References

CHAMBERLAIN (J. A.) and DELABIO (R. N.), 1965. Amer. Min., vol. 50, p. 682.
CLARK (A. H.), 1966*a*. Comptes Rend. Soc. géol. Finlande, vol. 38, p. 331.
—— 1966*b*. Neues Jahrb. Min., Monatsh., vol. 10, p. 300.
DEER (W. A.), HOWIE (R. A.), and ZUSSMAN (J.), 1962. Rock-forming minerals, vol. 5, Non-silicates. Longmans, London.
EVANS (H. T.), MILTON (C.), CHAO (E. C. T.), ADLER (I.), MEAD (C.), INGRAM (B.), and BERNER (R. A.), 1964. U.S. Geol. Surv., Prof. Paper 475-D, p. D64.
GREEN (D. H.), 1964. Journ. Petrology, vol. 5, p. 134.
KOUVO (O.), VUORELAINEN (Y.), and LONG (J. V. P.), 1963. Amer. Min., vol. 48, p. 511.
TAKENO (S.), 1965. Journ. Sci. Hiroshima Univ., ser. C, vol. 4, p. 455.

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Stellate wollastonite from calc silicate skarns of Jothwad Hill, Panchmahal District, Gujrat, India

IN his classic account of the manganese ore deposits of India, Fermor (1909) has described in detail the geology of Jothwad Hill. The hill lies about $3\frac{1}{2}$ Km north of Jambughoda, a pre-merger state capital, about 16 Km north of Bodeli junction on the Pratapgunj–Chote-Udepur branch line of the Western Railway. Here intricately folded gonditic gneiss and crystalline limestones have been invaded by a porphyritic biotite granite and its differentiates, with the result that a variety of interesting manganese and calc silicate minerals have been produced.

Stellate wollastonite occurs in the outer margin of the wollastonite zone of the calc silicate rocks, slightly away from the granite–limestone contact. A recent study by Sadashivaiah (1963) of the calc silicate skarns of the hill, with special reference to wollastonite paragenesis, fails to mention the stellate mode of occurrence of wollastonite reported here. As far as known to the authors, stellate wollastonite is not previously reported from India.

The stellate wollastonite aggregates are set in a matrix of calcite and other calc silicates, and are circular to ovoid in shape, ranging from 5 to 4 cm in diameter, and consisting of well-defined radiating needles of wollastonite. In general they exhibit a tendency for crowding, although scattered ones are not uncommon. In closely packed condition, they form rounded polygons, apparently due to mutual interference at the time of crystalloblastic growth. Actual merging is also common. Many of the large stellate bodies have grown around quartz granules while the smaller, more closely packed ones lack such nuclei.

In thin sections, especially large sections, the stellate forms are seen to consist of radiating needles of wollastonite in a fine grained mosaic of calcite, diopside, grossular, and radiating or randomly oriented blades and sheaves of wollastonite. The outer rim exhibits a micrographic intergrowth of wollastonite, calcite, and quartz together with the ends of radially arranged wollastonite needles and additional stouter rods of the same, similar to those of the interstellate areas. The stouter wollastonite rods show a preferred orientation parallel to the rim indicating that they may have rotated into position prior to engulfment in the stellate growth. Another interesting feature revealed in thin sections is the occurrence of a thin selvedge of quartz containing granules of wollastonite at the sharp junction of the rim with calcite.

The optical characters of the stellate wollastonite are: α 1·619, β 1·631, γ 1·633; $2V_\alpha$ 39°; γ:[001] 31°. These are identical to those found by Sadashivaiah (1963).

Wollastonite paragenesis at contacts between limestone and intrusives has been discussed by various authors, e.g. Pitcher (1950), Narayanaswami (1962), Reddy (1964), and Sadashivaiah (1963), and is evidently related to high temperature and introduction of silica metasomatically. The relative role of detrital and introduced silica has been discussed by Sadashivaiah (1963). In the present case, introduction of silica was no doubt an important feature in wollastonite formation, as is apparent from the occurrence of a thin selvedge of quartz containing granules of calcite and some wollastonite at the sharp junction of these two minerals. However from its formation around quartz nuclei the stellate growth, it appears, was initiated by the reaction between detrital silica and calcite and later enhanced by introduced ionized silica from the granite intrusion. Concentration of stellate growths, restricted to the outer margin of the wollastonite zone, can be explained as due to low temperature and consequent fall in the supply of introduced silica with increasing distance from the magmatic source. It seems that outwards in the wollastonite zone margin, just enough silica was introduced to enhance the growth of the needles but not to produce big crystals.

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References

FERMOR (L. L.), 1909. Mem. Geol. Surv. India, vol. 37, p. 330.
NARAYANASWAMI (P. L.), 1962. Jour. Geol. Soc. India, vol. 3, pp. 147–156.
PITCHER (W. S.), 1950. Min. Mag., vol. 29, pp. 126–141.
REDDY (N. L.), 1964. Indian Min., vol. 2, pp. 143–158.
SADASHIVAIAH (M. S.), 1963. Proc. Indian Acad. Sci., vol. 58, Sec. A, pp. 303–313.

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BOOK REVIEWS

STEWART (G. H.), editor. *Science of ceramics*. Vol. 2. London and New York (Academic Press for the British Ceramic Society), 1965. 431 pp. Price 84*s*.

This volume contains the papers presented at the second joint biennial meeting of the British and Dutch Ceramic Societies, which attracted contributions not only from the sponsoring societies but also from Belgium, Denmark, France, West Germany, Italy, and the U.S.A. Four papers are in German, three in French, the remainder (21) in English. Though covering a wide spectrum of ceramics, the papers are conveniently grouped under four headings: I. Properties of raw materials, II. Processing of materials, III. Behaviour during firing, and IV. Structures and properties of products.

Sections I, III, and IV contain much information of interest to the mineralogist. In the first, papers on the use of X-ray and d.t.a. in quantitative analysis of kaolinite clays, on the absorption of dyestuffs by clays, and on the bound water on clay are of particular significance to clay mineralogists, whereas the crystallographer will find useful information in the paper on the characteristics of fine oxide powders. Although grouped in section I, papers on the reaction of different types of alumina with lithium carbonate and on the behaviour of feldspars at high temperatures could equally well have been placed in section III. The first of these studies was undertaken with an automatic recording differential calorimeter and by X-ray methods; the second, by means of the hot-stage microscope, not only records the effect of heat on feldspar but gives information on interactions between feldspar and kaolin; the development of mullite is clearly shown.

Section III on behaviour during firing is largely devoted to various aspects of the sintering process; the dynamic properties of grain-boundaries, the effect of the surrounding atmosphere and reactions at the point of contact between silica and alumina are particular examples.