MEMORANDUM ON OCCURRENCE OF DOLOMITE IN WYOMING

Introduction

Since dolomite is being considered as a potential source of metallic magnesium, the occurrence of that rock type in Wyoming is here briefly treated.

Dolomite is a mineral composed of calcium and magnesium carbonates. Limestones which carry a high proportion of magnesium carbonate are called dolomitic limestones, or simply dolomites. The term dolomite, as used herein, refers to a carbonate rock made up essentially of the mineral dolomite.

There are all gradations from pure calcitic limestone, made up of the mineral calcite, ($CaCO_3$), to dolomitic limestone, to nearly pure dolomite, ($CaMg(CO_3)_2$). Dolomites are sedimentary rocks, generally light in color, and vary from microcrystalline to coarsely crystalline in texture.

It is difficult, or impossible, to definitely differentiate calcitic limestones from dolomites without chemical analyses. G. G. Huffel (1) (see list of references at end) has pointed out that during his work on Oklahoma dolomites "many specimens collected as dolomite turned out to be calcite, while not a few thought to be partly or wholly calcite were found to be exceptionally pure dolomite." The usual field tests, such as the use of weak acid, are misleading, and laboratory tests which utilize stains give no quantitative data. Chemical analyses are, therefore, the only trustworthy means of differentiating limestone from dolomite and of determining the magnesium content of dolomites.

The hypothetical composition of a pure dolomite is as follows:

Magnesia	MgO	21.9%
Lime	CaO	30.4%
Carbon dioxide	CO_2	47.7%

A pure dolomite would carry over 13% metallic magnesium. Most dolomites, however, contain impurities such as silica, iron compounds, etc.

DISTRIBUTION OF DOLOMITES IN WYOMING

Pre-Cambrian Dolomites

In a number of places in the State dolomites are known to occur with other metamorphosed sediments as isolated masses (roof pendants) in the pre-Cambrian granites. These dolomites are generally coarsely crystalline and some may be quite pure, although others are known to be siliceous. The main known occurrences are (1) in the Medicine Bow Mountains, (2) in the Laramie Range, especially in Tps. 18 and 19 N., R. 12 W., (3) in the Khalen group near Guernsey, and (4) in the Sierra Madre Mountains. Dolomites may occur in the pre-Cambrian rocks of the Wind River, Owl Creek, and Big Horn Mountains, but have not been reported. Areas of pre-Cambrian rocks are shown on the accompanying map.

In general the pre-Cambrian dolomites are of variable composition over short distances. They commonly show siliceous knots and carry such metamorphic minerals as diopside, tremolite, antigorite, etc.

Ordovician Dolomites

Bighorn dolomite. - The Bighorn dolomite is the thickest and probably the most uniformly pure dolomite in Wyoming. It is a massive, dense to finely crystalline light-colored dolomite which is thickest in the northwestern part of the State and thins out south of the Wind River and is absent in the southern part of the State. and Big Horn Mountains. It averages about 300 feet in thickness in the Big Horn Mountains, is 150' thick in Wind River Canyon, is about 200' thick in the Owl Creek Mountains, and ranges from 300' in thickness in the northern Wind River Mountains to about 150' at the southern end of that range. The outcrop of the Bighorn dolomite is shown on the accompanying map.

Several analyses of the Bighorn dolomite are as follows (2):

additional space

	(1)	(2)	(3)	(4)	(5)
SiO_2	2.30	.....	.....	.....	.....
Al_2O_3 and Fe_2O_3	1.50	.....	.22	trace	.....
Insoluble in dilute HCl	3.80	4.67	.53	.35	.42
CaO	29.35	30.14	31.17	30.62	30.43
MgO	20.19	18.41	20.76	20.38	20.85
CO_2	45.00	44.24	47.75	46.92	47.10
Undetermined	1.06	2.54	.00	1.79	1.32
	100.00	100.00	100.43	100.00	100.00

1. Bull Lake, Wind River Mountains. Analyst, J. G. Fairchild
2. Doubletop Peak, Gros Ventre Range, Analyst, C. Palmer
3. Labarge Mountain. Analyst, J. G. Fairchild
4. Shoal Creek, Gros Ventre Range, Analyst, J. G. Fairchild
5. Leigh Creek, Teton Mountains. Analyst, W. C. Wheeler

The Bighorn dolomite retains a similar lithology throughout the area in which it is found. The similarity in magnesia content of specimens from widely separated localities suggests that the Bighorn dolomite may be expected to be of high magnesia content throughout its outcrop.

Devonian Dolomites

In the northern part of the Wind River Mountains the Darby formation, of Devonian age, contains beds of dolomite which aggregate 50 feet or more in thickness. These dolomites weather brown and probably contain a great deal of ferruginous material. Many beds are very sandy. In northwestern-most Wyoming the Jefferson dolomite is of the same type as the Darby dolomite but is considerably thicker.

Carboniferous Dolomites

The rocks of Mississippian, Pennsylvanian and Permian age in Wyoming contain limestones and/or dolomites whose composition is unknown. The areal outcrop of these rocks is shown on the accompanying map.

Madison limestone. - The Madison limestone, of Mississippian age, attains a thickness of over 700 feet in the Big Horn, Owl Creek,

and Wind River Mountains. In the Wind River and Owl Creek Mountains the writer has noted beds which appear to be finely crystalline dolomites, but no analyses are available. Some of these beds, in the lower part of the formation, are over 100 feet thick. The Madison thins to the southward but is present in the Rawlins uplift, around Casper Mountain and the northern part of the Laramie Range, in the Hartville uplift (Guernsey limestone), and in the Seminoe and Ferris Mountains. In this region the formation seems to be largely limestone, but analyses might show the presence of beds of dolomite.

