08.4-10 LOVDARITE:THREE-MEMBERED RINGS IN A FRAMEWORK SILICATE. By S. Merlino, Institute of Mineralogy, University of Pisa, Pisa, Italy.

Lovdarite was found by Men'schikov in an alkaline intrusion on Mount Karnasurt in the Lovozero pluton and was described by Men'schikov et al.(Dokl. Akad. Nauk SSSR, 213, 130, 1973). New data were subsequently presented by Khomyakov et al.(Dokl. Akad. Nauk SSSR,221, 154, 1974), who described the diffraction pattern of the lovdarite crystals, classifying the lovdarite structure as an OD-structure.
I recently obtained a small sample of lovdarite through the kindness of Prof. Khomyakov and undertook a structure analysis on a selected crystal which, contrary to most crystals of lovdarite, gave a diffraction pattern with only sharp spots. The crystal is orthorhombic with a=39.58, b=6.93, c=7.15 Å, space group Pmam, Pma2 or $P2_1am$ on the basis of systematic absences. The crystal structure was solved by direct methods and refined by least squares methods in the space group Pma2. The lovdarite structure may be described as a three-dimensional framework of silicon and beryllium tetrahedra with alkali cations and water molecules in the cavities of the framework. The following ideal crystal chemical formula was obtained: $K_4Na_{12}(Si_{28}Be_8O_{72}).18H_2O$. The most outstanding feature of the structure is the arrangement of five tetrahedra in two three-membered rings sharing a tetrahedron. Lovdarite is the first example of a framework silicate containing three-membered rings: strain is released by the presence of a beryllium cation in each ring.

08.4-11 CRYSTAL STRUCTURE OF LIZARDITE 1T.

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Euhedral crystals of lizardite 1T were found in Val Sissone, Italy. Their size reaches 0.2 mm, and they show trigonal truncated pyramidal habit. The chemical analysis, obtained by electron microprobe, leads to the unit-cell content
$(Mg_{2.79}Fe^{2+}_{0.04}Fe^{3+}_{0.10}Al_{0.07})(Si_{1.83}Al_{0.17})O_{5.00}(OH)_{4.00}$
The unit-cell parameters are a = 5.332, c = 7.233 Å. The crystal structure was refined to R = 0.031, in the space group P31m, using 209 independent reflections. The main feature is given by the presence of 1:1 layers which show slight deviation from the idealized geometry of the serpentine layer. The outer oxygen atoms of the tetrahedral sheet are rotated away from the nearest magnesium atoms and towards the hydroxyl groups belonging to the adjacent layer (α = -3.5°), thus assuring closer O-H·· O distances (3.03 Å). No buckling of the magnesium plane is observed. The most important distances are: $Si\text{-}O_{br}$ 1.646 Å, $Si\text{-}O_{nbr}$ 1.616 Å; Mg-O bonds range from 2.06 to 2.12 Å.
The rotation of the tetrahedral sheet in flat-layer serpentine minerals is discussed. The occurrence of both negative and positive rotation angles is interpreted as due to interlayer effects. Owing to the different stacking operators, the best hydrogen bond system is obtained by positive or negative rotation of the tetrahedral sheet.

08.4-12 THE IRON DISTRIBUTION IN RHODONITE - A NEUTRON DIFFRACTION STUDY. By Frank H. Moore, Australian Institute of Nuclear Science & Engineering, and Ian M. Threadgold, Dept. of Geology, University of Sydney, Sydney Australia.

A moderately iron rich rhodonite from Broken Hill with a composition of $Ca_{0.96}Mn_{3.15}Fe_{0.84}Mg_{0.05}Si_5O_{15}$ and crystallizing in space group $P\bar{1}$, has unit cell dimensions

a = 7.675(1), b = 11.795(2), c = 6.682(1)Å
α = 92.403(7), β = 93.803(7), γ = 105.368(10)°.

2691 reflections were collected using neutrons of wavelength 0.9882Å.

The structure was refined anisotropically to an R of 3.7%. Whilst the refined site occupancies show some agreement with the results of the Mössbauer investigation, they are not in complete agreement but are considered to reflect, more correctly, the iron distribution in rhodonite.

08.4-13 THE CRYSTAL STRUCTURE OF EKANITE, $ThCa_2Si_8O_{20}$. J. T. Szymański, CANMET, Department of Energy, Mines & Resources, Ottawa, Canada, K1A 0G1.

The name ekanite was originally given to a metamict green mineral of composition $ThCa_2Si_8O_{20}$, which gave no diffraction pattern until heated to 650°C, when it recrystallized to give a body-centred tetragonal phase (Anderson *et al.*, (1961). *Nature*, 190, 997). Since then structural studies have been done on minerals, where part of the Ca is replaced by Na, with K filling additional sites in space group P4/mcc. Unfortunately, the name ekanite was retained in these cases (Mokeyeva & Golovastikov, (1966). *Doklady Akad. Nauk S.S.S.R.*, 167, 1131; Richard & Perrault, (1972) *Acta Cryst.* B28, 1994). The crystal structure of ekanite from the Yukon Territory, Canada, has been determined. The chemical composition of this is very close to the original metamict ekanite and contains no K or Na. Its powder pattern agrees with that of re-crystallized original ekanite. The space group is I422, with a=7.483(3), c=14.893(6)Å. The structure has been solved and refined to R=3.57% from 1319 independent reflections obtained from multiple data sets with Mo$K\alpha$ radiation. The stucture is related to that of the so-called ekanites (see above): Th is 8-coordinate in a square anti-prism of oxygens at 2.405 (5)Å; Ca has four nearest O neighbours (2.342(5)Å) in a very distorted tetrahedron, and four second-nearest O neighbours (2.688(5)Å) near the mid-points of the tetrahedral faces. Sheets of metals at z=0,½ are separated by a double silicate layer, which extends infinitely in x,y. In this structural aspect the present mineral differs from the so-called ekanites, which have discrete Si_4O_{20} units. The present structure is characterized by zeolite-like channels through the silicate layers, where non-structural water can become entrapped.
Nomenclature changes for the ekanite-group of minerals have been submitted to the Commission on New Minerals and Mineral Names, I.M.A.