

Strontium, Carbon and Oxygen Isotope Study on Marbles of the Greenschist to Eclogite Facies Austroalpine Basement (Eastern Alps): Tectonic and Stratigraphic Implications

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Within this study Sr- C- and O-isotopic ratios of marbles of the Austroalpine basement (Eastern Alps) were analysed. The aim of the study was to characterise marbles from different tectonic units and to get some stratigraphic information by comparing the ⁸⁷Sr/⁸⁶Sr ratios with the Sr-isotope seawater curve (Howarth & McArthur 2004). More than 60 samples of calcitic and a few dolomitic marbles from the Koralpe-Wölz and the Drauzug-Gurktal nappe systems were investigated. To avoid secondary effects the samples were taken from several meter thick more or less pure marble layers with minor quartz and white mica contents. Normally the marbles are characterised by Sr contents of 130-500 ppm whereas in a few samples up to 1300 ppm where measured. The contamination by quartz and white mica is expressed by contents of SiO₂ (< 5 wt%), K₂O (< 0.05 wt%) and Rb (< 4 ppm).

In the *Koralpe-Wölz nappe system* marbles occur in several units. Those from the Wölz and Radenthein Complexes, which are metamorphosed under greenschist to amphibolite facies conditions, are characterised by Sr-ratios from 0.70858 to 0.71109. $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ range between 0.41 and 2.02 ‰ and 18.87 and 24.65 ‰. The values of the polymetamorphic Rappold Complex of amphibolite facies grades are the lowest and lie between 0.70710 and 0.70829. $\delta^{13}\text{C}$ yields values of 0.28 – 3.51 ‰ and $\delta^{18}\text{O}$ of 25.11 – 26.95 ‰. The polymetamorphic Millstatt Complex and the according Laas Serie of South Tyrol (Italy) experienced amphibolite and in some parts eclogite facies conditions and comprise marbles with Sr-ratios within a narrow range of 0.70856 to 0.70883. $\delta^{13}\text{C}$ scatters from 0.24 to 2.17 ‰ and $\delta^{18}\text{O}$ from 22.97 and 25.34 ‰. The high-grade metamorphic Koralpe-Saualpe Complex reaches Sr-values between 0.70869 and 0.70878. The $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values are the highest and lie between 1.22 and 2.24 ‰ and 24.96 and 27.98 ‰. The Sr-ratios of marbles of the *Drauzug-Gurktal nappe* system vary from 0.70854 to 0.70906.

The results show that marbles from some of the units exhibit Sr ratios in a very narrow range, which are compatible with different time intervals. The marbles from the Rappold Complex with their unique values below 0.7085 can be traced throughout the Eastern Alps. Due to intersections with the fluctuating seawater curve and additional information about sedimentation and metamorphism the age of these marbles can be limited into three time intervals: 431-444 Ma (Llandovery), 388-404 Ma (Givetian-Emsian) and 371-382 Ma (Frasnian). For the marbles of the Millstatt Complex a time interval of 410-421 Ma (Lochkovian-Ludfordian) is obvious.

References:

Howarth, R.J., McArthur, J.M. (1997) Statistics for strontium isotope stratigraphy. A robust LOWESS fit to the marine Sr-isotope curve for 0 - 206 Ma, with look-up table for the derivation of numerical age (Look-Up Table Version 4: 08/03). *Journal of Geology*, 105: 441-456.

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