HUNTITE, $Mg_3Ca(CO_3)_4$, A NEW MINERAL*

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ABSTRACT

Huntite, $Mg_3Ca(CO_3)_4$, a new mineral from Currant Creek, Nevada, is named in honor of Professor Walter F. Hunt. This mineral was deposited by cool waters in cavities and vugs in rocks composed of magnesite, dolomite, and deweylite. Electron micrographs of huntite show that it is very fine-grained (1 micron and less). The *x*-ray powder diffraction data permit it to be differentiated from the other carbonates of magnesium and calcium. The principal lines in the powder pattern are: 2.838,VVS; 1.986,S; 1.769,S; 2.580,M; 2.444,M; 2.388,M; 2.204,M; 1.590,M; 1.488,M; 1.010,M. All values are expressed in Å.

The unit cell data are as follows: orthorhombic, primitive lattice; $a_0=5.66$ Å, $b_0=9.02$ Å, $c_0=8.51$ Å; 2 formulas per cell.

INTRODUCTION

The mineral described in this paper was first found in 1943 while the author was making a study of the distribution of dolomite in magnesite specimens from Currant Creek, Nevada, by means of the flame test for calcium. The physical appearance of this mineral suggested that it was magnesite, but the flame test showed calcium and accordingly the mineral was studied in more detail. The mineralogy and petrology of the

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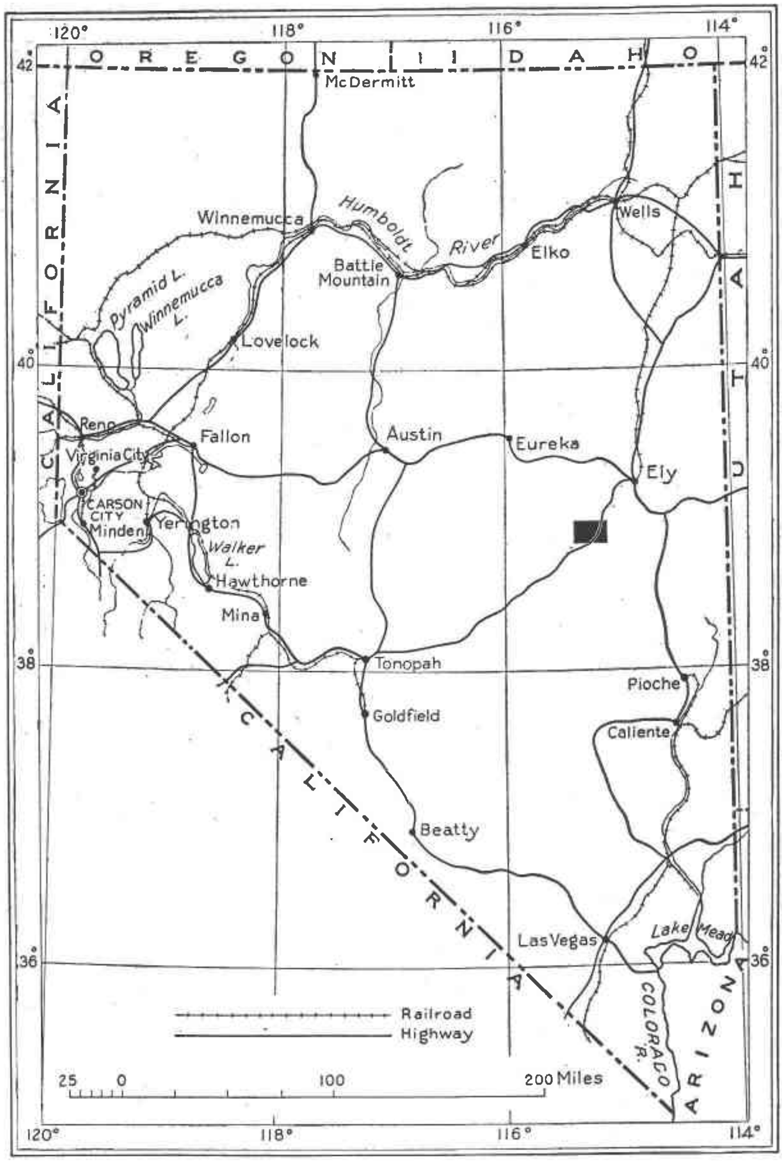

FIG. 1. Index-map of Nevada showing the location of the Currant Creek magnesite deposits.

deposits at Currant Creek were described by Faust and Callaghan (1948), and the material was tentatively considered to be a solid solution of magnesite and dolomite. A brief description of the mineral was included in that paper and its position in the sequence of the minerals was established. Further studies on this mineral showed that it is a new species. In September 1950, the mineral was identified in a sample submitted by Dr. T. S. Lovering from the north end of the Longyear Exploration Drift in the 1800 level of the Chief Consolidated Mine, Eureka, Utah.

It is possible that huntite has been observed before and considered to be impure magnesite. Evidence for such belief is given by Ford (1917, p. 221): "There is one analysis of magnesite quoted with some 23 per cent of calcium carbonate."

LOCALITY

The Currant Creek magnesite deposits are located in White Pine and Nye Counties, Nevada, about 29 miles southwest of Ely, Nevada (Fig. 1). This district contains seven prospects where development work has been done (Vitaliano, 1951). The prospects are the Chester, Windous, and Rigsby deposits in the eastern part of the area, in White Pine County, the Nevada Magnesite (sometimes referred to as the Rex-Pine Lode), Snowball, and White Knolls deposits in the western part of the area, in White Pine County, and the Ala-Mar deposit in Nye County. Huntite has been found at the Ala-Mar, Nevada Magnesite, and Snowball deposits.

