VESUVIANITE WITH DIFFERENT SPACE GROUPS FROM SZÁR HILL, POLGÁRDI, HUNGARY

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Vesuvianite is a rock forming mineral of the Szár Hill skarn, formed during the Mesozoic when the Devonian Polgárdi Limestone was metamorphosed by volcanic intrusions.

On the basis of morphology there are two types of vesuvianite. One consists of brown, idiomorphic elongated prisms with dipyramid terminations. The other type consists of anhedral isometric grains, forming granular aggregates at the boundary of the andesite.

Petrographic microscopy showed brownish isotropic crystals (garnet and vesuvianite) in calcite and clay matrix in the sample from the transition zone, i.e. the boundary zone between the andesite and the skarn.

The c_0 lattice constant and the 001 projection of the unit cell of vesuvianite is quite similar to that of garnets. The main difference between them is the presence of the channels in the vesuvianite structure with two fourfold axes. The fivefold and the eightfold coordinated cations (both of A and B positions) and oxygen anions (also A and B positions) are arranged along these axes and the ordering process between the A and B positions result the P4/n and P4nc space groups. The P4/nnc can be considered as the statistical arrangement of the P4/n and P4nc type ordering.

ALLAN & BURNHAM (1992) suggested 400 °C for the lower temperature limit of the presence of the P4/nnc vesuvianite. VEBLEN & WEICHMANN (1991) studied the cation ordering as a function of temperature. They found that the P4/nnc phase transforms into P4/n at slow cooling rate. They determined 780–800 °C as the transition temperature between the two symmetries (P4/n and P4/nnc) but there is no evidence for the stability conditions of the P4nc phase.

The samples from Polgárdi were studied by TEM. The SAED patterns revealed the high temperature P4/nnc and the ordered P4/n, P4nc phases besides garnet.

These observations confirmed that the isotropic crystals are garnet and P4/nnc vesuvianite. In the transition zone the mineralogically interesting P4nc space group vesuvianite was found.

According to these data, the skarn can be formed at high temperature by a volcanic body enriched in volatile materials. But the intruded body was not large and its temperature could not be higher than 500–600 °C. That is the reason why we suppose that a part of the intruding material saturated with volatiles parted from the main body and caused the metasomatosis the limestone. The coexistency of the ordered and the disordered vesuvianite phases suggests that the temperature of the metasomatism could reach 700 °C.

References

ALLAN, F. & BURNHAM, C.W. (1992). Can. Min., 30: 1–18.

VEBLEN, D. R. & WEICHMANN, M. J. (1991). Am. Min., 76: 397–404.