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High-Carbonate, Low-Silica, High-Calcium Stone in the High Bridge Group (Upper Ordovician), Mason County, North-Central Kentucky

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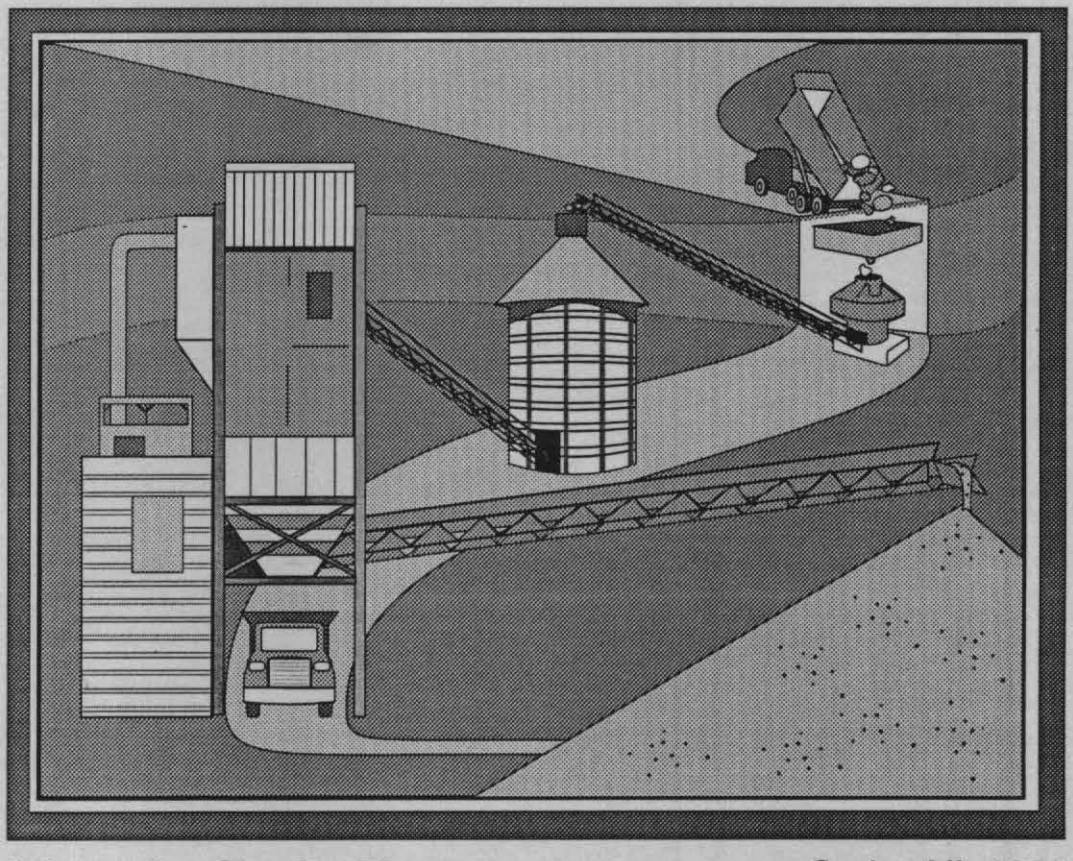

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HIGH-CARBONATE, LOW-SILICA, HIGH-CALCIUM STONE IN THE HIGH BRIDGE GROUP (UPPER ORDOVICIAN), MASON COUNTY, NORTH-CENTRAL KENTUCKY

Warren H. Anderson
and
Lance S. Barron

ABSTRACT

The High Bridge Group (Middle Ordovician) of northeastern Kentucky is a major source of limestone and dolomite for construction, agricultural, and industrial stone. These industries require carbonate rocks of high chemical purity. Chemical analyses of foot-by-foot samples from a Mason County core show that three zones of high-calcium and several thick zones of high-carbonate and low-silica stone are present in the High Bridge at a mineable depth. Mason County is located in northeastern Kentucky, on the Ohio River, and offers river access to transportation to the metropolitan Covington–Cincinnati market and the northern portion of the Eastern Kentucky Coal Field for mine-related markets.

INTRODUCTION

The Kentucky Geological Survey is conducting a regional study of the High Bridge Group (Upper Ordovician) to determine its chemical characteristics and to outline the occurrence of deposits suitable for industrial uses requiring carbonate rocks of high chemical purity. This is the third publication in a series of reports on the chemical characteristics of High Bridge carbonate rocks; analyses of foot-by-foot samples from Boone and Fayette County cores were previously published (Dever, 1974, 1981).

This report presents the chemical analyses of foot-by-foot samples of the High Bridge section from a core taken in Mason County. The core contains three zones of high-calcium and several thick zones of high-carbonate and low-silica stone.

The High Bridge Group (Middle Ordovician) is a thick (430 to 570 feet), widespread body of limestone and dolomite that is at a mineable depth beneath a large area of central and north-central Kentucky. It is being mined for construction and agricultural stone, for the production of lime for flux, and for flue-gas desulfurization (FGD). Lime is also used for rock dust, to neutralize acid mine drainage from coal mines, and in chemical industries. The High Bridge Group is being mined at two sites along the Ohio River in north-central Kentucky by the Dravo Lime Company: the Cabin Creek Mine at Springdale near Maysville in Mason County and the Black River Mine at Carntown in Pendleton County.

The Mason County core was given to the Kentucky Geological Survey by Cominco American, Inc. It is on file and available for inspection at the Survey's Well Sample and Core Repository. The interval from 474 to 1,093 feet was split and sampled for analysis. Laboratory analyses were performed under the supervision of Lance S. Barron, Kentucky Center for Energy Research Laboratory (KCERL) (now known as the University of Kentucky Center for Applied Energy Research), and Henry E. Francis, Kentucky Geological Survey (KGS), University of Kentucky. Catherine Crace (KCERL) and Mark Thompson (KGS) performed the actual laboratory analyses.

GEOGRAPHIC AND GEOLOGIC SETTING

The Cominco American core was drilled at a site in northwestern Mason County near the community of Minerva, approximately 2.5 miles east of the Mason–Bracken county line (Fig. 1). The core hole is on the east

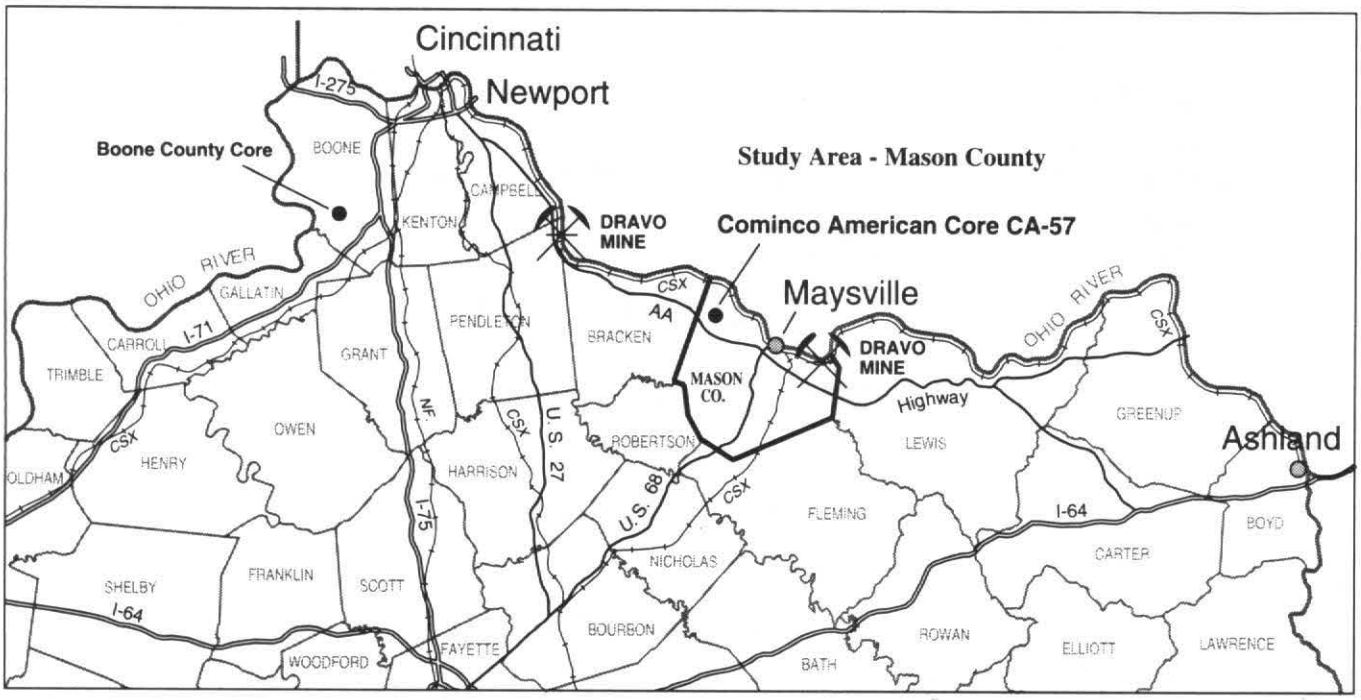

Figure 1. Generalized map of northern Kentucky showing locations of existing mine operations and Boone and Mason County cores, and major highways and railroads.

side of Kentucky Highway 435, 1.5 miles east of Minerva along an unnamed tributary of Lee Creek. The immediate area is covered by the Germantown topographic and geologic (Outerbridge, 1971) quadrangle maps, both at a scale of 1:24,000.

