



Constructing Antarctic lake chronologies: problems encountered and suggestions for the future studies

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In the early 1990s, Björck et al. identified several problems with the radiocarbon dating of sediments from Antarctica, including the input of reworked older material or glacial meltwater containing old CO₂ and possible disequilibrium between lake carbon reservoirs and atmospheric CO₂, which can compromise the reliability lake chronologies. Over twenty years later, often through necessity, many lake and marine studies still rely on radiocarbon ages from bulk sediments which have mixed and/or uncertain sources of carbon. In Antarctic lacustrine environments, low carbon and the absence of macrofossils can limit the use of radiocarbon dating, while sediment deposition under-ice or in darkness creates a fundamental problem for optically-stimulated luminescence dating. Relatively low sedimentation rates interspersed with periods of rapid deposition and/or reworking from variable and often unknown sources can sometimes create conflicting chronological data, which can be challenging to incorporate into a single, robust age-depth model, particularly when both marine and terrestrial sediments are present in the same sequence. Here, using examples from lake records collected over the last decade from the subantarctic islands, the Antarctic Peninsula, and East Antarctica, we show how the BAS-Ghent-Durham lake coring groups have worked towards addressing some of the issues identified by Björck et al. We show how chronological data from lake records from the northern Antarctic Peninsula region: 1) helped establish that the Last Glacial Maximum ice volume on the Antarctic Peninsula was much smaller than some coupled ice sheet/glacio-isostatic models had been predicting; 2) helped establish the reliability of chronological models for the James Ross Island ice core record; 3) can be used to provide better constraints on radiocarbon marine reservoir offsets. We also discuss methods which could be used in the future to improve lake chronologies in Antarctica.