

EGU21-10224

<https://doi.org/10.5194/egusphere-egu21-10224>

EGU General Assembly 2021

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



## Occurrence and significance of pumpellyite blasts from the greenschists of the Mt. Medvednica (Croatia)

**Dražen Balen** and Petra Schneider

University of Zagreb, Faculty of Science, Division of Mineralogy and Petrology, Department of Geology, Zagreb, Croatia  
(drbalen@geol.pmf.unizg.hr)

The Mt. Medvednica is located north of Zagreb, a capital of Croatia, reaching 1033 m in height. It belongs to a complex geological unit located in the border area between Alps, Tisia (crystalline basement of the Pannonian Basin) and Dinarides, that are separated with large and regionally significant tectonic zones. Such geological position inevitably resulted with preservation of characteristics inherited from those large tectonic units, as well as those related to the local scale geological processes. Despite the significant tectonism, the Cretaceous metamorphism of Mt. Medvednica did not exceed P-T conditions of a low-grade metamorphism, as a typical metamorphic rock present is greenschist originated from the mafic igneous rock protolith.

The investigated Mt. Medvednica greenschists are characterized with weak schistosity, granoblastic to granolepidoblastic texture and typically comprise chlorite (40 vol.%), albite (35 vol.%), opaques (up to 15 vol.%), epidote (5 vol.%) and quartz (5 vol.%) that do not exceed 0.5 mm in size, with accessory minerals like titanite, apatite, zircon and calcite, together with rare finding of pumpellyite. The pumpellyite was so far just sporadically reported in the greenschists and was not investigated in detail. On the contrary, pumpellyite was almost regularly reported in the basic rocks from Jurassic ophiolite mélange that tectonically overly greenschists. Pumpellyite can be found there as a secondary hydrous silicate occurring in the altered extrusive rocks that undergone low-temperature ocean floor hydrothermal metasomatism addressed to the ophiolite emplacement.

Since blasts of pumpellyite (ca. 0.2–0.3 mm in size) that we have found in the greenschists are possible indicators for a polyphase metamorphic evolution, we have conducted microtextural analyses combined with a phase equilibrium modeling approach through the construction of P-T pseudosections. Chemical composition of greenschists suggested an origin from the altered calc-alkaline basalt. Therefore, P-T pseudosections in the range of 100–1000 MPa and 250–450 °C were constructed with PERPLEX software in the complex MnNCKFMASHTO chemical system, and contoured by isopleths for the mode and chemical composition of major rock-forming minerals.

Pumpellyite chemistry is characterized with  $\text{SiO}_2=36.77\text{--}38.38$  wt.%,  $\text{Al}_2\text{O}_3=18.56\text{--}21.00$  wt.%,  $\text{CaO}=20.69\text{--}22.89$  wt.% and  $\text{FeO}=14.50\text{--}16.85$  wt.% that classify this mineral as a pumpellyite-( $\text{Fe}^{2+}$ ). Metamorphic P-T conditions for pumpellyite-( $\text{Fe}^{2+}$ ) blasts in the assemblage with chlorite and albite were modeled to 500 MPa and 270°C. Those values correspond well with

the theoretically expected values, as well as with previously obtained peak P-T values for greenschist metamorphism of Mt. Medvednica obtained on the metapelites and metabasites with aid of a classical geothermobarometry. For comparison, different pumpellyite chemistry and slightly higher P-T values obtained in this research with pressures (up to +300 MPa) and temperatures (approx. +40°C) point to metamorphic mineral different from pumpellyite related to Jurassic ophiolite mélange altered basic rocks. Microtextural relations between major mineral assemblage and assemblage with pumpellyite show that prograde part of Cretaceous metamorphism, as a consequence of closure of the Neo-Tethys oceanic crust, preceded the growth of pumpellyite that may be ascribed to the retrograde part of a clockwise P-T path.