Chemical Geology 310-311 (2012) 114–125

Contents lists available at SciVerse ScienceDirect

Chemical Geology

journal homepage: www.elsevier.com/locate/chemgeo

Oxygen and carbon isotope fractionation of marine ostracod calcite from the eastern Mediterranean Sea

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ARTICLE INFO

Article history:
Received 26 November 2011
Received in revised form 23 March 2012
Accepted 28 March 2012
Available online 5 April 2012

Keywords:
Marine ostracodes
Stable isotopes
Late Quaternary
Paleoceanography

ABSTRACT

Over the last two decades, non-marine ostracods have been intensively studied with respect to the stable isotopic composition ($\delta^{13}C$, $\delta^{18}O$) of their calcified valves, however, few data for marine taxa have been published so far. Here, we provide new data from recent and Pleistocene near-surface sediments of the Gulf of Taranto (recent) and the southern Aegean Sea (15 ka, both in the Mediterranean Sea) helping to improve our understanding of ostracod stable isotopes in palaeoceanography. Results are compared to those of certain benthic foraminiferal taxa for which the living habitat and the isotopic disequilibrium from ambient sea-water are known. In addition, monospecific size fractions of three common ostracod species (*Bairdia conformis*, *Bosquetina tarentina*, *Henryhowella sarsii*) have been studied from the Gulf of Taranto in order to test the existence of a size-dependent change in the $\delta^{13}C$ and $\delta^{18}O$ composition of the valve calcite. Our results reveal positive average species-specific deviations from the $\delta^{18}O$ of calcite equilibrium for two ostracod taxa (*B. conformis* 0.31‰, *H. sarsii* 0.33‰), while *B. tarentina* shows a negative off-set of −0.41‰. These values are substantially lower than those reported for most non-marine ostracods, which usually yield positive "vital effects" for $\delta^{18}O$ of more than 2‰. Furthermore, *B. tarentina* is thereby the only ostracod taxon so far for which a negative "vital effect" has been reported, apart from the non-marine *Eucypris mareotica*. $\delta^{13}C$ values cover a much larger range than $\delta^{18}O$ with a negative off-set from sea-water by −1.8 to −5‰. Size-fraction data show no systematic change, although a statistically-significant positive covariance between $\delta^{13}C$ and $\delta^{18}O$ has been observed, consisting of a slope similar to a kinetically controlled fractionation effect as has previously been documented for asymbiotic planktic foraminifera and corals. The documented interspecific offsets can be primarily attributed to differences in diet for $\delta^{13}C$ and for both $\delta^{13}C$ and $\delta^{18}O$ to fractionation processes related to different modes of calcification.

1. Introduction

Ostracods are microcrustaceans and occupy virtually all known aquatic habitats on Earth showing a high diversity with more than 20,000 recent species (Horne et al., 2002). In the marine realm, ostracods represent one of the most important components of the metazoan meiobenthos ecosystems (e.g., Richardson et al., 1985). A carapace consisting of two calcified chitinous valves covers the whole body and has a high fossilization potential. Ostracods are known to precipitate low-Mg calcite and moult up to nine times (instars) before they reach adulthood (Kesling, 1951; Sohn, 1958). At their adult stage, ostracods are usually between 0.5 and 2 mm large, sometimes showing a pronounced sexual dimorphism.

Assemblages of ostracods are widely used to reconstruct marine and non-marine environments as well as to study evolution through geologic time by investigating morphological features like size or ornamentation (see Holmes and Chivas, 2002a, and Park and Smith, 2003, for overviews; Hunt and Roy, 2006). Apart from these classical applications, it has been shown that chemical element uptake of the valves occurs directly from ambient water (Turpen and Angell, 1971; Chivas et al., 1983). In particular, changes of Mg/Ca and Sr/Ca ratios in ostracod calcite are widely used in palaeoenvironmental reconstructions (Dwyer et al., 2002; Holmes and Chivas, 2002b).

Formation of ostracod carapaces is a rapid process, which often takes place within hours to days (Turpen and Angell, 1971; Chivas et al., 1983; Roca and Wansard, 1997), however, it is still unknown to what extent factors like temperature, salinity, alkalinity or sea-water pH control the rate of calcite precipitation, e.g. Chivas et al. (1983) identified for the non-marine, saline ostracod *Mytilocypris henricae* that fully calcified adult valves took 13 ± 4 (1σ) days at

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doi:10.1016/j.chemgeo.2012.03.028