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THE UNIT CELL OF ETTRINGITE

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In the course of a review of the published x-ray powder data for ettringite, $Ca_6Al_2(SO_4)_3(OH)_{12} \cdot 24H_2O$, a difference was noted in the length of the a axis as reported by several writers. Bannister *et al.* (1936) obtained $a = 11.26$ Å, $c = 21.48$ Å, using rotation photographs about $[10\bar{1}0]$, $[11\bar{2}0]$ and c. Feitknecht and Buser (1949) give $a = 11.2$, $c = 21.4$, and Swanson *et al.* (1959) obtained $a = 11.23$, $c = 21.44$ for synthetic material. Hurlbut and Baum (1960), on the other hand, give $a = 22.28$ Å, $c = 21.29$ Å for crystal from Franklin, New Jersey. These authors also remeasured a on crystals from Scawt Hill and Ettringen, concluding that a should be double the value previously reported. Murdoch and Chalmers (1960) give $a = 22.49$ for Ettringen material and $a = 22.33$ for material from Crestmore, California. This larger value for a is also quoted by McConnell and Murdoch (1962).

The powder data of Swanson *et al.* (1959) indexes fully to $d = 1.768$ using $a = 11.23$, $c = 21.44$. The powder data given by Murdoch and Chalmers (1960) may be indexed using $a = 11.23$ except for two weak lines with $d = 10.5$ and 4.55 which are not present in the Swanson pattern and do not index when a is doubled.

Hurlbut and Baum (1960) obtained their cell dimensions from rotation and Weissenberg films about the c axis and about "a horizontal axis normal to the $\{10\bar{1}0\}$ cleavage." Their rotation films about c yield $c = 21.29$, which corresponds closely to other determinations. Their rotation film about the normal to $[10\bar{1}0] = [10\bar{1}0]$ gives 19.27 Å. The identity period in an hexagonal net normal to an a axis is the long diagonal of the 60° rhomb and thus the correct a is $19.27/\sqrt{3} = 11.13$ Å, not 22.25 as deduced by Hurlbut and Baum. The new doubled value of a for materials from Ettringen and Scawt Hill are based on the same method. Murdoch and Chalmers (1960) based their determination of $a = 22.4$ on rotation films about $[10\bar{1}0]$. From a rotation film about $[10\bar{1}0]$ Murdoch and Chalmers also obtain $a = 22.12$ Å for thaumasite, double the value given by Welin (1956).

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THE FLAME FUSION SYNTHESIS OF EMERALD

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The synthesis of emerald as a gem material is of considerable economic and academic interest to the mineralogist. Recent applications of chromium-doped beryl, particularly as a maser material, to the field of solid state physics have been evaluated by Geusic *et al.* (1959), Gerritsen (1962) and Goodwin (1961). This has stimulated investigation of techniques for the synthesis of emerald with the objective of synthesizing large single crystals of high quality.

The methods previously investigated have been concerned with the use of fluxes or hydrothermal processes. The first successful synthesis of emerald, using lithium molybdate as the flux, was reported by Hautefeuille and Perrey (1888). In 1930, the I. G. Farbenindustrie synthesized emerald (Schiebold, 1935) by dissolving the oxides in BeF_2 and allowing slow vaporization of the fluoride, thereby crystallizing emerald (Amstutz and Borloz, 1935). At about this time, C. Chatham of San Francisco announced the synthesis of emerald in his laboratory. His secret process which has culminated in the synthesis of large, nearly flawless emeralds leaves Chatham as the world leader in emerald synthesis at present. The Chatham process (1961) requires a run of six months' duration. The hydrothermal synthesis of emerald accomplished in 1928 by R. Nacken of the Mineralogical Institute, Frankfurt University, is discussed by Van Praagh (1947).

Most of the research in recent years has centered on using various fluxes including Li_2MoO_7, $Li_2W_2O_7$, $PbMoO_4$, $PbWO_4$ and V_2O_5. Linares