OCCURRENCE AND PARAGENESIS

(1) *Geological environment*

The Currant Creek magnesite deposits are located in the Horse Range, a group of relatively low hills of Tertiary volcanic rocks paralleling the northwest-trending White Pine Range on its east side. The layers of volcanic rock dip gently eastward away from the Paleozoic rocks of the White Pine Range, but are broken by many faults. The Paleozoic rocks are directly overlain by a series of flows consisting chiefly of dacite; in the western part of the area, near the Ala-Mar deposit, the dacite is overlain by volcanic breccia, tuffaceous in places, which in turn is overlain by basaltic andesite having a vesicular and basaltic appearance at the top. The dacite, volcanic breccia, and basaltic andesite are grouped together as the lower volcanics. The host rock of the magnesite and associated minerals is a bedded tuff formation, the Currant tuff, a few feet to more than 400 feet thick, which overlies the lower volcanics. The Currant tuff is overlain by latite which is exposed over a large part of the district, but east of the Ala-Mar mine it is overlain by latite crystal tuff. The latite and latite crystal tuff are grouped together as the upper volcanics. The association of magnesite-bearing areas with faults suggests that the faults provided the channel ways for the ascent of the magnesium-bearing solutions.

The Currant tuff was named by Faust and Callaghan (1948) for the Currant Creek area, Nevada, where it is well exposed; their paper contains full descriptions of the mineralogy and petrography of these tuffs, and the reader is referred to it for additional details. The minerals of the tuffs include hypersthene, augite, hornblende, biotite, plagioclase of various compositions, sanidine, quartz, apatite, magnetite, and calcite, all intimately mixed with glass shards and irregular glass fragments. The reworked members of the Currant tuff are calcareous and grade into tuffaceous limestones. Subsequent to deposition some of the tuff beds were altered by cool meteoric waters. The volcanic glass was in part changed to montmorillonite and there was some replacement by calcite.

The magnesite deposits were formed by hydrothermal solutions rich in magnesium and carbon dioxide which ascended along channelways provided by the fault zones. These solutions entered the tuff beds and preferentially attacked the calcite-bearing tuffs. Where calcite was present, the replacing solutions produced dolomite by reaction until no more calcite was in actual contact with the solution. Thereafter, the hydrothermal solutions were free to replace the tuffs with magnesite and deweylite. These rocks, formed by the action of the hydrothermal solutions on the tuffs, are designated as the replaced tuffs in this paper.

(2) *Order of succession of the minerals in the magnesite deposit*

The paragenetic sequences of the minerals in several specimens from the magnesite deposits are shown in Fig. 2. These specimens are fully described by Faust and Callaghan (1948). The composite paragenetic sequence is shown in Fig. 3. The early stage represents normal replacement of the tuffs by calcite and montmorillonite through the agency of ground waters. The hydrothermal stage represents, at first, the reaction of the magnesium-rich solutions on the calcite of the tuffs to form dolomite. When the solutions became impoverished in calcium, magnesite and, later, deweylite were formed. Thereafter, the solutions spread into the overlying calcareous tuffs, converted the calcite to dolomite and deposited deweylite. At the close of the hydrothermal stage, calcite and silica minerals (quartz, chalcedony, opal) were deposited along with some dolomite and deweylite in the upper tuff beds; finally the silica minerals and calcite were the sole phases forming. The solutions gradually cooled to the temperature of the ground waters and calcite continued to form. Some of the replaced rock has a very vuggy texture (Fig. 4). The vugs are commonly almond-shaped and range in size from 10 cm. down to microscopic dimensions. The matrix of the replaced rock is fine-grained, dense and in some specimens porcelaneous. During the late meteoric stage the vugs in the replaced rocks were lined with botryoidal calcite which

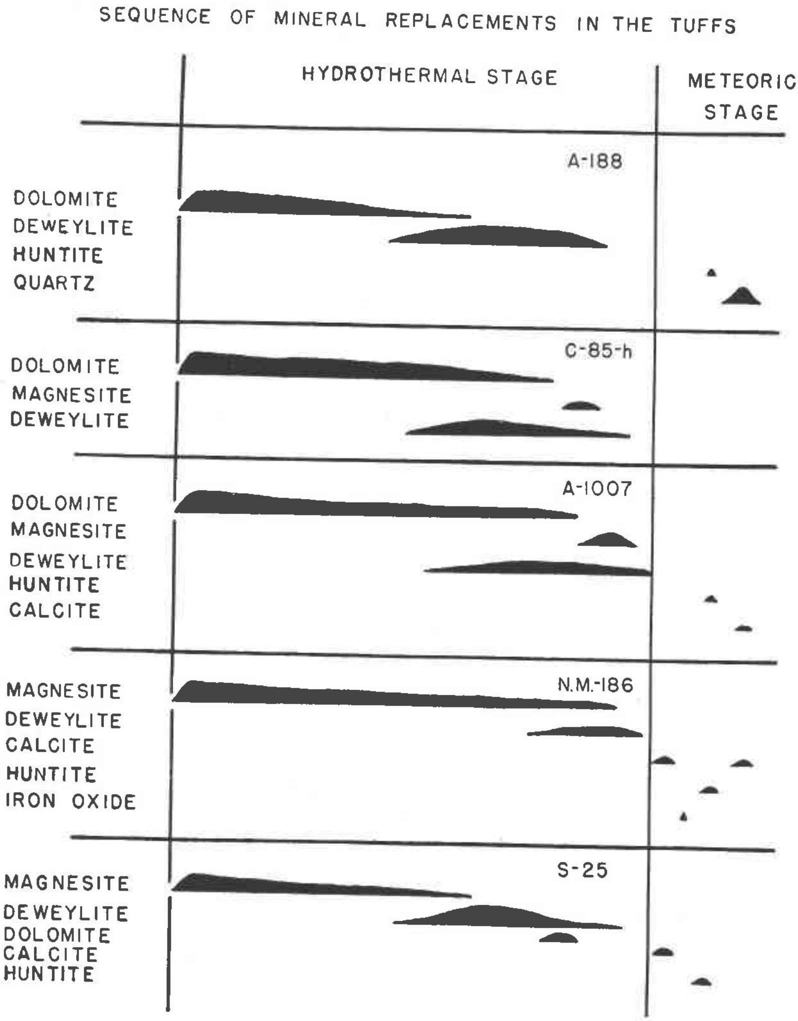

FIG. 2. Sequence of replacement for individual specimens which represent various stages in the formation of the magnesite deposits. The vertical superposition in the figure of the various sequences does not imply that replacement began and ended at the same time for all the specimens represented.

in turn was later stained yellow to brown by a thin film of iron oxides. The last mineral to fill these cavities is huntite, which occurs as a white fine-grained powdery mass; because of its white color, the huntite contrasts conspicuously with the matrix (Fig. 5). Some samples are encrusted by calcite.