The core hole is located 2 miles from the Ohio River, and river access is readily available via state highways. Kentucky Highways 435 and 546 ("AA" Highway) furnish access to the network of Federal and State highways in Mason County. The county is served by the CSX System Railroad, which runs from Covington to Ashland through Maysville. The TransKentucky Transportation Inc. Railroad, a subsidiary of CSX Transportation, runs from Maysville to Paris, where it connects with additional CSX systems.

The core hole is in the Outer Blue Grass Region, near the southern extent of Pleistocene glaciation. Topography is flat to moderately rolling hills along the Ohio River. The elevation of the collar of the drill hole is 718 feet above sea level, which is about 225 feet above the Ohio River.

The site is on the eastern flank of the Cincinnati Arch (Fig. 2). Some faults occur to the east along the Lewis–Mason county line (Schilling and Peck, 1967), but no known faults exist in the vicinity of the core hole. Surface rocks in the immediate area are principally limestone and shale of the Upper Ordovician Kope Formation, Fairview Formation, and the Grant Lake Limestone (Outerbridge, 1971). Pleistocene glacial outwash occurs as sand and gravel deposits along the Ohio River.

HIGH BRIDGE GROUP

General

The High Bridge Group consists of three formations, which are, in descending order, the Tyrone Limestone, Oregon Formation, and Camp Nelson Limestone (Fig. 3). Total thickness of the High Bridge in the Mason County core is 510.5 feet, of which the Tyrone is 146.6 feet, the is Oregon is 7.4 feet, and the Camp Nelson is 357.5 feet. The Tyrone consists of micrograined limestone, and the Oregon consists of very finely crystalline dolomite. The Camp Nelson is a micrograined limestone, partly mottled with finely crystalline dolomite. The depositional environments of the Tyrone, Oregon, and upper Camp Nelson have been interpreted by Cressman and Noger (1976), Horrell (1981), Kuhnhenn and others (1981), Lazarsky (1983), and Gorman (1984).

Several thin bentonites serve as useful markers for local and regional correlation in the High Bridge. The two most prominent bentonites occur in the upper Tyrone, and their regional association has been discussed in Huff and Kolata (1990). They are the Millbrig or "Mud Cave," present locally at or near the top of the formation, and the Deicke or "Pencil Cave," present across the region, 15 to 30 feet below the top of the Tyrone (Wolcott and others, 1972). In the Mason County

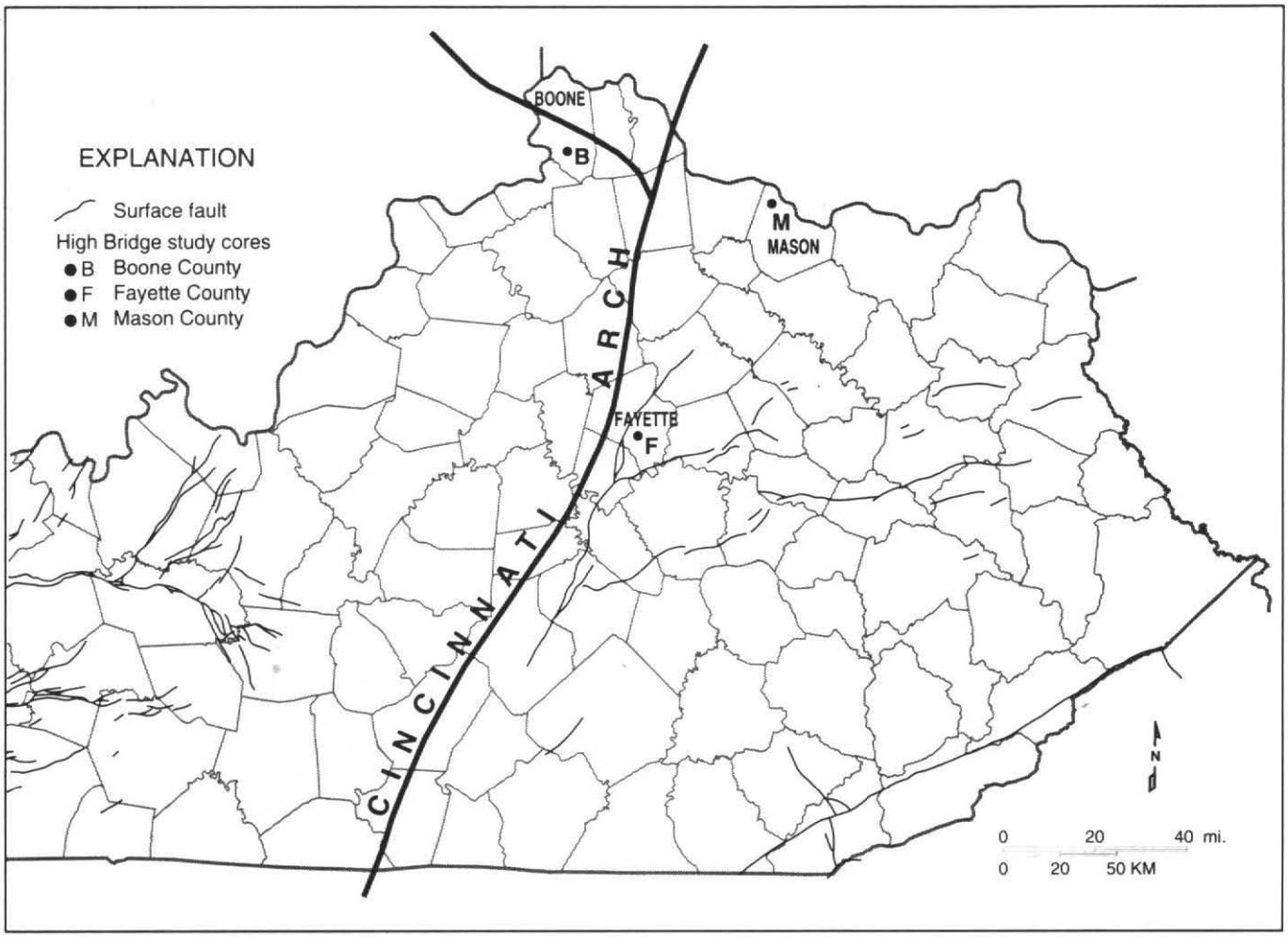

Figure 2. Structural features in central and eastern Kentucky, and their relation to the Boone, Fayette, and Mason County cores.

core, two additional thin bentonites are present, one about 51 feet above the base of the Tyrone and another about 132 feet below the top of the Camp Nelson.

The Tyrone is overlain by the Lexington Limestone, a coarse, crystalline, fossiliferous limestone. The Camp Nelson is underlain in turn by the Wells Creek Dolomite and, where present, the St. Peter Sandstone. In this core, the Wells Creek rests unconformably upon the Knox Group. The contact between the micrograined limestone of the Tyrone and the bioclastic limestone of the basal Lexington is distinct, but the contact between the Camp Nelson and Wells Creek is gradational. The lower Camp Nelson in the Mason County core is mainly limestone (in part slightly dolomitic) and shale; the Wells Creek is an interbedded dolomite and shale and the basal portion is a sandy dolomite. In this study, the contact between the Camp Nelson and Wells Creek has been placed below the lowest occurrence of micrograined limestone, a characteristic High Bridge lithology.

Potential Industrial Uses

The Federal Clean Air Act Amendments of 1990 (Public Law 101-549), also known as the Acid Rain Bill, will create a large demand for limestones and lime for reducing sulfur dioxide emissions from coal-burning power plants. Sulfur sorption techniques (Fluidized Bed Combustion [FBC] or Flue Gas Desulfurization [FGD]) generally require the use of limestone or lime, which react with the combustion coal gases. This reaction by-product is then a disposable commodity. In an FBC method, coal is burned on a bed of limestone or dolomite that is suspended or "fluidized" by an upward flow of air (Dever, 1990). As the coal burns, sulfur (SO_2) is released and reacts with the calcined limestone or dolomite and forms the by-product calcium sulfate ($CaSO_4$, gypsum). When the FGD method is used in existing plants, a hydrous lime mixture is sprayed into the flue gases to form a similar chemical reaction between sulfur and limestone (Cobb and Eble, 1992).

