Geophysical Research Abstracts
Vol. 16, EGU2014-1876, 2014
EGU General Assembly 2014

The Mediterranean coral Cladocora caespitosa as a Pleistocene palaeoclimate archive

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The Mediterranean coral *Cladocora caespitosa* has much potential as a palaeoclimate indicator. The work of Montagna et al. (2007), Montagna et al. (2006) and Silenzi et al. (2005) have shown that, at various resolutions, modern samples of this coral faithfully record sea surface temperatures in their trace elemental compositions. As this species is abundant in Mediterranean deposits dating back to the late Pleistocene this opens up the possibility of using well preserved fossil samples to analyse the palaeoclimate of previous interglacials at a sub-seasonal scale.

This study is based on modern samples from Mljet, Croatia and fossil samples from the actively uplifting southern coast of the Gulf of Corinth, Greece, dating from the interglacial marine isotope stages (MIS) 1, 5c, 5e and 7c.

High resolution (N = 200 μm, approximately bi-monthly) mass-spectrometric analysis of stable oxygen isotopes, trace element content and bulk sample analysis of multiply substituted oxygen isotopologues were all carried out on fossil and modern samples using the modern data to aid in calibrating the fossil data.

There are seasonal signals found in the geochemical profiles for the high resolution techniques in all well preserved samples. However, it is clear from the modern data that *C. caespitosa* precipitates its aragonitic skeleton out of equilibrium with ambient seawater for all of the geochemical parameters studied.

Intra-site trace element composition is too variable to provide reliable palaeoenvironmental data. Average sample Δ_{47}calculated temperatures of approximately -2 to +8˚C, from the same locality, in comparison to the ≈20.5˚C recorded at the site, confirm that this species does not precipitate its skeletal aragonite in isotopic equilibrium.

Using modern samples, measured $\delta^{18}O_{water}$ and recorded temperature values; *C. caespitosa* is, however, shown to precipitate at a relatively constant negative offset from oxygen isotopic equilibrium. This allows the calculation of a species specific δ^{18}O aragonite-water temperature relationship of T = 4.406 – 4.34($\delta^{18}O_{aragonite} - \delta^{18}O_{water}$+ 0.2).

Using this palaeotemperature equation, and assuming a $\delta^{18}O_{water}$ value for the Gulf of Corinth equal to modern at +1.15$\%_{,VSMOW}$, seemingly realistic average annual growth temperatures were found for the fossil samples. These calculated values suggest that, compared to today, during the early part of MIS 1 and in MIS 5c the Gulf of Corinth had slightly cooler average temperatures (by 1-2˚C), 5e was very similar, and 7c was on average warmer by around 2.5˚C. These results suggest that fossil *C. caespitosa* δ^{18}O values can preserve a reliable sub-seasonal palaeotemperature signal.

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