Agardite-(La) $(La,Ca)Cu_6(AsO_4)_3(OH)_6 \cdot 3H_2O$

Crystal Data: Hexagonal. *Point Group:* $6/m$ or 6. Crystals acicular, prismatic, to 3 mm, in tufted groups, spherical rosettes.

Physical Properties: Hardness = n.d. D(meas.) = 3.65(5) D(calc.) = 3.62(1)

Optical Properties: Semitransparent. *Color:* Grass-green to dull green, yellowish green to intense bluish green, rarely nearly colorless.
Optical Class: Uniaxial (+). $\omega = 1.715(2)$ $\epsilon = 1.795(2)$

Cell Data: *Space Group:* $P6_3/m$ or $P6_3$. $a = 13.586(4)$ $c = 5.931(5)$ $Z = 2$

X-ray Powder Pattern: n.d. ; presumably very similar to agardite-(Y).

Chemistry: (1) Red Cloud fluorite mine, New Mexico, USA; analysis not given, by electron microprobe, average of analyses on four crystals, $(OH)^{1-}$ calculated for charge balance; stated to correspond to $(Al_{0.36}La_{0.29}Ce_{0.21}Nd_{0.08}Pr_{0.03}Y_{0.02}Gd_{0.02}Sm_{0.01})_{\Sigma=1.02}(Cu_{5.50}Ca_{0.42}Pb_{0.06}Fe_{0.02}Zn_{0.01})_{\Sigma=6.01}[(AsO_4)_{2.74}(SiO_4)_{0.25}(VO_4)_{0.02}(SO_4)_{0.02}]_{\Sigma=3.03}(OH)_{5.76} \cdot 3H_2O$.

Mineral Group: Mixite group; Nd and Ce have also been noted as dominant rare-earth elements, but the corresponding species have not been fully described.

Occurrence: In small amounts in the oxidized zone of hydrothermal mineralized breccia and polymetallic mineral deposits (Red Cloud mines, New Mexico, USA).

Association: Fluorite, bastnaesite, barite, quartz (Red Cloud fluorite mine, New Mexico, USA); chrysocolla, malachite, azurite, mimetite, vanadinite, conichalcite, wulfenite, mottramite, cerussite, quartz (Red Cloud copper mine, New Mexico, USA); smithsonite, aurichalcite, hydrozincite, azurite, cuprian adamite, calcite, chrysocolla, zincaluminite, gibbsite (Kamariza mine, Greece).

Distribution: From the Red Cloud fluorite and copper mines, Gallinas district, Lincoln Co., New Mexico, USA. In the Kamariza mine, Laurium, Greece (Ce > La in part). In England, from Wheal Alfred, Phillack, Cornwall (Nd-rich); at the Brandy Gill and Deer Hills mines, Caldbeck Fells, Cumbria. In the Clara Mine, near Oberwolfach, and other localities in the Black Forest, Germany (Ce > La in part). From the Sa Duchessa mine, near Iglesias, Sardinia, Italy (Nd-rich in part, some with Ce > La).

Name: By analogy to *agardite*-(Y), with its rare-earth content dominated by *lanthanum*.

Type Material: National Museum of Natural History, Washington, D.C., USA, 148987, 148988.

References: (1) Modreski, P.J. (1983) Agardite-(La), a chemically complex rare-earth arsenate from the Gallinas district, Lincoln Co., New Mexico. In: Anthony, J.W., Ed., Oxidation mineralogy of base metal deposits: Fifth Joint Mineralogical Society of America – Friends of Mineralogy Symposium, Tucson, Arizona. (2) Fehr, T. and R. Hochleitner (1984) Agardite-La, ein neues Mineral von Lavrion, Griechenland. LAPIS, 9(1), 22, 37 (in German). (3) (1985) Amer. Mineral., 70, 871 (abs. ref. 2).