Dachiardite-K from the area of Austa village, Momchilgrad municipality, Eastern Rhodopes – a new mineral species of zeolite group

Дакиардит-К от района на с. Ауста, община Момчилград, Източни Родопи – нов минерален вид от групата на зеолитите

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Introduction

Dachiardite with unusually high content of potassium has been established during the study of mineral samples collected by Earth and Man National museum staff from the area of Austa village in the Eastern Rhodopes. A reference in the mineral list of the IMA shows that among dachiardite series only dachiardite-Ca and dachiardite-Na appear as mineral species (Cooms at al., 1997). This provoked us to send samples to DSc Nikita Chukanov, the Institute of Problems of Chemical Physics, RAS, Chernogolovka, Russia for further research. He made the necessary additions to the characterization of the mineral and proposed to the Commission on new minerals, nomenclature and classification of minerals of IMA to approve it as a new species. Dachiardite-K (simplified formula $K_2Ca(Al_4Si_{20}O_{48})\cdot 13H_2O$) was approved as a new mineral species on August 10, 2015, IMA №2015-041. The holotype specimen is deposited in Earth and Man National Museum, Sofia, Bulgaria with the registration number 23927.

Geological setting

The outcrop of dachiardite-K is located about 1 km northwest of the village of Zvezdel and about 0.5 km east of the village of Austa, Momchilgrad municipality, Eastern Rhodopes. The host rocks belong to the Zvezdel intermediate volcanic complex. The unit is composed of massive and brecciated lavas, epiclastic rocks, and less pyroclastics. The composition varies from basalts to dacites, but mainly – basaltic andesites and andesites. K-Ar dating of volcanism shows the age of 31.5 Ma, which corresponds to Early Oligocene (Raicheva, 2013). The zeolite bearing volcanic rocks are deeply altered.

Appearance and physical properties

Dachiardite-K is observed in the peripheral parts of opal-chalcedony veins in the altered epiclastic rocks. Associated minerals are: chalcedony, opal, dachiardite-Ca, dachiardite-Na, ferrierite-Mg, ferrierite-K, ferrierite-Na, clinoptilolite-Ca, clinoptilolite-K, mordenite, smectite, celadonite, calcite, and barite. Dachiardite-K forms spherical radial aggregates with a maximum radius of 8 mm consisting of flattened acicular individuals (Fig. 1). The mineral is brittle, with snow-white colour, vitreous lustre, white streak, stepped across cleavage fracture, and hardness 4 (Mohs). Perfect cleavage is observed on (100). Density: D_{meas} = 2.18(2), D_{calc} = 2.169 g/cm^3. Dachiardite-K

Fig. 1. Spherical aggregate of dachiardite-K embedded in chalcedony

is biaxial (+), α = 1.477 (calc.), β = 1.478(2), γ = 1.481(2), $2V_{meas}$ = 65(10)°. Dispersion is distinct, $r < v$. The optical axis *Y* coincides with the elongation direction *b*. The plane of perfect cleavage coincides with the plane (*YZ*). Dachiardite-K shows direct extinction in the plane (*YZ*). It is nonpleochroic, colourless under microscope.

Crystallography

Single-crystal X-ray study of dachiardite-K could not be carried out because of the absence of suitable single crystals: the mineral was observed only as aggregates consisting of tiny, divergent crystals.

Powder X-ray diffraction data were collected using a single-crystal diffractometer Rigaku R-AXIS Rapid II, equipped with cylindrical IP detector (shooting geometry Debye-Scherrer, d = 127.4 mm, CoKα-radiation) in St Petersburg State University. The strongest lines of the powder X-ray diffraction pattern [*d*, Å (*I*, %) (*hkl*)] are: 9.76 (24) (001), 8.85 (58) (200), 4.870 (59) (002), 3.807 (16) (202), 3.768 (20) (112, 020), 3.457 (100) (220), 2.966 (17) (-602). Dachiardite-K is monoclinic, space group *C*2/*m*, *Cm* or *C*2; unit-cell parameters refined from powder data are: a = 18.670(8), b = 7.511(3), c = 10.231(4) Å, β = 107.79(3)°, V = 1366(1) Å^3, Z = 1.

Chemistry

Chemical analyses were carried out using a Scanning Electron Microscope JEOL – JSM 35 CF & EDS SAMx at Eurotest-Control EAD, Sofia, and a Scanning Electron Microscope JEOL JSM 6390 & EDS Oxford INCA at Institute of Physical Chemistry, BAS, Sofia. Compositional data obtained at both laboratories are almost identical. The potassium content is in the range of 3.95 wt% up to 6.48 wt%. Distribution of Na, K and Ca in dachiardite-K from Austa is displayed on a triangular diagram (Fig. 2). Dachiardite with a high content of potassium is rare in nature. A variety of high-K dachiardite-Ca (3.00 wt% K_2O) was first described namely from Austa as a new zeolite svetlozarite (Maleev, 1976) but after detailed structural studies Gelens et al. (1982) redefine svetlozarite as a multiply-twinned and highly faulted dachiardite-Ca.

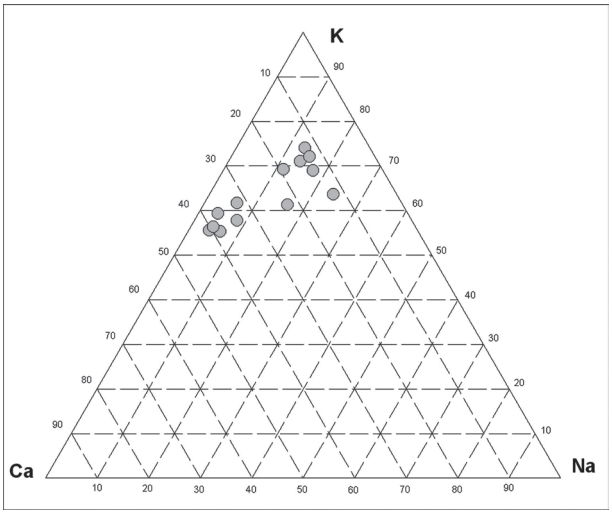

Fig. 2. Compositions of dachiardite-K from Austa plotted on triangular Na-K-Ca diagram

Conclusion

The approval of this new mineral from the region of Austa complements the dachiardite series of zeolite group with K-dominant end-member.

References

Coombs, D. S., A. Alberti, T. Armbruster, G. Artioli, C. Colella, E. Galli, J. D. Grice, F. Liebau, J. A. Mandarino, H. Minato, E. H. Nickel, E. Passaglia, D. R. Peacor, S. Quartieri, R. Rinaldi, M. Ross, R. A. Sheppard, E. Tillmanns, G. Vezzalini. 1997. Recommended nomenclature for zeolites minerals. Report of the Subcommittee on Zeolites of the International Mineralogical Association, Commission on New Minerals and Mineral Names. – *Canad. Mineral.*, *35*, 1571–1606.

Gellens, L. R., G. D. Price, J. V. Smith. 1982. The structural relation between svetlozarite and dachiardite. – *Mineral. Magazine*, *45*, 157–161.

Maleev, M. 1976. Svetlozarite, a new high-silica zeolite. – *ZVMO*, *4*, 449–453 (in Russian).

Raicheva, R. 2013. *The Role of Magma Mixing in the Petrologic Evolution of the Zvezdel Palaeovolcano*. PhD Thesis. Sofia, Geol. Inst., Bulg. Acad. Sci. (in Bulgarian).