With an increased reliance on the use of coal to meet the energy requirements of the United States, greater quantities of stone will be needed for sulfur sorption capabilities such as fluidized bed combustion and flue-gas desulfurization. Limestone and lime are used for rock dust, spoil-bank reclamation, and acid-mine-drainage neutralization in coal mining. The High Bridge is also a source of construction and agricultural stone for the area's mixture of agricultural and expanding urban markets near Cincinnati.

Chemically pure limestone and dolomite have industrial uses such as raw material for the production of lime, portland cement, agricultural lime products, and chemical products; and flux for steel and other metallurgical industries and fillers. Specifications for many of these industrial uses require that the stone be essentially free of non-carbonate constituents such as silicon dioxide (SiO_2), aluminum oxide (Al_2O_3), iron oxide (Fe_2O_3), sulfur (S), and phosphorus (P). For certain industrial uses, magnesium carbonate ($MgCO_3$) is a deleterious constituent (Dever, 1981).

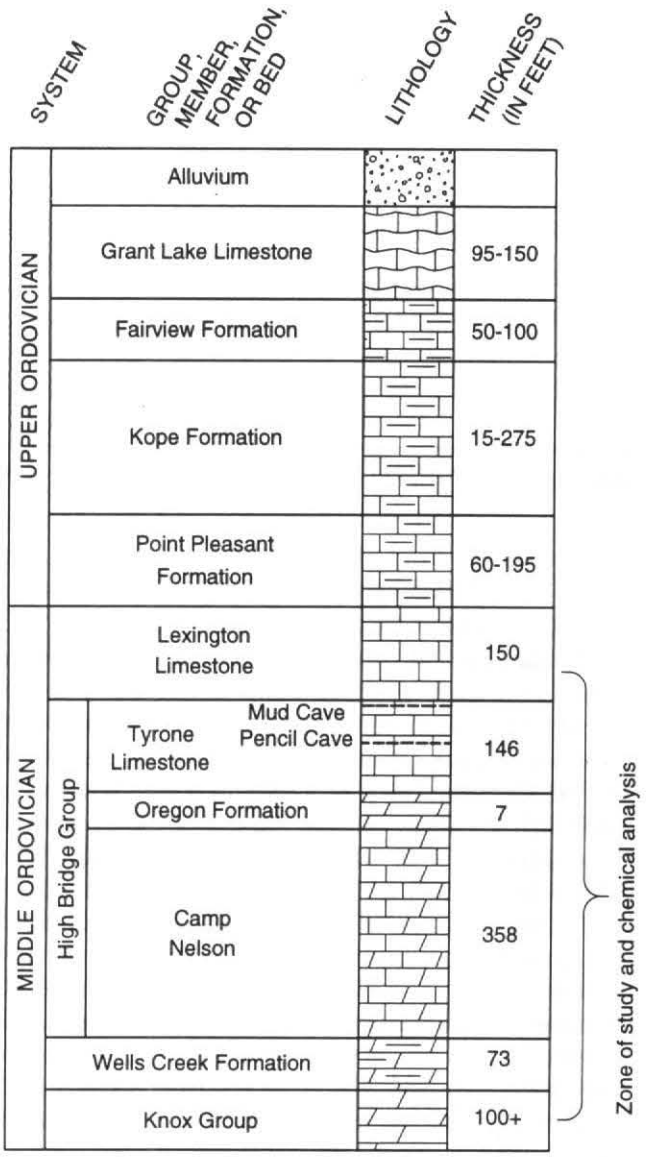

Figure 3. Generalized stratigraphic section for Mason County.

The term "high-calcium limestone" designates carbonate rocks composed of 95 percent or more calcium carbonate ($CaCO_3$). Carbonate rocks of high chemical purity are described by Dever (1974, 1981, 1990) and Dever and others (1991, 1992). These reports also provide a summary of several potential uses for high-carbonate and low-silica stone. The term "high-carbonate stone" designates carbonate rocks composed of 95 percent or more total carbonates—calcium carbonate plus magnesium carbonate ($CaCO_3 + MgCO_3$). The term "low-silica stone" designates carbonate rocks with a total (free and combined) silicon dioxide (SiO_2) content of 4 percent or less (Dever, 1981).

DISCUSSION OF ANALYTICAL DATA

In the Mason County core, a 10-foot-thick zone of high-calcium limestone occurs in the Tyrone, between the Mud Cave and Pencil Cave bentonites (Fig. 4). A thicker zone of high-calcium limestone can be obtained when averaged over an 18-foot interval (Table 1). This 18-foot-thick zone is not present in the Boone County core (Dever, 1974) and may be restricted to northeastern Kentucky. This zone could be worthy of exploration for high-calcium stone since it has a depth of approximately 500 feet, although the magnesium and silica contents (Table 1 and Appendix A) may restrict its use as a source of lime (John Ames, oral communication). Additional zones of high-calcium limestone in the core are only 1 to 2 feet thick and occur in the Camp Nelson. Several zones of high-carbonate stone, 12 to 61 feet thick, are present in the Mason County core (Fig. 4, Table 1, Appendix A); the zones are in the Camp Nelson and show a close correlation with the stratigraphic position of the high-carbonate zones of the Camp Nelson in the Boone County core, 50 miles to the northwest (Fig. 2).

The High Bridge is being mined at two sites on the Ohio River in north-central Kentucky for the production of lime. The Dravo Lime Company's Cabin Creek Mine in Mason County is producing a low-magnesium lime (MgO) for stack-gas scrubbing (Mining Engineering, 1977). The Cabin Creek Mine also produces limestone for FBC. Dravo's Black River Mine at Carntown in Pendleton County produces a high-calcium quicklime for FGD, steel-furnace flux, and chemical industries, and a hydrated lime for chemical industries and

