Late Pliocene depositional history and paleoclimate reconstructions of the southwest Pacific

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Abstract

Drift deposits off the eastern margin of New Zealand are important archives for the paleoclimate and palaeoceanographic history of the southwest Pacific (Hall et al., 2001; Hall et al., 2003; Land et al., 2010; Marsaglia et al., 2011). Ocean Drilling Program (ODP) Site 1123 is located on the North Chatham rise drift just North of the westerly wind driven Subtropical Front (STF) and provides a record of near continuous sediment deposition since the Miocene along the southwest Pacific deep western boundary current (DWBC). While the Miocene and Late Pleistocene portion of this record have been well studied (Winkler & Dullo, 2002), the Late Pliocene record is less well developed.

Southern Ocean geological records (i.e., McKay et al., 2012) demonstrate that Late Pliocene cooling is the transient time bracketing the warmer than present Early Pliocene and bipolar glaciation at ~2.7 Ma. The newly developed, robust, and astronomically tuned record of benthic $\delta^{13}C$ from 1123 implies a reduction in Southern Ocean ventilation and lowering of preformed values from waters sourced along the Antarctic margin during the Late Pliocene (Patterson et al., in prep). The downstream northwest Pacific bottom water temperature reconstructions highlights a slight warming of the deep ocean in the Pacific Ocean basin during this time (Woodard et al., 2014). Furthermore, atmospheric CO_2 reconstructions of demonstrate a reduction in long-term concentrations to around pre-industrial values (~280 ppm) (Boti et al., 2015). Thus, Late Pliocene Southern Hemisphere cooling and sea ice expansion may have drastically reduced outgassing and increased the burial of heat into the deep ocean. South Atlantic records off the west coast of Africa demonstrate an increase in the flux of iron to the open ocean during this time potentially enhancing surface ocean productivity and providing an additional cooling mechanism (Martinez-Garcia et al., 2011).

Currently, atmospheric transport of dust to the Southern Ocean is dominated by persistent mid-latitude circumpolar westerly winds, this is particularly relevant for dust sourced from New Zealand (Neff et al., 2015). The Late Pliocene to Early Pleistocene uplift of the North Island axial ranges and South Island southern alps potentially provided a greater amount of not only sediment to the deep ocean, but also wind blow dust to the Pacific sector of the Southern Ocean. We will present a detailed sedimentological study on the development of the Chatham Rise drift during the Late Pliocene in order to understand the role wind blow iron flux rates to the Southern Ocean had on this period of climatic transition. Detailed grain size analysis on the silt size fraction will be presented in order to assess the relationship between the intensity westerly wind driven deep ocean currents in this region (i.e., DWBC) and wind-blown dust.

Keywords: Southwest Pacific, Late Pliocene, iron fertilization

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