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The radiocarbon reservoir age of the Chukchi Sea, Arctic Ocean

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Radiocarbon (14C) dating is the standard method for obtaining the age of marine sediments of Holocene and late Pleistocene age. For accurate calibrations, however, this tool relies on precise knowledge of the local radiocarbon reservoir age of the surface ocean, i.e. the regional difference (ΔR) from the average global marine calibration dataset. This parameter has become impossible to measure from modern mollusk samples because of 14C contamination from extensive testing of thermo-nuclear bombs in the second half of the twentieth century. The local reservoir age can thus only be calculated from the radiocarbon age of samples collected before AD 1950 or from sediment records containing absolute age markers, derived from e.g. tephrochronology or paleomagnetism. Knowledge of the marine reservoir age in the Arctic Ocean is extremely sparse, and relies on work by only a few studies. No information exists for the entire East Siberian Sea, and the Chukchi Sea is represented solely by sites along the Alaskan coast. Here we present new radiocarbon measurements on historical mollusk collections from the East Siberian and Chukchi margins. Our results show a clear and consistent signal of "old" Pacific Water in the Chukchi Sea with ΔR values around 450 years. Towards the East Siberian Sea the values drop as Pacific Water has decreased influence further away from the Bering Strait. Complementing the modern data, we also provide constraints on the reservoir age during the late Holocene. These are based on tephrochronology and high resolution analyses of paleomagnetic secular variation from a sediment archive from Herald Canyon, Chukchi Sea.