

**Crystal Data:** Hexagonal. *Point Group:*  $3m$ . Massive.

**Physical Properties:** Hardness = 2.5–3 VHN = n.d. D(meas.) = n.d. D(calc.) = 7.22

**Optical Properties:** Opaque. *Color:* In polished section, yellow-orange, pure yellow in oil. *Pleochroism:* Strong, yellow to greenish yellow. *Anisotropism:* Strong, in oil pale green to pale orange-yellow, in air glowing cinder-red to blue-green or green.

$R_1$ – $R_2$ : (400) 24.0–25.0, (420) 27.5–30.0, (440) 31.0–35.0, (460) 35.3–38.7, (480) 39.4–41.6, (500) 43.0–43.8, (520) 46.0–45.8, (540) 48.8–47.4, (560) 51.1–48.6, (580) 53.2–49.6, (600) 54.9–50.5, (620) 56.3–51.2, (640) 57.4–51.9, (660) 58.5–52.4, (680) 59.4–52.9, (700) 60.2–53.4

**Cell Data:** *Space Group:* n.d.  $a = 10.01$   $c = 3.28$   $Z = 9$

**X-ray Powder Pattern:** Kuusamo, Finland.

2.88 (100), 2.63 (100), 2.35 (100), 1.95 (100), 4.99 (60), 1.81 (40), 1.71 (40)

**Chemistry:**

|       | (1)   | (2)    |
|-------|-------|--------|
| Ni    | 41.1  | 42.65  |
| Co    | 1.0   |        |
| Cu    | trace |        |
| Se    | 57.9  | 57.35  |
| Total | 100.0 | 100.00 |

(1) Kuusamo, Finland; by X-ray fluorescence analysis. (2) NiSe.

**Occurrence:** In sills of albite diabase in schist, associated with low-grade uranium mineralization (Kuusamo, Finland).

**Association:** Clausthalite, selenian melonite (Kuusamo, Finland).

**Distribution:** In Finland, from Kuusamo [TL] and Hitura.

**Name:** Honors Eero Mäkinen (1886–1953), Finnish geologist, and former President of the Outokumpu Company.

**Type Material:** National School of Mines, Paris, France.

**References:** (1) Vuorelainen, Y., A. Huhma, and A. Häkli (1964) Sederholmite, wilkmanite, kullerudite, mäkinenite, and trüstedtite, five new nickel selenide minerals. *Compt. Rendus Soc. Géol. Finlande*, 36, 113–125. (2) (1965) *Amer. Mineral.*, 50, 519–520 (abs. ref. 1).