THE GEOLOGICAL SURVEY OF WYOMING
Gary B. Glass, State Geologist

GEOLOGY AND ECONOMIC POTENTIAL OF A HIGH-CALCIUM LIMESTONE AND DOLOMITIC LIMESTONE DEPOSIT NEAR MANVILLE, NIOBRARA COUNTY, WYOMING

by
Ray E. Harris

Report of Investigations No. 39
1987

Laramie, Wyoming

First printing of 600 copies by Cheyenne Newspapers, Cheyenne, Wyoming.

This and other publications available from: The Geological Survey of Wyoming
P.O. Box 3008, University Station
Laramie, Wyoming 82071

Cover: Drilling the Guernsey Formation at the Manville locality. (Drawing by Phyllis A. Ranz.)

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Contents

	Page
Introduction	1
Geology	1
Stratigraphy..........	1
Structure	4
Limestone and dolomitic limestone resources	6
Size and quality	6
Transportation considerations	8
Uses of limestone	8
Potential uses for the limestone and dolomitic limestone in the Manville deposit	12
Suitability for sugar rock	12
Suitability for rock used for power-plant burn control..........	12
Suitability for construction aggregate	13
Suitability for the production of lime	13
Suitability for other uses	15
Uses for the underlying quartzite	15
Summary	15
References	16

Illustrations

Figures

	Panoramic view of Guernsey Formation exposure at the Manville locality..	center fold
1.	Regional map	2
2.	Geologic map of the Manville limestone deposit	3
3.	Northwest-southeast cross section of the Manville limestone deposit	5
4.	Contact of the Guernsey Formation with the underlying Deadwood Quartzite	6
5.	The Manville deposit showing westward dip of limestone beds	7
6.	Abandoned lime kiln near Manville	14

Illustrations continued

Tables Page

1. Lithologies and chemical analyses, center drill hole 9

2. Lithologies and chemical analyses, north drill hole 10

3. Lithologies and chemical analyses, south drill hole 11

4. Chemical specifications for sugar rock 12

5. Specifications for rock used for power-plant burn control.............. 13

Introduction

A high-calcium limestone and dolomitic limestone deposit is located about three miles south of Manville, Wyoming, in Niobrara County (**Figures 1** and **2**). This deposit is mostly located on State land. An isolated rocky hill, 400 feet high, contains the limestone and dolomitic limestone resource (**center fold**). This hill overlies a quartzite that may also have economic value.

The location of the deposit is especially significant since it contains large amounts of high-calcium limestone and is centrally located near markets in an extensive area of Wyoming and western Nebraska. (See **Figure 1** and Harris and Meyer [1986] for the location of Wyoming limestone quarries.) Since the cost of limestone at the point of use is largely influenced by transportation costs, the Manville deposit may represent the least expensive source of limestone for this area. The deposit may also be the most economical source of lime for the Colorado, Utah, Wyoming, and Nebraska region.

Funding for the drilling and coring program and sample analysis portions of this study was obtained by the town of Lusk from the Wyoming Economic Development and Stabilization Board (EDSB) through a planning-only grant. This grant was awarded to provide a preliminary estimate of the amount and quality of the limestone in the deposit. Drilling information and analytical results were given to the Geological Survey of Wyoming by the town of Lusk and EDSB. The Geological Survey provided technical advice for the study, including geologic mapping, drill hole siting, core description, and resource estimation.

Geology

Stratigraphy

The limestone resource is in the Guernsey Formation (Mississippian-Devonian), which is exposed at isolated outcrops in the northern part of the Hartville uplift in Niobrara County and over an extensive area in the southern Hartville uplift near Hartville and Guernsey. This formation was named by Smith (1903) for exposures along the North Platte River near Guernsey, Wyoming. It is dated as Mississippian-Devonian by the presence of upper Devonian (Famennian) conodonts in the lower part of the formation and by Mississippian brachiopods, including *Unispirifer madisonensis*, in the upper part of the formation. Conodonts were found south of Hartville by G.L. Snyder and identified by Bruce Wardlaw, both of the U.S. Geological Survey (G.L. Snyder, personal communication, 1986). Brachiopods were found and identified by the author north of Hartville and in core from the Manville deposit.

The overlying Pennsylvanian-Permian Hartville Formation was also named by Smith (1903) for exposures near the town of Hartville, Wyoming. It consists primarily of gray to pink limestone and dolomitic limestone with beds of gray to red arkosic shale and siltstone, and gray to pink dolomite. The thickness of the Hartville Formation was not measured, though Denson and Botinelly (1949) report a thickness of about 1,050 feet in this area.

