Progress on Radiocarbon Dating of Antarctic Marine Sediments

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Over the last five years we have been working on a number of innovative methods to improve the reliability of radiocarbon dating within Antarctic marine deposystems. Problems in application of the method are particularly troublesome in Antarctic marine settings where a large reservoir age, deep sediment mixing, reworking of organic particulates, and lack of inorganic carbon (calcite) carriers of ^{14}C result in uncertain age corrections. We outline progress on four specific experimental methods that include: compound class and compound specific (sterol) separation, stepped combustion at high and low temperatures, and fine-scale sampling of ^{14}C activity profiles within the sediment column. We also provide examples of how the methods are applied to specific dating questions within the Late Quaternary record from the Antarctic margin including: sub ice shelf systems, sediment drift systems, and glacial deposits. The specific challenges to radiocarbon dating include: the transition from glacial to glacial marine sediments (which typically involve large shifts in particulate carbon source), assignment of correction factors based upon ^{14}C activity within surface sediments at a core site (this correction may not always be appropriate), and assessments of the reservoir correction for ^{14}C activity which is complicated by vital effects between calcite secreting organisms. We provide a standard methodology by which to evaluate radiocarbon ages from marine sediments in Antarctica that emphasizes: selectivity in core site collection, multiple/replicate analyses, and independent age assessment using techniques independent from radiocarbon, including high-resolution ^{210}Pb profiles.