PROGRESS REPORT FOR AINGRA08044

PROJECT TITLE
Reconstruction of palaeodust transport pathways for eastern Australia using aeolian dust archives

INVESTIGATOR(S)
Chief Investigator Dr Samuel Marx
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Dr. Patrick Moss, The University of Queensland
Students Miss Lynda Petherick, The University of Queensland
ANSTO Investigators Geraldine Jacobsen
Specialist Committee A

SCIENTIFIC OBJECTIVES

The fundamental objectives of the proposed study are as follows:

• To reconstruct a continuous, high-resolution, record of intercontinental dust transport and deposition for Australia through analysis of peat cores,

• To reconstruct the position of major dust transport pathways for the eastern Australia,

• To relate the variations in dominant dust source areas and transport pathways to variations in meridional and zonal circulation - particularly the mid-latitude westerly circulation.

• To develop the understanding of palaeoclimatic and palaeoenvironmental variability in Australia, and consequently provide valuable information for the more accurate prediction of future climate change.

DATA, PROGRESS REPORT and RESEARCH OUTCOMES

A continuous 45 cal kyr BP record of palaeoclimatic and palaeoenvironmental variability has been developed from multiple proxies in lake sediment from Tortoise Lagoon, North Stradbroke Island. Radiocarbon AMS dates from the Institute of Environmental Research, ANSTO provided an age chronology for the record (Fig. 1). A core sampling frequency of ca. 2 – 5 mm has provided a record of aeolian sedimentation with a high temporal resolution of ca. 10 – 40 years (average 22 years).
Figure 2. Age/depth relationship for the Tortoise Lagoon core. All dates were analysed at the ANTARES facility, ANSTO and represent calibrated $^{14}$C years. The age/depth relationship was best described by a 2nd order polynomial fit which returned an $r^2$ value of 0.99 (shown on the figure). This was used to construct an age model for the core.

In addition to aeolian sediment content, grain size, pollen and charcoal analyses were used to provide insight into past climatic and environmental variability in subtropical eastern Australia. Identification of the bioclimatic envelopes associated with pollen taxa present in the Tortoise Lagoon record has allowed quantification of past climate variables (viz. temperature and precipitation). Vegetation assemblages from Tortoise Lagoon correlate well with those from other sites in southeastern Australia e.g. Caledonia Fen, Victoria (Kershaw et al. 2007), Redhead Lagoon, New South Wales (Williams et al. 2006) and Barrington Tops, New South Wales (Sweller and Martin 2001) suggesting that the record reflects regional temperate conditions. The presence of Nothofagus, Asteraceae tubilifloreae and spineless Asteraceae indicate significantly cooler temperatures during the Last Glacial Maximum (LGM). The LGM appears to be an extended period of cool, dry climate, characterised by two peaks, which corresponds well with the record from nearby Native Companion Lagoon (McGowan et al. 2008; Petherick et al. 2008; Petherick et al. 2009), along with records from Chile (Denton et al. 1999), New Zealand (Suggate and Almond 2003; Alloway et al. 2007; Newnham et al. 2007) and Antarctica (Rothlisberger et al. 2002; EPICA 2006). Results indicate that climate reversals during the deglaciation saw the return to conditions of possible increased aridity. The Holocene is generally characterised by decreased aridity. A peak in ferns and rainforest suggests the presence of an early-Holocene climatic optimum. The presence of Pinus in the late Holocene signifies the arrival and occupation of the region by Europeans around 180 years ago.

References:


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<td>Lynda Petherick:</td>
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**PUBLICATIONS / REPORTS arising as a result of your work.**


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**PhD STUDENTS**

Lynda Petherick PhD candidate.

Thesis title: Late Quaternary palaeoenvironments of eastern Australia: A high resolution, multiple proxy reconstruction.

Expected date of completion, December 2010.