## Haradaite $Sr_2V_2^{4+}O_2Si_4O_{12}$



**Crystal Data:** Orthorhombic. *Point Group:* $2/m\ 2/m\ 2/m$. As tubular aggregates, to 2 mm; massive.

**Physical Properties:** *Cleavage:* Perfect on {010}, distinct on {100} and {001}. Hardness = 4.5 D(meas.) = 3.80 D(calc.) = 3.83

**Optical Properties:** Transparent to translucent. *Color:* Bright green. *Luster:* Vitreous. *Optical Class:* Biaxial (–). *Pleochroism:* $X$ = colorless to very pale green; $Y$ = colorless to light yellowish green; $Z$ = bluish green. *Orientation:* $X = a$; $Y = b$; $Z = c$. *Dispersion:* $r < v$, very strong. $\alpha = 1.713(2)$ $\beta = 1.721(2)$ $\gamma = 1.734(2)$ 2V(meas.) = n.d.

**Cell Data:** *Space Group: Amam.* $a = 7.06$ $b = 14.64$ $c = 5.33$ Z = 4

**X-ray Powder Pattern:** Synthetic.
3.20 (100), 2.88 (90), 3.65 (40), 2.65 (40), 2.12 (40), 2.04 (35), 7.30 (30)

**Chemistry:**

| | (1) | | (1) |
|---|---|---|---|
| $SiO_2$ | 38.38 | CaO | 1.27 |
| $TiO_2$ | 0.06 | SrO | 27.08 |
| $VO_2$ | 26.16 | BaO | 4.90 |
| $Al_2O_3$ | 0.36 | $Na_2O$ | 0.01 |
| FeO | 0.12 | $K_2O$ | 0.04 |
| MnO | 0.19 | $H_2O^+$ | 1.24 |
| CuO | 0.20 | $H_2O^-$ | 0.20 |
| PbO | 0.02 | Total | 100.23 |

(1) Yamato mine, Japan; corresponds to $(Sr_{3.26}Ba_{0.40}Ca_{0.28}Mn_{0.03}Fe_{0.02}K_{0.01})_{\Sigma=4.00}(V_{3.94}Al_{0.07}Ti_{0.01})_{\Sigma=4.02}(Si_{7.98}Al_{0.02})_{\Sigma=8.00}O_{28}$.

**Occurrence:** In coarse-grained rhodonite ore (Noda-Tamagawa mine, Japan); as veinlets cutting rhodonite-goldmanite ore (Yamato mine, Japan).

**Association:** Rhodonite, quartz.

**Distribution:** In Japan, in the Yamato mine and on Amamioshima Island, Kagoshima Prefecture; in the Noda-Tamagawa mine, Iwate Prefecture; and in the Matsuo mine, Kochi Prefecture. From the Gambatesa mine, near Chiavari, Val Graveglia, Liguria, Italy.

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**Type Material:** National Science Museum, Tokyo, Japan, M15111.

**References:** (1) Watanabe, T., A. Kato, J. Ito, T. Yoshimura, H. Momoi, and K. Fukuda (1974) Haradaite, $Sr_2V_2(O_2)(Si_4O_{12})$, a new mineral from the Noda Tamagawa mine, Iwate Prefecture, and the Yamoto mine, Kagoshima Prefecture, Japan. IMA, 9th General Meeting, 97 (abs.). (2) (1975) Amer. Mineral., 60, 340 (abs. ref. 1). (3) Watanabe, T., A. Kato, J. Ito, T. Yoshimura, H. Momoi, and K. Fukuda (1974) Haradaite, $Sr_2V_2^{4+}[O_2Si_4O_{12}]$, from the Noda Tamagawa mine, Iwate Prefecture, and the Yamoto mine, Kagoshima Prefecture, Japan. Proc. Japan Acad., Ser. B, 58(2), 21–24 (in English). (4) (1975) Chem. Abs., 96, 146305 (abs. ref. 3). (5) Takéuchi, Y. and W. Joswig (1967) The structure of haradaite and a note on the Si:O bond lengths in silicates. Mineral. J. (Japan), 5, 98–123. (6) (1971) Amer. Mineral., 56, 1123 (abs. ref. 5). (7) Ito, J. (1965). Synthesis of vanadium silicates: haradaite, goldmanite and roscoelite. Mineral. J. (Japan), 4, 299–316.