For this study, the Guernsey Formation was mapped as four distinctive

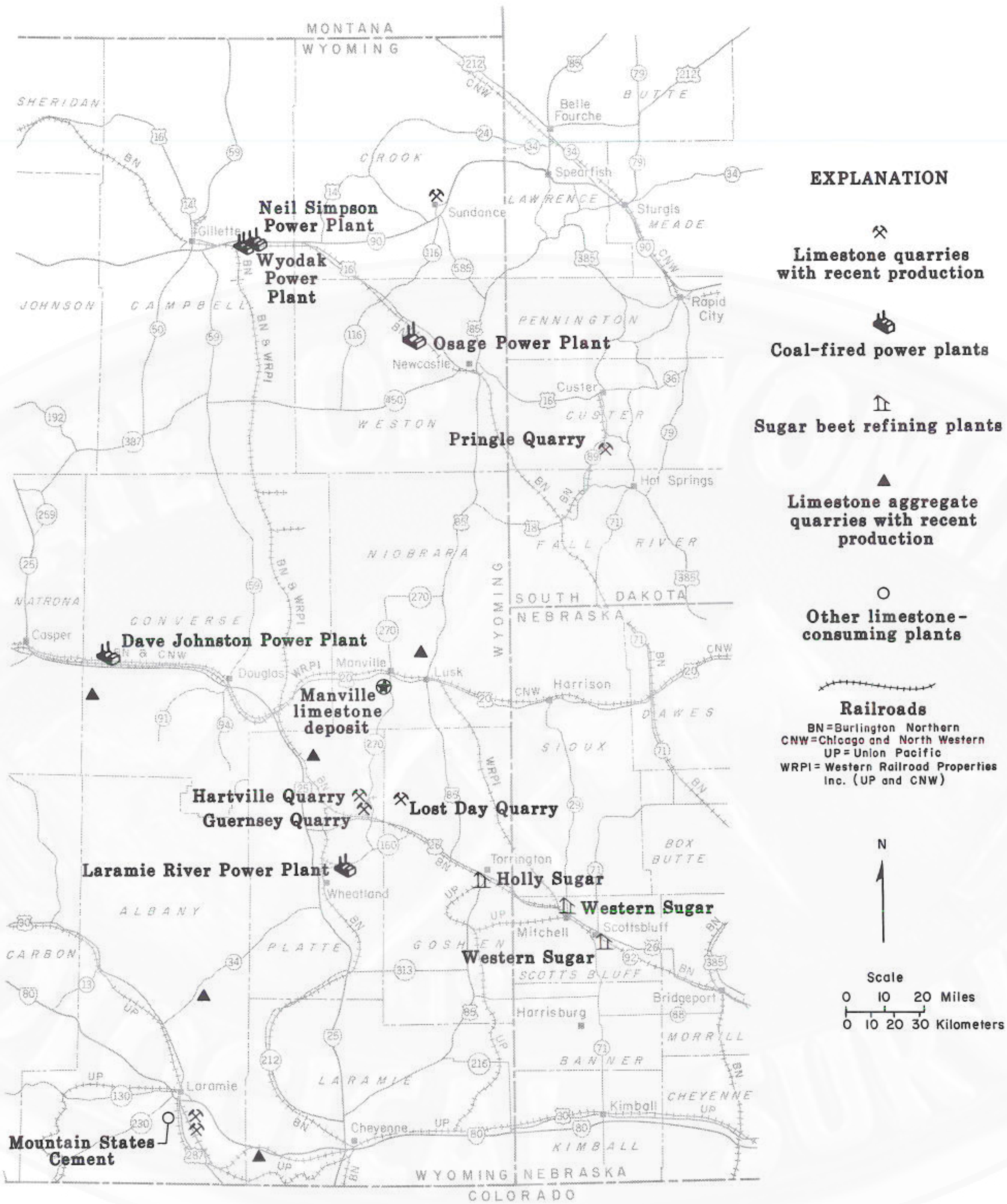


Figure 1. Regional map showing Manville limestone deposit (near center), quarries, plants that use limestone, and transportation routes.