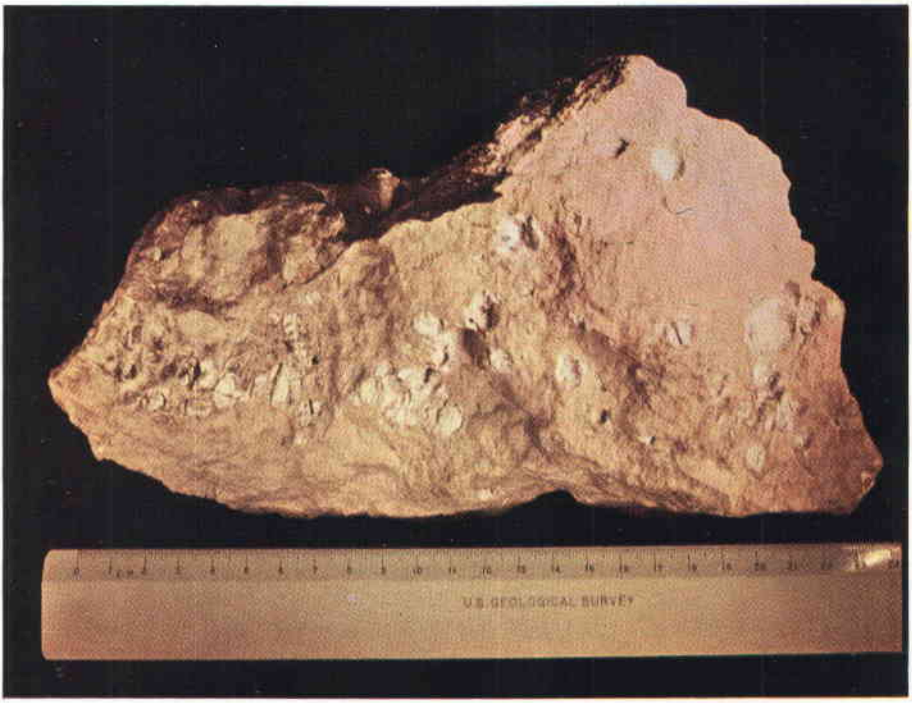

Fig. 5. Replaced tuff N.M.-186. Huntite filling vugs in buff matrix. The matrix is magnesite with some deweylite.

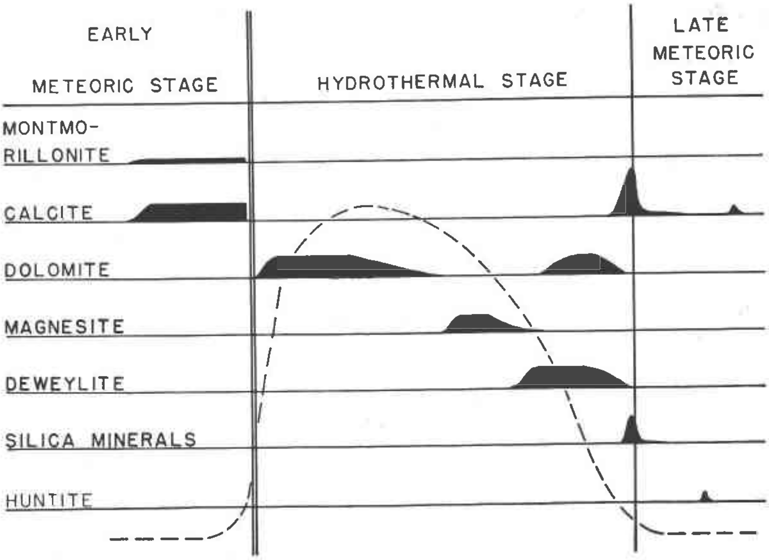

FIG. 3. Composite chart showing the paragenesis of the minerals of the magnesite deposits.

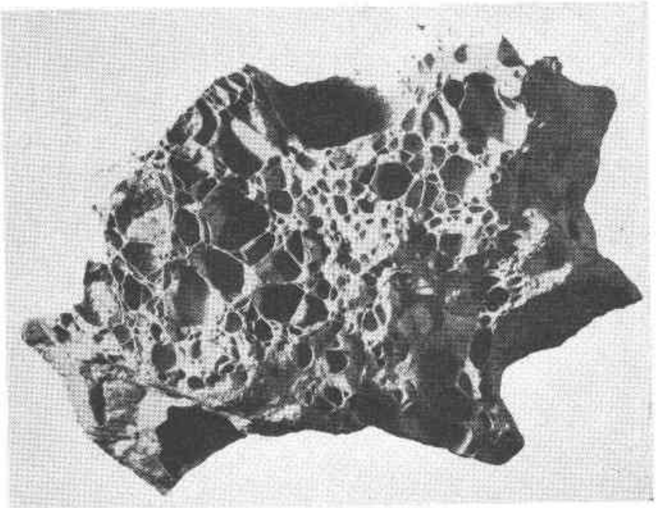

FIG. 4. Vuggy texture developed in microcrystalline magnesite rock R-99, Rigsby deposit, Currant Creek, Nevada. Specimen two-thirds natural size.

