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Note added in proof: A third natural occurrence of coesite has been found. Chao, Fahey and Littler (1961), Coesite from Wabar Crater, near Al Hadida, Arabia: *Science* **133**, 882-3.

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LATTICE CONSTANTS OF SYNTHETIC LAWSONITE

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Natural lawsonite, $CaO \cdot Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$, is orthorhombic, space group $C22_1$ (Pabst 1959), with lattice constants ranging between $a_0 = 8.82-8.90$ kX, $b_0 = 5.76-5.87$ kX, $c_0 = 13.19-13.33$ kX (Gossner and Mussgnug 1931, Wickman 1947, Rumanova and Skipetrova 1959). The remarkable fact that the molar volume of lawsonite, despite its two molecules of water, approximates that of anorthite, $CaO \cdot Al_2O_3 \cdot 2SiO_2$, is an indication that lawsonite might only be stable at high water vapor pressures. The stability of lawsonite should be scarcely affected by load pressure though very strongly influenced by water pressure. Fyfe and Turner (1958) pointed out that this makes lawsonite an excellent indicator of high water pressures.

Pure synthetic lawsonite has, in fact, up to the present moment only been synthesized under conditions of very high water pressure (Coes 1955; Pistorius, Kennedy and Sourirajan, in press). The latter authors

reproducibly synthesized lawsonite in the presence of a large excess of quartz or coesite at H₂O pressures above 23 kilobars at 400–600° C. and 20 kilobars at 850° C. Since their starting material was natural Iceland scolecite, their lawsonite might have been slightly impure. Furthermore, the presence of excess silica influenced the stability field of lawsonite, since the lawsonite was formed by the phase reaction zoisite + pyrophyllite + water \rightleftharpoons 4 lawsonite + 2 coesite.

In the present experiments lawsonite was prepared from a hydroxide mixture of its own composition. Analytic grade chemicals were used throughout. The finely ground samples were subjected to suitable conditions of H₂O pressure and temperature in the simple squeezer high-pressure apparatus (Griggs and Kennedy 1956).

In the absence of excess silica it was found that lawsonite starts to form at H₂O pressures at least as low as 19 kilobars, and possibly even lower. The temperatures used ranged from 500° to 650° C. This means that the field of stability of lawsonite is extended towards lower H₂O pressures by at least as much as 4 kilobars if no excess amount of silica is present. Experiments of longer duration might increase this figure slightly. At pressures of 14–19 kilobars, a mixture of zoisite, pyrophyllite and corundum was obtained at these temperatures.

Some runs were also made using a hydroxide mixture of zoisite composition as starting material. In this case lawsonite did not appear until 27 kilobars H₂O pressure at 650° C.

The best yield of lawsonite was obtained in a run made at 28.5 kilobars and 650° C. from hydroxide starting material of its own composition. The duration of the run was one hour. This lawsonite was subsequently used for the determination of the lattice constants from the powder pattern.

The *x*-ray powder diffraction pattern of the finely ground synthetic lawsonite at 25° C. was obtained in a Philips high angle recording diffractometer, using filtered Co K α radiation ($\lambda = 1.7889$ Å). The resulting powder data are given in Table I.

A least-squares treatment of the observed reflections yielded the following lattice constants:

$$a_0 = 8.787 \pm .005 \text{ \AA}$$

$$b_0 = 5.836 \pm .005 \text{ \AA}$$

$$c_0 = 13.123 \pm .008 \text{ \AA}$$

The systematic absences correspond to the space group *Ccmm*. However, Pabst (1959) has shown that false symmetry, the Templeton effect (Templeton 1956), arises in lawsonite due to special values of the *y* parameters of all atoms in general positions. Consequently, though the space group is actually *C222*₁, the systematic absences correspond to *Ccmm*.

TABLE I. POWDER DATA FOR SYNTHETIC LAWSONITE
 (CoK α radiation)

<i>hkl</i>	d_{obs} in Å	d_{calcd} in Å	I
002	6.557	6.562	30
110	4.862	4.861	40
111	4.565	4.559	15
201	4.167	4.166	50
202	3.650	3.651	60
020	2.918	2.918	25
114	2.720	2.719	100
022	2.666	2.666	40
204	2.631	2.629	50
310	2.618	2.618	70
220, 312	2.432	2.431, 2.431	40
221	2.391	2.390	5
115	2.313	2.310	40
222	2.279	2.279	20
205	2.253	2.253	20
313	2.247	2.246	5
006	2.189	2.187	20
024	2.180	2.180	10
401	2.166	2.167	5
223	2.125	2.125	70
402	2.084	2.083	5
403	1.964	1.965	20
206	1.958	1.958	5
130	1.898	1.899	2
131	1.880	1.880	20
026, 117	1.752	1.750, 1.749	15
133	1.747	1.747	15
207	1.724	1.724	15
405, 510	1.684	1.685, 1.683	2
511	1.668	1.669	10
008, 134	1.642	1.640, 1.644	5
512, 423	1.630	1.630, 1.629	40
226	1.625	1.626	5
330	1.620	1.620	5
406, 424	1.549	1.550, 1.548	30
040, 425	1.459	1.459, 1.459	5

The calculated density of synthetic lawsonite is 3.100 g/cm³ taking 4 formula weights in the unit cell. This is in good agreement with the pycno-metric value for natural lawsonite, viz. 3.084–3.091 g/cm³.

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ALLANITE FROM WADI EL GEMAL AREA, EASTERN
DESERT OF EGYPT, AND ITS RADIOACTIVITY

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INTRODUCTION

The Geological Survey of Egypt recently reported small pegmatite dikes and veins carrying sporadic large crystals of allanite in the Precambrian basement complex rocks of Wadi El Gemal area, near the Red Sea coast, Eastern Desert of Egypt. Sadek (1953) indicated the localities of these occurrences and gave a brief report of other mineral deposits there. The allanite-bearing pegmatites are particularly frequent in the rectangle limited by longitudes $34^\circ 40' - 34^\circ 50'$ and latitudes $24^\circ 30' - 24^\circ 40'$ where they seem to be closely associated with a complex of xenolithic and gneissic tonalites, granodiorites and diorites. These pegmatite dikes and veins are of rather simple mineralogy and are mainly made up of unzoned acid oligoclase with smaller amounts of quartz and potash-rich feldspars. Allanite is almost the only colored constituent present; other accessories being either absent or in rare tiny grains. These include opaque ores, apatite, sphene and late hydrothermal clinozoisite, epidote and muscovite. The allanite-pegmatites show signs of late stage hydrothermal alterations; plagioclase being variably sericitized or kaolinized and allanite is also affected as described below.