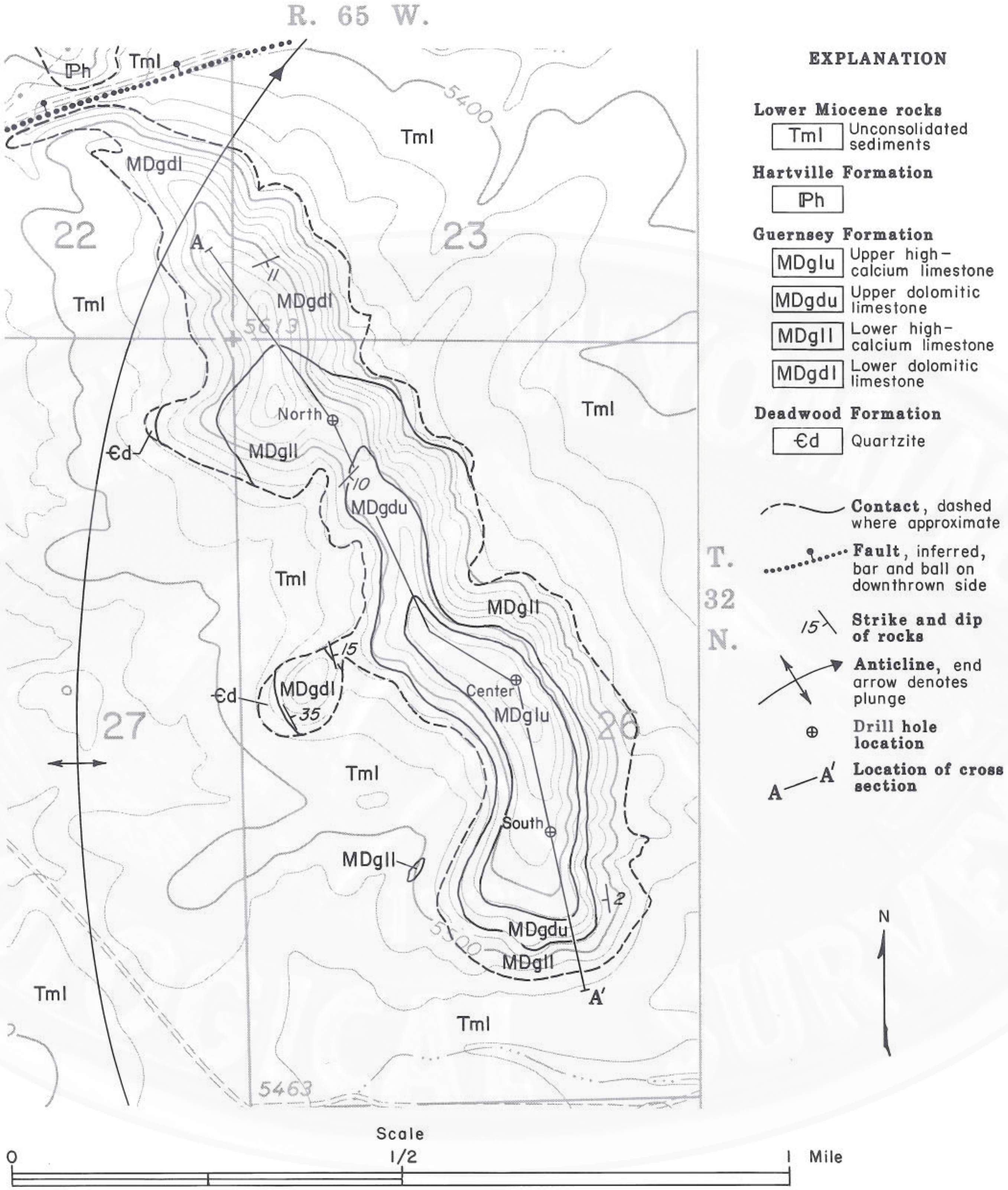


Figure 2. Geologic map of the Manville limestone deposit.

units (**Figures 2** and **3**). The lower unit is approximately 150 feet thick and consists of pinkish gray dolomitic limestone with a few thin, gray limestone beds. The lower dolomitic limestone is overlain by 65 feet of light brownish gray high-calcium limestone. This limestone is overlain by another 32 feet of purplish gray to gray dolomitic limestone, which is in turn overlain by at least 50 feet of gray to brown high-calcium limestone. Irregular areas of bleached recrystallized limestone and dolomitic limestone are present. These do not appear to be of different chemical composition than the layers in which they are found. Thin (0.5 inch or less), dark red to pink, clayey and silty layers occur at a few locations. Calcite-filled or open vugs up to two inches across are present in all units but appear to be more common in the lower dolomite. The top of the unit is not exposed. In NE1/4SE1/4 sec. 22, T.32N., R.65W., a fault with normal movement down to the north displaces the section, so that Pennsylvanian Hartville Formation sediments are exposed on the hills north of the fault. Only small isolated exposures of the Guernsey Formation are found elsewhere in Niobrara County (Denson and Botinelly, 1949).

The base of the Guernsey Formation is exposed in SW1/4SW1/4SW1/4NW1/4 sec. 26, T.32N., R.65W. and in SW1/4NE1/4NE1/4NE1/4 sec. 27, T.32N., R.65W. resting disconformably, but with no angularity, on hard, medium-bedded, pink to maroon quartzite (**Figure 4**). This quartzite was mapped as Cambrian by Denson and Botinelly (1949) and was considered to be partly Cambrian by Love and others (1980). Since this quartzite closely resembles the upper Cambrian Deadwood Formation of the southern Black Hills, it was mapped as the Deadwood Formation for this study (**Figure 2**).

These older formations are locally covered by lower Miocene rocks (after Love and others, 1980), which surround the exposure of the Guernsey Formation and other older units in this area. Lower Miocene rocks are gray to brown unconsolidated silts and sands with local channel conglomerates or sandstones. Exposures of these sediments are poor in the area of this study, and they were not studied in detail.

Structure

The rocks exposed on the hill in Sections 22, 23, 26, and 27 T.32N., R.65W. (**Figure 2** and **center fold**) are gently folded, with dips of 1° to 2° south. North of the north drill hole, dips increase to about 10° south (**Figure 2**). The area of limestone exposure is a syncline, with dips of 2° west or less toward the center of the hill (**Figure 5**). On the west edge of the exposures, east dips increase to 35° at the top of the Deadwood Formation. A north-plunging anticline was mapped just west of the area of limestone exposure (**Figure 2**) on the basis of subsurface information reported by Denson and Botinelly (1949). This structure is buried by poorly indurated lower Miocene rocks (Love and others, 1980). Older rocks, including parts of the Deadwood Formation, may be present beneath lower Miocene rocks in that area.

