Early Holocene calcareous nannofossil assemblages as indicators of past sea surface temperature and nutrient conditions in the New Zealand region

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The early Holocene (~12–6ka) in the New Zealand region was a time when sea surface temperatures (SSTs) were as much as 3ºC warmer than today, but CO_2 concentrations were lower (e.g., Bostock *et al*., 2013). The early Holocene is important because it is the most recent interval in which temperatures in the southwest Pacific were in the range predicted for the coming century, making it an analog for future climate. In this study, we use calcareous nannofossil assemblages to infer changes in SST and nutrient conditions along a latitudinal transect of five piston cores that span from north of New Zealand to near the Polar Front. We have ~12–15 samples from each piston core that were radiocarbon dated to between ~6 and 13cal kyrs BP, plus a core top sample that represents modern conditions. We prepared samples using the drop method of Bordiga *et al*. (2015) that allows calculation of absolute abundances. We examined samples using either a Zeiss transmitted light microscope or a scanning electron microscope and counted a minimum of 300 specimens per sample. The assemblages included *Emiliania huxleyi*, *Gephyrocapsa oceanica*, *Gephyrocapsa muellerae*, *Gephyrocapsa* spp. <3μm, *Calcidiscus leptoporus*, *Coccolithus pelagicus*, *Helicosphaera carteri*, and *Florisphaera profunda*. Variations in the assemblages indicated that temperatures warmed after ~12cal kyrs BP and began to cool again after 8cal kyrs BP, which suggests that the subtropical front shifted southward at that time. The most northerly site also showed an increase in the abundance of *Florisphaera profunda* after 8cal kyrs BP, which suggests deeper surface-water stratification and decreased upwelling. These data will be combined with other micropaleontological and geochemical proxy data to have a better understanding of how oceanographic conditions changed in the early Holocene in the New Zealand region in order to improve predictions of how a warmer climate might impact marine resources in the future.

References

Bordiga, M., Bartol, M. & Henderiks, J. 2015. Absolute nannofossil abundance estimates: Quantifying the pros and cons of different techniques, *Revue de micropaléontologie*, **58**: 155–165.

Bostock, H., Barrows, T.T., Carter, L., Chase, Z., Cortese, G., Dunbar, G.B., Ellwood, M., Hayward, B., Howard, W., Neil, H.L., Noble, T.L., Mackintosh, A., Moss, P.T., Moy, A.D., White, D., Williams, M.J.M. & Armand, L.K. 2013. A review of the Australian/New Zealand sector of the Southern Ocean over the last 30ka (Aus-INTIMATE Project), *Quaternary Science Reviews*, **74**: 35–57.