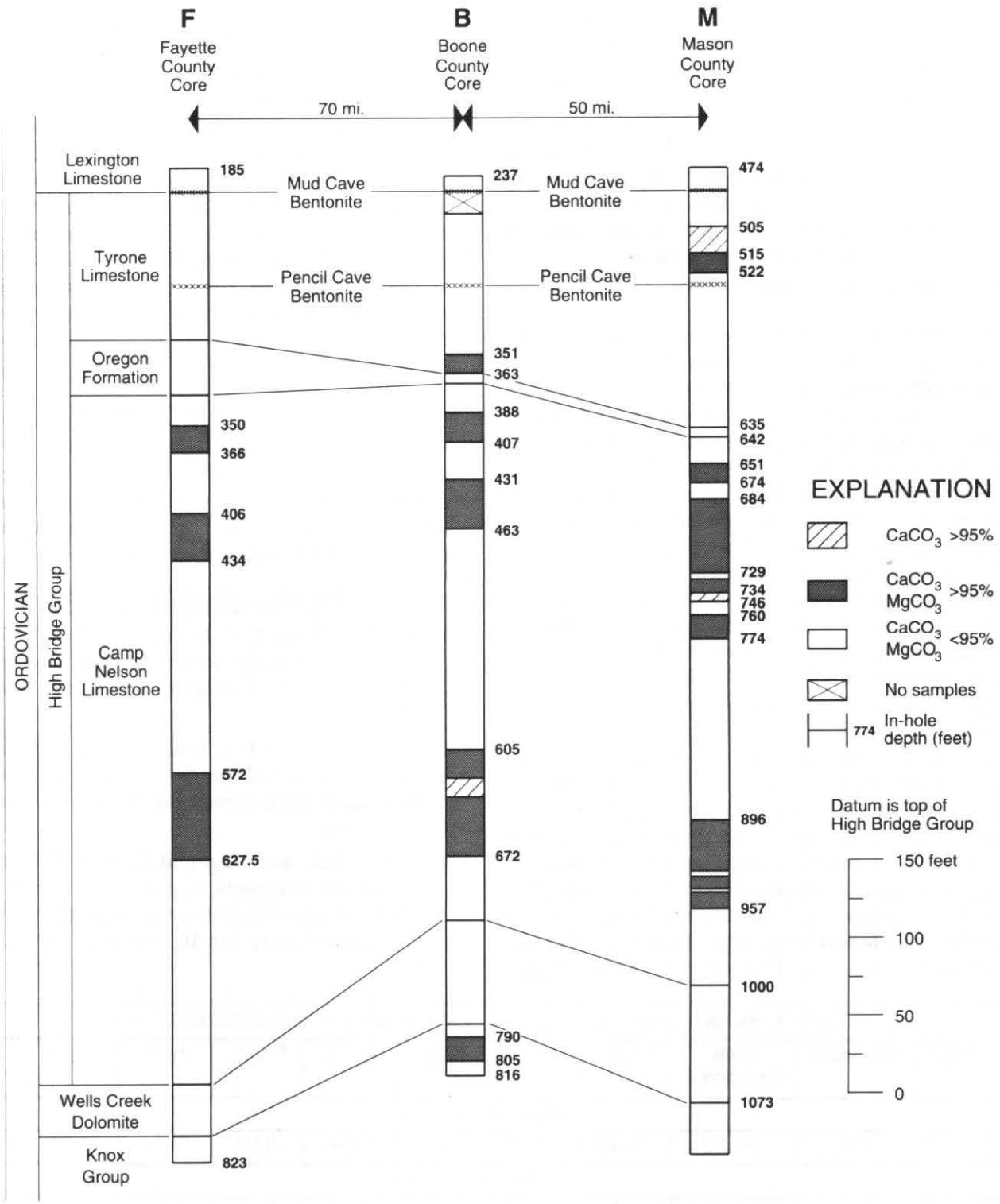

Figure 4. Zones of high-carbonate and high-calcium stone, and stratigraphy of analyzed sections in cores from Fayette, Boone, and Mason Counties. Section from Fayette County to Boone County is along the Cincinnati Arch, and section from Boone County to Mason County is across the arch and into the Appalachian Basin. Modified from Dever (1981).

water treatment (John Ames, oral communication). Limestone from the Pendleton County mine also is marketed for the production of rock dust for coal mines (Dever, 1981).

Most of the limestone in the Camp Nelson appears suitable for construction stone. A zone of argillaceous limestone and shale in the uppermost Camp Nelson of central Kentucky is not present in the Mason County or Boone County cores, correlative with the approximate interval from 670 to 690 feet in the Cominco American core (Appendix A). Rock in this zone in central Kentucky does not meet specifications for construction stone.

Limestone and dolomite samples from Kentucky have been tested in an atmospheric fluidized bed combustion pilot plant at the Kentucky Center for Energy Research Laboratory (now University of Kentucky Center for Applied Energy Research) (Barron and others, 1991). One of the samples studied by Barron and others (1991) was from the Oregon Formation. Barron and others (1991) found that dolomites or calcareous dolomites such as those in the Oregon have a greater sulfur sorption capacity and calcium utilization potential than the limestones in this study. The Oregon dolomite in the study by Barron and others (1991) was obtained from stockpiles at the Vulcan Materials Central Mine, Fayette County. Dolomitic limestone from Dravo's Cabin Creek Mine is also being used in FBC (Dever, 1990).

Structure contours on the top of the Tyrone in north-central Kentucky (top of High Bridge) have been compiled by Potter (1993) in a map covering a large area of north-central Kentucky (Fig. 5). Depth to the top of the High Bridge is generally less than 800 feet along the Ohio River in northern Kentucky. Wolcott and others (1972) used a trend-surface statistical analysis to predict thickness trends in the High Bridge of central and north-central Kentucky. This information could benefit exploration for additional mine sites.

CONCLUSIONS

Thick deposits of chemically pure carbonate rock are present in the High Bridge Group in north-central Kentucky. Regional stratigraphic correlation between deposits across northern Kentucky suggests that the deposits are widespread and represent large reserves of stone for industrial use. The High Bridge of north-central Kentucky along the Ohio River has potential for the production of limestone and lime for various industrial and agricultural uses. These carbonate rocks are being used for the production of lime for flue-gas desulfurization and as sorbent stone in a fluidized-bed combustion system.

ACKNOWLEDGMENTS

Appreciation is extended to Garland R. Dever, Jr., who contributed much of the work and analytical data on limestones in Kentucky. Without his advance work, knowledge, and stimulating discussions, this publication would not have been possible.

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Table 1. Average chemical analysis of high-calcium and high-carbonate zones.

Footage	Thickness	Total Carbonate	$CaCO_3$	$MgCO_3$	SiO_2	Al_2O_3	Fe_2O_3	K_2O	Na_2O	Total
High-calcium zone										
504-522	18 ft.	97.28	95.49	1.79	1.60	0.64	0.22	0.24	0.05	100.03
High-carbonate zone										
651-674	23 ft.	96.27	91.04	5.23	1.67	0.36	0.18	0.21	0.05	98.76
684-729	46 ft.	96.41	88.47	7.94	2.23	0.25	0.17	0.13	0.07	99.26
734-746	12 ft.	97.27	91.53	5.74	1.39	0.20	0.13	0.10	0.06	99.16
760-774	14 ft.	95.68	90.44	5.24	3.17	0.54	0.34	0.41	0.19	100.33
896-957	61 ft.	96.59	84.66	11.93	1.65	0.14	0.17	0.16	0.08	98.79

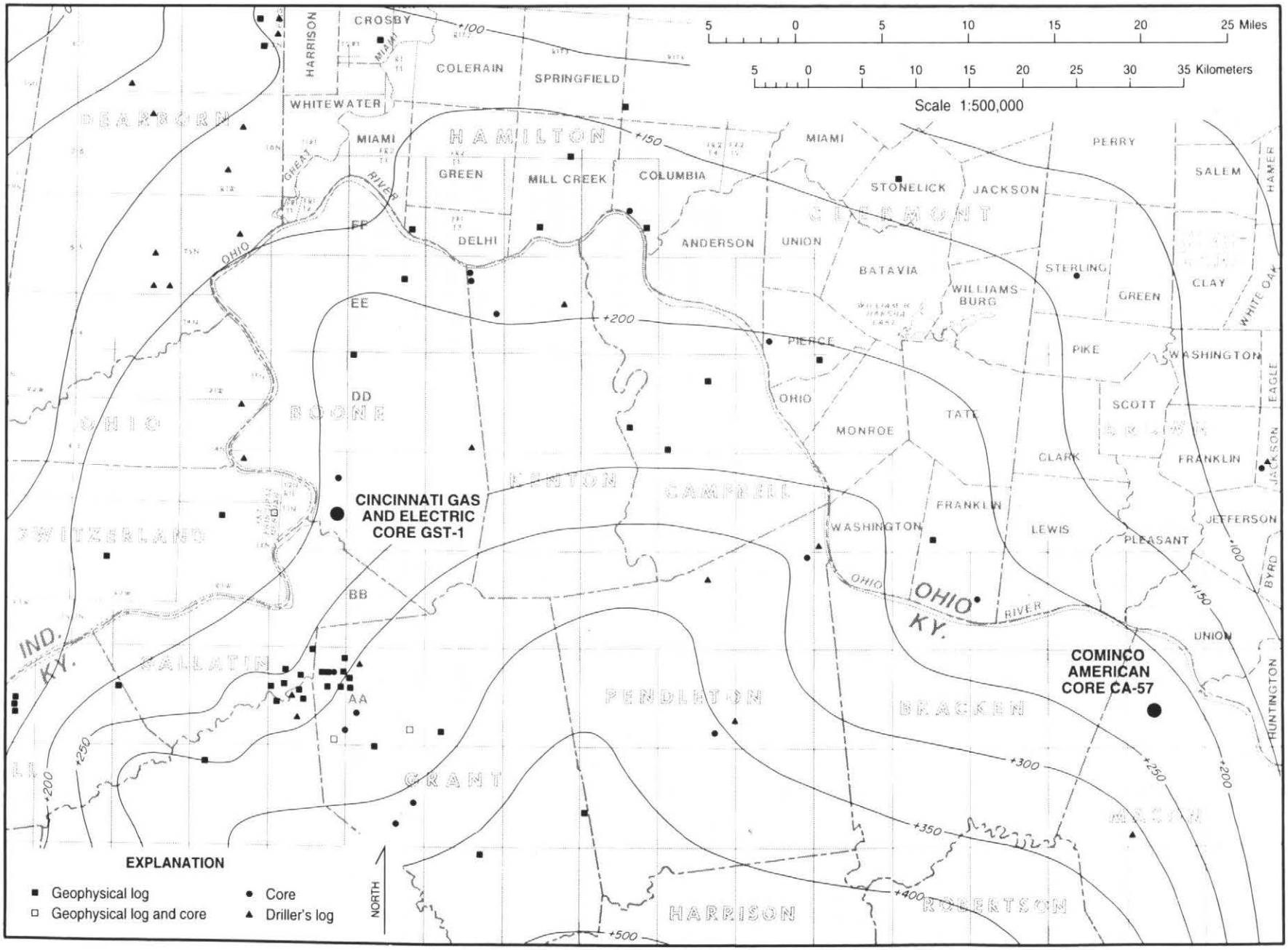

Figure 5. Structure-contour map on top of the High Bridge/Black River Groups. Modified from Potter (1993).

