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SYNTHESIS OF $MBa(CO_3)_2$ COMPOUNDS

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This note reports results on the synthesis and attempted synthesis of binary compounds in systems of $BaCO_3$ with other carbonates which

TABLE 1. POWDER *x*-RAY DATA FOR $MgBa(CO_3)_2$ AND $MnBa(CO_3)_2$

hk.l	Norsethite[1]		$MgBa(CO_3)_2$		$MnBa(CO_3)_2$	
	$d_{hk.l}$	I	$d_{hk.l}$	I	$d_{hk.l}$	I
10.1	4.210	30	4.201	32	4.251	10
01.2	3.860	35	3.860	40	3.918	25
10.4	3.015	100	3.015	100	3.098	100
00.6	2.795	3	2.749	3	2.837	5
01.5	2.656	35	2.649	32	2.724	10
11.0	2.512	35	2.502	35	2.544	25
11.3	2.290	25	2.282	30	2.335	10
02.1	2.154	25	2.151	30	2.184	8
20.2	2.104	35	2.098	35	2.135	30
02.4	1.931	35	1.930	25	2.027	15
01.8	1.890	25	1.881	28	1.932	25
11.6	1.864	35	1.862	28	1.900	25
20.5	1.824	3	1.824	3	1.862	2
21.1	1.636	6	1.639	8	1.659	3
12.2	1.612	18	1.624	15	1.650	8
10.10	1.563	6	1.578	8	1.633	8
21.4	1.530	25	1.523	22	1.572	15
20.8	1.510	6	1.505	20	1.555	12
11.9	1.496	6	1.489	8	1.523	3
12.5	1.475	9	1.478	5	1.494	2

[1] From Westvaco trona mine, Sweetwater Co., Wyo. (Mrose *et al.*, 1961).

of themselves form calcite-type structures. To date, $CaBa(CO_3)_2$ (Palache *et al.*, 1951) and $MgBa(CO_3)_2$ (Mrose *et al.*, 1961) have been found in nature, but $CaBa(CO_3)_2$ in the form of barytocalcite is the only compound of this type to have been synthesized (Chang, 1964). The 1:1 $CaCO_3$-$BaCO_3$ composition produced in the laboratory is in the monoclinic barytocalcite structure at temperatures below 520° C. and as a disordered calcite-type form at higher temperatures.

Reagent grade $BaCO_3$ and $MnCO_3$, and laboratory synthesized

batches of $CoCO_3$, $NiCO_3$ and $MgCO_3$ were treated in a furnace at 110° C. under approximately 1 atmosphere of CO_2 for 3 hours before weighing. Equimolar mixtures of four combinations in the systems $BaCO_3$-$MnCO_3$, $BaCO_3$-$NiCO_3$, $BaCO_3$-$CoCO_3$, and $BaCO_3$-$MgCO_3$ were carefully prepared by grinding in alcohol in an agate mortar. Experiments were carried out at 500° C. and 15 kilobars in a squeezer device (Griggs and Kennedy, 1956, 1956) for a period of 25 hours. Samples were quenched and examined by *x*-ray diffraction.

The results show that 1:1 binary compounds are formed in the systems $BaCO_3$-$MnCO_3$ and $BaCO_3$-$MgCO_3$. A comparison of the *x*-ray diffraction data of natural norsethite and the synthetic $MgBa(CO_3)_2$ compound is given in the first and second columns of Table 1. The agreement is fair.

The interplanar spacings and *x*-ray diffraction intensities obtained from the synthetic $MnBa(CO_3)_2$ make it obvious that this compound is isostructural with norsethite, and calcite-like in structure. These *x*-ray data are listed in the third column of Table 1.

Similar compounds of $BaCO_3$ with $CoCO_3$ and $NiCO_3$ were not observed to form under the conditions of these experiments.

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A NEW OCCURRENCE OF LANGITE

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Langite, $Cu_4(SO_4)(OH)_6 \cdot H_2O$ (?), has been found in a complex suite of supergene lead and copper minerals occurring in the Caroline tunnel of the Ward mine, about 18 miles south of Ely, Nevada.

Langite occurs as minute crystals which coat superficially altered chalcopyrite in a quartz gangue. Other hypogene sulfides in the ores include galena, sphalerite, pyrite, and hessite. Incipient oxidation of the