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An annually-resolved marine radiocarbon bomb-pulse compilation from the temperate North Atlantic using long-lived molluscs (Arctica islandica)

JD Scourse (1), AD Wanamaker Jr (1), C Weidman (2), J Heinemeier (3), and CA Richardson (1)

(1) School of Ocean Sciences, College of Natural Sciences, Bangor University, Menai Bridge, Anglesey, LL59 5AB, Wales, UK (a.wanamaker@bangor.ac.uk, +44 (0)1248 716367), (2) Waquoit Bay National Estuarine Research Reserve, PO Box 3092, Waquoit, Massachusetts, 02536-3092, USA, (3) AMS 14C Dating Centre, Department of Physics and Astronomy, University of Aarhus, DK-8000 Aarhus C, Denmark

Radiocarbon measurements from increments of annually-banded corals covering the past 60 years from sub-tropical and tropical contexts provide valuable records of the marine expression of the atmospheric excess radiocarbon "bomb-pulse" due to post-war nuclear weapons tests. These records can be used as calibration series for high-resolution post-bomb marine radiocarbon dating and constitute tracers for identifying watermass age and mixing processes. Until now, such applications have been restricted in temperate shelf seas because of the lack of widespread measurements from annually-resolved archives. Here we present a compilation of bomb-pulse data from annual growth increments of the bivalve mollusc Arctica islandica from relatively shallow sites (< 200 m) across the temperate North Atlantic (Georges Bank, north Icelandic shelf, north Norway, North Sea). The temporal response is highly correlated at all sites, but the amplitude of the bomb-pulse varies, with the highest values attained in the North Sea and the most damped response on the north Icelandic shelf. These differences can be attributed to the integrated hydrographic context of these sites (entrainment of deep, old water; rates of air-sea exchange; fluvial runoff; removal of high radiocarbon level surface waters through north Atlantic deep water formation). The north Icelandic data contain a reversal in the rising limb of the bomb-pulse which is not present elsewhere, even in the more sensitive sites. This reversal is coincident with instrumental data characterising the Great Salinity Anomaly of the 1960s when cold, relatively fresh, and old (with respect to radiocarbon; Delta R = + 200 years) waters of the East Icelandic Current flooded the north Icelandic shelf as a result of southward migration of the Polar Front. However this reversal may also be a result of the short hiatus in bomb testing in the late 1950s. The evolution of bomb-pulse data will be discussed as well as other potential applications of these records.