

Crystal Data: Triclinic, pseudomonoclinic. *Point Group:* $\bar{1}$. As prismatic crystals, to 4 cm, with well-developed striations || elongation; rarely in radiating groups. *Twining:* Polysynthetic, ubiquitous, twin axis \perp pseudomonoclinic (010).

Physical Properties: *Cleavage:* Two good, intersecting at $\sim 55^\circ$; a parting \perp elongation. *Fracture:* Uneven. *Tenacity:* Brittle. *Hardness* = 5.5 *D*(meas.) = 3.85–3.88 *D*(calc.) = 3.92–3.98

Optical Properties: Opaque; transparent to translucent only in ultrathin sections. *Color:* Black. *Streak:* Dark green. *Luster:* Subadamantine to nonmetallic. *Optical Class:* Biaxial (–) (?). *Pleochroism:* Very strong; *X* = bronze; *Z* = green. $\alpha = 1.78$ (α') $\beta = \text{n.d.}$ $\gamma = 1.82$ (γ') *2V*(meas.) = Large.

Cell Data: *Space Group:* $P\bar{1}$. *a* = 10.317(1) *b* = 10.724(1) *c* = 8.855(1) $\alpha = 105.77(1)^\circ$ $\beta = 96.21(1)^\circ$ $\gamma = 124.77(1)^\circ$ *Z* = 2

X-ray Powder Pattern: Near Mo i Rana, Norway. 2.529 (100), 8.48 (90), 2.098 (63), 2.925 (59), 2.676 (48), 2.075 (47), 3.125 (46)

| Chemistry: | (1) | (2) | (1) | (2) |
|--------------------------------|---------|-------|-------------------------------|-----------------|
| SiO ₂ | 31.60 | 30.09 | MgO | 0.42 |
| TiO ₂ | 2.77 | 6.02 | CaO | 10.44 |
| SnO ₂ | 0.53 | | Na ₂ O | 1.52 |
| Al ₂ O ₃ | 2.64 | 3.55 | K ₂ O | 0.00 |
| Fe ₂ O ₃ | [19.03] | 11.12 | H ₂ O ⁺ | 0.35 |
| FeO | [28.06] | 26.91 | H ₂ O [–] | 0.07 |
| MnO | 0.27 | 1.26 | F | 0.00 |
| BeO | 2.65 | 2.32 | LOI | 0.22 |
| | | | Total | [99.93] [99.68] |

(1) Near Mo i Rana, Norway; by electron microprobe and ICP, average of four samples, $\text{Fe}^{2+}:\text{Fe}^{3+}$ by wet chemical analysis and Mössbauer spectroscopy; corresponding to $(\text{Ca}_{1.63}\text{Na}_{0.43})_{\Sigma=2.06}(\text{Fe}_{3.42}^{2+}\text{Fe}_{2.08}^{3+}\text{Ti}_{0.30}\text{Mg}_{0.09}\text{Mn}_{0.03}\text{Sn}_{0.03})_{\Sigma=5.95}(\text{Si}_{4.60}\text{Be}_{0.92}\text{Al}_{0.45})_{\Sigma=5.97}\text{O}_{20}$. (2) Ilmen Mountains, Russia; original total given as 100.28%; corresponding to $(\text{Ca}_{2.09}\text{Na}_{0.38}\text{K}_{0.03})_{\Sigma=2.50}(\text{Fe}_{3.29}^{2+}\text{Fe}_{1.22}^{3+}\text{Ti}_{0.66}\text{Mg}_{0.30}\text{Mn}_{0.08})_{\Sigma=5.55}(\text{Si}_{4.39}\text{Be}_{0.81}\text{Al}_{0.61})_{\Sigma=5.81}\text{O}_{20}$.

Mineral Group: Aenigmatite group.

Occurrence: As a late-stage metamorphic mineral in peraluminous granitic gneisses and mafic pegmatites associated with a beryllium deposit (near Mo i Rana, Norway).

Association: Quartz, albite, microcline, biotite, phenakite, zircon, fluorite, calcite, many minor beryllium and sulfide minerals (near Mo i Rana, Norway).

Distribution: Found about 16 km northwest of Mo i Rana, Norway. In the Ilmen Mountains, Southern Ural Mountains, Russia.

Name: For Høgtuva Mountain, near the type locality in Norway.

Type Material: University of Oslo, Oslo, Norway; National Museum of Natural History, Washington, D.C., USA.

References: (1) Grauch, R.I., I. Lindahl, H.T. Evans, Jr., D.M. Burt, J.J. Fitzpatrick, E.E. Foord, P.-R. Graff, and J. Hysingjord (1994) Høgtuvaite, a new beryllian member of the aenigmatite group from Norway, with new X-ray data on aenigmatite. *Can. Mineral.*, 32, 439–448. (2) Yakubovich, O.V., Y.A. Malinovskii, and O.V. Polyakov (1990) Crystal structure of makarochkinite [høgtuvaite]. *Kristallografiya* (Sov. Phys. Crystal.), 35, 1388–1394 (in Russian). (3) (1992) *Amer. Mineral.*, 77, 448 (abs. ref. 2).

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