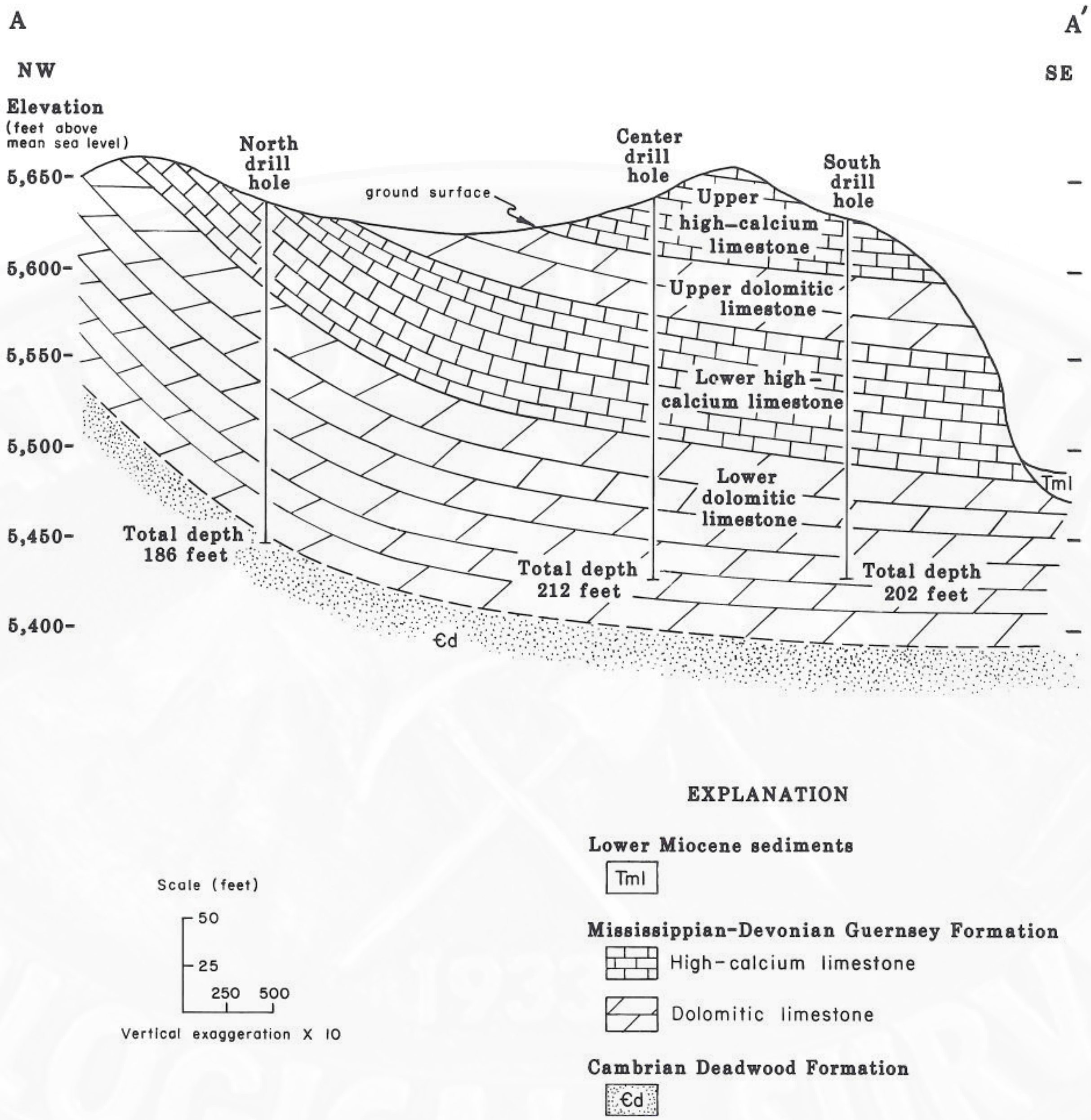


Figure 3. Northwest-southeast cross section of the Manville limestone deposit showing subsurface configuration of the limestone units as determined by drilling.

Panoramic view of Guernsey Formation exposure at the Manville locality.

Limestone and dolomitic limestone resources

Size and quality

Two thick beds of high-calcium limestone are present in the Guernsey Formation in this area, separated by a bed of dolomitic limestone (**Figure 3**).

Limestone resources in the area of this study were estimated by the author from drilled thicknesses, measured outcrop sections, and mapped area (**Figures 2 and 3**). These resources are 2,340,000 tons within the upper limestone unit and 23,372,000 tons within the lower limestone unit, for a total of 25,712,000 tons of high-calcium limestone.

Dolomitic limestone resources in the are of this study, (**Figure 3**) and outcrops (**Figure 2**), include 1,993,000 tons in the upper dolomitic limestone layer and 344,900,000 tons in the lower dolo-

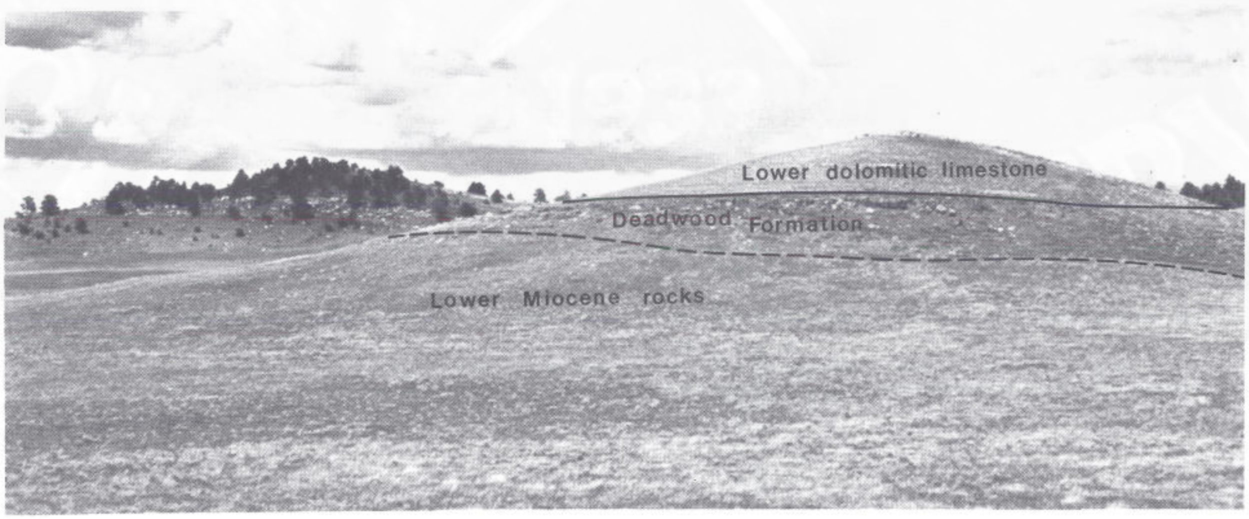


Figure 4. Contact of the lower dolomitic limestone unit of the Guernsey Formation with the underlying Deadwood quartzite. Quartzite forms a low resistant ridge along the hill slope. Lower Miocene rocks overlap the Deadwood Formation.

mitic resources limestone layer. Total resources are an estimated 346,893,000 tons of dolomitic limestone.

The upper high-calcium limestone averages 52.88 percent calcium oxide and is composed of more than 98 percent calcium carbonate. The lower high-calcium limestone averages 50 percent calcium oxide, and has a calcium carbonate content of 95 percent or more. The main impurities in the rock are dolomite (in the dolomitic layers), silica (mostly chert), and alumina (in feldspar in sandy zones or clay in clayey zones).

The upper dolomitic limestone averages 16.1 percent magnesium oxide, and the lower dolomitic limestone averages 17.8 percent magnesium oxide. Chert is more abundant in the dolomitic limestones than in the high-calcium limestones.

