

MINERALOGY

Kilchoanite, a Polymorph of Rankinite

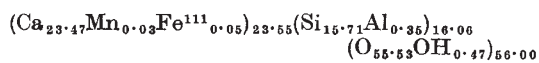
THE compound  $9CaO6SiO_2H_2O$  was originally synthesized and described by Roy<sup>1,2</sup>, who called it phase Z. Revised data on its properties have been given by Roy, Gard, Nicol and Taylor<sup>3</sup>, who showed that, when hydrothermally synthesized at 715° C. and with a pressure of 1,100 bars, its composition was  $3CaO2SiO_2$  and that it became inverted to rankinite on heating between 954° C. and 1,090° C.

A mineral corresponding to phase Z has been found in limestones thermally metamorphosed by gabbro at Ardnamurchan, Scotland, and Carlingford, Eire. It has been named kilchoanite after the village in Ardnamurchan near where it was first found.

It has the following properties: colourless, slightly turbid due to minute inclusions and no visible cleavage,  $\alpha$  1.647,  $\gamma$  1.650,  $\gamma - \alpha$  0.003,  $+2V$  60°, dispersion distinct  $r > v$ , density 2.992. In thin section the interference colours are commonly weak ultra-blue and ultra-brown.

Kilchoanite has always been found as a replacement of rankinite and no crystal form has been observed. Single crystal X-ray data indicate that it is orthorhombic with  $a$  11.42 Å.,  $b$  5.09 Å.,  $c$  21.95 Å. (all  $\pm$  0.05 Å.). The Laue group is  $mmm$  and the probable space group  $I\ m\ m$  or  $I\ m\ a2$ . X-ray powder data, given in Table 1, agree with those of Roy<sup>3</sup> for the phase Z apart from discrepancies which could be due to impurities in the latter.

Separation of kilchoanite for analysis was difficult owing to the complexity of the mineral assemblages with which it is associated and because of its irregular distribution. A rock containing no rankinite was eventually used to prepare a sample in which spurrite was the only impurity. Having established that kilchoanite contained no carbon dioxide, this sample was analysed. On the assumption that all the carbon dioxide was in the contaminating spurrite, this analysis, together with the cell dimensions and the determined density, gave the calculated cell contents as:



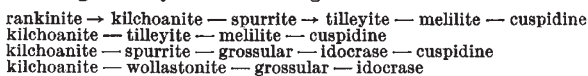
This value is in close agreement with  $8(Ca_3Si_2O_7)$  and confirms that kilchoanite corresponds to the

phase Z and is a polymorph of rankinite. Further confirmation is found in that on heating at 1,000° C. for 10 hr. a single crystal of kilchoanite became inverted to a polycrystalline aggregate of rankinite.

The metamorphic assemblages from which kilchoanite is developed consist essentially of:



These give way to assemblages such as:



It is suggested that kilchoanite does not form in normal prograde metamorphism as under conditions of relatively high carbon dioxide pressure the reaction spurrite + wollastonite  $\rightarrow$  rankinite + carbon dioxide, is above the stability limit of kilchoanite. If, however, the rock has been decarbonated, a later retrograde phase or repeated thermal metamorphism under a low carbon dioxide pressure may convert the rankinite to kilchoanite at lower temperatures in the presence of water.

Further work on this mineral and these rocks is in progress and will be reported in detail later.

S. O. AGRELL  
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<sup>1</sup> Roy, D. M., *J. Amer. Ceram. Soc.*, **41**, 293 (1958).

<sup>2</sup> Roy, D. M., *Amer. Mineralogist*, **43**, 1009 (1958).

<sup>3</sup> Roy, D. M., Gard, J. A., Nicol, A. W., and Taylor, H. F. W., *Nature*, **188**, 1187 (1960).

CRYSTALLOGRAPHY

Etch Patterns on Cadmium Crystals grown from Vapour

SERVI<sup>1</sup> showed complex spirals on the basal plane of cleaved zinc crystals after etching, and spiral terraced etch pits have been obtained on zinc crystals<sup>2</sup> grown from vapour using 'Superoxol' etch. Presented here are two types of etch figures obtained on 99.9 per cent cadmium crystals grown from vapour. Of several etching reagents that had been tried the most suitable one was a saturated solution of picric acid in acetone and a normal time of 2 min. was decided on. For longer periods of etching the solution acted as polishing agent.

Table 1

Kilchoanite			Phase Z			Kilchoanite			Phase Z		
$d_{hkl}$	$I$	$d_{hkl}$	$I$	$d_{calc.}$	$hkl$	$d_{hkl}$	$I$	$d_{hkl}$	$I$	$d_{calc.}$	$hkl$
5.17 Å.	$m$	5.10 Å.	0.2	5.07 Å.	202	2.26	$vw$	2.26	0.05	2.27	222
—	—	4.76	0.1	—	—	2.18	$vw$	—	—	—	—
4.26	$w$	—	—	4.28	112	2.06	$w$	—	—	—	—
—	—	4.18	0.1	4.18	013	1.996	$w$	—	—	—	—
4.00	$w$	3.97	0.2	3.97	204	1.964	$ms$	1.964	0.3	—	—
—	—	3.76	0.1	3.74	211	1.906	$m$	1.902	0.15	—	—
—	—	3.67	0.1	3.66	006	1.872	$m$	—	—	—	—
3.56	$ms$	3.56	0.4	3.54	114	—	—	1.833	0.3	—	—
3.39	$vw$	—	—	3.37	213	1.814	$w(b)$	—	—	—	—
3.07	$s_3$	3.06	0.75	3.08	206	1.779	$w$	—	—	—	—
—	—	—	—	3.05	310	1.745	$m$	1.749	0.2	—	—
2.89	$s_1$	2.88	1.0	2.88	116	1.694	$m$	1.692	0.1	—	—
—	—	2.84	0.3	2.87	215	1.659	$vw$	—	—	—	—
2.77	$vw$	—	—	2.86	400	1.602	$w$	—	—	—	—
—	—	2.73	0.1	2.76	402	1.569	$w$	1.570	0.05	—	—
—	—	2.73	0.1	2.74	008	1.559	$w$	—	—	—	—
2.68	$s_2$	2.67	0.75	2.69	017	1.548	$w$	—	—	—	—
—	—	—	—	2.67	314	1.526	$m$	—	—	—	—
2.55	$m$	2.55	0.2	2.55	020	1.487	$w$	1.489	0.05	—	—
2.48	$m$	2.48	0.2	2.48	121	1.418	$m$	—	—	—	—
—	—	—	—	2.48	411	1.398	$vw$	—	—	—	—
2.42	$m$	2.42	0.3	2.43	217	1.379	$vw$	—	—	—	—
—	—	—	—	2.36	118	1.357	$vw$	—	—	—	—
2.36	$ms$	2.35	0.15	2.35	123	1.337	$vw$	—	—	—	—
—	—	—	—	2.34	316	1.332	$w$	—	—	—	—
—	—	—	—	—	—	—	—	etc.	—	—	—