Chemostratigraphic constraints of marbles from the medium-grade, partly polymetamorphic Austroalpine Basement (Eastern Alps)

Schuster, R.[1], Hoinkes, G.[2], Puhr, B.[2], Richoz, S.[2] & Moshammer, B.[1]

[1] Geological Survey of Austria, Neulinggasse 38, 1030 Wien, Austria
(ralf.schuster@geologie.ac.at; beatrix.moshammer@geologie.ac.at)
[2] University of Graz, Institute of Earth Sciences, Universitätsplatz 2/II, 8010 Graz, Austria
(georg.hoinkes@uni-graz.at; barbara.puhr@uni-graz.at; sylvain.richoz@uni-graz.at)

Calcitic marbles of different tectonic units from the Austroalpine Crystalline Basement (Eastern Alps) were studied regarding their geochemical and isotope characteristics. The investigated units, the Greim, Wölz, Rappold, Koralpe-Saualpe, Pohorje, Millstatt, Plankogel and Radenthein Complexes are part of the polymetamorphic Koralpe-Wölz nappe pile, composed of garnet-bearing micaschists and paragneisses, quartzites, amphibolites, eclogite relics and different types of metacarbonate rocks.

For stratigraphic purposes samples were selected by geochemical screening using Mn/Sr- and Rb/Sr-ratios as well as Sr-, C, and O-isotope signals to control their primary compositions. Limiting factors for Mn/Sr are proposed by ≤2 and for Rb/Sr by ≤0.02. Limits for primary isotope ratios are given by the spread of well-established secular Phanerozoic seawater curves. Marbles reflecting primary signals do not exceed 0.70925 for 87Sr/86Sr and O- and C-values scatter between -8 to 0 and -1 to 6‰ respectively (V-PDB).

Although high-P/T metamorphic conditions within the nappe pile may facilitate a high level of post-depositional changes of the signals, a sufficient quantity of samples falls within the primary fields. Mn/Sr-ratios vary between 0.036 and 2.814 and Rb/Sr-ratios between 0 and 0.132. Delta18O- and delta13C-values range from -12.95 to 0.10‰ and -1.58 to 4.78‰ respectively.

The evaluation of the geochemical and isotope signals allows distinguishing two distinct groups of marbles within the Koralpe-Wölz nappe pile. The Rappold, Plankogel and Koralpe-Saualpe Complexes are summarized within group I which is characterized by relatively low and less variable Sr-values (between 0.707997 and 0.708465). In contrast O- and C-data are strongly scattering with ratios between -11.08 and 0.10‰ and -1.58 and 4.78‰ respectively. Just a few samples of this group show altered values not in equilibrium with the primary seawater. Group II, including the Wölz, Greim, Millstatt and Radenthein Complexes, shows variable and relatively high Sr-ratios from 0.708556 and 0.711090, most of them exceeding the possible values provided by the seawater curve. The oxygen-isotope signature fluctuates within -12.95 and -4.01‰ and carbon-ratios scatter from -0.9 and 2.02‰.

For each group a complex showing the best fitting dataset was used for chemostratigraphy by comparing the obtained isotope ratios with the seawater curves. For group I, represented by the Rappold Complex, a deposition age in the late Early to Middle Devonian is likely. Marble-chemistries from the Millstatt Complex as a representative of group II point to sedimentation ages from the late Silurian to the earliest Devonian.

The obtained deposition ages as well as lithologic successions allow comparing both groups with un- or weakly metamorphosed Paleozoic counterparts from the Austroalpine and Southalpine. The lack of an Ordovician magmatic event and a minor influence of the Variscan tectonometamorphic evolution are characteristic for the complexes of group I, lying in the south-eastern parts of the Koralpe-Wölz nappe pile. These facts as well as isotope signatures and ages are similar to the Paleozoic of Graz. Group II, mainly within northern and western areas, however shows similarities with the other Austro- and Southalpine Paleozoic units including the Greywacke Zone, Gurktal nappes, Carnic Alps and the Karawanken.