

Crystal Data: Triclinic or monoclinic. *Point Group:* $\bar{1}$ or 2/m. Interleaved with and rimmed by phlogopite plates to 1.2 mm, as aggregates of platy crystals.

Physical Properties: *Cleavage:* Perfect on {001}. *Tenacity:* Elastic. *Fracture:* n.d. Hardness = 2-3 (by analogy to phlogopite). D(meas.) = n.d. D(calc.) = 2.885

Optical Properties: Translucent. *Color:* Light brown, olive green. *Streak:* White. *Luster:* Pearly. *Optical Class:* Biaxial (-). Positive elongation. *Orientation:* Z || cleavage. *Pleochroism:* X = colorless to yellow, Y = Z = pale yellowish brown.

Cell Data: *Space Group:* $C\bar{1}$. $a = 5.289(6)$ $b = 9.16(1)$ $c = 9.892(9)$ $\alpha = 94.45(9)^\circ$ $\beta = 97.74(9)^\circ$ $\gamma = 90.0(1)^\circ$ $Z = 2$ (1A); $C2/m$. $a = 5.291(8)$ $b = 9.16(2)$ $c = 10.12(2)$ $\beta = 105.1(1)^\circ$ $Z = 2$ (1M)

X-ray Powder Pattern: Kasuga-mura, Gifu Prefecture, central Japan.

(polytype 1A) 2.62 (100), 9.73 (80), 4.57 (40), 3.26 (40), 2.55 (30), 2.45 (20), 3.46 (10)

(polytype 1M) 9.77 (100), 2.61 (100), 3.26 (50), 4.59 (25), 2.55 (25), 2.45 (20), 2.19 (20)

Chemistry:	(1)		(1)
SiO ₂	37.0	Na ₂ O	6.79
TiO ₂	0.96	K ₂ O	0.97
Al ₂ O ₃	22.7	F	0.16
FeO	4.12	<u>H₂O</u>	<u>[4.26]</u>
MgO	22.1	Total	99.0
CaO	0.04		

(1) Kasuga-mura, Gifu Prefecture, central Japan; electron microprobe analysis, H₂O calculated for OH+F+Cl = 2.0 a.p.f.u.; corresponds to (Na_{0.90}K_{0.10}) $\Sigma=1.00$ (Mg_{2.27}Al_{0.41}Fe²⁺_{0.23}Ti_{0.05}) $\Sigma=2.96$ (Si_{2.56}Al_{1.44}) $\Sigma=4.00$ O₁₀[(OH)_{1.97}F_{0.03}] $\Sigma=2.00$.

Polymorphism & Series: Polytypes 1A and 1M; limited series with phlogopite.

Mineral Group: Mica group.

Occurrence: In thermally metamorphosed rocks (greenschist to amphibolite facies) in the contact aureole of a granite; in metamorphosed evaporite rocks (Algeria); from norite xenoliths (Chile); as inclusions in chromites of mafic layered intrusions and ophiolite complexes (China).

Association: Phlogopite, pargasite, magnesiosadanagaite, titanite, calcite, scapolite, apatite, pyrrhotite, chalcopyrite, chlorite, pyrite (Kasuga-mura, Japan); enstatite, spinel (China).

Distribution: From Derrag, Tell Atlas, Algeria and Volcán San Pedro, Andes Mountains, Chile. From the dumps of Kawai pit, Kasuga-mura, Gifu Prefecture, central Japan. From Zillertal, Tyrol, Austria. In the North Qilian Mountains, Qinghai Province, northwestern China.

Name: From the Greek "aspida" for "a shield" and "lithos" for "stone", alluding to the crystal habit.

Type Material: Geological Museum, Geological Survey of Japan, AIST, Tsukuba (M35151-4) and at the National Science Museum, Tokyo (NSM-28719), Japan.

References: (1) Banno, Y., R. Miyawaki, T. Kogure, S. Matsubara, T. Kamiya, and S. Yamada (2005) Aspidolite, the Na analog of phlogopite, from Kasuga-mura, Gifu Prefecture, central Japan: description and structural data. *Mineral. Mag.*, 69(6), 1047-1057. (2) Kogure, T., Y. Banno, and R. Miyawaki (2004) Interlayer structure in aspidolite, the Na analogue of phlogopite. *Eur. J. Mineral.*, 16, 891-897. (3) Schreyer, W., K. Abraham, and H. Kulke (1980) Natural sodium phlogopite coexisting with potassium phlogopite and sodian aluminian talc in a metamorphic evaporite sequence from Derrag, Tell Atlas, Algeria. *Contrib. Mineral. Petrol.*, 74, 223-233. (4) Costa, F., M.A. Dungan, and B.S. Singer (2001) Magmatic Na-rich phlogopite in a suite of gabbroic crustal xenoliths from Volcán San Pedro, Chilean Andes: Evidence for a solvus relation between phlogopite and aspidolite. *Am. Mineral.*, 86, 29-35. (5) Tseng, Chien-Yuan, Houg-Yi Yang, Han-Quan Wu,

and Guo-Chao Zuo (2007) The silicate mineral inclusions in the chromian spinel from the Dongcaohe Ophiolite, North Qilian Mountains, Northwestern China: record of syntaxis of lower oceanic crust. *Can. Mineral.*, 45, 793-808.