Contribution to the mineralogy of Norway, No. 54

On Chromian Montmorillonite (Volkonskoite) in Norway

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Chromian montmorillonite (volkonskoite) is described as a surface alteration product on ruby corundum from Froland, south Norway, and from a nepheline syenite pegmatite in the Langesundsfjorden area, south Norway. Volkonskoite from Froland contains 1.5% Cr_2O_3.

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The ruby corundum occurrence at Froland, near Arendal, south Norway, was described by Oftedahl (1963). Subsequent blasting in the deposit has revealed a small body of strong hydrothermal alteration, of approximate size $1 \times 1 \times 1\frac{1}{2}$ m, buckling out from the main corundum-bearing lens on its northern side.

This zone is characterized by rather abundant brown tourmaline and the occasional occurrence of elongated, tapered sapphire crystals up to 1 cm in length. Associated minerals include kyanite, scapolite, fluor-apatite, and rutile, but the mineralogy has not been studied in detail.

Ruby corundum from this zone shows signs of surface alteration, and is often covered by a thin, green crust. X-ray powder patterns of this mineral (Table 1) show it to belong to the montmorillonite group.

The Cr content was determined by neutron activation analysis. The sample was irradiated for 10 min at a thermal neutron flux of $1.5 \cdot 10^{13}$ n/cm$^2 \cdot$ sec. The 320 keV peak of ^{51}Cr (half-life 27.8 days) was counted after 4 days. USGS rocks DTS-1 and PCC-1 were included as standards, using values from Brunfelt & Steinnes (1966). The Cr content was found to be 1.0 ± 0.1 % (or ~ 1.5 % Cr_2O_3), the uncertainty being assigned on account of small amounts of admixed corundum (less than 10 %). The unaltered corundum also contains around 1 % Cr (Oftedahl 1963).

The Cr_2O_3 content of volkonskoite may vary within wide limits, and values up to 15–20 % have been reported from Russian occurrences (references in Sartori 1967), but in such cases the inclusion of chromium oxides in the analyzed samples may be suspected. Some recent descriptions quote the following values: 1.67 % Cr_2O_3 on impure material from Utah (McConnell 1954), 7.12 % Cr_2O_3 on material from Bavaria, heated to 1000 °C (Weiss et al. 1954), 1.14 % Cr_2O_3 on material from Italy (Sartori 1967), and up to 7.7 % Cr_2O_3 on material from Israel (Gross et al. 1967).

A green, clay-like mineral from a nepheline syenite pegmatite on Vesle Arøy, Langesundsfjorden, south Norway, was recently sent to Mineralogisk

Table 1. X-ray powder data for volkonskoite (air-dried).

I/I_0	(hkl)		d (Å) Groschlatten-grün, Bavaria[1]	d (Å)[2] Froland, Norway	d (Å)[2] Vesle Arøy, Langesunds-fjorden, Norway
s	(001)		14.4	10–12[3]	12.5
m	(110)	(020)	4.47	4.42	4.49
w–m	(130)	(200)	2.58	2.54	2.58
vvw	(220)	(040)	2.24		
w	(310)	(150)	1.69		
w	(240)		1.66		
m	(330)	(060)	1.49	1.49	1.50
w	(260)	(400)	1.29		
w	(350)	(170)	1.25		
	(420)				

[1] Weiss et al. 1954.
[2] 9 cm Debye-Scherrer camera, Fe radiation, Mn filter.
[3] Broad and diffuse reflection, could not be measured.

Geologisk Museum for identification. The mineral occurred as a 1 × 1 cm large patch in the middle of a red 'spreustein' pseudomorph (fibrous zeolite mixture, mainly natrolite, after sodalite or nepheline). The powder pattern (Table 1) is very much like that of volkonskoite from Froland. A qualitative XRF examination proved the presence of chromium.

X-ray powder patterns of montmorillonites (*sensu lato*) are variable and cannot be used for an unequivocal identification of different varieties. The (060) reflection can be used to indicate the di- or tri-octahedral nature of the mineral (Deer et al. 1963). A d-spacing at 1.49–1.50 Å is typical for di-octahedral montmorillonites, as opposed to 1.52–1.55 Å for tri-octahedral saponites. The inter-layer spacing d_{001} can vary between about 10 and 20 Å, and is dependent on the humidity and to some extent influenced by the nature of the exchangeable cations. A basal spacing of 12.5 Å (Table 1, on air-dried material) indicates one layer of water molecules per cell. Most natural montmorillonites have a basal spacing around 15 Å.

X-ray powder data for the two Norwegian minerals compare well with data for volkonskoite from Groschlattengrün, Bavaria (Weiss et al. 1954), (see Table 1). A simple test to differentiate between volkonskoite and green nontronite was proposed by the same authors (op. cit.). Small grains of the mineral are treated with 1N NH_3 for some minutes. In the case of volkonskoite, its green color is maintained, whereas nontronites turn brown or yellow. The test was tried out on the Norwegian material, and samples from both localities remained green even after several hours.

Volkonskoite must be considered to be a relatively rare mineral, and this short note about the first Norwegian occurrences would seem to be justified for this reason.

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REFERENCES

Brunfelt, A. O. & Steinnes, E. 1966: Instrumental neutron-activation analysis of 'standard rocks'. *Geochim. et Cosmochim. Acta 30,* 921–928.

Deer, W. A., Howie, R. A. & Zussman, J. 1963: *Rock-Forming Minerals.* Vol. 3. Sheet silicates. Longmans, Green and Co., Ltd., London. 270 pp.

Gross, S., Mazor, E., Sass, E. & Zak, I. 1967: The Mottled Zone Complex of Nahal Ayalon (Central Israel). *Israel J. Earth-Sci. 16,* 84–96.

McConnell, D. 1954: An American occurrence of volkonskoite. *Proc. 2nd Nat. Conf. Clays and Clay Minerals* (Nat. Acad. Sci. Publ. 327), 152–157.

Oftedahl, Chr. 1963: Contributions to the mineralogy of Norway, No. 19. Red corundum of Froland at Arendal. *Norsk geol. tidsskr. 43,* 431–440.

Sartori, F. 1967: La wolchonskoite di Castiglioncello (Livorno). *Period. Miner. 36,* 103–124.

Weiss, A., Koch, G. & Hofmann, U. 1954: Zur Kenntnis von Wolchonskoit. *Ber. d. Keram. Ges. 31,* 301–305.