## Kornerupine $(Mg, Fe^{2+}, Al, \square)_{10}(Si, Al, B)_5O_{21}(OH, F)$

**Crystal Data**: Orthorhombic. *Point Group*: 2/*m* 2/*m* 2/*m*. Crystals prismatic, to over 20 cm, showing principally {110}, {100}, and {010}, rarely terminated; as radiating aggregates.

**Physical Properties**: *Cleavage*: Good on {110}. Hardness = 6-7 D(meas.) = 3.29-3.35 D(calc.) = 3.288

**Optical Properties**: Transparent to translucent and opaque. *Color*: Colorless, white, blue, green, dark green, greenish yellow, yellow-brown, black. *Luster*: Vitreous.
*Optical Class*: Biaxial (-); may be pseudouniaxial (-). $\alpha$ = 1.660-1.671 $\beta$ = 1.673-1.683 $\gamma$ = 1.674-1.684 2V(meas.) = 3°-48° *Pleochroism*: *X* = colorless to green; *Y* = colorless, pale brownish yellow, pale yellowish green; *Z* = pale brownish green, green, light amber. *Orientation*: *X* = *c*; *Y* = *a*; *Z* = *b*. *Dispersion*: *r* < *v* or *r* > *v*.

**Cell Data**: Space Group: *Cmcm*. *a* = 16.041(3) *b* = 13.746(2) *c* = 6.715(2) Z = 4

**X-ray Powder Pattern**: Mautia Hill, Tanzania.
2.639 (100), 3.03 (80), 3.37 (60), 2.118 (60), 1.503 (40), 2.096 (30), 1.685 (30)

**Chemistry**:

| | (1) | | (1) |
|---|---|---|---|
| $SiO_2$ | 29.80 | MgO | 18.96 |
| $TiO_2$ | 0.06 | CaO | 0.07 |
| $B_2O_3$ | 1.44 | $Li_2O$ | 0.08 |
| $Al_2O_3$ | 45.85 | $Na_2O$ | 0.04 |
| FeO | 1.60 | F | 0.01 |
| MnO | 0.05 | $H_2O$ | [1.21] |
| | | Total | [99.17] |

(1) Fiskenæsset, Greenland; by electron microprobe, Li, B, F by ion microprobe, $H_2O$ calculated from stoichiometry; corresponding to $(Mg_{3.48}Fe_{0.16}Li_{0.04}Ca_{0.01}Na_{0.01}Al_{5.64}Ti_{0.01})_{\Sigma=9.35}(Si_{3.67}Al_{1.02}B_{0.31})_{\Sigma=5.00}O_{21}[(OH)_{0.99}F_{0.01}]_{\Sigma=1.00}$.

**Occurrence**: In boron-rich volcanic and sedimentary rocks subjected to amphibolite to granulite facies metamorphism; in metamorphosed anorthosite complexes.

**Association**: Sapphirine, cordierite, spinel, corundum, tourmaline, grandidierite, dumortierite, kyanite, sillimanite, andalusite, biotite, phlogopite, magnetite, ilmenite, hematite, rutile.

**Distribution**: Some localities for well-studied material follow. In Greenland, at Fiskenæsset. At Bjordam, near Kragerö, Norway. In Germany, from Waldheim, Saxony. From Mautia Hill, Tanzania. On the Bok se Puts Farm, Namaqualand, Cape Province, South Africa. Gem crystals from Itrongahy, near Betroka, and elsewhere in Madagascar. From gem gravels of the Matale, Ratnapura, and Embilipitiya districts, Sri Lanka. In the Harts and Strangways Ranges, Northern Territory, Australia. At Lac Ste-Marie, Quebec, Canada.

**Name**: For the Danish geologist, Andreas Nikolaus *Kornerup* (1857-1883).

**Type Material**: University of Copenhagen, Copenhagen, Denmark, 1883.754.

**References**: (1) Dana, E.S. (1892) Dana's system of mineralogy, (6th edition), 560-561. (2) McKie, D. (1965) The magnesium aluminium borosilicates: kornerupine and grandidierite. Mineral. Mag., 34, 346-357. (3) Grew, E.S., R.K. Herd, and N. Marquez (1987) Boron-bearing kornerupine from Fiskenæsset, West Greenland: a re-examination of specimens from the type locality. Mineral. Mag., 51, 695-708. (4) Moore, P.B., P.K. Sen Gupta, and E.O. Schlemper (1989) Kornerupine: chemical crystallography, comparative crystallography, and its cation relation to olivine and to $Ni_2In$ intermetallic. Amer. Mineral., 74, 642-655. (5) Grew, E.S., J.V. Chernosky, G. Werding, K. Abraham, N. Marquez, and J.R. Hinthorne (1990) Chemistry of kornerupine and associated minerals, a wet chemical, ion microprobe, and X-ray study emphasizing Li, Be, B and F contents. J. Petrol., 31, 1025-1070. (6) Cooper, M.A., F.C. Hawthorne, and E.S. Grew (2009) The crystal chemistry of the kornerupine-prismatine series. I. crystal structure and site populations. Can. Mineral., 47, 233-262.