MYTILUS GALLOPROVINCIALIS AS AN ENVIRONMENTAL INDICATOR OF METAL POLLUTION IN COASTAL AREAS OF E ADRIATIC

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Abstract

The isotopic composition of carbon and oxygen in carbonate, as well as the concentrations of 24 major, minor and trace elements in recent shells of *M. galloprovincialis* from 22 locations were analysed for the purpose of monitoring the environmental conditions along the entire Eastern Adriatic coast. Lower salinity and temperature in areas influenced by inflows of freshwater tributaries are reflected in lower $\delta^{13}C$ and $\delta^{18}O$ values of shell carbonates. Increased metal concentrations were observed in areas exposed to industrial and urban pollution sources.

Key words: Adriatic Sea,bivalve,metals

Introduction

Mollusc shells are considered to be a powerful tool for monitoring environmental conditions. The variability of shell element chemistry between individuals strongly influences the precision of environmental information inferred from shell composition, and therefore the relation of chemical parameters to the shell stable isotope profiles is of great value to obtain better insight into the environmental factors governing the distribution of metals in the shell (1). The aim of this work was to check whether bivalve shells are good environmental indicators of metal pollution of coastal waters of E Adriatic.

Materials and methods

Samples of M. galloprovincialis were taken at 22 sampling locations along the E Adriatic coast in October 1998 (Fig. 1). At each site, 5 samples ranging from 2.5 to 5.9 cm in length were collected.

For isotopic analysis, the aragonite and calcite layers of the shells were separated by careful grinding with emery paper. $\delta^{18}O$ and $\delta^{13}C$ of both layers were determined using a dual inlet Varian Mat 250 mass spectrometer. The carbonate was transformed into CO_2 by reacting with anhydrous H_3PO_4 at 55°C under vacuum. NBS 18 and NBS 19 were used as standards to report all isotopic signatures in ‰ relative to the V-PDB (2). Precision determined by repeated analyses of the working standard was better than ±0.05 ‰ for $\delta^{18}O$ and ±0.1 ‰ for $\delta^{13}C$. Multielemental analysis was performed at ACTLAB in Ontario, where concentrations of major (Ca, Na, Mg, Fe), minor (P, Mn, Ba) and trace elements (Ni, As, Sr, B, Cr, Cu, Pb, Zn, Li, Zr, Se, Te, Sn, Mo, Hg, Ag, Sb) of the bulk shells were analysed using ICP - MS. The accuracy of the analyses was checked using the MAG – 1 standard. The reproducibility was sufficient for an analysis of spatial variations of these elements in the shells.

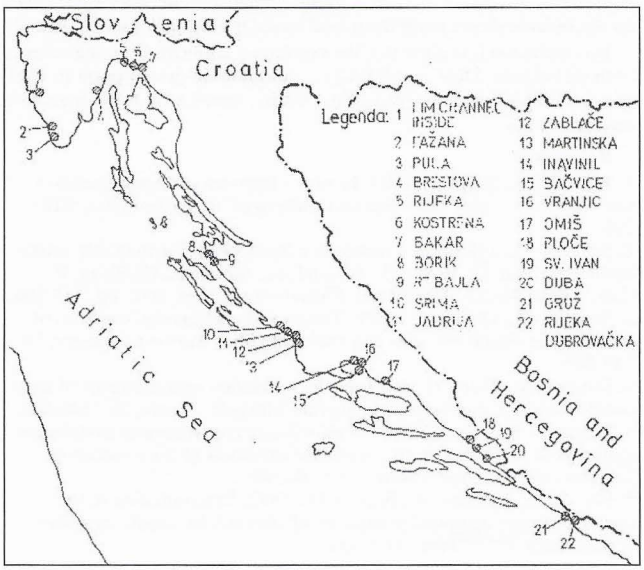

Figure 1: Sampling sites.

Results and discussion

Biogenic aragonite was systematically enriched by 0.15 ‰ in ^{18}O and by 1.07 ‰ in ^{13}C relative to calcite. The temperatures of excretion of both phases were calculated (3,4), ranging from 17.7 to 24.7°C for calcite and from 20.5 to 28.3°C for aragonite, which are in good agreement with the observed sea temperatures. According to the $\delta^{18}O$ and $\delta^{13}C$ values of shells, locations in the investigated area can be separated into three groups with respect to varying freshwater influence (Fig.2). Only a weak correlation was observed between δ values and metal concentrations. To prove these correlations, separate growth bands of the shells should be analysed (1). The highest concentrations of Mn, Ba, B, As and Ni were determined at sites of Omis, Zablace and Bacvice (sites 12, 15, 17), where both sewage sludge from cities, as well as contaminants from chemical and metallurgical industries are released to the coastal sea with poor or no pre-treatment. The high Mn concentration at Sv. Ivan (site 19) in the Neretva delta is due to the mining and metallurgical industry in the wider Mostar area in Bosnia and Herzegovina. Increased Pb, Zn and Cu are typical of industrial areas with the large ports of Pula, Rijeka and Gruz (sites 3, 5, 21). The results of preliminary monitoring showed that shells are good biomonitors for environmental conditions that can be successfully applied for monitoring urban and industrial pollution of coastal seas.

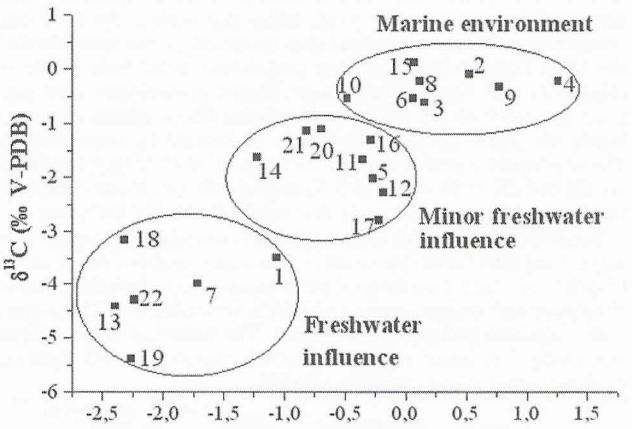

Figure 2: $\delta^{18}O$ vs. $\delta^{13}C$ of aragonite layer of the shells; grouping of the results is due to the varying freshwater influence.

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