# Magnesite deposits in the Eastern Alps – integrative approaches

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Austria is an important producer of magnesite which is used to a large extent in the refractory industry. In 2020, 816.370 t of magnesite were produced. Sparry magnesite deposits are the economically most important type in Austria. In order to secure the supply of magnesite and minimize dependence on exports from China, it is important that primary mining is also actively pursued in the future. Therefore, in addition to resource efficiency and recycling, raw material exploration will continue to play an important role. Successful exploration in turn requires knowledge of the national raw material potential as well as the deposit-forming processes, as only on this basis a correct exploration model can be developed. Magnesite deposits occur in different Austroalpine geological-tectonic units and their genesis has been debated for decades. More recently epigenetic metasomatic-hydrothermal models have been revived although in the past also syngenetic models were discussed. This MRI (Mineral Rohstoff Initiative) project – a cooperative project between Geologische Bundesanstalt, Montanuniversität Leoben, Technische Universität Graz and RHI Magnesita – is intended to provide clarification about application-oriented and basic research-oriented questions. A main objective of applied research aspects is the three-dimensional/vertical distribution of minerals (silicate phases etc.) and their compositional variation within the Breitenau deposit. Here, the main question is whether there exists a facies-controlled variation in the chemistry/mineralogy with increasing depth and whether this may influence the quality of the raw material. Various methods will be used to tackle open scientific questions. Fluid Inclusion studies can provide information on the pressure-temperature conditions of magnesite formation and the chemical composition of the fluids. They have only been carried out to limited extent on magnesite deposits in the Eastern Alps and are to be accelerated in this project. Sm-Nd dating of magnesite from two deposits (Breitenau, Hohentauern) located in different geological units, yielded Early Triassic and Late Carboniferous/ Early Permian ages, respectively. The differing ages indicate more than one event of magnesite formation in the Eastern Alps. Other important deposits like Hochfilzen are not dated yet. Recently, new isotope chemical methods became available in addition to classical stable isotope methods. Magnesium isotope composition of magnesite had been analysed in a previous one-year MRI project. The analyses show some variation in the limited magnesite data set and the reasons for the observed fractionation have to be further explored. Clumped isotopes have the potential to obtain formation temperatures of carbonate minerals. In combination with mineralogical-petrological methods (e.g., carbonaceous matter Raman geothermometry) and FI studies it should be possible to better constrain the conditions of ore formation. Together with additional age data these data hopefully will allow establishing a correct genetic model. When integrated with the modern geodynamic-tectonic concepts of the Eastern Alps this provides the basis for future exploration for magnesite.