

Captain Cook and climate change?

SCIENTISTS at Unitec Institute of Technology in Auckland have compared historic native leaf samples taken during Captain Cook's first visit to New Zealand nearly 250 years ago with modern day samples to see if they have changed over that time.

They were looking for changes in the density of microscopic pores called stomata. Links have been shown between the levels of carbon dioxide (CO₂) in the surrounding atmosphere and the density of stomata on certain plants, and these historic herbarium specimens provide a unique opportunity to see what plants were like before the modern rise in atmospheric CO₂ levels.

Stomata regulate the intake or release of CO₂, oxygen, and water vapour. Plants need carbon dioxide for photosynthesis, the process by which they make 'food'. Plants are known to change the density of these microscopic pores in response to changing amounts of CO₂ in the atmosphere – the higher the CO₂ concentration, the lower the number of pores.

When Captain Cook made his first voyage to the South Pacific during 1769–1770 he was accompanied by two distinguished botanists, Sir Joseph Banks and Dr Daniel Solander. The pair gathered samples as they travelled which were sent to the British Museum in 1828. Sets of these samples numbering 313 species are now held at Auckland War Memorial Museum and the Museum of New Zealand.

The samples from Cook's voyage were extremely fragile, having been preserved nearly 250 years ago. This required researchers to develop a new technique for casting the samples to avoid causing damage. A solution of agarose gel extracted from seaweed was applied to the samples then peeled away, taking an imprint of the surface. This proved far less destructive than the traditional approach which uses nail varnish to create a cast.

Of the hundreds of samples collected by Banks and Solander, Unitec researchers found leaves from the Karaka tree were the most suitable, having remained intact and with good sized leaves which clearly showed the stomata. Samples from this tree had been taken from six of the seven landing sites visited on the first tour of New Zealand – three from the East Cape, and the

remaining three from Coromandel Peninsula, Bay of Islands, and Queen Charlotte Sound.

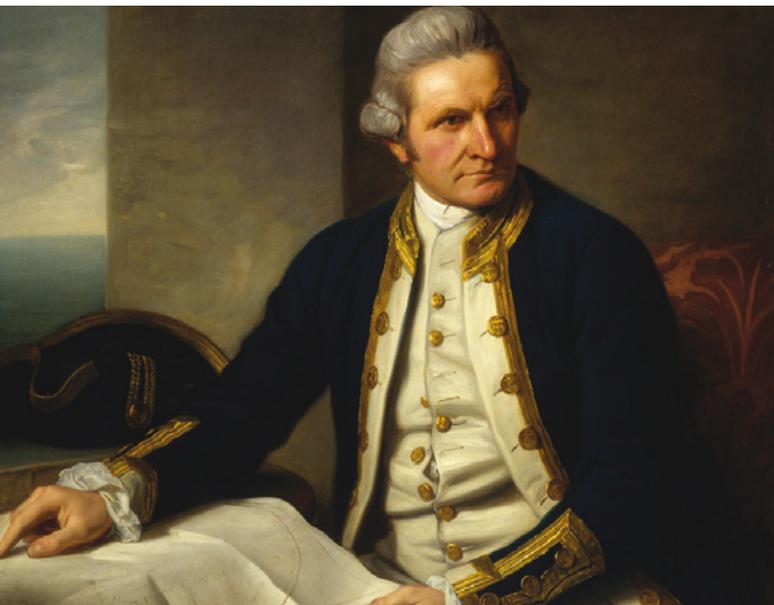
These were compared with specimens taken in Northland during 1867 and Auckland during 1894, and with modern samples in herbaria and collected by the Unitec researchers. The samples showed little variation between the 18th to 19th century samples, but when the modern samples were analysed they showed a decrease in stomatal density of up to 53 percent. This corresponds to an increase in atmospheric CO₂ over that time.

Unitec Associate Professor Mark Large said the tests showed a critical change after the 19th Century, a result reflected in studies of Northern Hemisphere plants.

"But this has been a unique opportunity to look at some of the oldest herbarium specimens collected the southern hemisphere," he said.

"These precious plants which survived the long voyage aboard HMS Endeavour in returning to the United Kingdom, provide us with a unique record of the New Zealand environment before the rise in atmospheric CO₂ levels."

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Captain Cook was accompanied on his South Pacific voyage by botanists, Sir Joseph Banks and Dr Daniel Solander, who gathered samples as they travelled.



Leaf samples collected by Banks and Solander, held by the Auckland Museum.