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A Regional Holocene Vegetation/Climate History of South-East Queensland

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The Holocene period has been one of rapid climatic change out of the Last Glacial period, with an optimum at approx 4,900ybp. However since then there have been several factors which have shaped climatic change, whilst temperature has been the same, studies form Northern and Southern Australia have found increasing seasonality. The limited work from the mid latitude South-East Australia has identified a 'mid Holocene arid Anomaly'. Predominantly most studies to date have dealt with singular locations. This has been in part to a limitation on the availability of replication within the region. The giant sand islands of South-east Queensland span the latitudes of 24°40' S to 27°40' S and are all composed of predominantly sedimentary quartz. This similarity provides a solid basis for replication. Extracting cores and analysing fossil pollen and charcoal from Fraser, Moreton and North Stradbroke Island's and the Cooloola Sandmass can establish a regional multi-proxy Holocene climatic record. Rather than extracting cores from large lakes, these cores have been taken from swamps existing at community boundaries to amplify the effects of climate change. Results thus far from Fraser Island suggest that present day major plant community boundaries have remained relatively stable for long periods of time with a couple of obvious and significant exceptions. Results from Allom Swamp displays a dual record of two vegetation communities (Wet Sclerophyll and Heathland) existing side by side, the boundary appears to have remained stable with internal shifts in the rainforest species associated with charcoal level. The Northern Rd site demonstrates a relatively high proportion of Araucaria at the base of the core associated with low charcoal and an immediate decline as charcoal and fern spores rise. Both of these records show a direct response of the fire sensitive rainforest species to fluctuations in the charcoal record. Results from Stradbroke Island indicate a fire prone woodland community that has been becoming more open throughout the Holocene.

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Unravelling the climate signals preserved in diatom silica oxygen isotope ratios: a case study from Lochnagar, Scotland

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Oxygen isotope ratios of diatom silica ($\delta^{18}O_{silica}$) preserved in lake sediments offer a potentially valuable palaeoclimate record of past water temperature and water oxygen isotopes. However, the transmission of climate signals to the sediment record involves a number of competing effects and interactions which make palaeoclimatic interpretation complex. The major factors affecting lake sediment $\delta^{18}O_{silica}$ include: (a) changes in the oxygen isotope composition of precipitation feeding the lake ($\delta^{18}O_P$); (b) changes in the extent to which $\delta^{18}O_{lake}$ reflects $\delta^{18}O_P$ - driven by residence time and lake water stratification; (c) the timing and extent of seasonal diatom productivity; and (d) the temperature dependent oxygen isotope fractionation between diatom silica and water. We investigate these processes through intensive monitoring of $\delta^{18}O_P$, $\delta^{18}O_{lake}$ and $\delta^{18}O_{silica}$ at Lochnagar, a remote, high altitude loch (lake) in Scotland. A basic model is presented which combines each process, enabling the prediction of sediment diatom silica oxygen isotope ratios under various hypothetical climate scenarios. Using this model, the climate sensitivity of the Lochnagar sediment record is examined, and problems and potentialities concerning the use and development of $\delta^{18}O_{silica}$ as a palaeoclimate proxy are discussed.

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Establishing a chronology for MIS 11 vegetation changes in SW Europe

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A persistent handicap of Pleistocene pollen sequences is the paucity of sufficiently precise timescale because of dating uncertainties on the order of 10% or more, which precludes any meaningful phase comparisons with other palaeoclimatic archives. One of the most promising approaches to address this is the linking of terrestrial and marine records directly through joint pollen analysis and oxygen isotope measurements on benthic foraminifera from the same sample set in marine cores. Such a coupling allows an in situ assessment of relative leads and lags and the use of the marine timescale for dating land events. While combined foraminiferal oxygen isotope and pollen analyses have long provided an insight into the broad correspondence between marine and terrestrial stages, it is only recently that coring cruises have been undertaken with the quality of the pollen signal and the issue of marine-terrestrial comparisons in mind from the initial planning stages. A prominent example of such an undertaking has been the cruises of the Marion Dufresne along the Portuguese margin, where the combined effects of major river systems and a narrow continental shelf lead to the rapid delivery of terrestrial material, including pollen, to the deep-sea environment. Coring sites have been selected so as to be near enough to the continent to derive a regional pollen signal, but deep enough to generate high-quality isotopic records from planktonic and benthic foraminifera. In the south Portuguese margin, SW of Lisbon, pollen is mainly transported to abyssal sites by the outflow of the Tagus river, while aeolian transport is limited as the dominant winds come from the northwest. Here we report high-resolution pollen results from two combined marine sequences (MD01-2443 and MD03-2699), providing a complete sequence from Termination V to the MIS 11/10 transition. A detailed chronological framework is developed by aligning the benthic $\delta^{18}O$ record to the Antarctic D/H record, following the implications of the study of Shackleton et al. (2000), who showed a remarkable similarity between the benthic $\delta^{18}O$ record off Portugal and Antarctic temperatures. This allows the derivation of a detailed chronology of vegetation events during MIS 11, which can be transferred to terrestrial sequences. In addition, the alignment to Antarctic ice core records allows an opportunity to compare the phasing of these changes relative to those in greenhouse gas concentrations.