# PETROLOGY AND GEOTHERMOBAROMETRY OF THE VEITSCH MN-DEPOSIT (STYRIA, AUSTRIA)

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The rock samples investigated in this study were collected from the manganese ore deposit of Veitsch (Styria, Austria). The area is located in the eastern section of the Northern Greywacke Zone (Upper Austroalpine), which had been overprinted by eo-Alpine greenschist-facies metamorphism. The manganese ores of Veitsch occur within the so-called ore bearing limestones („Erzführende Kalke“), as flat dipping, s-concordant lenses with an average thickness of 1.5 m and they consist mainly of rhodochrosite. The Mn-ore is very fine-grained and consists mostly of rhodochrosite. In addition subordinated kutnahorite and calcite, as well as different silicates (Mn-chlorite, spessartine, friedelite, Mn-serpentine, tephroite, sonolite, pyroxmangite and quartz) occur. Sulfides, mostly Co-Ni sulfides (the linnaeite-group, cobaltite, co-pentlandite and jaipurite), as well as chalcopyrite, sphalerite, pyrite and galena were identified in the majority of the thin sections. In addition, some veins occur which contain accessory Mn-allanite (androsite-Ce, ferriandrosite-Ce, manganiandrosite-Ce as well as four hitherto unnamed species). All examined allanites have very high Mn contents and one can also distinguish between V-rich and V-poor Mn allanites. In order to capture the full spectrum of the rare earth elements and trace elements, LA-ICP MS analysis was carried out. The rare earth elements probably originated from dissolved monazite. The solubility of monazite, and the subsequent formation of allanite, was most likely facilitated by a fluid during eo-Alpine greenschist-facies metamorphism. Geothermobarometric calculations were performed with the THERMOCALC v.3.33 program. The phases involved in these calculations were tephroite, pyroxmangite, pyrophanite, rhodochrosite, $CO_2$, rutile and quartz. Using ideal mixing models for these phases isobaric *T- X(*$CO_2$*)*-diagrams, as well as *P-T*-diagrams at constant *a*$CO_2$ were calculated. Latter diagrams were correlated with the observed phase assembly in the samples. The diagrams suggest that the fluid which co-existed during the formation had a very low $CO_2$-content (<0.1) which varies slightly from sample to sample. Moreover, the diagrams indicate that the temperature of the metamorphism at a pressure of 3 kbar is likely within a temperature range from about 380°C to 430°C well in agreement with previous estimates.