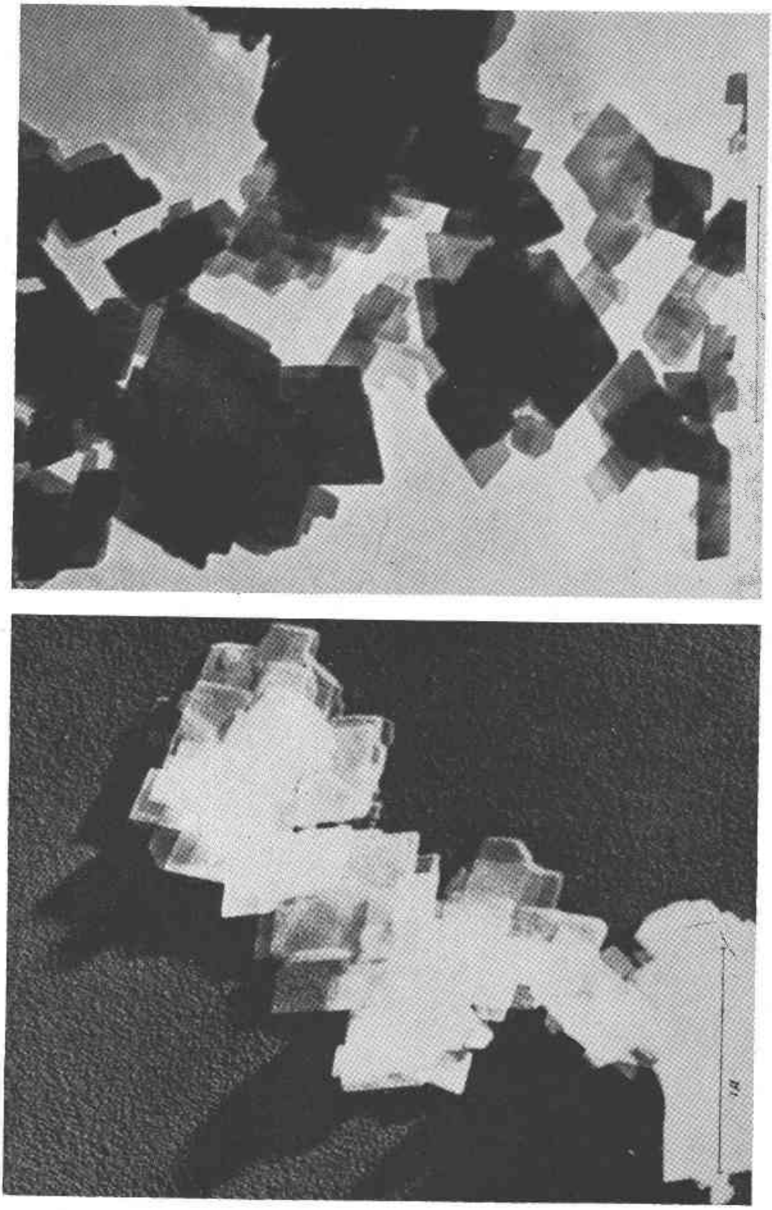

FIG. 6. Electron micrographs of huntite. The upper photograph demonstrates the homogeneity of the sample (magnification approximately 32,000×). The lower photograph shows the crystals of huntite shadowed with chromium at an angle of 9°35′ (magnification approximately 30,000×). Electron micrographs prepared by E. J. Dwornik.

Huntite also occurs as a white powdery mass at the base of the replaced tuffs where the replaced tuff is in contact with vitric tuff.

(3) *Origin of huntite*

The paragenetic sequences for various specimens suggest that huntite was formed during the late meteoric stage. It is definitely younger than the calcite and iron oxides lining the vugs but it is older than some of the calcite. It is believed that huntite was precipitated as a very fine powder from cool ground waters which gathered their magnesium locally in traversing the magnesite deposits. It is believed that huntite is a metastable phase and experimental work is in progress to determine its range of stability.

CRYSTALLOGRAPHIC STUDIES

(1) *Morphology*

The crystals of huntite were judged to be exceedingly small, both from the microscopic examination of the powder and from the similarity of its behavior to that of a fine-grained chemical precipitate which has been redispersed in water. Accordingly, the powder was examined by electron microscopy, with most gratifying results. The electron micrographs of huntite prepared by E. J. Dwornik are shown in Fig. 6. The size of the largest crystals appears to be about one micron, measured in the direction of the longest diagonal. These micrographs suggest that huntite has a platy habit.

(2) *X-ray powder diffraction data*

Powdered huntite was mixed with "Duco" cement as a binding medium and formed into a spindle. A powder pattern was obtained using filtered copper radiation. The data for the interplanar spacings, *d*-spacings, were corrected according to the method of Straumanis and Ievins (1940); the results are given in Table 1, together with the data for dolomite, magnesite, calcite, aragonite, and vaterite. A comparison of these data shows clearly the difference between huntite and the other carbonates.

(3) *X-ray crystallographic study*

Although the visual comparison of the powder photograph of huntite with those of dolomite, magnesite, and a mixture of dolomite and magnesite (specimen W-300; estimated composition magnesite 93%, dolomite 7%), see figure 7, removes any doubt of its uniqueness, it is very desirable to index the lines in the *x*-ray diffraction pattern.

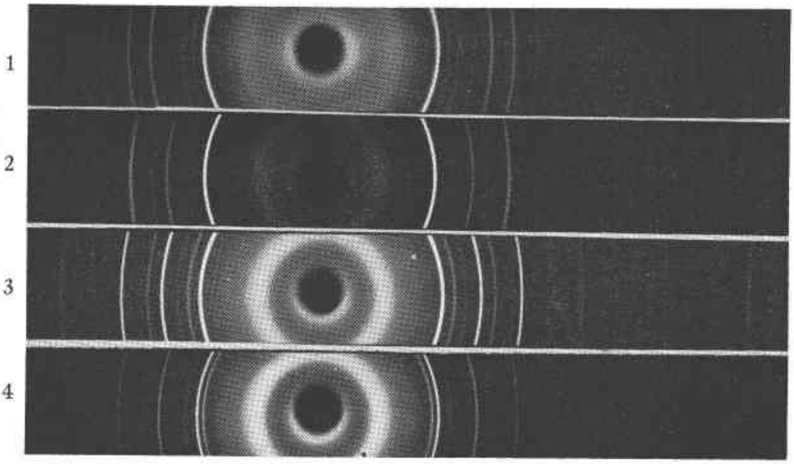

FIG. 7. 1. Huntite. 2. Dolomite. 3. Magnesite. 4. Dolomite 7%, magnesite 93%.