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APPENDIX A:
Major-Element Analyses and Lithologic Descriptions of Cominco American Inc. Core CA-57, Mason County, Kentucky

County: Mason
Operator: Cominco American Inc.
Carter Coordinate Location: sec. 14-AA-68 (Germantown Quadrangle)

Chemical Analysis							
% $CaCO_3$	% $MgCO_3$	% SiO_2	% Al_2O_3	% Fe_2O_3	% K_2O	% Na_2O	% Total
78.30	1.81	15.98	1.53	0.50	0.42	0.39	98.93
85.58	1.14	10.29	0.81	0.48	0.16	0.11	98.57
77.07	2.70	14.97	2.34	0.87	0.73	0.43	99.11
67.17	1.83	26.99	1.15	0.64	0.42	0.29	98.49
82.89	1.09	11.70	1.85	0.92	0.32	0.17	98.94
89.65	0.77	7.09	1.15	0.26	0.22	0.10	99.24
81.95	1.15	13.70	0.17	0.32	0.57	0.22	98.08
93.90	0.96	3.80	1.19	0.18	0.36	0.07	100.46
92.61	1.00	4.46	1.15	0.20	0.32	0.08	99.82
92.17	0.60	4.35	0.87	0.26	0.22	0.06	98.53
90.48	0.77	6.17	1.53	0.26	0.46	0.11	99.78
90.06	0.65	6.01	1.26	0.39	0.33	0.07	98.77
87.96	0.56	7.93	1.26	0.32	0.43	0.17	98.63
83.81	0.91	11.39	3.14	0.32	1.03	0.20	100.80
85.29	0.99	9.94	1.98	0.23	0.66	0.11	99.20
61.09	0.82	35.06	0.85	0.24	0.22	0.06	98.34
70.92	1.38	24.04	1.49	0.35	0.57	0.06	98.81
85.86	2.06	8.40	1.45	0.32	0.58	0.05	98.72
90.50	1.32	6.25	1.15	0.27	0.29	0.05	99.83
94.93	0.96	2.32	1.21	0.12	0.40	0.05	99.99
94.80	0.91	1.80	0.83	0.22	0.16	0.04	98.76
93.60	1.47	2.68	1.00	0.20	0.20	0.04	99.19
94.24	0.95	2.41	1.20	0.28	0.23	0.05	99.36
95.08	0.63	2.43	1.13	0.25	0.20	0.07	99.79
92.32	1.01	3.55	1.79	0.37	0.40	0.09	99.53
93.95	0.74	2.13	1.44	0.23	0.18	0.05	98.72
87.20	1.86	6.52	3.20	0.81	0.68	0.09	100.36
90.01	1.72	4.31	2.55	0.52	0.47	0.07	99.65
89.64	1.72	4.27	2.09	0.72	0.47	0.07	98.98
88.10	1.90	5.35	2.54	0.70	0.68	0.11	99.38
93.44	1.29	2.16	0.68	0.39	0.35	0.05	98.36
97.97	0.34	0.73	0.30	0.06	0.06	0.06	99.52
98.07	0.73	0.72	0.48	0.09	0.16	0.04	100.29
98.11	0.70	0.41	0.39	0.25	0.09	0.03	99.98
97.75	0.74	0.28	0.45	0.11	0.08	0.03	99.44
97.00	1.40	0.83	0.42	0.07	0.08	0.03	99.83
96.55	1.85	0.98	0.43	0.09	0.08	0.03	100.01
96.01	2.08	1.43	0.60	0.13	0.19	0.03	100.47
96.17	2.01	1.39	0.66	0.10	0.22	0.03	100.58
96.99	1.55	1.37	0.53	0.11	0.15	0.03	100.73
96.80	0.86	1.76	0.85	0.13	0.38	0.03	100.81
94.57	2.90	1.87	0.76	0.50	0.28	0.04	100.92
91.40	2.91	3.19	1.19	0.39	0.53	0.05	99.66
92.80	2.62	3.15	1.20	0.36	0.50	0.12	100.75
92.41	2.71	2.51	0.68	0.27	0.30	0.06	98.94
94.40	2.09	1.69	0.43	0.17	0.17	0.04	98.99
96.39	1.90	1.39	0.38	0.14	0.14	0.04	100.38
92.01	3.50	3.01	1.04	0.67	0.55	0.07	100.85
85.90	3.56	6.73	2.14	0.82	0.70	0.09	99.94
86.93	3.22	5.54	1.78	0.67	0.68	0.07	98.89
88.62	1.57	6.27	1.60	0.35	0.87	0.07	99.35
97.42	1.27	1.34	0.51	0.16	0.20	0.03	100.93

Sampled and Described By: Warren H. Anderson and Lance S. Barron
Analyzed By: Kentucky Center for Energy Research Laboratory and Kentucky Geological Survey
Date Sampled: August 10-11, 1993

Description		
Footage (feet)	*Thickness (feet)*	*Formation and Lithology*
474.4-489.4	15	**Lexington Limestone** Limestone, light- to medium- to light-olive-gray, moderately to coarsely crystalline; becomes finely to moderately crystalline in lower 6 ft.; scattered bioskeletal debris; some shale and argillaceous partings; blue porcelaneous chert at 475.4 ft.; blue porcelaneous chert with relict bioclastic texture in basal 0.6 ft.
		High Bridge Group
		Tyrone Limestone
489.4-490.4	1	**Mud Cave** Bentonite; green shale with biotite flakes.
490.4-499.7	9	Limestone, light-gray; becomes light-olive-gray in lower part; micrograined; in part moderately crystalline; floating bioskeletal debris, pellets, shell fragments, bryozoans, trilobites, scattered shale partings; stylolites.
499.7-504.6	5	Limestone, light-olive-gray to yellowish-gray; in part medium-gray; micrograined, in part with birdseye calcite; bioclastic calcilutite from 500 to 501.1 ft.; mottled with medium-gray and light-olive-green burrowing at 501.1 ft.
504.6-516.1	11	Limestone, yellowish-gray to light-olive-gray, with scattered medium-gray mottling; micrograined; birdseye calcite in upper 3 ft; some stylolites; in part with coarsely crystalline calcite veinlets; irides cent pyrite at 505.5 ft.; shale partings at 507.1 ft.
516.1-525.5	9	Limestone, yellowish-gray to light-olive-gray; in part brownish-gray; micrograined, with birdseye calcite; medium-gray burrows and mottling; numerous shale and argillaceous partings; greenish-gray, ar gillaceous limestone from 522.6 to 524.7 ft.
525.4-525.5	0.1	**(Pencil Cave)** Bentonite; green shale with biotite flakes.

