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OCCURRENCE OF COWLESITE IN ANDESITE AT PILISSZENTLÁSZLÓ, PILIS MTS., HUNGARY

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Cowlesite was first described by WISE & TSCHERNICH (1975) from seven different localities from the U.S.A. All known occurrences are in basic lavas. VEZZALINI *et al.* (1992) mentioned some localities of cowlesite in basalt from Northern Ireland. It was unknown in the Carpathian region to date.

There are a few zeolite occurrences in cavities and fissures of andesite in the Pilis Mts. (NNW from Budapest). Usual zeolite associations in this territory include stilbite, chabazite and heulandite. However, near Pilisszentlászló (in the Pálbükk quarry) white, soft, spherical aggregates have very rarely been found in the cavities of the rocks. They consist of very thin radiating plates with pearly lustre. The diameter of the spherules reaches up to 0.5 mm. These spherules are cowlesite according to XRD patterns and electron-microprobe analyses. Cowlesite is often covered by thin smectite (saponite?) and/or goethite films. In the cavities some relatively high temperature rock-forming minerals occur in the form of well-developed, but tiny crystals (*e.g.* plagioclase, amphibole, apatite, magnetite, hematite, and rarely cheralite–monazite). These earlier formed minerals are followed by cowlesite, chabazite, smectites, goethite, hematite and calcite.

Cowlesite is a zeolite with unknown structure. Complete single crystal X-ray study has not been performed so far because cowlesite crystals are always very small (up to 0.1 mm in width) and thin (up to 2 µm). According to X-ray powder data and very faint precession photographs, cowlesite is orthorhombic; this symmetry corresponds to the results of the optical studies (GOTTARDI & GALLI, 1985).

Because of the very limited quantity of available material from the cowlesite from Pilisszentlászló, experimental XRPD pattern was obtained by a 114.6 mm Gandolfi camera using CoK_α radiation. Observed reflections on the X-ray film are [d in Å (intensity, *hkl*)]: 15.15 (vs, 010), 12.44 (w, 001), 8.46 (w, 101), 7.64 (vw, 020), 5.68 (w, 121), 4.16 (vw, 202), 3.80 (w, 040), 3.45 (vw, 141), 3.27 (vw, 321), 3.12 (w, 004), 3.06 (vw, 050), 2.953 (vw, 051), 2.826 (w, 043), and 2.225 (vw, 352). Unit cell data calculated from the powder pattern are a = 11.46(6) Å, b = 15.19(3) Å, c = 12.45(3) Å, V = 2166(12) Å^3.

Electron-microprobe analyses (sample G145) were carried out in the wavelength-dispersive mode. The results are very close to those published earlier (WISE & TSCHERNICH, 1975; VEZZALINI *et al.,* 1992). The data (Table 1) correspond to a composition close to the stoichiometric formula for cowlesite ($CaAl_2Si_3O_{10} \cdot 6H_2O$) and indicate a relatively narrow compositional range. H_2O could not be directly determined due to the paucity of the sample.

References

GOTTARDI, G. & GALLI, E. (1985): Natural zeolites. Berlin: Springer-Verlag.
VEZZALINI, G., ARTIOLI, G., QUARTIERI, S. & FOY, H. (1992): Mineralogical Magazine, 56: 575–579.
WISE, W.S. & TSCHERNICH, R.W. (1975): American Mineralogist, 60: 951–956.

Table 1: Chemical composition (in wt%) according to electron-microprobe analyses and corresponding structural formulae for cowlesite from Pilisszentlászló (H_2O was calculated from difference)

No.	BaO	FeO	SrO	K_2O	CaO	SiO_2	Na_2O	MgO	Al_2O_3	Total
1	0.00	0.00	0.05	0.02	11.95	40.99	0.69	0.10	21.67	75.47
2	0.04	0.02	0.00	0.02	11.15	39.33	0.65	0.09	20.25	71.55
3	0.05	0.07	0.08	0.09	11.85	41.24	0.92	0.15	22.36	76.81
4	0.01	0.10	0.01	0.08	11.40	43.59	0.99	0.13	24.77	81.08
5	0.00	0.06	0.06	0.04	12.17	41.21	0.82	0.14	22.47	76.97
6	0.00	0.07	0.01	0.08	11.21	40.21	0.76	0.10	19.88	72.32
7	0.00	0.05	0.00	0.08	11.41	46.04	0.94	0.12	25.24	83.88

1) $(Ca_{0.96}Na_{0.10}Mg_{0.01})_{\Sigma=1.07}[Al_{1.91}Si_{3.06}O_{10}] \cdot 6.11H_2O$
2) $(Ca_{0.94}Na_{0.10}Mg_{0.01})_{\Sigma=1.05}[Al_{1.88}Si_{3.09}O_{10}] \cdot 7.45H_2O$
3) $(Ca_{0.93}Na_{0.13}Mg_{0.02}K_{0.01})_{\Sigma=1.09}[Al_{1.94}Si_{3.03}O_{10}] \cdot 5.68H_2O$
4) $(Ca_{0.85}Na_{0.13}Mg_{0.01}Fe_{0.01}K_{0.01})_{\Sigma=1.01}[Al_{2.02}Si_{3.02}O_{10}] \cdot 4.37H_2O$
5) $(Ca_{0.96}Na_{0.12}Mg_{0.02})_{\Sigma=1.10}[Al_{1.94}Si_{3.02}O_{10}] \cdot 5.63H_2O$
6) $(Ca_{0.93}Na_{0.11}Mg_{0.01}K_{0.01})_{\Sigma=1.06}[Al_{1.82}Si_{3.13}O_{10}] \cdot 7.19H_2O$
7) $(Ca_{0.81}Na_{0.12}Mg_{0.01}K_{0.01})_{\Sigma=0.95}[Al_{1.98}Si_{3.07}O_{10}] \cdot 3.58H_2O$