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Stable isotopic composition of cryptocrystalline magnesite from deposits in Turkey and Austria

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Cryptocrystalline magnesite (CM) occurs all over the world predominantly in ultramafic rocks and within those mainly in ophiolite zones. The mineralization forms either veins and networks, which are strictly controlled by regional fault tectonics (Kraubath-type), or nodules and layers, which occur in sediments above the ophiolite close to the paleosurface (Bela Stena type). These types are well established and named after their type deposits in Austria and Serbia, respectively (Pohl, 1990; Prochaska, 2000; Wilson & Ebner, 2006).
Stable isotopic studies of CM showed that in comparison to sparry magnesite CM has lower 13C values (-18‰ to -6‰) and more constant 18O values (+22‰ to +29‰) (Kralik et al., 1989). Furthermore, it was observed that the Kraubath-type and Bela Stena-type CM differ in their isotopic composition in that the latter is characterised by higher 13C (-1‰ to +4‰) and 18O values (+26‰ to +36‰) (Jurković & Pamić, 2003).
The formation of CM is still a subject of debate. The 18O values suggests formation temperatures below 80°C (Kralik et al., 1989; Ece et al., 2005). The C isotope data indicate that the C was either derived from the atmosphere or by decarboxylation of organic-rich sediments (Zedef et al. 2000).
Our research addresses the following major questions:
(a) What are the reasons for the difference in stable isotopic composition between the Kraubath and the Bela Stena-type?
(b) Is it possible to distinguish different types of mineralizations within a deposit using stable isotope data and can this information be applied as a tool for CM exploration?
(c) Do the individual isotopic patterns of the individual deposits reflect different conditions for formation or later (post-mineralization) alteration events?
Our investigations were concentrated on the type locality in Kraubath (Austria) as well as on some currently operating deposits in the magnesite districts of Eskişehir and Tavşanlı (western Anatolia/ Turkey). The results show that each of the deposits is characterized by a characteristic C isotopic composition. Furthermore, network and vein mineralizations in the magnesite district of Eskişehir (Tutluca/Koçbal, Günaydin, Çırçır) can be distinguished by their isotopic pattern: Tutluca/Koçbal (network mineralization) - low 13C values (-11,0‰ to -8,3‰), Günaydin (vein mineralization) - intermediate 13C values (- 8,9‰ to -3,1‰), and Çırçır, (Bela Stena-type CM in weathered serpentinite at the bottom of lacustrine sediments) - high 13C values (+2,3‰ to +3,1‰). The 18O values are very similar at all deposits (+25,5‰ to +27,3‰).

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