

TABLE 4. THE ACTION OF CO<sub>2</sub>-FREE WATER ON DOLOMITE, CaCO<sub>3</sub>·MgCO<sub>3</sub>

Temp., ° C.	CaCO <sub>3</sub> , ppm	MgCO <sub>3</sub> , ppm	Mg(OH) <sub>2</sub> , ppm
25	4	3	
50	6	5.5	
80	8.6	7.3	
110	11	8	
130	13	7.8	
150	14.5	6	
200	18		11
225	17		10
250	15.5		8
300	12.5		4
340	7		1.5

MgCO<sub>3</sub>+H<sub>2</sub>O⇌Mg(OH)<sub>2</sub>+CO<sub>2</sub> began at about 150° C.; with dolomite it began a little higher, at 180° C. X-ray studies below 209° C. of material from the top of the reaction tube show only the dolomite patterns, but at 209° C. the pattern was of calcite and brucite. The results are in Table 4 and Fig. 3.

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## SOME ALKALI ALUMINATE CRYSTALS AND POTASSIUM FERRITE

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The following alkali aluminate crystals were found in a study started about 1940 at the Geophysical Laboratory of the Carnegie Institution of Washington, but never completed.

At 130° C. the solid phase in equilibrium with a solution of the composi-

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tion  $\text{H}_2\text{O}$  70.6%,  $\text{Na}_2\text{O}$  15.4%,  $\text{Al}_2\text{O}_3$  14%, under its own vapor pressure was gibbsite. The crystals in equilibrium with a solution of composition  $\text{H}_2\text{O}$  56.7%,  $\text{Na}_2\text{O}$  40.3%,  $\text{Al}_2\text{O}_3$  3%, had the composition  $\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$  and were eight-sided tetragonal plates, uniaxial, negative,  $\epsilon=1.535$ ,  $\omega=1.535$ . At  $500^\circ\text{C}$ . under a steam pressure of 100 atm crystals of anhydrous sodium aluminate,  $\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3$ , were formed: optically (-), small 2V,  $\alpha=1.560$ ,  $\gamma=1.580$ .

At  $130^\circ\text{C}$ . the compound  $\text{K}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$  was obtained by dissolving  $\text{Al}_2\text{O}_3$  in KOH in the molecular proportion  $\text{K}_2\text{O}:\text{Al}_2\text{O}_3$  in an autoclave, under the vapor pressure of the solution. The crystals were long lath-like monoclinic, biaxial, negative, large 2V,  $\alpha=1.485$ ,  $\gamma=1.512$ . At a little higher temperature,  $150^\circ\text{C}$ ., its crystals had the composition  $\text{K}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ , probably uniaxial,  $\alpha=1.510$ ,  $\gamma=1.518$ , and at  $370^\circ\text{C}$ . the crystals had the composition  $\text{K}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ , uniaxial (-),  $\epsilon=1.535$ ,  $\omega=1.550$ . At  $500^\circ\text{C}$ . under a steam pressure of 100 atm, well-formed octahedral crystals of  $\text{K}_2\text{O} \cdot \text{Al}_2\text{O}_3$  were formed,  $n=1.580$ .

Under similar conditions at  $500^\circ\text{C}$ ., using KOH and  $\text{Fe}_2\text{O}_3$ , ruby-red octahedral crystals of  $\text{K}_2\text{O} \cdot \text{Fe}_2\text{O}_3$  were obtained, often in crystals several millimeters in diameter. They were rapidly attacked by atmospheric moisture and reacted with the index liquids.

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STUDIES ON MANGANESE OXIDE MINERALS  
VI. THALLIUM IN SOME MANGANESE OXIDES<sup>1</sup>

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INTRODUCTION

The occurrence of unusual amounts of thallium in manganese ores from the Apache mine, Gila County, Arizona, was reported to the U. S. Geological Survey in 1943 by John Herman, of Smith-Emery Company, commercial analysts serving the Federal stockpile in Phoenix, Arizona. In June 1944, specimens from the Apache mine were included in a group of samples submitted to the laboratory by one of us (M.D.C.) to verify the presence of thallium and to determine the chemical nature of its occurrence. Spectrographic analysis by K. J. Murata of three samples from this mine showed that thallium was indeed present, in amounts estimated to be a few tenths of one per cent. The samples were set aside

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