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A chemical study of apophyllite from Poona

ALTHOUGH apophyllite occurs widely in cavities in the Deccan basalts, in association with stilbite, heulandite, scolecite, mesolite, laumontite, calcite, etc., the Indian material has been very little studied. Haughton (1866) analysed apophyllite from 'Bombay', and Friedel (1894) found 0·065 % NH_3 in Poona apophyllite; Zimanyi's (1893) refractive index data for a Poona specimen, ω 1·5343, ϵ 1·5369, suggest a low to medium fluorine content. Des Cloiseaux (1862) found Poona apophyllite to have the unusual variation of birefringence with wavelength characteristic of the variety called leucocyclite.[1]

Recently, Sowani and Phadke (1964), in an optical and goniometric study of apophyllite from the Parvati Hills and other localities round Poona, showed that while some specimens are optically uniaxial, others are biaxial, with $2V_\gamma$ 42–6°, $r < v$ strong, α 1·535, β 1·536, γ ($\parallel$ [001]) 1·538. Goniometric study of such specimens showed them to be orthorhombic, with (001):(101) 59° 45′, (001):(011) 57° 30′, $a:b:c = 0{\cdot}9004:1:1{\cdot}5697$; most of the crystals are interpenetration twins around [001], showing division into four sectors on a basal cleavage. Biaxial apophyllites are not uncommon, but have usually been explained as due to strain or to inhomogeneity in distribution of fluorine (Klein, 1892; Gossner, 1927; Gossner and Kraus, 1928); Sahama (1965), however, obtained optical and goniometric evidence of orthorhombic symmetry in an apophyllite from Korsnäs, Finland.

In view of Sowani and Phadke's results, a chemical analysis appeared desirable. Two samples, cleaved from clear crystals 1–2 cm in size selected from a specimen from the Parvati Hills, were each analysed in triplicate by standard gravimetric methods (Groves, 1949; the $KClO_4$ method was used for K, and water determined by loss on ignition); a spot test for fluorine was negative; iron and magnesium were found to be present in traces only, and were not determined.

The analysis (table I) shows a much higher content of aluminium than has ever been recorded for apophyllite. The highest reliable[2] figure is 1·54 % recorded by Cross and Hillebrand (1882) for clear inclusion-free crystals from Table Mountain, Golden,

[1] This name is attributed by Des Cloiseaux to Herschell [*sic*], but to Brewster by E. F. Glocker (Grundr. Min., 1839, 517). Dana (*Syst. Min.*, 6th edn. (1892), 566) cites Sir J. F. W. Herschel, *Trans. Camb. Phil. Soc.* (1821), **1**, 21, but, although both Herschel and Brewster (*Edin. Phil. Journ.* (1819), **1**, 1) described the peculiar optical properties of the variety, the name does not appear in either of these papers. Klein (1892) traced the name to *Vom Licht* (1831), a translation by E. Schmidt of Sir J. F. W. Herschel's article 'Light' (1827) in *Encyclopedia Metropolitana* (London), where it appears in vol. 4, p. 578. The name chromocyclite for the variety of apophyllite giving a coloured conoscopic pattern was introduced by Klein (1892)—*Ed.*

[2] Streng (1874) recorded 3·2 % Al_2O_3 in a partial analysis of apophyllite from Bucholz, Rheinland, but attributed it to contamination by natrolite or phillipsite. Sahama (1965) assigns the whole of the 1·65 % Al_2O_3 found in the Korsnäs material to the mica inclusions present.

Colorado; they comment: 'The Al_2O_3 is much higher than in most analyses, and the condition in which it is present seems undeterminable.'

TABLE I. *Mean and standard deviations of six analyses of apophyllite from the Parvati Hills, Poona, India (two samples), with atomic ratios to a basis of 29* (O,OH)

SiO_2	54·47±0·19	Si	8·04±0·03
Al_2O_3	5·80±0·06	Al	0·01±0·01
CaO	18·96±0·23	Ca	3·00±0·03
K_2O	5·49±0·21	K	1·03±0·04
H_2O	16·06±0·14	O	[21·10]
Sum	100·78	H_2O	7·90±0·08

When recalculated to a basis of 29 (O,OH), the Parvati Hills apophyllite approximates closely to $KCa_3AlSi_8O_{21}.8H_2O$, with AlO replacing Ca(OH,F) of normal apophyllite. A. V. Phadke (private communication) informs me that much of the Poona 'apophyllite' gives an appreciably different X-ray powder pattern from the normal, and it is possible that we are dealing with a distinct species. It is hoped to continue and extend this study.

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