Dr. W. F. Bradley of the Illinois Geological Survey suggested that an attempt be made to index the lines in the powder pattern on the assumption of a mixture consisting of a solid solution of magnesite in dolomite and of a solid solution of dolomite in magnesite. The results of lengthy calculations failed to provide any good agreement between the observed and calculated values of the *d*-spacings for two hexagonal unit cells. The application of the requirements of a rhombohedral unit cell, that the algebraic sum of the hexagonal indices satisfy the relations: (1) $-h+k+l=3n$, or (2) $h-k+l=3$n, eliminated a very large number of the possible agreements. It should be noted that the *intensity* of the 2.838 (line) stands in marked contrast to all other lines in the pattern of huntite and this relationship serves to differentiate huntite from the other carbonates.

Dr. Howard T. Evans examined a series of electron micrographs of huntite and suggested (1) that the huntite crystals may be orthorhombic with a platy habit, and (2) that the 2.838 Å line may correspond to an $00l$ reflection.

Accordingly, an attempt was made to index the *d*-spacings on an orthorhombic cell. By indexing the strongest *d*-spacing as 003 and using the charts for orthorhombic crystals prepared by J. O. Wilhelm (1927), two possible solutions, yielding two different axial ratios, were found. A possible morphological "axial ratio" was derived from the measurements of the diagonals of a number of the "diamond-shaped" plates in the electron micrographs. The two axial ratios obtained from the charts of Wilhelm were qualitatively related by simple multiples to the possible morphological "axial ratio" derived from the electron micrographs. Next,

TABLE 1. X-RAY POWDER DATA FOR HUNTITE AND OTHER ANHYDROUS CARBONATES OF CALCIUM AND MAGNESIUM

Huntite (*A*-1007-*a*), Ala-Mar deposit, Current Creek, Nev.		Dolomite, data from Mehmel (1939)		Magnesite (W-180), Windous deposit, Currant Creek, Nev.		Calcite, data from Mehmel (1939)		Aragonite, data from Mehmel (1939)		Vaterite, data from Brooks, Clark, and Thurston (1950)	
d(Å)	*I*	*d*(kX)	*I*	*d*(Å)	*I*	*d*(kX)	*I*	*d*(kX)	*I*	*d*(kX)	*I*
5.69	VVVVW										
4.81	VVVVW					4.28	W				
4.16	VVVVW										
		3.81	W			3.86	MW				
3.67	VVVVW										
										3.59*	
				3.56	VF						
						3.40	M				
								3.39	S		
										3.285	
								3.23	M		
3.15	VVVVW	3.18	W								
				3.04	W	3.06	VS				
2.905	W										
2.838	VVS	2.85	VS								
										2.719	
				2.738	VS						
		2.65	MS					2.68	MS		
2.580	M										
		2.53	W			2.52	M				
				2.508	S						
								2.47	M		
2.444	M										
2.388	M	2.39	MW								
				2.318	M	2.31	MS	2.34	S		
2.298	W										
2.204	M										
		2.18	MS					2.18	W		
		2.00	M	2.099	M	2.11	MS	2.09	MW	2.060	
1.986	S†										
								1.958	S		
				1.939	S						
						1.929	S				
1.900	VVW										
				1.884	VF	1.887	S				
								1.860	MS		
1.840	VVW										
		1.837	W								
1.803	VVW					1.807	W	1.800	M		
		1.780	S								
1.769	S			1.771	WM						
								1.720	S		
1.708	VVW			1.701	VS						
						1.689	W				
						1.620	M			1.644	

Huntite (*A*-1007-*a*), Ala-Mar deposit, Current Creek, Nev.	Dolomite, data from Mehmel (1939)	Magnesite (W-180), Windous deposit, Currant Creek, Nev.	Calcite, data from Mehmel (1939)	Aragonite, data from Mehmel (1939)	Vaterite, data from Brooks, Clark, and Thurston (1950)
1.590 M					
	1.560 W			1.550 W	
1.529 VW	1.532 M		1.535 M		
		1.510 M			
1.488 M		1.487 M	1.488 W		
				1.460 W	
1.453 W	1.456 MW		1.451 MS		
1.423 VVW	1.427 W				
1.403 VVW		1.406 M		1.400 W	
1.378 VVW	1.382 M	1.372 VW			
1.360 VVW		1.355 M		1.350 W	
		1.336 S			
1.322 VW	1.329 M				
1.311 W			1.307 W		
1.284 VVVW	1.291 W				
1.263 VVVW	1.265 MW				
1.245 W		1.251 WM		1.250 W	
	1.230 M	1.238 VVW		1.230 M	
1.222 VW					
	1.195 W	1.201 VW		1.188 W	
		1.180 W			
1.179 VW			1.181 W		
				1.180 W	
1.167 VVVW	1.162 M				
		1.159 VF	1.159 W		
				1.168 W	
1.148 VVVW			1.150 W		
	1.139 W				
1.131 VVW		1.128 VF			
	1.119 MW			1.120 W	
	1.105 M	1.101 VF		1.100 W	
1.081 VVVW	1.093 MW	1.067 M			
		1.051 W	1.050 M	1.030 MW	
1.010 M	1.002 MW	1.014 VF	1.014 MW	1.000 MW	
0.9771 W					
		0.9683 M			
		0.9563 M			
0.9538 VW					
0.9478 VVVW					
		0.9449 VVF			
0.9297 VVW					
0.9176 VVW		0.9184 VW			
		0.9128 S			
0.8971 VVW		0.9113 W			
		0.8930 VVF			

* Strong reflections only; other reflections not certain.

† Doublet.

the volume of cells containing one, and two molecules of $Mg_3Ca(CO_3)_4$ respectively, were calculated from the measured specific gravity.

With these data, the value of the axial ratio was refined until a good correspondence between the observed and the calculated *d*-spacings was obtained. The results are given in Table 2 which shows that all of the lines can be indexed on the basis of an orthorhombic cell. Donald H. Richter and T. Woodward assisted the author in the numerical computation of the data.

The dimensions of the unit cell obtained from the calculations are: $a_0=5.663$ Å, $b_0=9.020$ Å, $c_0=8.514$ Å. The number of molecules per unit cell, *Z*, equals 2. The morphological axial ratio derived from the *x*-ray data are a:b:c=0.6278:1:0.9439. A survey of the 43 reflections present in the pattern shows that the lattice of huntite is primitive (*P*). The data available are, however, not sufficient to determine the space group.

