10th European Ostracodologists' Meeting
16 to 20 September 2024 in Catania, Sicily

Geochemical analysis of ostracod shells from Miocene deposits in Eastern Slovenia

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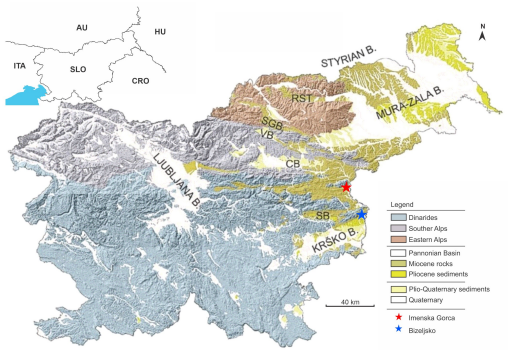
The first geochemical analysis on ostracod shells was done in the 1950s (Sohn, 1958). Initially, only measurements of the trace elements were made (Sohn, 1958), but in the early 1980s, a systematic study of the relationship between the trace elements in ostracod shells and water temperature and composition was being carried out (Chivas et al., 1983). In addition to the trace elements, there have been studies on the isotopic composition of the shells. Since the shells are composed of low-magnesium calcite, oxygen and carbon isotopes are the most commonly analysed. In the presented study we analysed the trace elements on 31 samples and oxygen and carbon isotopes on 10 samples along two separate outcrops. Our goal was to see if the geochemistry of ostracod shells, from Miocene, can be used in conjunction with the species assemblage to better determine the palaeoecology of the studeid sediments.

Stable carbon and oxygen isotope compositions of approximately 150-200 µg carbonate samples were determined applying the carbonate-orthophosphoric acid reaction at 72°C (Spötl and Vennemann, 2003) and using an automated GASBENCH II sample preparation device attached to a Thermo Finnigan Delta Plus XP mass spectrometer. The isotopic compositions of carbonate samples are expressed as δ13C and δ18O in ‰ relative to V-PDB (Vienna Pee Dee Belemnite), with a precision better than ±0.1‰ from standards. To calculate the temperature from the oxygen isotopes the equation presented in Xia et al. (1997a) was used.

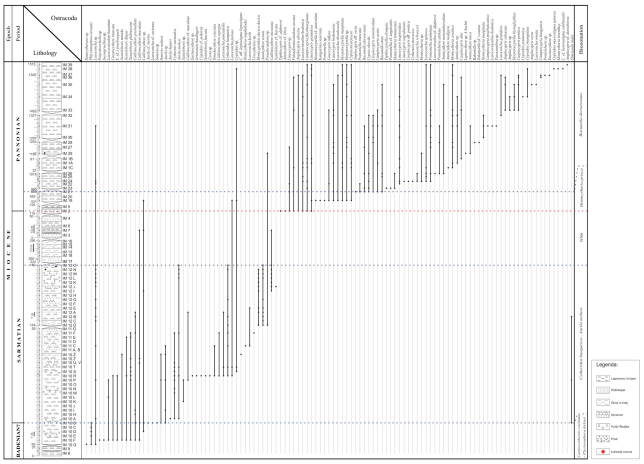
For the following trace elements Mg, Ca, Sr, Mn, Fe, and Al we used the following method: For the concentration determination, the available amount of sample (1 - 10 mg) was digested in 1 mL of HCl (37 %, supra pure) in a PE vial. The solutions were put on a hot plate and heated to 40 °C for 1h. After obtaining a clear solution, Milli-Q water was added to obtain a total volume of 10 mL. The concentrations were determined by an inductively coupled plasma mass spectrometer (ICP-MS, Agilent 7900).

With the combination of these two methods, we were able to approximate the changes in the environment. The samples that were correlated to the Sarmatian and Badenian had a higher temperature (20°C<) that those correlated to the Pannonian (20°C>). This trend fits the data provided by ostracods and the trace elements as there has been a significant change from the Sarmatian to Pannonian. We were also able to compare the differences between two localities and what it showed is that the two "basins" were in fact connected as previously thought to be separate. It should be noted that the Badenian and Sarmatian samples both gave us a temperature higher than 30°C, but we later agreed that this result was not feasible, and we attributed the calculated temperature to recrystallization of the ostracod valves. What we found out is that even tough we did not get the perfect parallel the results of the study have shown us that the general trend does correspond with the changing of the fauna and therefore the changon of the paleopecology.

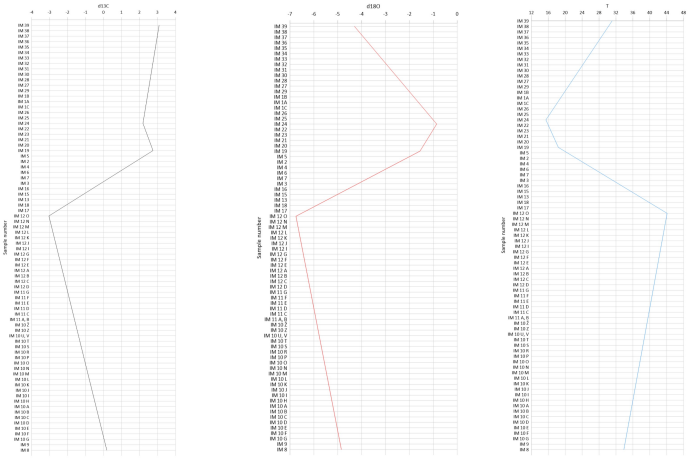
We would like to thank Attila Demeny from the Institute for Geological and Geochemical Research, HUN-REN Research Centre for Astronomy and Earth Sciences, Budapest, Hungary for preparation and measurements of our isotope samples.



