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MINERALOGICAL NOTES

WEGSCHEIDERITE ($Na_2CO_3 \cdot 3NaHCO_3$), A NEW SALINE MINERAL FROM THE GREEN RIVER FORMATION, WYOMING[1]

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INTRODUCTION

The Green River formation of Wyoming, Utah, and Colorado has been generous in providing many carbonate minerals for mineralogical study. Milton and Fahey (1960) list 19 distinct species; one, $Na_2CO_3 \cdot 3NaHCO_3$, was new and unnamed at the time that paper was published. The optical, physical, and chemical properties of this new mineral are recorded here, and the *x*-ray crystallography is given in the following paper by Daniel Appleman.

The name, wegscheiderite, is given to this new mineral in honor of Rudolf Wegscheider, who, in his phase-equilibrium study of the system Na_2CO_3-$NaHCO_3$-H_2O, was the first to synthesize the compound $Na_2CO_3 \cdot 3NaHCO_3$ (Wegscheider, 1913).

OCCURRENCE

The new mineral was first found in the drill core of the Perkins Well No. 1, which is located in the NE$\frac{1}{4}$ Sec. 32, T. 15N., R. 108 W., Sweetwater County, Wyoming. It occurs as a 3-inch stratum (depth 1609′6″ to 1609′9″) colored reddish brown by approximately 4 per cent organic matter. A photomicrograph, taken with crossed nicols, of a thin section (Fig. 1) shows that the stratum is composed of an assemblage of tiny, randomly oriented crystals of wegscheiderite that range in type from acicular to bladed.

Wegscheiderite was also found in the drill core of the Perkins Well No. 2, located about 6 miles west of the Perkins Well No. 1, and in the drill core of the Grierson Well No. 1, located approximately 12$\frac{1}{2}$ miles northwest of the Perkins Well No. 1. In the Grierson well the new mineral is found at a depth of 1940′ as bladed crystals as much as 5 centimeters long in massive halite (Fig. 2).

The 3 wells penetrate the Wilkins Peak member of the Green River formation, a lacustrine deposit of middle Eocene age. Trona, nahcolite and halite are also present in these drill cores. Thin sections show that trona is replaced by wegscheiderite, which in turn is replaced by halite.

[1] Publication authorized by the Director, U. S. Geological Survey.

Fig. 1. Photomicrograph of thin section from the drill core of the Perkins No. 1 Well, depth 1609′8″. Crossed nicols, ×40.

Fig. 2. Photograph of crystals of wegscheiderite from the Grierson Well No. 1, depth 1940′.

Optical and Physical Properties

Wegscheiderite is triclinic, colorless when pure, and has a distinct prismatic cleavage and a vitreous luster. It is biaxial (−) with a very strong birefringence and a moderate 2V angle. The indices of refraction are:

$$\alpha = 1.433$$
$$\beta = 1.519 \quad \pm 0.002$$
$$\gamma = 1.528$$
$$2V = 34° \text{ (calc.)}$$
$$2V = 32.4° \text{ (meas. Na light)}$$
$$r < v$$

The hardness of wegscheiderite is $2\frac{1}{2}$–3, and it has an uneven to subconchoidal fracture. A small fragment placed on the lid of a platinum crucible, and heated by a gas flame, melted to a colorless globule that became white upon cooling. The specific gravity, 2.341 at 25° C., was determined on material that passed a 100-mesh sieve. The method used was one that was recently developed in the Geological Survey laboratory (Fahey, 1961) for the determination of the specific gravity of sand, or mineral specimens ground to pass a 100-mesh sieve. The specific gravity of the sample of wegscheiderite that contained 4.38 per cent of organic matter was 2.214. The organic matter was found to have a specific gravity of 1.011. For each of these determinations ethyl alcohol (95 per cent), that had been saturated with wegscheiderite, was used as the liquid medium. From these data the specific gravity of the wegscheiderite was computed as follows:

$$\frac{100.00 - 4.38}{x} + \frac{4.38}{1.011} = \frac{100.00}{2.214}$$
$$x = 2.341 = G \text{ of wegscheiderite.}$$

This is in good agreement with the figure 2.334 that was obtained by calculation from the unit cell content.

Chemical Properties

Wegscheiderite is decomposed rapidly by the common acids with evolution of carbon dioxide. It is readily soluble in hot water and less rapidly in cold water. In the analyses (Table 1) the carbonate and bicarbonate were determined by titrating with 0.1 normal sulfuric acid to the phenolphthalein end point and then to the methyl red end point while bubbling air through the solution. Sodium was computed from the weight of the sodium sulfate. No potassium was present in the sample. The organic matter was determined by treating a 0.5-g sample with dilute nitric acid,

TABLE 1. CHEMICAL ANALYSIS OF WEGSCHEIDERITE

Joseph J. Fahey, analyst

	Per Cent	Computed to 100.00 Per Cent[1]	Theoretical $Na_2CO_3 \cdot 3NaHCO_3$
Na	30.60	32.20	32.11
K	none		
CO_3	15.77	16.62	16.73
HCO_3	48.58	51.18	51.13
Cl	0.06		
H_2O—105° C.	0.36		
Organic matter	4.38		
Total	99.75	100.00	100.00

[1] 0.04% Na, equivalent to 0.06% Cl in NaCl, was deducted before computing the analysis to 100.00 per cent.

filtering, washing well with water, allowing to air dry at room temperature for seven days, and then weighing. The small amount of chlorine was measured nephelometrically as silver chloride.

Several patents that describe methods of synthesizing the compound $Na_2CO_3 \cdot 3NaHCO_3$ have been granted in the United States. Among these is U. S. Patent No. 1,503,481 in 1924 to Herbert E. Cocksedge of Hartford, England, and two in 1926, Nos. 1,583,662 and 1,583,663 granted to Carl Sundstrom and George N. Terziev of Syracuse, New York. The X-ray Powder Data File (Card 2-0696) of the American Society for Testing Materials lists the compound as Wegscheider's Salt. The stability field of this compound at 89.5° C. lies between the stability fields of trona and sodium bicarbonate (Wegscheider and Mehl, 1928).

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