PHYSICAL PROPERTIES

Huntite from the Currant Creek district, Nevada, occurs as compact, chalklike masses which have an even to subconchoidal fracture. It is brittle when cut with a knife and is soft enough to leave a mark on a dark surface. The compact masses are easily cut by the fingernail. It is porous and a fragment dropped into water crumbles, emitting crackling noises as it breaks into smaller fragments. This crackling is accompanied by a hissing sound produced by the displacement of air bubbles from the porous mass. Huntite has a smooth feel and adheres to the tongue.

The specific gravity was determined by J. J. Fahey, using a pycnometer of the type referred to as a "milk test bottle," and a sample weighing 3.8 grams. The specific gravity was found to be 2.696 at 4° C.

OPTICAL PROPERTIES

Huntite is white; in thin section it is colorless. Its luster is nonmetallic and dull, and its streak is white. It is nonfluorescent when examined under the radiation from a "Mineralite."

No determinations of the optical properties of huntite were possible by the usual immersion techniques, owing to the very small size of the crystals. Examination in thin section shows, as would be expected, that the birefringence is very strong. When examined in immersion liquids of index of refraction 1.615 and 1.620, some of the aggregates show color fringes.

DIFFERENTIAL THERMAL ANALYSIS

The equipment and technique used in this laboratory in differential thermal analysis studies, together with references to the literature, are

TABLE 2. COMPARISON OF OBSERVED AND CALCULATED *d*-SPACINGS FOR HUNTITE INDEXED ON AN ORTHORHOMBIC CELL

I	*d* (observed)	*d* (calculated)	*hkl*
VVVVW	5.69	5.66	100
VVVVW	4.81	4.82	110
VVVVW	4.16	4.19	111
VVVVW	3.67	3.54	120
VVVVW	3.15	3.20	112
W	2.91	3.00	030
VVS	2.838	2.840	003
M	2.580	2.574	211
M	2.444	2.447	113
M	2.388	2.397	220
W	2.298	2.306	221
M	2.204	2.208	123
S	1.986	1.992	104, 042, 231*
VVW	1.900	1.887	300
VVW	1.840	1.841	301
VVW	1.803	1.802	050
S	1.769	1.765	043
VVW	1.708	1.707	321
M	1.590	1.591	224
VW	1.529	1.533	125
M	1.488	1.484	323
W	1.453	1.453	160
VVW	1.423	1.425	341
VVW	1.403	1.402	016
VVW	1.378	1.376	106, 054
VVW	1.360	1.361	116
VW	1.322	1.321	145
W	1.311	1.311	261
VVVW	1.284	1.283	036
VVVW	1.263	1.264	305
W	1.245	1.246	352
VW	1.222	1.221	226
VW	1.179	1.179	117, 404
VVVW	1.167	1.167	433
VVVW	1.148	1.148	173
VVW	1.131	1.130	272
VVVW	1.081	1.082	174, 415
M	1.010	1.011	175
W	0.9771	0.978	426
VW	0.9538	0.953	076, 543
VVVW	0.9478	0.948	534, 148
VVW	0.9297	0.930	472
VVW	0.9176	0.918	417, 621
VVW	0.8971	0.897	209, 293

* This line is a doublet.

given by Faust (1948 and 1950). The samples were heated at the rate of approximately 12° C. per minute. The records were obtained as photographs.

(1) *Description of the specimens studied*

The descriptions of the calcite, magnesite, and dolomite standards have been given in an earlier volume of this Journal (Faust, 1949, p. 793). Huntite and other minerals used in the differential thermal analysis examinations are described below.

Huntite. Locality: Ala-Mar deposit, sec. 34, T. 12 N., R. 59 E., Nye County, Nevada. Specimen *A*-1007*a*, compact mass. A portion of the tube sample used in the analysis reported in Table 3 (see under Chemical properties) was used for the differential thermal analysis examination.

Magnesite, dolomite, and deweylite. Locality: Windous deposit, White Pine County, Nevada. Specimen *W*-199, snow-white porous masses, full of cavities. A chemical analysis of this specimen by J. G. Fairchild is given by Faust and Callaghan (1948). Mode obtained from chemical and petrographic data shows: magnesite 64 per cent, dolomite 22 per cent, and deweylite 14 per cent. The ratio of magnesite to dolomite is 75:25.

Magnesite and dolomite. Locality: North Windous tunnel, Windous deposit, White Pine County, Nevada. Specimen *W*-300, white fluffy powder, occurring as a filling in a vug. Euhedral crystals of dolomite are found in the powder. Composition estimated by thermal analysis: magnesite 93 per cent, dolomite 7 per cent.

Mixture of huntite with dolomite and deweylite. Locality: All the material is from the Ala-Mar deposit, Nye County, Nevada. This is an artificial mixture of specimens *A*-1008 and *A*-1007*a* and consists of huntite, dolomite, and deweylite.

(2) *Comparison of differential thermal analysis curves*

The differential thermal analysis curves of huntite, calcite, dolomite, magnesite, and natural and artificial mixtures of these minerals are given for purposes of comparison in Figs. 8 and 9. The curve for huntite (*D*) differs from that of dolomite (*C*) in one very important characteristic, namely, the ratio of the areas under the breaks in the curve. The ratio of the area under the breaks at 792° C. and 926° C. for dolomite from Millville, West Virginia, is 296:510, whereas the ratio of the area under the breaks at 644° C. and 901° C. for huntite from the Ala-Mar deposit is 427:228.

Curve *E* represents the character of the dissociation of a natural mixture, sample W-199 containing 64 per cent magnesite, 22 per cent dolomite, and 14 per cent deweylite. The ratio of magnesite to dolomite in this mixture is 75:25. The clear-cut separation of the break in the curve representing the dissociation of magnesite at 659° C. from the two breaks in the curve arising from the dissociation of dolomite at 806° C. and 885° C. is apparent. The break at 826° C. is due to recrystallization.