Chemical Analysis

% $CaCO_3$	% $MgCO_3$	% SiO_2	% Al_2O_3	% Fe_2O_3	% K_2O	% Na_2O	% Total
97.00	1.21	1.75	0.30	0.12	0.10	0.03	100.51
94.16	1.65	1.56	0.38	0.37	0.11	0.04	98.27
93.66	1.95	2.25	0.54	0.36	0.16	0.04	98.96
92.02	3.75	2.67	1.02	0.39	0.22	0.05	100.12
90.01	3.85	3.04	1.17	0.38	0.25	0.05	98.75
84.77	5.80	5.56	2.03	0.68	0.55	0.06	99.45
86.56	4.46	5.77	2.04	0.72	0.50	0.09	100.14
90.20	3.56	4.53	1.62	0.55	0.42	0.06	100.94
90.25	3.50	4.46	1.66	0.55	0.40	0.06	100.88
82.10	4.01	8.22	2.73	1.00	0.64	0.10	98.80
85.50	3.47	5.98	1.96	0.71	0.51	0.08	98.21
94.00	2.50	1.80	0.60	0.21	0.10	0.03	99.24
94.03	2.25	1.64	0.57	0.20	0.10	0.03	98.82
74.90	4.45	12.00	5.11	1.39	0.87	0.16	98.88
82.25	2.65	8.50	3.50	0.90	0.64	0.12	98.56
81.40	2.85	9.01	3.75	1.07	0.74	0.13	98.95
74.71	4.02	13.56	4.09	1.65	1.00	0.19	99.22
75.69	4.15	11.90	4.53	1.37	0.85	0.17	98.66
84.45	3.85	7.50	2.40	1.00	0.65	0.10	99.95
85.09	3.12	7.00	2.08	0.79	0.58	0.10	98.76
87.82	2.73	5.41	1.72	0.75	0.51	0.09	99.03
89.95	2.10	3.97	1.32	0.56	0.20	0.07	98.17
88.75	3.30	5.20	1.66	0.77	0.50	0.08	100.26
86.41	2.79	6.75	2.04	0.84	0.62	0.09	99.54
87.34	3.34	5.41	1.60	0.67	0.50	0.12	98.98
85.00	3.46	7.20	2.00	0.84	0.70	0.15	99.35
77.40	4.89	11.60	3.70	1.36	0.86	0.17	99.98
86.65	4.20	5.60	1.74	0.72	0.58	0.10	99.59
93.57	2.69	1.43	0.40	0.26	0.12	0.05	98.52
90.45	5.27	1.80	0.55	0.33	0.23	0.06	98.69
88.20	4.53	4.06	0.85	0.49	0.45	0.07	98.65
89.98	4.39	3.21	0.42	0.30	0.28	0.07	98.65
88.99	4.54	3.66	0.60	0.31	0.33	0.07	98.50
86.83	4.80	5.09	1.42	0.73	0.51	0.11	99.49
84.30	3.99	6.95	1.96	0.67	0.57	0.12	98.56
66.45	12.40	14.86	2.66	1.64	1.12	0.19	99.32
67.90	10.57	14.00	3.98	1.57	0.94	0.19	99.15
58.61	11.98	15.99	7.74	2.00	1.63	0.21	98.16
70.18	13.50	10.50	2.00	1.35	0.70	0.22	98.45
92.07	3.57	1.60	0.36	0.18	0.23	0.07	98.08
91.93	3.65	1.66	0.60	0.20	0.24	0.06	98.34
90.97	3.60	3.06	0.68	0.25	0.39	0.06	99.01
87.14	4.31	4.80	1.18	0.54	0.48	0.08	98.53
80.60	14.40	3.56	0.89	0.44	0.35	0.08	100.32
68.90	24.77	3.00	0.38	0.86	0.32	0.07	98.30
79.45	14.50	3.12	0.56	0.43	0.35	0.08	98.49
81.02	12.80	3.25	0.62	0.44	0.37	0.08	98.58
90.14	5.11	2.25	0.36	0.17	0.11	0.04	98.18
89.66	5.19	1.91	0.44	0.86	0.20	0.04	98.30
78.49	15.00	2.78	0.76	0.48	0.43	0.07	98.01
87.49	5.10	3.87	1.45	0.49	0.62	0.08	99.10
88.80	5.25	2.76	0.94	0.44	0.50	0.06	98.75
89.40	5.20	3.50	0.99	0.40	0.60	0.07	100.16
87.84	4.76	3.60	1.08	0.43	0.73	0.06	98.50
72.97	14.39	8.50	1.83	0.72	0.90	0.09	99.40
77.28	14.57	4.46	0.94	0.47	0.57	0.06	98.35
88.25	3.85	4.65	1.14	0.42	0.58	0.07	98.96
85.20	3.03	7.79	2.08	0.52	0.97	0.06	99.65
76.60	9.50	10.00	1.75	0.63	1.32	0.09	99.89
90.70	5.66	1.99	0.34	0.17	0.22	0.02	99.10

Description

Footage (feet)	Thickness (feet)	Formation and Lithology
525.5-531.6	6	Limestone, yellowish-gray to light-olive-gray; micrograined; gray laminated and argillaceous mottling and partings; some coarsely crystalline veinlets.
531.6-539.1	8	Limestone, yellowish-gray to light-olive-gray; micrograined; in part very fine grained; mottled with shale; stylolitic; irregular bodies of light-olive-gray to greenish-gray, finely crystalline dolomite; dark shale partings from 532.1 to 537.2 ft.; brownish-gray limestone, in part with moderately crystalline calcite, in basal foot.
539.1-565.7	26	Limestone, yellowish-gray to light-olive-gray to greenish-gray, micrograined to very fine-grained, in part argillaceous, with abundant dark-gray, silty shale partings; some scattered floating bioskeletal debris, in part with yellowish-gray, micrograined limestone; 0.25-in. pyrite cube at 539.5 ft.; dolomite mottling at 543.7 ft.; birdseye texture from 554.5 to 559.9 ft.; algal laminations at 561.4 ft.; varved, argillaceous, laminated, and composed of intercalated greenish-gray shale and limestone, with some birdseye calcite in basal 5 ft.
565.7-585.6	19	Limestone, yellowish-gray to light-olive to pinkish-gray, with gray and brown coloration, some black mottling in lower part; micrograined, with birdseye calcite; in part fine-grained; argillaceous laminations; pyrite at 569.5 ft.; 0.5 ft. of shaly, argillaceous partings at 569.8 ft.; scattered shale partings; stylolites in lower 2 ft.
585.6-585.9	0.3	Bentonite; green shale with some biotite flakes and iridescent pyrite.

Chemical Analysis

% $CaCO_3$	% $MgCO_3$	% SiO_2	% Al_2O_3	% Fe_2O_3	% K_2O	% Na_2O	% Total
85.60	7.75	3.90	0.49	0.26	0.51	0.05	98.56
83.01	10.01	5.60	0.83	0.49	0.71	0.04	100.69
88.53	4.99	3.85	0.66	0.32	0.57	0.07	98.99
92.04	3.25	2.06	0.40	0.20	0.31	0.04	98.30
93.90	3.54	2.30	0.30	0.16	0.18	0.05	100.43
94.14	3.50	2.15	0.30	0.13	0.20	0.13	100.55
88.69	7.97	1.87	0.32	0.16	0.23	0.05	99.29
78.20	14.78	4.50	0.79	0.52	0.56	0.09	99.44
91.70	5.57	1.55	0.32	0.30	0.14	0.05	99.63
91.50	4.76	1.70	1.40	0.21	0.25	0.04	99.86
92.47	4.40	1.58	0.27	0.14	0.26	0.06	99.18
93.90	3.69	1.50	0.28	0.13	0.25	0.23	99.98
92.38	2.79	2.50	0.40	0.14	0.32	0.05	98.58
91.58	3.87	2.60	0.45	0.21	0.30	0.06	99.07
83.73	11.02	2.07	0.41	0.28	0.95	0.23	98.69
86.56	9.10	1.98	0.25	0.25	0.24	0.08	98.46
81.62	10.47	5.39	0.36	0.39	0.20	0.07	98.50
86.01	11.30	2.10	0.32	0.24	0.29	0.06	100.32
82.56	13.05	2.40	0.40	0.35	0.47	0.09	99.32
81.94	13.75	2.04	0.40	0.24	0.19	0.17	98.73
80.55	11.26	5.10	0.28	0.34	0.87	0.09	98.49
83.59	11.29	2.42	0.47	0.17	0.34	0.23	98.51
78.90	15.40	3.01	0.50	0.24	0.30	0.09	98.44
75.64	18.15	3.51	0.59	0.53	0.31	0.06	98.79
79.20	15.90	2.27	0.26	0.23	0.16	0.05	98.07
83.30	12.76	1.76	0.21	0.21	0.13	0.03	98.40
74.01	20.25	3.36	0.43	0.30	0.28	0.09	98.72
72.14	20.41	4.50	0.64	0.38	0.50	0.10	98.67
71.94	21.09	4.11	0.60	0.36	0.37	0.14	98.61
82.47	13.15	2.40	0.34	0.26	0.22	0.05	98.89
83.49	12.12	2.73	0.26	0.17	0.16	0.08	99.01
69.70	24.54	4.50	0.68	0.38	0.36	0.06	100.22
75.92	18.24	2.99	0.38	0.29	0.23	0.08	98.13
77.97	16.30	2.91	0.54	0.21	0.30	0.07	98.30
79.89	13.78	3.56	0.51	0.26	0.31	0.06	98.37
91.95	4.79	1.97	0.56	0.14	0.18	0.06	99.65
73.96	19.00	4.21	0.68	0.35	0.46	0.09	98.75
67.58	25.40	3.97	0.55	0.35	0.37	0.08	98.30
68.56	23.94	4.45	0.59	0.37	0.48	0.08	98.47
73.17	19.60	4.13	0.57	0.37	0.45	0.08	98.37
82.97	13.03	1.50	0.34	0.20	0.23	0.09	98.36
93.69	4.70	1.98	0.21	0.16	0.15	0.04	100.93
94.15	3.95	1.46	0.17	0.13	0.12	0.05	100.03
87.12	7.84	2.67	0.42	0.18	0.29	0.07	98.59
89.84	6.03	2.88	0.62	0.28	0.33	0.10	100.08
90.60	5.81	2.73	0.60	0.23	0.32	0.13	100.42
90.30	4.30	2.46	0.57	0.61	0.24	0.06	98.54
82.84	10.04	5.60	0.49	0.27	0.25	0.05	99.54
59.65	31.10	5.26	1.15	0.76	0.56	0.12	98.60
58.01	34.04	4.45	0.77	0.58	0.45	0.12	98.42
57.70	35.56	3.68	0.55	0.35	0.34	0.10	98.28
59.00	33.74	4.05	0.66	0.41	0.44	0.11	98.41
59.80	33.15	4.04	0.51	0.49	0.44	0.12	98.55
60.70	31.97	3.95	0.62	0.54	0.43	0.09	98.30
79.12	13.20	3.94	0.89	0.48	0.46	0.09	98.18

