Chromatographic radiocarbon pretreatment methods and their effects on bone dating accuracy: Case studies from the Americas

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Résumé

The question of when the Americas were first colonised by humans is becoming better understood through new aDNA studies and modern archaeological excavations, but absolute dating of late Pleistocene sites remains crucial to a proper understanding of the timing and process. This endeavour depends on the accurate 14C dating of fossil remains (i.e. bones, teeth and ivory). We have developed a single-amino acid extraction protocol using preparative High Performance Liquid Chromatography (prep-HPLC) which enables us to extract hydroxyproline, a virtual biomarker of mammalian bone collagen, and thereby produce demonstrably contaminant-free AMS dates of archaeological bones. We re-dated vertebrate fossils associated with the key North American butchering sites of Wally's Beach (Canada), La Prele, also known as Fetterman (Wyoming), Lindsay (Montana) and Dent (Colorado) using this method. We also dated material from the important archaeological site of Anzick (24PA506), Montana, which contains the only known Clovis burial. Our work demonstrates the crucial importance of sample preparation to completely remove contaminants derived from sediments or post-excavation museum curation. Specifically, our work illustrates that chromatographic methods, e.g. preparative High Performance Liquid Chromatography or column chromatography using XAD resins are the only efficient methods for removing extensive environmental and museum-derived contaminants. These advanced methods yield unquestionably accurate AMS 14C measurements that refine the ages of these sites and thereby advance our understanding of human population dispersals across North America during the late Pleistocene.

Mots-Clés: AMS dating, hydroxyproline, Clovis

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