



## **The enigma of the Australian Alps, young landscapes and missing cryogenic features.**

Adrian Slee (1), James Shulmeister (2), and Doug Clark (2)

(1) School of Geography Planning and Environmental Management, University of Queensland, Brisbane Australia, (2) Western Washington University, Geology Department, Bellingham, United States

Widespread evidence for pre last glacial cycle glaciation of late Quaternary ages has been documented from mid-latitude southern hemisphere mountain environments in New Zealand, southern South America and the Tasmanian Highlands. On mainland Australia however cirque and small valley glaciation in the Australian Alps is limited to OIS 4-3 and the last glacial maximum (OIS 2) (Barrows et al. 2001). This contrasts with the other southern hemisphere glacial records that indicate significantly more extensive glaciations preceding the last glacial cycle. In both the Southern Andes and Tasmania the maximum glaciations occurred prior to 783 kya (Glasser et al. 2008, Colhoun et al. 2010) while in tectonically active New Zealand it is at least clear that the scale of glaciation has been diminishing over the last 3 glacial cycles (Shulmeister et al. 2010). In all these locations early workers argued for extensive ice coverage, but subsequent investigations limited the extent and number of glacial advances before more recent work has locally re-extended the glacial limits and greatly increased the number of glacial advances. Similarly, in the highlands of SE Australia the possibility of more pervasive ice coverage was initially entertained; but since the 1960s and especially the 1980s the general consensus is that the lack of glacial evidence is a result of cold dry conditions prevailing for much of the Quaternary on the Australian Alps (Reeves et al. 2013) Recent work by the authors on the extent of relict periglacial block deposits in Australia have identified these block deposits as far north as 29°30'S on the Great Dividing Range, confirming strong freeze-thaw conditions well into the sub-tropics at moderate (900-1200 m) elevations. Curiously, however, the same mapping work has also highlighted the limited development of block deposits and other freeze-thaw landforms, such as tors, in the highest regions of the Australian Alps, in areas beyond the known limits of glaciation. It is also noteworthy that the periglacial features on mainland SE Australia that have absolute ages relate primarily to the last glacial maximum (Barrows et al. 2004). This again contrasts with Tasmania where the periglacial features are both associated with multiple ice ages and are often polygenetic. This presentation reviews geomorphic evidence from two of the highest regions of SE Australia (Bogong High Plains and the Kosciuszko Massif) to determine the extent and nature of cryogenic landscape features in these areas. It will attempt to resolve questions both about the nature of processes operating in these landscapes and add to the debate about the curious paucity of pre-last glacial landscapes at high elevations in SE Australia.

### References:

- Barrows, T.T., Stone, J.O., Fifield, L.K. and Cresswell, R.G., 2001. Late Pleistocene glaciation of the Kosciuszko Massif, Snowy Mountains, Australia. *Quaternary Research*, 55: 179-189
- Barrows, T.T., Stone, J. O. and Fifield, L.K., 2004. Exposure ages for Pleistocene periglacial deposits in Australia. *Quaternary Science Reviews*, Vol. 23 (5-6): 697-708
- Colhoun, E.A., Kiernan, K., Barrows, T.T. and Geode, A., 2010, *Advances in Quaternary studies in Tasmania*. Geological Society, London, Special Publications 346:121-139
- Glasser, N.F., Jansson, K.N., Harrison, S. and Klenman, J., 2008. The glacial geomorphology and Pleistocene history of South America between 38°S and 56°S. *Quaternary Science Reviews* 27 (3-4): 365-390
- Reeves, J.M., Barrows, T.T., Cohen, T.J., Kiem, A.S., Bostock, H.C., Fitzsimmons, K.E., Jansen, J.D., Kemp, J., Krause, C., Petherick, L. and Phipps, S.J., Climate variability over the last 35,000 years recorded in marine and terrestrial archives in the Australian region: an OZ-INTIMATE compilation. *Quaternary Science Reviews* 74: 21-34
- Shulmeister, J., Thackray, G.D., Rieser, U., Hyatt, O.M., Rother, H., C.C. Smart, and D.J.A. Evans 2010. The stratigraphy, timing and climatic implications of glacial-lacustrine deposits in the middle Rakaia Valley, South Island, New Zealand. *Quaternary Science Reviews* 29:2362-2381.