Description

Footage (feet)	Thickness (feet)	Formation and Lithology
585.9-597.4	11	Limestone, light-olive-gray, micrograined to fine-grained, some birdseye calcite; greenish-gray dolomite mottling in upper 0.5 ft; shale partings.
597.4-604.4	7	Limestone, yellowish-gray to olive-gray, micrograined to very finely crystalline, mottled with dark-yellowish-gray, finely crystalline dolomite and black argillaceous burrows; bioclastic calcilutite-calcarenite with brownish-gray and grayish-black mottling, stylolites from 601.2 to 603 ft.
604.4-635	31	Limestone, light-olive-gray, in part with yellowish-gray and black mottling in upper 2 ft.; micrograined to very fine-grained; in part earthy porcelaneous texture and dolomitic with black argillaceous mottling; bioclastic calcilutite from 623.2 to 624.1 ft.; dark-gray to brownish-gray bioclastic calcarenite from 633 to 634.6 ft.; shaly partings at base.
635-642.4	7	**Oregon Formation** Dolomite, pale-yellowish-brown to light-olive-gray to light-gray, with dark-gray mottling; finely crystalline; in part limy; shale partings at base.

Chemical Analysis

% $CaCO_3$	% $MgCO_3$	% SiO_2	% Al_2O_3	% Fe_2O_3	% K_2O	% Na_2O	% Total
88.15	2.70	6.38	0.64	0.15	0.17	0.04	98.23
86.89	5.00	5.10	1.17	0.58	0.51	0.11	99.36
87.70	5.60	5.01	1.06	0.58	0.50	0.09	100.54
90.78	3.26	2.76	0.59	0.30	0.26	0.10	98.05
93.01	2.46	3.09	0.93	0.55	0.38	0.08	100.50
88.52	3.61	4.15	0.81	0.54	0.40	0.09	98.12
68.80	11.00	16.02	2.49	1.45	0.79	0.18	100.73
86.91	5.01	4.01	1.73	0.90	0.70	0.15	99.41
87.09	5.60	3.11	0.93	0.86	0.41	0.08	98.08
96.09	1.71	1.05	0.19	0.11	0.13	0.03	99.31
96.45	0.82	0.80	0.11	0.10	0.08	0.06	98.42
92.57	0.94	2.86	0.81	0.12	0.66	0.08	98.04
96.99	1.20	1.58	0.30	0.11	0.24	0.04	100.46
88.44	8.13	1.81	0.42	0.05	0.24	0.04	99.13
90.20	6.25	2.05	0.40	0.08	0.26	0.05	99.29
89.93	5.40	2.00	0.36	0.06	0.25	0.04	98.04
90.03	5.27	2.00	0.40	0.28	0.26	0.05	98.29
87.99	7.05	2.09	0.43	0.26	0.26	0.05	98.13
86.06	8.80	2.30	0.50	0.30	0.28	0.05	98.29
88.88	6.90	1.80	0.50	0.36	0.27	0.12	98.83
91.83	4.30	1.75	0.30	0.25	0.17	0.07	98.67
93.12	3.15	1.81	0.15	0.13	0.11	0.05	98.52
93.18	3.45	1.72	0.47	0.26	0.20	0.07	99.35
93.30	3.60	2.31	0.79	0.42	0.35	0.07	100.84
90.98	5.70	1.25	0.23	0.15	0.13	0.04	98.48
90.85	5.75	1.00	0.19	0.12	0.10	0.04	98.05
90.70	5.92	1.66	0.45	0.22	0.21	0.04	99.20
90.10	5.40	1.78	0.47	0.21	0.19	0.04	98.19
89.77	6.48	1.30	0.21	0.14	0.12	0.04	98.06
88.20	9.05	1.00	0.17	0.15	0.10	0.05	98.72
88.69	8.31	0.95	0.19	0.13	0.10	0.06	98.43
89.66	6.75	1.50	0.34	0.18	0.23	0.07	98.73
84.96	6.67	4.26	1.00	0.50	0.57	0.17	98.13
89.22	6.63	2.13	0.42	0.23	0.17	0.04	98.84
85.45	9.14	2.78	0.59	0.29	0.26	0.10	98.61
86.91	7.79	2.68	0.57	0.35	0.25	0.11	98.66
79.70	13.18	4.14	0.91	0.46	0.40	0.13	98.92
82.02	12.04	2.95	0.46	0.28	0.24	0.06	98.05
84.11	11.90	2.15	0.30	0.17	0.16	0.06	98.85
82.90	11.87	3.39	0.77	0.38	0.36	0.11	99.78
80.50	10.77	5.71	1.00	0.14	0.40	0.09	98.61
80.70	11.00	4.88	0.85	0.43	0.36	0.09	98.31

Description

Footage (feet)	*Thickness (feet)*	*Formation and Lithology*
642.4-666.7	24	**Camp Nelson Limestone** Limestone, light-olive-gray to pale-yellowish-brown, with dark-gray mottling, micrograined, with birds-eyes and veinlets of calcite; mottled with irregular bodies of greenish-gray, finely crystalline dolo mite, in part medium-light-gray calcarenite from 663 to 666.7 ft.; white agate chert at 664.4 ft.; stylolites.
666.7-684.4	18	Limestone, light-olive-gray to yellowish-gray, micrograined; with yellowish-gray to light-olive-gray to olive-gray, finely crystalline dolomite; thin zones of calcarenite, in part dark-greenish-gray, stylolites; argillaceous and shaly partings at 678.5 and 682.9 ft.

Chemical Analysis

% $CaCO_3$	% $MgCO_3$	% SiO_2	% Al_2O_3	% Fe_2O_3	% K_2O	% Na_2O	% Total
85.40	9.72	2.25	0.30	0.36	0.16	0.07	98.26
83.20	12.06	2.53	0.36	0.43	0.19	0.07	98.84
83.89	11.78	2.00	0.25	0.15	0.13	0.07	98.27
87.30	8.82	1.63	0.15	0.14	0.12	0.08	98.24
91.25	4.26	2.00	0.20	0.15	0.11	0.05	98.02
89.82	6.60	1.55	0.20	0.15	0.10	0.05	98.47
88.90	7.65	1.30	0.12	0.11	0.07	0.05	98.20
87.80	7.59	2.70	0.43	0.23	0.18	0.04	98.97
85.00	8.84	4.07	0.43	0.22	0.18	0.04	98.78
90.00	5.83	3.11	0.28	0.15	0.12	0.04	99.53
88.26	6.45	3.29	0.32	0.18	0.14	0.07	98.71
85.23	9.39	2.79	0.32	0.20	0.14	0.05	98.12
88.74	8.00	2.34	0.25	0.23	0.13	0.06	99.75
79.97	11.20	7.28	0.36	0.29	0.19	0.10	99.39
90.09	7.60	1.33	0.19	0.17	0.12	0.09	99.59
86.96	7.70	3.59	0.21	0.13	0.12	0.09	98.80
84.68	8.98	4.96	0.21	0.15	0.12	0.10	99.20
86.88	8.91	1.97	0.28	0.17	0.16	0.09	98.46
88.00	8.75	2.37	0.45	0.25	0.20	0.07	100.09
91.58	6.26	1.57	0.23	0.13	0.10	0.09	99.96
91.67	4.79	2.07	0.11	0.12	0.08	0.08	98.92
91.50	6.32	1.87	0.19	0.11	0.10	0.09	100.18
89.00	8.01	2.60	0.40	0.19	0.18	0.07	100.45
88.01	8.57	1.61	0.25	0.14	0.10	0.07	98.75
89.33	7.61	1.57	0.15	0.08	0.07	0.05	98.86
91.60	5.85	1.70	0.23	0.11	0.12	0.05	99.66
88.50	8.54	2.12	0.42	0.22	0.17	0.05	100.02
90.56	7.25	1.31	0.17	0.10	0.07	0.04	99.50
91.03	7.01	1.38	0.19	0.12	0.07	0.04	99.84
89.81	8.25	1.94	0.34	0.15	0.12	0.06	100.67
88.56	8.72	1.89	0.28	0.16	0.14	0.08	99.83
88.96	7.12	1.79	0.17	0.17	0.13	0.09	98.43
89.01	6.99	1.57	0.17	0.18	0.13	0.07	98.12
92.08	6.10	1.53	0.19	0.11	0.12	0.07	100.20
91.53	6.75	1.43	0.17	0.13	0.11	0.07	100.19
93.55	4.01	1.40	0.25	0.11	0.10	0.08	99.50
91.80	7.01	1.27	0.23	0.09	0.09	0.04	100.53
92.14	6.00	1.28	0.17	0.10	0.10	0.06	99.85
92.90	5.50	1.84	0.26	0.15	0.14	0.09	100.88
88.60	9.20	1.83	0.34	0.25	0.17	0.15	100.54
66.80	26.66	5.68	0.34	0.23	0.15	0.10	99.96
90.61	4.91	1.69	0.28	0.50	0.12	0.17	98.28
89.56	6.95	1.59	0.23	0.09	0.10	0.04	98.56
89.99	6.02	1.60	0.19	0.15	0.09	0.08	98.12
89.00	9.36	1.56	0.15	0.12	0.08	0.05	100.32
90.49	5.26	1.94	0.19	0.15	0.12	0.07	98.22
78.00	3.60	15.97	0.11	0.29	0.17	0.10	98.24
91.73	5.79	1.55	0.21	0.13	0.09	0.06	99.56
89.07	9.03	1.47	0.15	0.16	0.06	0.06	100.00
86.99	5.29	5.63	0.16	0.16	0.06	0.04	98.33
91.36	5.31	1.29	0.15	0.11	0.06	0.03	98.31
91.95	4.39	1.37	0.13	0.13	0.07	0.05	98.09
93.75	3.31	1.19	0.25	0.10	0.09	0.07	98.76
94.62	2.19	1.15	0.17	0.09	0.09	0.06	98.37
95.40	3.56	0.99	0.11	0.07	0.06	0.05	100.24
92.71	5.85	1.10	0.17	0.11	0.09	0.06	100.09
87.26	10.40	1.19	0.17	0.12	0.11	0.06	99.31
84.29	12.70	1.40	0.23	0.13	0.12	0.10	98.97
94.44	3.73	1.41	0.17	0.16	0.10	0.06	100.07
90.38	6.22	1.26	0.28	0.16	0.14	0.05	98.49
92.17	3.97	2.09	0.28	0.17	0.15	0.07	98.90
90.01	7.30	2.20	0.34	0.18	0.17	0.06	100.26
87.39	6.20	3.20	0.63	0.30	0.31	0.15	98.18
86.97	8.06	2.76	0.39	0.19	0.25	0.16	98.78
77.97	12.49	5.43	0.92	0.37	0.70	0.24	98.12
82.19	10.94	4.00	0.44	0.13	0.32	0.19	98.21