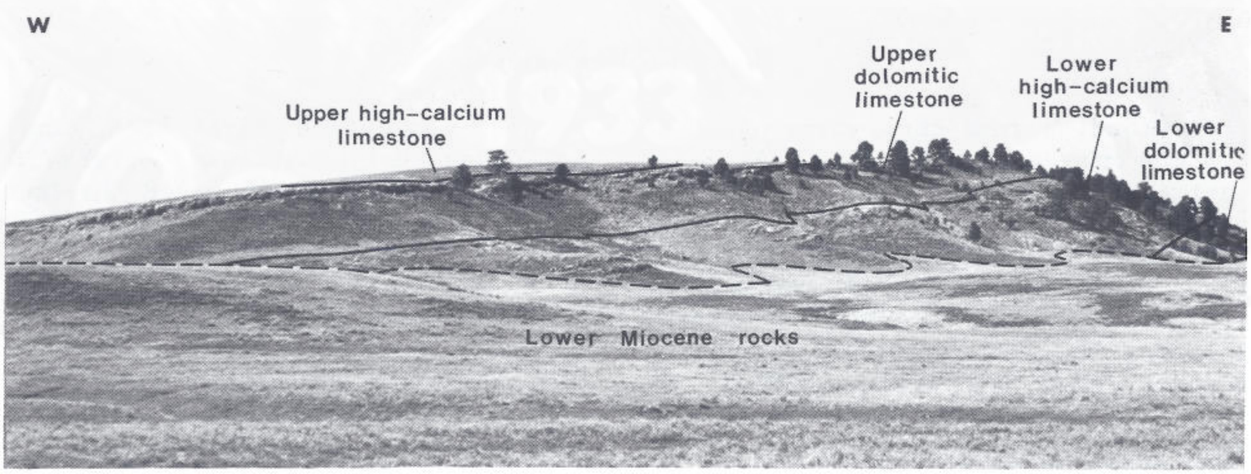


Figure 5. The Manville deposit showing westward dip of limestone beds (view looking northeast).

The most variable impurity in the high-calcium and dolomitic limestone beds is silica. This is due to the irregular distribution of chert, which occurs as replacement nodules or fracture fillings. Silica values vary in the upper limestone from less than 0.5 to 6.72 percent and in the lower limestone from 0.5 to 10.57 percent. The chert content is estimated to be about two percent in the high-calcium limestone and about three percent in the dolomitic limestone.

As seen in core, thin (0.5 inch or less) clayey or sandy beds are found in both the high-calcium limestone and the dolomitic limestone. These can be recognized in the analyses (**Tables 1 through 3**) on the basis of a higher alumina (Al_2O_3) content indicative of feldspar or clay minerals. Iron, manganese, phosphate, sodium, potassium, and titanium impurities are quite low in the entire section of carbonates.

Transportation considerations

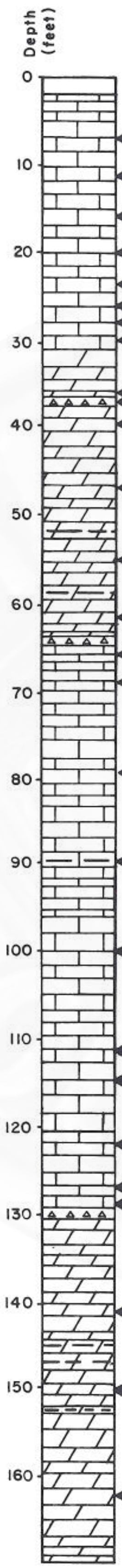
This limestone deposit is located 0.5 mile from Wyoming Highway 270, four miles south of its junction with U.S. Highway 20 at Manville (**Figure 1**). Manville is also located on the Chicago and North Western Railroad/Union Pacific Railroad combination, Western Railroad Properties, Inc. (WPRI) (**Figure 1**). The WPRI interchanges with the Burlington Northern Railroad at Orin Junction (29 miles west of Manville) with the Chicago North Western at Lusk, and with the Union Pacific Railroad at Mitchell, Nebraska (70 miles southeast of Manville). Limestone from this deposit can therefore be shipped throughout the region by rail. Short distances to highways and railroads mean this deposit may have the lowest transportation costs of any limestone within most areas of northeastern Wyoming and western Nebraska. There are other exposures of the Guernsey Formation in the area (Denson and Botinelly, 1949; Love and others, 1980); however, this exposure is the largest located close to an all-weather highway and near a railroad.

Uses of limestone

Limestone, a rock consisting primarily of the mineral calcite ($CaCO_3$), is an industrial material having a wide variety of uses. Limestone is the most common type of stone quarried in the United States, composing 75 percent of all rock products. Only Delaware, Louisiana, and New Hampshire produce no limestone (Carr and Rooney, 1983). In and near Wyoming, limestone is used as construction aggregate (especially for highway construction), as sugar rock for refining sugar, as the primary ingredient in cement, in coal-fired power plants for burn control, in the calcination of phosphatic shale for the production of phosphate fertilizer, and for emissions control in power plants. High-calcium limestone is mined in Montana and elsewhere for the production of lime.

Dolomite is a rock consisting of the mineral dolomite ($MgCO_3$). Dolomitic limestone is a limestone containing more than ten percent and less than 50 percent mineral dolomite. Dolomitic limestone is used as aggregate and in the production of magnesium lime and it is preferred for sugar rock in the eastern United States.

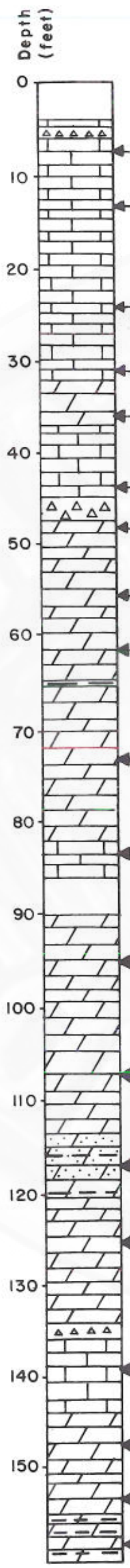
Table 1. Lithologies[1] and chemical analyses of the upper 170 feet, center drill hole, Manville area.



