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Book of abstracts

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Authigenic vivianite in glacial sediments of Batizovské pleso, Tatra Mts., Slovakia

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The Batizovské pleso is a glacial mountain lake, located in Batizovská dolina (Tatra Mts.) at an altitude 1884 m a.s.l., with surface area of 3 ha. Lake is dammed by granitoid bedrock, recharged by underground flow through blocky moraines and discharged by one surface stream. Two sediment cores were taken by percussion corer in 2016.

Microchemical scanning by X-ray fluorescence (XRF) revealed distinct phosphate enrichment in some laminae, rare dark blue drusy aggregates of vivianite $Fe^{2+}_3(PO_4)_2 \cdot 8H_2O$ are bound to these layers, of size up to 18 mm. Vivianite concretions are buried in the depth of 315 cm within finely laminated, organic-poor sequence presumably deposited in periglacial conditions. Sediment is composed of quartz, plagioclase, K-feldspar, muscovite, illite/smectite, chlorite, kaolinite and biotite, grain-size fraction <0.06 mm dominates. Alternating dark- and light grey laminae have thickness ca. 0.5 – 2 mm, dark laminae are enriched in iron and fine grained organic matter.

Vivianite was identified by means of XRPD analysis and Raman spectroscopy. Its structure was described using Pawley refinement. A monoclinic cell with a = 10.009(12), b = 13.416(7), c = 4.706(5) Å, β = 102.53(5) ° and space group I2/m could be used to fit its structure. The basic features in Raman spectra correspond to vivianite, with lattice modes below 360 cm^{-1}, internal modes at 454, 540, 835, 950, 1054 cm^{-1}, and vibrations of molecular water at frequencies 3100 – 3500 cm^{-1}. The structure of vivianite partially degrades under oxidative conditions, resulting in decay of spectra. XRF analyses show enrichment in Mn.

Vivianite nodules form postdepositionally in lake sediments, when Fe^{III} oxyhydroxides dissolve under reducing conditions in absence of sulfur. Released Fe^{II} and sorbed P reprecipitates in form of Fe^{II} phosphates. Source of phosphorus is an open question – organic-bound phosphorus or weathering of accessory phosphates in granitoids come under consideration.

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