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# A cosmogenic glacial chronology of Lake Judd, south west Tasmania, and latitudinal shifts in the Roaring Forties

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Unlike Patagonia and New Zealand's Southern Alps, limited attention has been paid to the glacial history of Tasmania. At 40-44 degrees S, it lies at northern limits of today's Westerly storm track (the Roaring Forties), experiencing highly variable inter-annual precipitation related to changes in the Southern Annular Mode and northerly shift of the ITCZ southern limit. The long-term trend suggested by Toggweiler (2009) is that during glacial times the Southern Hemisphere Westerlies track towards the equator but weaken, while in interglacial conditions, they migrate poleward and strengthen. Somewhat counterintuitively, this means enhanced Westerly circulation should occur in Tasmania during glacial stadials. Hence maxima in valley glaciation should coincide with peak and near-peak global glacial maxima. Cosmogenic dating by Kiernan et al (2010, 2014, 2017) highlights the marginal nature of glaciation in south west Tasmania. As plateaus and peaks have similar elevations small precipitation or temperature changes cause large changes in mass balance. This makes western Tasmania an excellent location to examine changes in paleo SH Westerly flow through the Last Glacial Cycle. Unfortunately, well preserved, laterally extensive terminal moraine sequences covering the last glacial cycle, similar to those in New Zealand and South America, are not common in Tasmania. We have located one outstanding moraine system at Lake Judd, a large cirque lake in the SW wilderness corner of Tasmania. South of Lake Judd, about 20 terminal moraine positions are recorded over a 3 km distance. Morphologically, the Lake Judd sequence presents three phases (Kiernan, 1990); pre-MIS-6, MIS 5-3 and MIS 2 (LGM), and their lateral and elevation spread represents substantially different volumes of ice accumulation. Our first field campaign mapped a set of 8 distinct moraines concentric with Lake Judd (probable LGM and retreat phases) providing 20 dolerite samples (36Cl) and 3 outer older moraines (4 sandstone boulders; 10Be, 26Al). Our aim is to test correlation of the long-term glacial history with records of westerly fluctuations from NZ speleothems (Whittaker et al., 2011) to determine whether variable Westerly latitudes in the Australasian region are zonal during glacial times as they are inferred to be in interglacial intervals (Fletcher and Moreno, 2012). This presentation will discuss the first set of Lake Judd ages, their relationship to previously dated glacial sites in SW Tasmanian and allow preliminary correlations to be made.

Fletcher and Moreno, 2012. Zonally symmetric changes in the strength and position of the Southern Westerlies drove atmospheric $CO_2$ variations over the past 14 ky. Geology 39:419-422.
Kiernan, Fink and McConnell, 2017. Cosmogenic 10Be and 26Al exposure ages of glaciations in the Frankland Range, southwest Tasmania reveal limited MIS-2 ice extent, Quaternary Science Reviews, v157 141-151 (and references therein)
Toggweiler (2009) Science, v323:1434-1435.
Whittaker, Hendy, and Hellstrom, 2011. Abrupt millennial-scale changes in intensity of Southern Hemisphere westerly winds during marine isotope stages 2-4. Geology, v39: 455-458.