CaO	MgO	SiO_2	Al_2O_3	Fe_2O_3	MnO	TiO_2	K_2O	Na_2O	LOI[2]	P_2O_5	Totals
No core recovery											
53.55	0.19	4.46	0.24	0.10	0.02	<0.01	0.09	0.02	41.70	0.07	100.45
53.00	0.22	0.44	0.11	0.05	0.02	<0.01	0.05	<0.01	43.40	0.07	97.38
51.80	0.48	3.65	0.33	0.13	0.03	<0.01	0.10	0.06	41.90	<0.01	98.50
50.46	0.32	1.03	0.07	0.06	0.02	<0.01	0.06	0.01	43.00	0.06	95.10
54.18	0.37	2.39	0.65	0.25	0.01	0.02	0.21	0.04	42.40	0.07	100.59
55.93	0.25	0.71	0.18	0.05	0.02	<0.01	0.06	0.03	43.40	0.02	100.66
52.50	0.40	2.85	0.98	0.47	<0.01	0.03	0.40	<0.01	41.90	0.08	99.63
51.99	0.31	1.09	0.37	0.23	0.01	<0.01	0.19	<0.01	42.90	0.06	97.17
34.12	13.96	5.05	0.95	0.32	0.01	0.03	0.46	<0.01	43.20	0.04	98.15
24.83	12.48	19.35	5.21	2.30	0.03	0.23	1.99	0.04	34.30	0.13	100.89
33.61	16.23	4.21	0.87	0.27	0.03	0.03	0.41	0.02	44.20	0.04	99.92
32.54	17.39	2.06	0.39	0.20	0.02	0.01	0.16	0.05	45.70	0.12	98.64
29.49	18.46	5.42	1.18	0.34	0.03	0.03	0.24	0.22	43.70	0.08	99.19
26.18	16.41	14.85	0.69	0.28	0.06	0.02	0.14	0.14	39.60	0.05	98.42
49.37	3.21	1.31	0.33	0.07	0.05	<0.01	0.11	0.03	43.40	<0.01	97.90
51.14	1.29	3.30	0.21	0.04	0.02	<0.01	0.08	0.04	42.00	0.10	98.23
51.56	0.73	2.99	0.65	0.15	0.02	0.02	0.12	0.14	41.90	0.05	98.33
47.27	0.63	8.64	1.72	0.47	0.02	0.06	0.23	0.38	38.30	0.05	97.77
51.05	0.39	5.28	0.85	0.21	0.02	0.02	0.14	0.19	40.60	0.06	98.81
53.17	0.27	4.66	0.67	0.14	<0.01	0.02	0.12	0.15	41.20	0.05	100.46
46.72	5.05	3.65	0.63	0.14	0.04	0.01	0.12	0.15	42.60	0.08	99.19
54.40	0.34	0.50	0.16	0.02	<0.01	<0.01	0.07	0.02	43.10	0.08	98.71
52.97	1.41	0.27	0.12	0.01	<0.01	<0.01	0.07	0.02	43.40	0.05	98.34
45.93	6.13	2.90	0.06	0.04	0.04	<0.01	0.05	0.02	43.50	0.03	98.71
29.99	19.36	2.02	0.43	0.20	<0.01	0.02	0.19	0.02	48.40	0.03	100.67
29.90	19.83	1.22	0.33	0.19	<0.01	0.01	0.15	0.03	48.90	0.07	100.64
32.02	20.15	0.34	0.13	0.10	0.04	<0.01	0.09	0.02	46.50	0.07	99.47

[1] See explanation of lithology symbols, **Table 3.** [2] Loss on ignition.

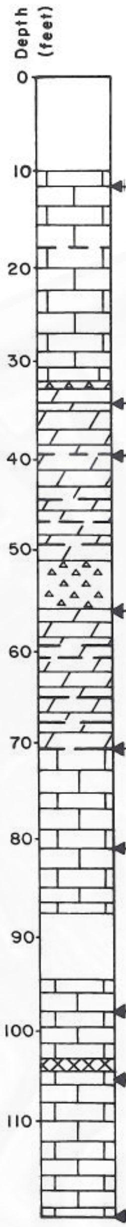
Table 2. Lithologies[1] and chemical analysis of rocks in the north drill hole, Manville area.



