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Variation of the 1.5 ka surface water marine radiocarbon reservoir age in the Adriatic based on the study of algal rims

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Abstract:
The latest research on relative sea-level change along the eastern Adriatic has been cantered on algal rims build by *Lithophyllum byssoides* (FAIVRE *et al*., 2010; 2013). Such fossil bio-constructions have proven to be precise sea-level indicators in microtidal environments (LABOREL *et al.*, 1994). However, this perfect relative sea-level marker is constrained by its marine radiocarbon reservoir age (MRE) which is not known. Previous research assumes that *Lithophyllum* does not appear to be subject to any kind of reservoir effect. Those assumptions were based on the datation of living thalli (LABOREL *et al*., 1994). Here, we provide evidence for the algal MRE based on algal samples of known age obtained from the Natural History Museums in Paris and Vienna and from the Universität Hamburg. The algae used for ^{14}C dating were collected from AD 1858 to 1913 and represent the pre-bomb period. We applied radiocarbon dating of marine material with a known calendar date of death of the organism. This approach enables a comparison of contemporaneous atmospheric and marine radiocarbon ages. The deficiency in ^{14}C content of the measured marine sample relative to the global atmospheric calibration curve is then used to calculate the "apparent age" of the material. We further used palaeo data from 10 Eastern Adriatic algal rims from which we obtained radiocarbon and stable isotope ($\delta^{18}0$ and $\delta^{13}C$) records. Based on those records we provide several lines of evidence that the alga which lives in the intertidal zone has a lower marine radiocarbon reservoir age than the mean surface water MRE. On the other hand, shells (mytilid bivalves) from algal rims reveal higher

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reservoir ages than global means, similar to previously published data (FAIVRE *et al.*, 2015).
Furthermore, as living exclusively in the intertidal zone *L. byssoides*, could reflect long-term surface water MRE variations as surface ocean radiocarbon time series can provide a unique opportunity to study both air-sea $^{14}CO_2$ exchanges and ocean circulation dynamics.
Till now continuous marine ^{14}C records have only been acquired from a limited number of biogenic calcifying archives. Currently, only sparse ^{14}C data are available for the Mediterranean Sea in order to constrain the MRE with limited age ranges (SIANI *et al.*, 2000, 2001; REIMER and MCCORMAC, 2002; MCCULLOCH *et al.*, 2010; TISNÉRAT-LABORDE *et al.*, 2013; FAIVRE *et al.*, 2015). In this framework, several research lines on algal and shell MREs (shells inhabiting algal rims) have been initiated, which could together provide records on MRE variability throughout the 1.5 ka period. Our radiocarbon and stable isotope records over the last 1.5 ka from 10 algal rims revealed bimodal properties of the Adriatic surface water MRE.

Keywords:
Algal rims, Bioconstructions, *Lithophyllum byssoides*, Marine radiocarbon reservoir age, Adriatic, Mediterranean.

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