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Paleogene Temperature Evolution of the Southwest Pacific Ocean: Warming and Cooling the Greenhouse

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There is general agreement that (i) high latitude climates were warm in the Greenhouse world of the early Paleogene (∼65-35 Myrs ago) and that (ii) this warmth was somehow induced by high concentrations of atmospheric CO2 (pCO2). Yet, the Paleogene SST evolution of the surface waters fringing the Antarctic continent is still poorly resolved, and pCO2 reconstructions for that time are scarce and poorly constrained. Resolving both would increase our understanding of Antarctic climates before the presence of major ice sheets, and may ultimately provide insight in the climate sensitivity to pCO2 in a Greenhouse world. Up to now, lack of compelling data from around Antarctica had always hampered such reconstructions.

In order to reconstruct the Paleogene SST evolution of the Southern Ocean, we measured the organic paleothermometer TEX86 and Uk'37 on tightly calibrated, quasi continuous Paleocene and Eocene sediments retrieved from the East Tasman Plateau (ODP Leg 189, Site 1172, ∼65ºS paleolatitude). Site 1172 was situated in the middle of the Tasman Current, which brought Antarctic-derived surface currents over the coring site. In the early Paleogene, absolute Tasman Current SSTs range from a tropical ∼34ºC in the Early Eocene Climatic Optimum (EECO; ∼52 to 50 Myrs ago) to about 21ºC in the Paleocene and Middle-Late Eocene. Now we have a long ranging record of southern high latitude Paleogene SSTs, we can properly reconstruct the Eocene evolution of SST gradients. We note virtually no latitudinal SST gradient during the EECO and gradual increase thereafter.

Superimposed on the Paleogene evolution of Southwest Pacific sea surface temperatures, two phases of extreme warming were recorded at Site 1172: the Paleocene-Eocene Thermal Maximum (PETM; ∼56 Myrs ago) and the Middle Eocene Climatic Optimum (MECO; ∼40 Myrs ago). We will present high resolution TEX86 SST data and biotic response from the PETM at Site 1172, which to date represents the southernmost marginal marine PETM section. For the MECO we will present high resolution, TEX86, UK'37 and oxygen isotope SST reconstructions in conjunction with a tightly constrained pCO2 increase. With the SST and pCO2 reconstructions, we infer an estimate of climate sensitivity of the Paleogene Greenhouse world.