CaO	MgO	SiO_2	Al_2O_3	Fe_2O_3	MnO	TiO_2	K_2O	Na_2O	LOI[2]	P_2O_5	Totals
No core recovery											
53.09	2.14	<0.16	0.10	0.03	<0.01	<0.01	0.11	<0.01	43.50	0.07	99.23
53.42	0.43	0.01	0.04	<0.01	<0.01	<0.01	0.06	<0.01	43.60	0.02	97.62
53.18	1.08	1.17	0.25	0.04	<0.01	<0.01	0.08	0.05	42.80	0.04	98.71
49.48	3.68	2.40	0.46	0.10	0.02	<0.01	0.09	0.10	42.70	0.02	99.06
32.71	18.62	1.61	0.41	0.14	0.06	0.01	0.10	0.08	45.60	0.10	99.44
55.48	0.43	0.99	0.30	0.07	<0.01	<0.01	0.08	0.05	42.70	0.02	100.14
40.38	10.37	5.28	0.07	0.04	0.05	<0.01	0.05	0.05	42.90	0.06	99.26
28.51	17.10	10.68	0.44	0.14	<0.01	0.02	0.12	0.06	41.40	0.06	98.54
30.88	18.88	1.31	0.37	0.14	<0.01	0.01	0.13	0.03	45.70	0.05	97.51
31.56	20.48	<0.01	0.14	0.08	<0.01	<0.01	0.09	0.02	46.80	0.06	99.26
55.95	0.39	<0.01	0.08	0.05	<0.01	<0.01	0.05	0.02	43.80	0.01	100.38
No core recovery											
32.80	18.49	0.10	0.10	0.10	0.03	<0.01	0.07	0.02	46.20	0.04	97.96
27.93	18.69	6.52	0.61	0.30	0.01	0.02	0.34	0.03	43.30	0.04	97.79
28.86	15.15	11.41	3.34	1.21	0.02	0.16	1.68	0.07	39.20	0.01	101.11
30.20	18.71	5.28	0.66	0.18	0.02	0.03	0.51	0.05	43.90	0.05	99.59
54.28	0.66	2.74	0.41	0.09	0.02	0.02	0.31	0.02	42.10	0.01	100.66
27.05	15.39	18.78	0.82	0.26	0.03	0.03	0.66	0.04	37.30	0.05	100.41
29.31	18.02	9.41	0.94	0.25	0.03	0.04	0.85	0.04	41.80	0.04	100.73
30.87	18.16	6.24	0.32	0.16	0.03	0.01	0.27	0.04	43.40	0.03	99.53

[1] See explanation of lithology symbols, **Table 3.** [2] Loss on ignition.

Table 3. Lithologies[1] and chemical analyses of rocks in the south drill holes, Manville area.



CaO	MgO	SiO_2	Al_2O_3	Fe_2O_3	MnO	TiO_2	K_2O	Na_2O	LOI[2]	P_2O_5	Totals
No core recovery											
52.55	0.53	6.72	0.14	0.03	0.01	0.01	0.12	0.01	40.20	0.01	100.33
32.78	16.27	5.70	0.98	0.32	0.05	0.03	0.28	0.19	42.80	0.02	99.42
31.81	14.68	9.51	1.79	0.60	0.03	0.06	0.29	0.48	40.20	0.05	99.50
30.80	17.10	7.37	1.43	0.44	0.03	0.04	0.33	0.33	41.90	0.07	99.84
29.91	15.16	8.86	1.86	0.51	0.04	0.07	0.38	0.48	40.60	0.04	97.91
47.21	2.01	8.07	0.94	0.24	0.02	0.03	0.23	0.24	39.60	0.05	98.64
No core recovery											
52.52	0.57	6.32	0.49	0.12	0.01	0.02	0.18	0.12	40.40	0.01	100.76
47.30	1.32	10.57	0.87	0.22	0.02	0.03	0.22	0.22	38.40	0.03	99.20
49.48	15.62	7.00	1.18	0.27	0.04	0.04	0.27	0.33	48.20	0.05	122.48

[1] Explanation of lithology symbols.

- Limestone
- Dolomitic limestone
- Clay bed
- Bedded chert
- Breccia
- ← Sampled interval

[2] Loss on ignition

Potential uses for the limestone and dolomitic limestone in the Manville deposit

Suitability for sugar rock

The Manville deposit's high-calcium limestone beds may meet or exceed requirements for limestone used in the sugar beet refining process (**Table 4**). Although the average silica content in the Manville deposit exceeds one percent, silica may be partially removed during crushing and screening. In 1981 and 1982, Holly Sugar Company used a relatively sandy limestone in the Guernsey Formation from the Lost Day Quarry north of Fort Laramie at its Torrington Plant (**Figure 1**). Grindability and decrepitation tests have not been performed on the Manville rock.

Exposures of the Guernsey Formation, some of which are of similar quality to the Manville deposit, are also found near Guernsey and Fort Laramie, Wyoming. These exposures are closer to the existing sugar beet refining plants at Torrington, Wyoming (Holly Sugar Company) and Mitchell, Scottsbluff, and Bridgeport, Nebraska (Western Sugar Company). However, all of the exposures of the Guernsey Formation including the Manville deposit are closer to the plants than Pringle, South Dakota, the location of the sugar rock used by all of the plants in 1986.

In 1987, Western Sugar contracted for sugar rock from an existing quarry at Warren, Montana, north of Lovell, Wyoming. Low rail transportation rates make the use of this rock possible, and suggest an important consideration in the marketing of the Manville deposit, which could supply sugar beet refineries throughout Wyoming, southern Montana, western Nebraska and South Dakota, and Colorado if rail transportation costs can be kept low.

Table 4. Chemical specifications for sugar rock (personal commmunication, Western Sugar Company, 1986).

Calcium carbonate	95 percent by weight or greater
Silica	1 percent by weight or less
Magnesium carbonate	5 percent by weight or less

Suitability for rock used for power–plant burn control

Limestone used to provide even burning and emissions control for coal-fired power plants must meet certain specifications (**Table 5**). With the possible exception of silica content, which may be partially reduced during crushing and screening, the high-calcium limestone of the Manville deposit meets these specifications. Limestone is now being produced from the Guernsey Formation near the Lost Day quarry north of Fort Laramie for Missouri Basin Electric's Laramie River power plant northeast of Wheatland (**Figure 1**). Although the Manville deposit is not the closest limestone to any existing power plant, the plant near Gillette, Wyoming; the Dave Johnston plant at Glenrock, Wyoming; and the Laramie River plant (**Figure 1**) are close. The Wyodak and Neil Simpson plants near Gillette, Wyoming (**Figure 1**) are also possible markets for limestone from the Manville deposit. Since larger deposits can be mined at lower costs per ton, the Manville location may be less expensive to mine than closer sources.

Table 5. Specifications for rock used for power plant burn control (personal communication, Missouri Basin Electric Company, 1987).