Amsden, Casper, and Hartville formations. - The Amsden, Casper, and Hartville formations, of Pennsylvanian age, have been reported to contain dolomites at various places. Certain beds now classed as limestones, because of lack of information on their composition, might prove to be dolomites. Numerous beds of dolomite have been reported in the Amsden formation in the Wind River, Owl Creek, and Big Horn Mountains (3). Thick beds of dolomite are known to occur at depth in the Pennsylvanian rocks in the Lance Creek oil field. Some of the numerous limestones in the Amsden or in the Casper ~~formations~~ in the Rawlins uplift, along the Ferris and Seminoe Mountains, around Casper Mountain, and along both flanks of the Laramie Range might prove to be dolomites if analyzed, as might similar beds in the Hartville formation of the Hartville uplift.

Phosphoria and Embar formations. - The Phosphoria formation, of Permian age, is exposed along the Wind River and Owl Creek Mountains. In some places beds have been recognized as being dolomites or of dolomitic nature, but there are no analyses to indicate their magnesia content. It is possible that some of the so-called limestones of the Phosphoria are actually dolomites.

To the eastward, in central and southeastern Wyoming, there are dolomitic limestones in the redbeds equivalent of the Phosphoria formation. These are the Forelle, the Minnekahta, and other un-named beds. Some of these dolomitic limestones are quite sandy, others are gypsiferous, but some are perhaps quite pure dolomite. These limestones are found in the base of the Chugwater redbeds in the Rawlins uplift, in the Ferris and Seminoe Mountains, the Freezeout Hills, around Casper Mountain, in the Hartville uplift, and along both flanks of the Laramie Range.

Triassic Limestones

Alcova limestone. - The only limestone of post-Paleozoic age which might have a high magnesia content is the Alcova limestone, of Triassic age. The outcrop of this limestone is not shown on the accompanying map. This limestone shows some of the lithologic features which generally characterize dense dolomites but without analyses it is impossible to tell whether the formation is a limestone or a dolomite. Its general pinkish color suggests a rather high iron content. The Alcova limestone is exposed at numerous places in central Wyoming, around Casper Mountain, in the Rawlins uplift, and along the Ferris, Seminoe, and Freezeout Mountains. The various individual layers making up the limestone are quite variable in character and should the rock be dolomitic, the magnesia content would probably be found to vary greatly both vertically and laterally.

Field and Laboratory Investigations

Essentially no analyses have been made of Wyoming dolomites. In order to gain a real concept of the occurrence of high-magnesium dolo-

nites it would be necessary to carry out field investigations over a great area within the State. Thicknesses of beds should be determined and suites of samples systematically collected. Several hundred chemical analyses would then be desirable in order to determine the magnesia content of the various dolomites at different places, and to detect the presence of any undesirable impurities.

SUMMARY AND CONCLUSIONS

1. The Bighorn dolomite, so far as is known, is the thickest purest dolomite in the State. The Burlington Railroad crosses its outcrop in the Wind River Canyon, north of Shoshoni. The next most accessible outcrops are in the canyons west of Lander, on the east flank of the Wind River Mountains.

2. There is a possibility that pure dolomites occur in the Mississippian, Pennsylvanian and Permian rocks of the State, but this is largely speculation. Samples would need to be collected in the field, and chemical analyses made, in order to substantiate this conjecture.

3. The quality of the pre-Cambrian dolomites is unknown, but in general they are quite siliceous. There may be isolated occurrences of pure dolomite, however.

4. The Devonian dolomites are too inaccessible and, judging by their mode of weathering, too ferruginous and sandy to be considered here.

5. The Alcova limestone is probably not a very pure dolomite and is quite variable in its lithology.

APPENDIX

LIST OF REFERENCES

(1) G. C. Suffel, "Dolomites of western Oklahoma", Okla. Geol. Surv. Bull. 49, 1930, p. 11.

(2) Blackwelder, Eliot. "Origin of Bighorn dolomite", Bull. Geol. Soc. America, Vol. 24, 1913, p. 612.

(3) C. G. Branson, "Pennsylvanian formations of central Wyoming", Ibid. Vol. 50, pp. 1199-1226.

February 10, 1942

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MR42-50

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

AREAL DISTRIBUTION OF DOLOMITE-BEARING FORMATIONS

Carboniferous rocks - dolomites of unascertained purity

Bighorn dolomite - thick beds of probable high purity

Pre-Cambrian rocks - scattered areas of dolomite

Compiled by H.D.Thomas
Feb. 9, 1942

20% MgO

20% MgO

21% MgO

CASPER

WYOMING

MONTANA

SOUTH DAKOTA

NEBRASKA

COLORADO

UTAH

YELLOWSTONE NATIONAL PARK

BIGHORN

CAMPBELL

JOHNSON

WESTON

WASHAKIE

SPRINGS

SUBLETTE

FREMONT

NATRONA

CONVERSE

NIOBRARA

PLATTE

GOSHEN

LINCOLN

SWEETWATER

CARBON

ALBANY

LARAMIE

CROOK

WASHAKIE NATIONAL FOREST

MEDICINE BOW NATIONAL FOREST

HAYDEN NATIONAL FOREST

INDIAN RESERVATION

A. F. Hassan, Cartographic Engineer
Compiled in 1913. Revised in 1924

Scale

Lambert conformal conic projection. Standard parallels 33° and 45°
North American datum
1940

National Forest names and boundaries not corrected to date