Curve *F* is the differential thermal analysis curve for a natural mix-

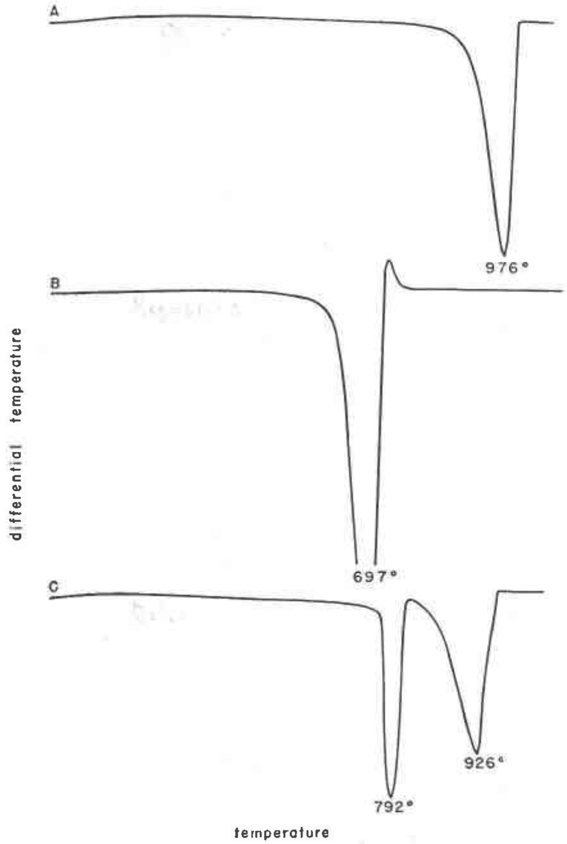

FIG. 8. Differential thermal analysis curves. *A*, calcite no. 13, Joplin, Missouri, record *C*-89, resistance in series with the galvanometer 999.9 ohms. *B*, Magnesite no. 1, Windous deposit, White Pine County, Nevada, record *C*-79, resistance in series with the galvanometer 999.9 ohms. *C*, Dolomite, Millville, West Virginia, Record *F*-3, resistance in series with the galvanometer 900 ohms.

→

FIG. 9. Differential thermal analysis curves. *D*, Huntite, specimen no. *A*-1007*a*, Ala-Mar deposit, Nye County, Nevada, record *C*-86, resistance in series with the galvanometer 999.9 ohms. *E*. Magnesite and dolomite, with a small amount of deweylite, specimen no. *W*-199, Windous deposit, White Pine County, Nevada, record *C*-151, resistance in series with the galvanometer 600 ohms. *F*, Magnesite 93 per cent, dolomite 7 per cent, specimen *W*-300, vug filling in the North Windous Tunnel, Windous deposit, White Pine County, Nevada, record *C*-152, resistance in series with the galvanometer 600 ohms. *G*, Artificial mixture of 50 per cent huntite (specimen *A*-1007*a*) and 50 per cent of specimen *A*-1008 consisting of dolomite with a small amount of deweylite, both specimens from the Ala-Mar deposit, Nye County, Nevada, record *C*-149, resistance in series with the galvanometer 600 ohms.

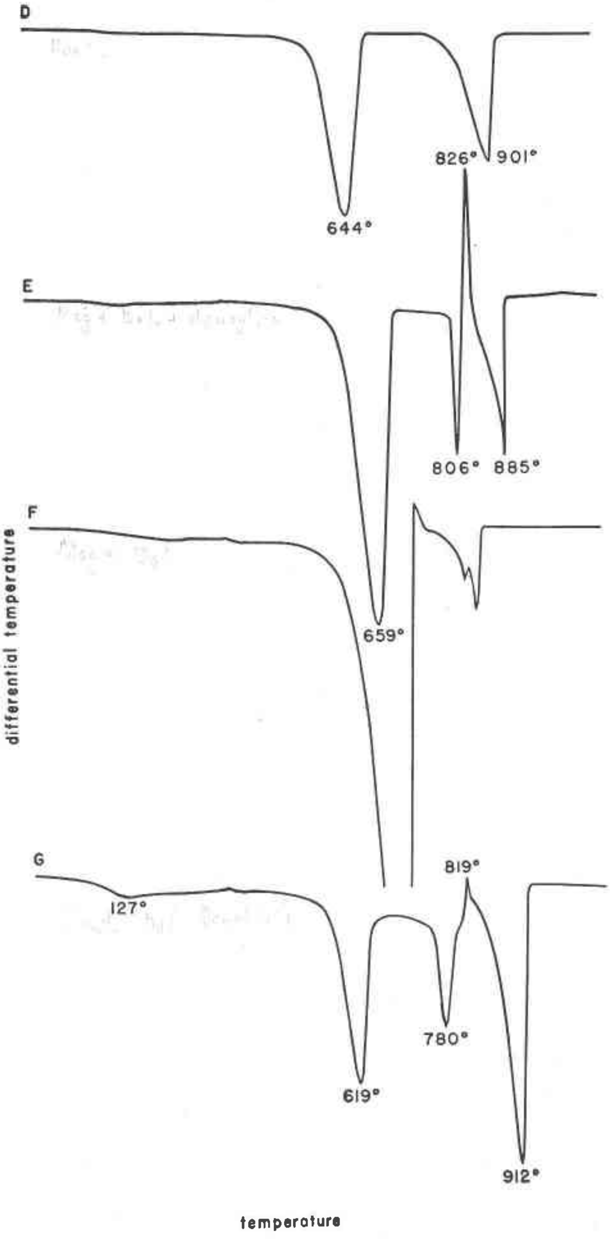
D
644°
826°
901°
E
806°
885°
F
659°
G
127°
819°
780°
619°
912°
differential temperature
temperature

FIG. 9

Table 3. Measurement of Area Under the Differential Thermal Curves

Sample	Area of break representing the dissociation of magnesite	Area of break representing the dissociation of $MgCO_3$	Area of break representing the dissociation of $CaCO_3$	Ratio of $MgCO_3$ $/CaCO_3$ in sample	Measured ratio of total area due to $MgCO_3$ /area due to $CaCO_3$	Calculated ratio of total area due to $MgCO_3$ /area due to $CaCO_3$
Dolomite, Curve *C*		296 units	510 units	1:1	0.584	Assumed as 0.60
Huntite, Curve *D*		427	228	3:1	1.87	1.80
Natural mixture of magnesite, dolomite, and deweylite, specimen *W*-199, Curve *E*	753	90*	180	7:1	4.66	4.20

* This area is too large, for it includes the area contributed by the decomposition of deweylite.

ture, sample *W*-300, containing approximately 93 per cent magnesite and 7 per cent dolomite. Here again the breaks in the curve arising from the dissociation of these two minerals is clearly resolved. Curves *E* and *F* should be compared with curve *D* (for huntite).