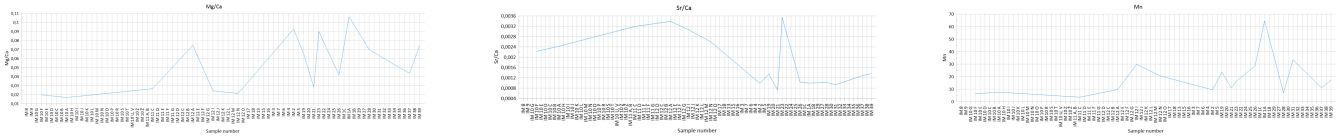
Simplified geological map of Slovenia with location of previous ostracod research. SGB - Slovenjgradec basin; VB - Valenje basin; SB - Senovo basin; Ribniško-Selniški basin (modified after Ivančič, 2021).



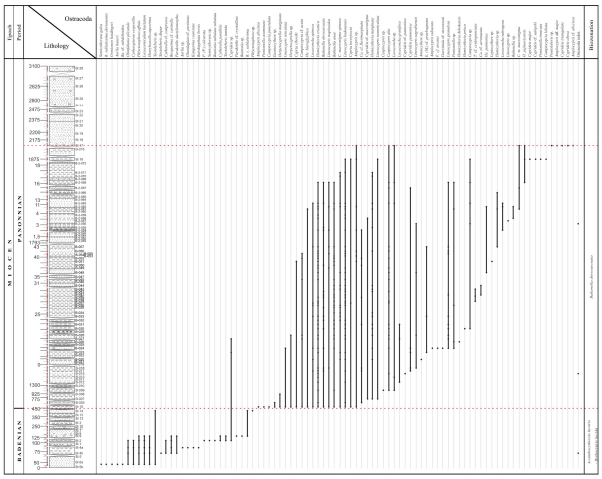
The distribution of ostracod spacies in the studied section of Imenska Gorca with a corresponding biozonation.



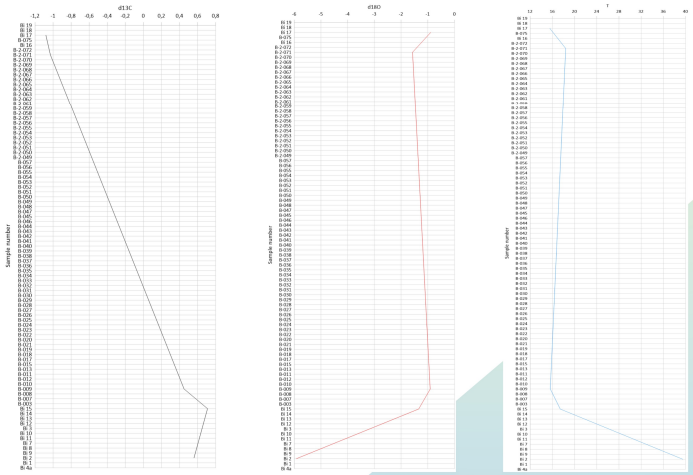
Results of Oxygen and Carbon isotopic analysis on ostracod shells found in the Imeno outcrop. The last graph shows the calculated temperature in °C.



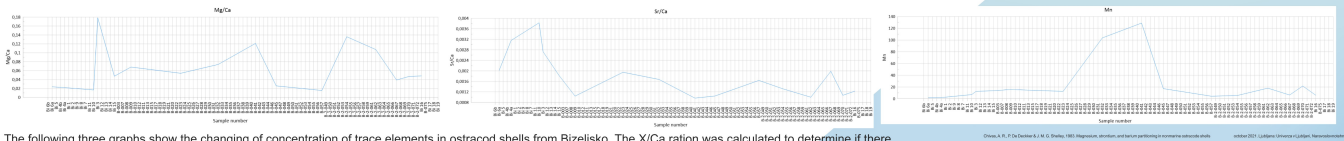
The following three graphs show the changing of concentration of trace elements in ostracod shells from Imenska Gorca. The X/Ca ration was calculated to determine if there was any correlation with changing of salinity.



The distribution of ostracod spacies in the studied section of Bizeljsko with a corresponding biozonation.



Results of Oxygen and Carbon isotopic analysis on ostracod shells found in the Bizeljsko outcrop. The last graph shows the calculated temperature in °C.



The following three graphs show the changing of concentration of trace elements in ostracod shells from Bizeljsko. The X/Ca ration was calculated to determine if there was any correlation with changing of salinity.

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