DETERIORATION OF DACITE FROM THE CSÓDI HILL QUARRY, DUNABOGDÁNY, HUNGARY

MÁDAI, F.* & KRISTÁLY, F.
Institute of Mineralogy and Geology, University of Miskolc, H-3515 Miskolc-Egyetemváros, Hungary
* E-mail: askmf@uni-miskolc.hu

The dacite laccolite of the Csódi-hill is a well-known object among mineralogists, petrologists and also rockhounds from Hungary. The quarrying in the Csódi-hill started in 1860, the present quarry has been operating since the 1980s, its main product is crushed stone, but there were attempts also to use it as a dimension stone. Hydrothermal alteration of the rock mass resulted in post volcanic cavity fillings that were investigated in detail by several authors (articles in PAPP, 1999). This monograph collected the information on mineralogy of different cavity fillings (zeolites, calcite) inclusions (serpentine-group minerals), petrogenesis of the dacitic rock mass as well as on appearance of iron-rich trioctahedral smectite.

In 2008 the operating firm indicated a specific problem of the hydrothermally altered rock type, asking some research from the Institute of Mineralogy and Geology of the University of Miskolc. It was observed that deponated crushed stone left for about a year in depot, has significantly lost its petrophysical quality after the sulphate crystallization test, while the freshly quarried stone fulfilled the quality requirements. Several methods, for instance, optical microscopy, whole rock XRPD, EDS, acoustic wave propagation, were used to characterize the differences among the freshly quarried unaltered (rock type 1), freshly quarried, hydrothermally altered (type 2) and the problematic, altered and deponated (type 3) rock types. Only very slight differences were found.

The alteration, appearance, composition, quantity of the main rock forming minerals (plagioclase, quartz, sanidine, biotite, amphibole) were very similar. Felsic minerals were fresh, while mafic minerals were intensively altered and interstitial smectite, nontronite and Fe-rich vermiculite, as well as iron oxides and hydroxides were found in all rock types. The hydrothermally altered samples contained more zeolites, and vermiculite. Significant difference was found however in acoustic wave propagation, showing that the deponated altered (type 3) rock has higher porosity than the freshly quarried ones (type 1 and 2): 3640 m/s vs. 4250 m/s respectively.

It was supposed that the interstitial smectite of the deponated, hydrothermally altered rock gradually changed to mixed-layer clay mineral, resulting in enhanced porosity.

Recently an other problem of the altered rock type from the same quarry was investigated: surface deterioration of dimension stone blocks made from this rock was observed. The blocks were used for pavement since 2006 and a 2–3 mm thick detachment crust has been formed.

Same methods were used for characterisation, accomplished with SEM element mapping. Detailed optical and SEM investigation of the detachment zone showed that the main detachment plane is accompanied by a zone of microcracks. Appearance of tiny (30–50 micrometers) Ca-sulphate grains were detected in the detachment plane by element mapping. Broken, cracked biotite and plagioclase crystals were found in the detachment zone, showing the result of salt-frost deterioration.

The interstitial smectite (reddish brown in thin section) in the detachment zone was replaced by blackish, loose aggregates of clay minerals, composition of which is characterised as follows by EDS. Combined with previous investigations, it was found that the smectite of the altered rock type changes by atmospheric interactions, resulting in quick deterioration of the stone.

Reference

PAPP, G. (Ed.) (1999): Minerals of Csódi Hill, Dunabogdány, Hungary. Topographia Mineralogica Hungariae, Vol. 6, Herman Ottó Museum, Miskolc.

Table 1. *Composition of interstitial clay mineral phases (EDS results) within and near the detachment zone.*

point number, phase	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	FeO
2, blackish fine-grained aggregate	0.73	5.32	24.92	52.14	1.54	2.10	13.25
3, blackish fine-grained aggregate	0.51	4.82	22.10	56.43	0.87	1.89	13.38
5, blackish fine-grained aggregate	0.78	3.32	21.90	56.88	1.15	3.02	12.95
6, reddish-brown interstitial smectite	0.41	5.41	23.42	47.54	1.35	2.34	19.52
7, reddish-brown interstitial smectite	0.44	7.88	19.98	47.34	1.69	2.20	20.47