Three-layer monoclinic lepidolite from Tørdal, Norway

S. W. Bailey

Department of Geology and Geophysics, University of Wisconsin
Madison, Wisconsin 53706

AND OLA V. H. J. CHRISTIE

Laboratory for Mass Spectrometry, University of Oslo
P. O. Box 1048, Blindern, Oslo 3, Norway

Abstract

A 3-layer monoclinic lepidolite from a pegmatite at Tørdal, Norway, previously described as 2-layer orthorhombic, has been identified as the 3Mz polytype. The space group is C2 with a = 5.239(2), b = 9.070(3), c = 29.886(5) Å, and β = 92.58(2)°. The X-ray powder pattern differs in detail from those of the conventional mica polytypes. Electron microprobe analysis gives SiO2 48.78, Al2O3 23.87, FeO 1.39, MgO 0.02, MnO 4.61, TiO2 0.07, K2O 9.88, Na2O 0.20, BaO 0.03, F 6.21 weight percent for the 3Mz, flakes and SiO2 53.41, Al2O3 21.43, FeO 0.06, MgO 0.02, MnO 1.82, TiO2 0.06, K2O 9.85, Na2O 0.19, BaO 0.03, F 7.63 weight percent for associated 2M1, lepidolite flakes.

Heinrich et al. (1953) described a 3-layer monoclinic lepidolite from a pegmatite at Skuleboda, Sweden. Neumann et al. (1957) and Christie (1961) have described other lepidolite specimens from pegmatites at Varuträsk, Sweden, and Tørdal, Norway, that give X-ray powder patterns similar to that of the Skuleboda specimen. This note reports a more detailed study of the Tørdal material.

Single-crystal X-ray precession photographs of over 50 individual flakes of lepidolite from Tørdal showed three polytypic structures to be present—1M, 2M1, and 3M. The 3M flakes represent the same material that was originally described as 2-layer orthorhombic by Christie (1961).

The 3M lepidolite has diffraction symmetry that could be described as C2/m, C2, or Cm. Single-crystal intensities were collected on an automated Syntex diffractometer and used for comparison with intensities calculated from the six possible 3-layer stacking sequences. Good agreement was found for only one model, which has ideal symmetry C2. Relative to a fixed initial set of axes, the intralayer shifts of a/3 in this model are directed in the sequence −Xz, +Xz, and −Xz within the three successive layers. The resultant shift then is a/3 along −Xz of the initial axes to give an ideal β angle of 93.4°.

The structure deduced above is identical to the ideal structure described as 3Mz by Ross et al. (1966) in their systematic study of possible mica polytypes. Comparison of Weissenberg photographs of the Tørdal specimen with those illustrated by Heinrich et al. (1953, Figs. 10–12) indicates that the latter specimens also have the 3Mz structure.

Table 1 lists the powder pattern of a pure sample of lepidolite-3Mz from Tørdal. Indexing was achieved by direct comparison of the powder data with observed single-crystal intensities. The pattern differs in detail from those of the conventional mica structures and is characterized by the occurrence of several non-overlapping triplets of indices 11l, 02l, and 11l. Least-squares refinement of the powder data gave cell dimensions a = 5.239(2), b = 9.070(3), c = 29.886(5) Å, and β = 92.58(2)°.

Table 2 lists electron microprobe analyses of flakes of 3Mz and 2M1, lepidolite from Tørdal. Although this method does not give Li or OH, the high F-contents and the individual oxide totals are characteristic of lepidolite. The 3Mz flake has less SiO2 than the 2M1, flake but higher Al2O3, MnO, and Fe (expressed as FeO) contents. The Li2O contents must be approximately 4 to 5 weight percent for each flake,
but lower for the $3M_2$ flake than for the $2M_2$ flake, as based on the observed F contents and oxide sums.

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References

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