

**Crystal Data:** Orthorhombic. *Point Group:* 2/m 2/m 2/m. Prismatic crystals, to 1.0 mm, are elongated along [001] and display {100}, {010}, {110}, {120}, {111}, {001}; and in random aggregates. *Twinning:* On (130) with 65° between the *c* axes of the components.

**Physical Properties:** *Cleavage:* None. *Fracture:* Uneven. *Tenacity:* Brittle. Hardness = 5.5 VHN = 615 (20 g load). D(meas.) = n.d. D(calc.) = 5.332

**Optical Properties:** Transparent to translucent. *Color:* Brown to very dark reddish brown, almost black; light gray, with reddish brown internal reflections in reflected light.

*Streak:* Brownish red. *Luster:* Adamantine.

*Optical Class:* n.d. *n*(calc.) = 2.267

R<sub>1</sub>-R<sub>2</sub>: (400) 17.3-16.8, (420) 16.8-16.4, (440) 16.4-16.0, (460) 16.0-15.5, (470) 15.8-15.3, (480) 15.6-15.2, (500) 15.3-15.0, (520) 15.3-14.8, (540) 15.0-14.7, (546) 15.0-14.7, (560) 15.0-14.6, (580) 14.9-14.6, (589) 14.9-14.5, (600) 14.8-14.5, (620) 14.8-14.5, (640) 14.8-14.4, (650) 14.8-14.4, (660) 14.8-14.4, (680) 14.7-14.4, (700) 14.7-14.3

**Cell Data:** Space Group: *Cmca*. *a* = 7.2985(3) *b* = 14.1454(4) *c* = 10.1607(4) *Z* = 4

**X-ray Powder Pattern:** In den Dellen (Zieglowski) pumice quarry, Eifel region, Germany. 2.903 (100), 2.963 (91), 1.796 (51), 2.540 (39), 1.543 (20), 1.519 (16), 1.823 (15)

Chemistry:	(1)		(1)
CaO	5.45	Pr <sub>2</sub> O <sub>3</sub>	1.04
MnO	4.19	Nd <sub>2</sub> O <sub>3</sub>	2.18
FeO	7.63	ThO <sub>2</sub>	2.32
Al <sub>2</sub> O <sub>3</sub>	0.27	TiO <sub>2</sub>	17.78
La <sub>2</sub> O <sub>3</sub>	3.17	ZrO <sub>2</sub>	27.01
Ce <sub>2</sub> O <sub>3</sub>	11.48	<u>Nb<sub>2</sub>O<sub>5</sub></u>	<u>17.04</u>
		Total	99.59

(1) In den Dellen (Zieglowski) pumice quarry, Eifel region, Germany; average of 5 electron microprobe analyses supplemented by Raman spectroscopy, Fe<sup>2+</sup> and Mn<sup>2+</sup> assumed from structural data and by analogy with laachite; corresponds to

(Ce<sub>0.59</sub>La<sub>0.17</sub>Nd<sub>0.11</sub>Pr<sub>0.05</sub>)<sub>Σ=0.92</sub>Ca<sub>0.82</sub>Th<sub>0.07</sub>Mn<sub>0.50</sub>Fe<sub>0.90</sub>Al<sub>0.05</sub>Zr<sub>1.86</sub>Ti<sub>1.88</sub>Nb<sub>1.07</sub>O<sub>14</sub>.

**Occurrence:** In cavities in sanidine volcanic ejectum.

**Association:** Sanidine, “dark” mica, magnetite, baddeleyite, nosean, a chevkinite-group mineral.

**Distribution:** From the In den Dellen (Zieglowski) pumice quarry, 1.5 km northeast of Mendig, Laach Lake (Laacher See) paleovolcano, Eifel region, Rhineland-Palatinate, Germany.

**Name:** Honors Johann Jacob *Nöggerath* (1788-1877), a German professor of mineralogy and geology at the University of Bonn. A suffix indicates the dominant rare earth element.

**Type Material:** A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (5123/1).

**References:** (1) Chukanov, N.V., N.V. Zubkova, S.N. Britvin, I.V. Pekov, M.F. Vigasina, C. Schäfer, B. Ternes, W. Schüller, Y.S. Polekhovskiy, V.N. Ermolaeva, and D.Yu. Pushcharovskiy (2018) Nöggerathite-(Ce), (Ce,Ca)<sub>2</sub>Zr<sub>2</sub>(Nb,Ti)(Ti,Nb)<sub>2</sub>Fe<sup>2+</sup>O<sub>14</sub>, a new zirconolite-related mineral from the Eifel Volcanic Region, Germany. *Minerals*, 8(10), 449. (2) (2020) *Amer. Mineral.*, 105(8), 1280 (abs. ref. 1).