
Justification for an International Intercomparison Exercise to Assess the Reproducibility of In Situ C-14 Measurements in Quartz

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Abstract

In situ cosmogenic C-14 in quartz is increasingly used to investigate late Quaternary and Holocene geomorphic and climatic processes, including glacier retreat, sediment dynamics, erosion, soil production, and complex exposure-burial histories. However, the extremely low carbon concentrations involved make C-14 measurements highly sensitive to laboratory blanks, contamination, extraction efficiency, and methodological differences. Since the last formal intercomparison of in situ C-14 laboratories in 2014, the number of active laboratories has increased, extraction systems have evolved, and methodological divergence has expanded, the gap between consensus values widened. This paper proposes a coordinated international intercomparison of in situ C-14 extraction from two purified quartz samples across active laboratories. Participating laboratories will extract duplicate CO from two purified quartz samples using their standard protocols and ship sealed gas samples to ANSTO, where graphitisation and AMS measurement will be conducted under uniform conditions. This design isolates variability associated with extraction procedures while eliminating differences arising from graphitisation and AMS facilities. The exercise will quantify inter-laboratory reproducibility, extraction efficiencies, and systematic offsets among the different CO extraction methods currently in use. Data will be reduced using a consistent framework to establish updated consensus reference values and assess implications for production-rate calibration and exposure-age interpretation. The results will provide a robust benchmark for future method development, strengthen confidence in published in situ C-14 datasets, and be published in collaboration with the participating laboratories.

Keywords: in, situ C, 14, proposed intercomparison exercise

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