Calcium carbonate	94 percent by weight, minimum
Chert	0.5 percent by weight, maximum
Grindability index	12 kilowatt-hours per short ton, maximum
Size	less than 0.75 inch, no more than 10 percent fines passing 0.25-inch sieve

Suitability for construction aggregate

Both the high-calcium limestone and the dolomitic limestone of the Manville deposit may meet construction aggregate specifications. Although no tests have been performed on this deposit, carbonate rocks from the Guernsey Formation have been quarried, crushed, and screened for aggregate at two nearby locations. If this deposit is being quarried for other uses, it may be economical to process the dolomitic limestone found between the high-calcium limestone layers for construction aggregate.

Aggregates are usually produced on a job-by-job basis. However, developers of the Manville deposit might increase market opportunities for their rock by establishing crushed and sized limestone aggregate stockpiles in areas of the Powder River Basin and in western Nebraska where rocks suitable for aggregate are not found. The overall cost of aggregate used from these stockpiles would be competitive since a large volume of rock from the Manville deposit could be processed and shipped to the stockpiles at lower cost than smaller shipments of rock from quarries opened for individual contracts. Such stockpiles could be owned by the operator of the Manville quarry or sold to other operators. The highway departments of Wyoming and Nebraska may want to establish such stockpiles for anticipated road construction and maintenance projects.

Suitability for the production of lime

Lime (CaO) is a chemical produced from limestone. It is also known as quicklime, calcium oxide, or calcia. Magnesium lime ($CaO \cdot MgO$) is produced from dolomitic limestones. Lime and magnesium lime are used in a wide variety of industries, including steel production; metal refining; water treatment; emissions control; manufacturing of chemicals such as bleaches, pesticides, and paper-treating chemicals; and manufacturing of organic products such as stearates, glucose, and dyes from petroleum. They are also used in construction products such as hydraulic cement, sand-lime bricks, concrete blocks, insulation, and masonry; as an additive in paving materials; in glass manufacturing; in sugar refining; in paint and pigment manufacturing; as an adsorbent in produce storage; etc. (Boynton and Gutschick, 1983).

Limestone and dolomitic limestone are burned in kilns to drive off carbon dioxide to produce lime or magnesium lime. The reaction to produce lime is $CaCO_3$ (limestone) --> CaO (lime) + CO_2 (carbon dioxide). High-calcium limestones are necessary for the efficient production of lime. Specifications vary for limestones used to make lime and magnesium lime depending upon the intended use of the lime. Usually, limestones containing less than three percent noncarbonate impurities are necessary (Boynton and Gutschick, 1983). The high-calcium limestones of the Manville deposit meet or exceed this limit in most samples taken from the drill hole cores (**Tables 1** through **3**). Limited benefication may be necessary to remove chert.

Lime production in the United States is concentrated in the industrial states of Ohio, Pennsylvania, Missouri, Kentucky, Alabama, and Texas (Pressler, 1986). In 1985, about 15,800,000 short tons of lime were produced in the United States. The average price of lime has remained fairly steady, near $50.50 per short ton, over the past three years. No lime is produced in Wyoming at the present time. Abandoned lime kilns, located two miles south of the Manville deposit, (**Figure 6**) were used to produce lime over eighty years ago. Continental Lime Company operates a calcining plant at Winston, Montana, east of Helena and ships lime west to Washington and Oregon and east to Minnesota. Lime supplies for the central and southern Rocky Mountains and Great Plains come from Texas, Missouri, or other areas. A study of lime consumption in the Colorado Front Range and Salt Lake valley areas, or in all of Colorado, Wyoming, Nebraska, Utah, and adjacent areas is needed to estimate the regional needs for a lime supply. If the demand for lime in this area is large enough to make lime production in the region economically viable, the Manville deposit, situated close to transportation, may be a good source of high-calcium limestone and dolomitic limestone used to produce lime and magnesium lime.

Figure 6. Abandoned lime kiln near Manville.

Suitability for other uses

Limestone is also used in a wide variety of products, including glass, refractories, fillers, abrasives, fertilizer, and dimension stone (Carr and Rooney, 1983). The production of limestone from this deposit for uses other than the main ones listed above should be studied.

Uses for the underlying quartzite

The quartzite that is found beneath the lower dolomite unit may also be useful as aggregate, especially for railroad ballast. Although this unit has not been tested for suitability for ballast, a similar Pennsylvanian quartzite near Hartville was found to be suitable for ballast, according to Burlington Northern Railroad specifications (H.E. Reed, personal communication, 1984). The Precambrian Sioux Quartzite in eastern South Dakota has been extensively used for ballast. Since the Manville deposit is near the Chicago and North Western Railroad, it may be more economical for the Chicago and North Western than present ballast sources. Quartzite is probably much more durable than the clinker (baked and fused rock) used as ballast on the coal lines in the Powder River Basin. If the overlying carbonate units are removed, the quartzite will be exposed on the quarry floor and can be mined with no overburden removal. The thickness of the quartzite and its durability need to be determined.

Summary

The limestone deposit south of Manville is a potential source of limestone for existing sugar beet processing and power generating plants, and for construction aggregate. It is also a possible source of limestone for future development, particularly for the production of lime. The underlying quartzite may be suitable for aggregate. An economic feasibility study could investigate these and other possibilities.

An ideal development scheme for the Manville property would include production of the high-calcium limestones for lime, sugar rock, power rock, or other uses, with the coproduction of the dolomitic limestone for aggregate or other uses. The quartzite could be quarried at the same time or reserved for later development. In this way, a quarrying operation could produce rock for all uses without the added cost of removing and stockpiling waste rock or rock scheduled for later use. The development of a large operation requires committed production, consisting of long-term contracts for a calcining plant, aggregates, etc. The larger the quarrying operation, the less expensively limestone can be produced. Since this deposit is close to highways and a railroad, transportation costs can be kept low.

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