## Fluor-schorl $NaFe^{2+}_3Al_6Si_6O_{18}(BO_3)_3(OH)_3F$

**Crystal Data**: Hexagonal. *Point Group*: 3*m*. As prismatic crystals striated along [0001], to 1 cm.

**Physical Properties**: *Cleavage*: Poor/indistinct on {0001}. *Fracture*: Irregular, uneven to subconchoidal. *Tenacity*: Brittle. Hardness = 7 D(meas.) = 3.20(3) D(calc.) = 3.23

**Optical Properties**: Translucent to transparent. *Color*: Pale brownish to pale grayish-bluish black. *Streak*: Bluish white. *Luster*: Vitreous.
*Optical Class*: Uniaxial (–). $\omega$ = 1.660(2) $\varepsilon$ = 1.636(2) *Pleochroism*: *O* = brown to gray-brown (Zschorlau), blue (Grasstein); *E* = pale gray-brown (Zschorlau), cream (Grasstein).

**Cell Data**: *Space Group*: *R*3*m*. *a* = 16.005(2) *c* = 7.176(1) Z = 3 (Zschorlau)

**X-ray Powder Pattern**: Grasstein, Trentino, South Tyrol, Italy.
2.584 (100), 3.469 (99), 2.959 (83), 2.044 (80), 4.234 (40), 4.005 (39), 6.382 (37)

| **Chemistry**: | (1) | (2) | | (1) | (2) |
|---|---|---|---|---|---|
| $Li_2O$ | 0.04 | n.d. | $Al_2O_3$ | 31.09 | 31.76 |
| $Na_2O$ | 2.44 | 2.35 | $B_2O_3$ | 9.86 | n.d. |
| $K_2O$ | 0.05 | 0.04 | $B_2O_3$ | [10.00] | [10.12] |
| CaO | 0.06 | 0.02 | $TiO_2$ | 0.73 | 0.17 |
| MgO | 0.89 | 0.07 | $SiO_2$ | 33.44 | 34.38 |
| ZnO | 0.09 | 0.12 | F | 1.20 | 1.40 |
| MnO | 0.10 | 0.89 | $H_2O$ | 2.70 | n.d. |
| $FeO_{total}$ | 16.49 | 15.84 | $H_2O$ | [2.88] | [2.83] |
| FeO | 15.83 | 13.15 | $–O = F_2$ | 0.51 | 0.59 |
| $Fe_2O_3$ | 0.73 | 2.99 | Total | 99.06 | 99.70 |

(1) Zschorlau, Germany; average of 20 electron microprobe analyses supplemented by Mössbauer and secondary-ion mass spectrometry; corresponds to $^{X}(Na_{0.82}K_{0.01}Ca_{0.01}\square_{0.16})^{Y}(Fe^{2+}_{2.30}Al_{0.38}Mg_{0.23}Li_{0.03}Mn^{2+}_{0.02}Zn_{0.01}\square_{0.03})_{\Sigma=3.00}{}^{Z}(Al_{5.80}Fe^{3+}_{0.10}Ti^{4+}_{0.10})^{T}(Si_{5.81}Al_{0.19}O_{18})(BO_3)_3{}^{V}(OH)_3{}^{W}[F_{0.66}(OH)_{0.34}]$.
(2) Grasstein, Italy; average of 8 electron microprobe analyses supplemented by Mössbauer and secondary-ion mass spectrometry; corresponds to $^{X}(Na_{0.78}K_{0.01}\square_{0.21})^{Y}(Fe^{2+}_{1.89}Al_{0.58}Fe^{3+}_{0.13}Mn^{2+}_{0.13}Ti^{4+}_{0.02}Mg_{0.02}Zn_{0.02}\square_{0.21})_{\Sigma=3.00}{}^{Z}(Al_{5.74}Fe^{3+}_{0.26})^{T}(Si_{5.90}Al_{0.10}O_{18})(BO_3)_3{}^{V}(OH)_3{}^{W}[F_{0.76}(OH)_{0.24}]$.

**Polymorphism & Series**: Complete solid-solution exists between fluor-schorl and schorl.

**Mineral Group**: Tourmaline supergroup.

**Occurrence**: A pneumatolytic phase associated with tin mineralization (Zschorlau) and in high-temperature hydrothermal veins in granitic pegmatites (Grasstein).

**Association**: Quartz, biotite, albite, orthoclase, schorl, apatite, beryl, cassiterite, "wolframite" (Zschorlau).

**Distribution**: From alluvial tin deposits near Steinberg, Zschorlau, Erzgebirge (Saxonian Ore Mountains), Saxony, Germany, and from pegmatites near Grasstein (area from Mittewald to Sachsenklemme), Trentino, South Tyrol, Italy.

**Name**: As the F-analogue of schorl.

**Type Material**: Natural History Museum, Vienna, Austria (N8165 and N8166); the Museum of Nature, South Tyrol, Bozen/Bolzano, Italy (MIN 9777); and Mineralogische Sammlung, Geowissenschaftliche Sammlungen, TU Bergakademie Freiberg, Saxony, Germany (MiSa 83180).

**References**: (1) Ertl, A., U. Kolitsch, M.D. Dyar, H.-P. Meyer, G.R. Rossman, D.J. Henry, M. Prem, Th. Ludwig, L. Nasdala, C.L. Lengauer, E. Tillmanns, and G. Niedermayr (2016) Fluor-schorl, a new member of the tourmaline supergroup, and new data on schorl from the cotype localities. Eur. J. Mineral., 28(1), 163-177. (2) (2016) Amer. Mineral., 101, 2358 (abs. ref. 1).