

The ecology of early Miocene plants of Central Otago

by Mike Pole, Dept of Geology, University of Otago
[a summary of his talk to the Bot. Soc.]

Sediments of the Manuherikia Group are found in many areas of Central Otago overlying the schist basement and underlying fanglomerate and glacial river outwash gravels. The work of Douglas (1986) has indicated that the sediments of the Manuherikia Group were laid down first in braided river valleys, then in and around a single, growing, Lake Manuherikia. Palynological results (Mildenhall 1987) give an age of early to mid Miocene for the sediments.

Study of the fossil macroflora has been progressing since 1983 and some tentative ecological models have been proposed.

An interesting feature of the flora is that individual plant fossil localities often provide a unique assemblage of taxa. This is irritating from a stratigraphic point of view but it does suggest that mixing of material from different communities was minimal. i.e. the distinct fossil assemblages represent distinct original communities or fragments of them. What caused this variety of communities? It has been known for quite some time that relief in the Early Miocene was subdued, macroenvironments would have been at a minimum. It is not probable that the range of communities observed is a result of climatic fluctuations.

A number of fossils are present that suggest they were part of a hydrosere, adapted to varying water-tables. These include beds of ferns, beds of a parallel-veined, reed-like plants, beds of palm fronds, and several other forms of plant remains. Some of the dicotyledonous floras were probably also swamp communities.

A group of communities remain which could probably be regarded as "climax" and were controlled by factors other than water-table. Fortunately some fossil taxa do occur in the Manuherikia Group which I can, with reasonable confidence, assign to extant genera having defined ecologies. These taxa strongly suggest that fire was a dominant environmental agent. The key genera supporting this conclusion are Nothofagus, Casuarina, and Eucalyptus.

Casuarina has been described formally from the Manuherikia Group (Campbell and Holden 1984). Leaves assumed to be forms of Nothofagus were noted by Pole (1987). Eucalyptus is represented by

linear, sometimes falcate leaves with an intra-marginal vein, dense covering of oil glands, and associated "gum-nuts". The inter-relationship of these taxa with fire is based on the situation in Tasmania (Jackson 1968). Nothofagus is a closed-canopy taxon and is basically fire-sensitive. Eucalyptus, with some exceptions, is fire-resistant, even fire-promoting, and an open-canopy taxon. Casuarina is fire sensitive and an open-canopy taxon. Open-canopy taxa will not germinate under a closed-canopy. The presence of Eucalyptus in an area which would otherwise (due to high rainfall) be in closed-canopy rainforest, indicates destruction of the canopy by fire within 350 years (average age of Eucalyptus maturity). Any longer without fire and the mature Eucalyptus die and the area reverts to rainforest.

Two sequences in the Cromwell region have been studied which show a variety of local communities interpreted to be open-canopy, closed-canopy, and mixed forests together with swamp vegetation.

Open-canopy forests contain Eucalyptus and sometimes Casuarina. Closed-canopy forests are dominated by broad-leaved taxa and conifers with no Eucalyptus, Casuarina or Nothofagus. The absence of Nothofagus here I believe is due to ground-water level. Mixed forests contain both Nothofagus and Casuarina, or Eucalyptus with rare Nothofagus.

Campbell, J.D. and A.M. Holden. 1984. Miocene casuarinacean fossils from Southland and Central Otago, New Zealand. New Zealand Journal of Botany. 22: 159-167.

Douglas, B.J. 1986. Lignite resources of Central Otago. Publication P104 New Zealand Energy Research and Development Committee.

Jackson, W.D. 1968. Fire, air, water and earth - an elemental ecology of Tasmania. Proc. ecol. Soc. Aust. 3: 9-16.

Mildenhall, D.C. 1987. Palynology and paleoenvironments of Miocene sediments, Central Otago, New Zealand (abstract). Time, Change and the Vegetation of NZ. 24-26 November 1987. Botany Division, DSIR, Christchurch.

Pole, M.S. 1987. Fagacean-like leaves from the Miocene of Otago. Geological Society of New Zealand miscellaneous publication 37A.