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Radiocarbon dating of some mineral relics of a ship cargo and their carbon isotope geochemistry

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A unique discovery has been made recently at the wreckage of a sunken ship, in the shallow littoral zone on the bottom of the Baltic Sea (Chebowski and Kowalski, 1999). A sand layer 0.5 to 1.7 m thick covers the wreckage of a wooden ship along with elements of the cargo and equipment lying at depths of 5-7 m, ca. 500 m from the shore. The transported cargo included iron plates and bars, and the equipment included barrels filled with wood tar, the organic material used those days for protection of wooden components of ships. The catastrophe leading to the sinking of the ship with equipment and members of the crew according to written sources took place on the Baltic Sea during a storm on the 27th of September 1785. Due to spilling of the wood tar transported in barrels, beneath the wrecked ship, which got stuck in the sandy bottom, a culture layer comprising the sunken iron cargo, ship equipment and bodies of the crew was formed. The physical and chemical conditions at the sea bottom allowed formation of siderite ($FeCO_3$) in such environment.

Samples of siderite and wood tar were collected from the wreckage of a sunken ship, in the shallow littoral zone on the bottom of the Baltic Sea for studies of siderite-water oxygen isotope fractionation in low temperatures and subjected also to radiocarbon determination. Because of small amount of accessible samples of siderite and wood tar, the radiocarbon measurements were performed by accelerator mass spectrometry (AMS) technique. Graphite targets were prepared in the Gliwice Radiocarbon Laboratory and sent for measurements to Kiel, Germany. The radiocarbon dating provided following results: 760±20 BP for siderite and 715±25 BP for wood tar.

The above results were calibrated with use of OxCal programme in order to obtain the calendar age of samples (see Figure 1). Both ages are concordant, indicating the age of samples to ca. 1300 AD, what is unfortunately inconsistent with historical date of sinking (1785 AD). This discrepancy can be explained by incorporation of old carbon, which was present on the ship in form of fossil coal used as a fuel source. Simple calculation allows estimating ca. 7% content of coal of infinite age would be required to produce observed shift of calendar age. Such amount is not unlikely in dated samples, as the present-day rock, which was formed under the isolation of the spilled wood tar includes chips of fossil coal as well as other fragments of the ship equipment and human remains. Nevertheless, the consistent radiocarbon content in both samples supports the geochemical model of the siderite formation established on the basis of stable oxygen and carbon isotopes analysis, which will be published elsewhere (Halas, Chlebowski, 2004)

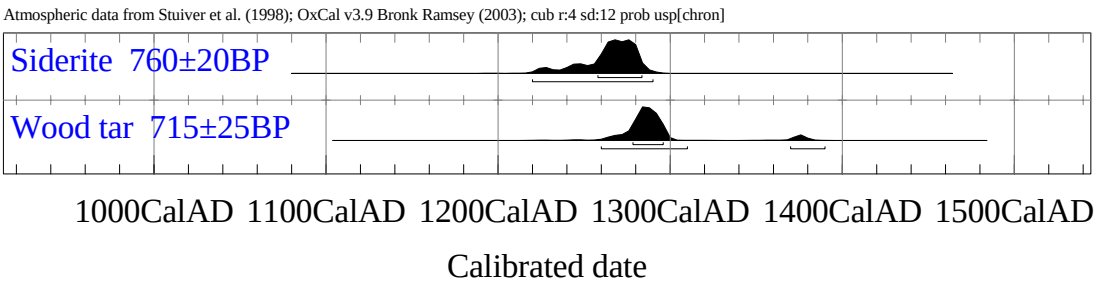

Fig. 1. Calibration of radiocarbon age of investigated samples.

References

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