In order to determine the character of the dissociation of a mixture of dolomite and huntite, a mixture was prepared and subjected to differential thermal analysis. The material mixed with the huntite consists chiefly of dolomite with a small amount of deweylite. This material is similar to the matrix of huntite. The resultant curve *G* is shown in Fig. 9. This curve has three large, distinct, and well-separated breaks. The break at 619° C. represents the dissociation of the $MgCO_3$ in the structure of huntite; the break at 780° C. represents the dissociation of the $MgCO_3$ in the structure of dolomite and, in addition, the dissociation of the small amount of deweylite in the sample; this break is followed by a small exothermic effect at 819° C. due to recrystallization of the constituents in the dissociated deweylite; at 912° C. the break appears for the dissociation of the $CaCO_3$ (derived from the huntite and dolomite).

These thermal analysis curves show that a mixture of dolomite and magnesite can be differentiated from huntite.

(3) *Measurements of areas under the thermal curves*

Areal measurements were made with a simple grid. This grid, approximately 18.5×23.5 cm., is the negative obtained by photographing a piece of high-quality coordinate paper. The areas mentioned in this paper are all given in terms of the smallest unit square. Since we are interested in ratios only, it was not necessary to convert these measurements to square centimeters. The data are presented in Table 3. From the areal measurements was obtained the ratio of the total area under the curve which is produced by the thermal effects of the dissociation of the $MgCO_3$ to the total area under the curve which is produced by the thermal effects of the dissociation of the $CaCO_3$ in the structure. Then, assuming 0.60 as the value of this ratio for dolomite, the value of the ratio was calculated for huntite and for a mixture of 75 per cent magnesite and 25 per cent dolomite, specimen *W*-199. The concordance between the measured and calculated value of the ratio is excellent. It must be emphasized that the above calculations are based on the arbitrary assumption that the area under the curve for the thermal effects produced in the dissociation of magnesite are not greatly different from those produced in the dissociation of the $MgCO_3$ in the structures of huntite and dolomite.

Kelley and Anderson (1935) give equations for calculating the heat of the dissociation of calcite and of magnesite. The values of ΔH for the two-stage dissociation of the dolomite from Millville, West Virginia (curve *C*), were calculated by means of these equations and the measured temperature of the two maxima, 792° C. and 926° C. The calculated values are $\Delta H_{1065}=23{,}440$ calories for the dissociation of the $MgCO_3$ in the structure and $\Delta H_{1199}=39{,}702$ calories for the $CaCO_3$. The ratio of these values of ΔH is 0.590, and this is in excellent agreement with the value 0.584 obtained by areal measurement.

CHEMICAL PROPERTIES

(1) *Pyrognostics*

Huntite is infusible before the blowpipe. A fragment, when held in the forceps and heated, glows and colors the flame a rich red. The heated fragment, when dropped onto wet turmeric paper, turns the paper brown, thus showing an alkaline reaction. Fragments dissolve quickly and with brisk effervescence in cold (1:1) acids such as HCl, HNO_3, or H_2SO_4. Gypsum is precipitated when H_2SO_4 is used as the solvent. Huntite does not become colored with Meigen's solution.

(2) *Chemical analysis and composition*

A chemical analysis was made on pure material, specimen *A*-1007a, from the Ala-Mar deposit, and the results are given in Table 4.

TABLE 4. ANALYSIS OF HUNTITE FROM THE ALA-MAR DEPOSIT, NYE COUNTY, CURRANT CREEK, NEVADA

	Per Cent	Mol. Numbers	Mol. Ratios
MgO	34.09	0.8455	3.07
CaO	15.42	0.2750	1.00
MnO	.001		
H_2O-	.47		
H_2O+	.86		
CO_2	48.85	1.1102	4.03
SiO_2	.06		
Al_2O_3	none		
Fe_2O_3	none		
FeO	none		
TiO_2	none		
SO_3	none		
BaO	none		
Sum	99.75		

Analyst: R. E. Stevens

This analysis yields the formula $3MgO\cdot CaO\cdot 4CO_2$ or $3MgCO_3\cdot CaCO_3$ or $Mg_3Ca(CO_3)_4$. This composition lies between dolomite and magnesite and is in the ratio of two moles of magnesite to one mole of dolomite.

K. J. Murata made a spectrographic examination of huntite obtained from a cavity filling in specimen no. *N.M.186* from the Nevada Magnesite deposit; this examination showed that the minor constituents present in amounts of a few hundredths of a per cent, or less, were Si, Fe, Sr, Ba, Ti, B, Al, and Mn.

NOMENCLATURE

Huntite is named in honor of Professor Walter Frederick Hunt, sometime chemist in the Chemical Laboratory, U. S. Geological Survey, for many years professor and head of the Mineralogical Laboratory at the University of Michigan, and, since 1922, editor of this Journal. The author is particularly happy to name the mineral after one of his former teachers in the Graduate School of the University of Michigan, as a token of appreciation to a professor who was everything that he should be to a graduate student.

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During the latter part of 1942 the author was requested by Eugene Callaghan to undertake the study of the mineralogy of the magnesite deposits of the Currant Creek area. The original specimens of huntite were discovered in collections made by C. J. Vitaliano and E. Callaghan. These were supplemented in 1944 by specimens collected by the author and Callaghan. The author is indebted to R. E. Stevens for the chemical analysis, to J. J. Fahey for the determination of the density, to E. J. Dwornik for the electron micrographs, and to K. J. Murata for spectrographic data. J. M. Axelrod made preliminary *x*-ray examinations of this material and confirmed its unique character. To all of these colleagues the author expresses his sincere thanks.

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