials and two interstadials were identified. The entire lower lake phase corresponding to MIS 4 was identified as a stadial, being characterised by a very low total pollen concentrations, a dominance of herb over tree pollen and significant reworking of pre-Quaternary forms and wood fragments. The upper lake phase contains two interstadials split by an intervening stadial. The interstadials are characterised by higher total pollen concentrations and proportion of woody species including the sporadic presence of relatively warm climate species with the upper of the two appearing better developed with these indicators more strongly expressed. This upper interstadial corresponds to the location of well dated plant remains putting its age around 35 ka cal BP, strongly suggesting a correlation to Greenland interstadial 7, while the correspondence of the lower interstadial is uncertain. Overall, the vegetation of the central Inn Valley during MIS 3 and 4 was dominated by steppe-like open-vegetation (consistent with earlier work from the upper part of the sequence) with tree stands (but not forests) establishing themselves during the interstadials.