## Västmanlandite-(Ce) $(Ce,La)_3CaAl_2Mg_2[Si_2O_7][SiO_4]_3F(OH)_2$

**Crystal Data**: Monoclinic. *Point Group*: 2/*m*. As irregular grains to 3mm.

**Physical Properties**: *Cleavage*: Good on {001}. *Fracture*: Uneven to conchoidal. *Tenacity*: n.d. Hardness = 6 D(meas.) = n.d. D(calc.) = 4.51(2)

**Optical Properties**: Translucent. *Color*: Black to dark brown. *Streak*: Yellowish gray. *Luster*: Vitreous.
*Optical Class*: Biaxial (+). $\alpha$ = 1.781(4) $\beta$(calc) = 1.792 $\gamma$ = 1.810(4) 2V = 75(5)°
*Dispersion: r >v*, strong. *Pleochroism*: Strong, *X* = pale yellow, *Y* = reddish brown, *Z* = dark brown. *Absorption: Z ~ Y > X* (orientation unknown).

**Cell Data**: *Space Group: P*$2_1/m$. $a$ = 8.939(1) $b$ = 5.706(1) $c$ = 15.855(2) $\beta$ = 94.58(1)°

**X-ray Powder Pattern**: Malmkärra iron deposit, Västmanland county, south-central Sweden. 2.9831 (100), 3.503 (20), 2.6250 (19), 15.81 (16), 2.1874 (15), 2.6852 (13), 2.6784 (11)

**Chemistry**:

| | (1) | | (1) |
|---|---|---|---|
| $La_2O_3$ | 13.65 | CaO | 4.65 |
| $Ce_2O_3$ | 23.90 | FeO | 3.56 |
| $Pr_2O_3$ | 2.07 | MgO | 5.51 |
| $Nd_2O_3$ | 6.28 | $Al_2O_3$ | 8.58 |
| $Sm_2O_3$ | 0.42 | $SiO_2$ | 26.61 |
| $Gd_2O_3$ | 0.15 | $P_2O_5$ | 0.05 |
| $Dy_2O_3$ | 0.01 | $TiO_2$ | 0.04 |
| $Ho_2O_3$ | 0.02 | F | 1.06 |
| $Er_2O_3$ | 0.00 | [$H_2O$] | 1.6 |
| $Yb_2O_3$ | 0.03 | - O = F | 0.45 |
| $Y_2O_3$ | 0.18 | Total | 96.31 |

(1) Malmkärra iron deposit, Västmanland county, south-central Sweden; average of 3 electron microprobe analyses, $H_2O$ estimated as 2OH per formula unit, $Fe^{2+}/Fe^{3+}$ by Mössbauer spectroscopy, $OH^-$ confirmed by IR spectroscopy; corresponding to $(Ce_{1.62}La_{0.93}Nd_{0.42}Pr_{0.14}Sm_{0.03}Y_{0.02}Gd_{0.01})_{\Sigma=3.17}$ $Ca_{0.92}Al_{1.88}(Mg_{1.52}\ Fe^{3+}_{0.37}Fe^{2+}_{0.18})_{\Sigma=2.07}(Si_{4.94}P_{0.01})_{\Sigma=4.95}O_{0.19}(F_{0.62}O_{0.38})_{\Sigma=1.00}(OH)_2$.

**Polymorphism and Series**: Forms a solid solution series with an Fe analog.

**Occurrence**: In disseminated magnetite-amphibole calc-silicate replacements in marble.

**Association**: Fluorbritholite-(Ce), tremolite, dolomite, magnetite, and minor arsenopyrite, bastnäsite-(Ce), bismuthinite, cerite-(Ce), chalcopyrite, dollaseite-(Ce), ferriallanite, gadolinite-(Ce), molybdenite, pyrite, talc, zircon.

**Distribution**: From the Malmkärra iron deposit (also the Bastnäs and Östanmossa deposits), Norberg district, Västmanland county, Bergslagen mining region, south-central Sweden.

**Name**: For the county in Norway in which the first specimens were collected.

**Type Material**: Swedish Museum of Natural History, Stockholm, Sweden (01+0081).

**References**: (1) Holtstam, D., U. Kolitsch, and U.B. Andersson (2005) Västmanlandite-(Ce) - a new lanthanide- and F-bearing sorosilicate mineral from Västmanland, Sweden: description, crystal structure, and relation to gatelite-(Ce). Eur. J. Mineral., 17, 129-141. (2) (2005) Amer. Mineral., 90, 1948-1949 (abs. ref. 1).