Description

Footage (feet)	Thickness (feet)	Formation and Lithology
684.4-743.4	59	Limestone, light-olive-gray to yellowish-gray, micrograined, birdseye calcite, in part with floating bioclastic debris; with greenish-gray to light-olive-gray dolomite; scattered tripolitic chert; birdseye calcite; stylolites, vertical fracture with argillaceous parting at 727 ft.; chert with relict bioclastic texture at 731.2 ft.; thin zones of light-brownish-gray, bioclastic calcilutite from 738 to 741 ft.; very light-gray, with dark mottling, earthy texture in basal 0.5 ft.
743.4-749.9	6	Limestone, light-olive-gray to olive-gray, fine- to medium-grained; thin zones of calcilutite with floating and bioclastic calcarenite; dolomite stringers at 743.4 and 747 ft.; mainly yellowish-gray to light-olive-gray, micrograined, with birdseye and veinlets of calcite, stylolites in lower 3 ft.; in part medium-dark-gray, fine-grained, argillaceous with floating bioclastic grains in lower 3 ft.; mottled with irregular bodies of greenish-gray, fine-grained dolomite at 749 ft.

Chemical Analysis

% $CaCO_3$	% $MgCO_3$	% SiO_2	% Al_2O_3	% Fe_2O_3	% K_2O	% Na_2O	% Total
92.48	4.91	2.18	0.29	0.08	0.26	0.16	100.36
92.39	4.11	2.13	0.39	0.12	0.30	0.14	99.58
95.15	3.50	1.15	0.15	0.09	0.09	0.08	100.21
95.83	1.50	0.89	0.13	0.09	0.09	0.06	98.59
95.55	2.91	0.75	0.10	0.09	0.10	0.06	99.56
95.00	3.37	0.77	0.21	0.11	0.12	0.07	99.65
91.90	4.35	2.96	0.70	0.12	0.36	0.11	100.50
86.40	6.90	4.51	1.33	0.13	0.65	0.19	100.11
88.06	6.30	3.80	0.90	0.47	0.43	0.22	100.18
91.95	3.79	3.25	0.49	0.28	0.27	0.12	100.15
91.40	5.30	2.71	0.30	0.24	0.36	0.14	100.45
92.16	4.50	2.50	0.38	0.22	0.34	0.11	100.21
95.67	2.40	1.61	0.25	0.14	0.23	0.09	100.39
91.03	2.26	4.85	0.87	0.42	0.87	0.29	100.59
95.14	2.18	2.12	0.36	0.18	0.31	0.13	100.42
91.26	4.47	3.43	0.68	0.38	0.49	0.27	100.98
93.18	4.13	1.88	0.26	0.18	0.22	0.09	99.94
82.16	9.55	4.96	0.80	0.39	0.75	0.36	98.97
89.48	6.00	3.40	0.53	0.25	0.50	0.27	100.43
90.08	5.90	3.30	0.44	0.23	0.37	0.19	100.51
87.58	7.50	3.45	0.70	0.47	0.35	0.23	100.28
88.02	7.29	3.47	0.80	0.41	0.37	0.20	100.56
87.07	8.06	3.44	0.70	1.00	0.33	0.17	100.77
76.80	7.20	11.59	2.55	0.50	1.71	0.47	100.82
85.99	5.00	4.97	1.26	0.26	0.73	0.29	98.50
90.03	5.75	2.26	0.47	0.17	0.63	0.21	99.52
92.09	5.09	1.38	0.26	0.27	0.74	0.26	100.09
91.57	5.08	1.01	0.19	0.24	0.07	0.05	98.21
87.84	7.59	2.47	0.42	0.13	0.10	0.06	98.61
83.64	8.80	3.94	0.91	0.22	0.43	0.17	98.11
82.20	10.97	2.97	1.34	0.49	0.56	0.27	98.80
85.29	8.97	3.00	0.70	0.79	0.29	0.19	99.23
87.23	6.81	2.99	0.61	0.49	0.30	0.17	98.60
71.73	14.29	8.94	2.26	0.50	0.36	0.19	98.27
70.75	14.63	8.28	2.17	1.15	0.80	0.53	98.31
72.69	13.25	9.51	2.25	1.17	0.90	0.41	100.18
88.42	8.04	1.80	0.47	1.11	0.13	0.06	100.03
88.77	8.16	2.10	0.30	0.21	0.16	0.10	99.80
88.94	6.99	2.13	0.26	0.29	0.26	0.14	99.01
90.34	6.57	1.30	0.17	0.24	0.12	0.07	98.81
92.89	3.77	1.19	0.09	0.19	0.07	0.09	98.29
90.60	6.00	2.09	0.25	0.15	0.17	0.12	99.38
86.99	8.68	2.33	0.47	0.23	0.27	0.17	99.14
82.48	9.65	4.03	1.02	0.39	0.56	0.34	98.47
87.31	4.14	4.59	1.02	0.40	0.59	0.37	98.42
79.88	10.25	5.71	1.40	0.54	0.65	0.41	98.84
90.79	3.49	2.47	0.59	0.26	0.34	0.19	98.13
88.22	3.28	4.29	1.02	0.41	0.60	0.43	98.25
89.95	4.25	2.60	0.50	0.30	0.27	0.20	98.07
91.95	3.65	3.26	0.25	0.17	0.13	0.11	99.52
83.36	8.05	4.60	1.15	0.53	0.40	0.30	98.39
87.31	4.31	4.71	1.30	0.59	0.53	0.36	99.11
90.50	3.00	2.98	0.75	0.34	0.30	0.21	98.08
94.35	1.60	1.75	0.34	0.17	0.16	0.08	98.45
94.07	1.36	1.89	0.34	0.18	0.17	0.11	98.12
92.87	1.81	3.00	0.30	0.20	0.23	0.11	98.52
90.49	3.29	2.97	0.75	0.20	0.26	0.10	98.06
90.01	3.08	3.19	0.87	0.41	0.37	0.24	98.17
73.70	12.36	9.53	1.59	0.50	0.84	0.42	98.94
88.53	4.43	4.74	0.81	0.31	0.59	0.39	99.80

Description

Footage (feet)	*Thickness (feet)*	*Formation and Lithology*
749.9-785.9	36	Limestone, olive-gray, fine- to medium-grained; bioclastic calcilutite to calcarenite with floating bioclastic debris, burrows, scattered shale partings, and floating brachiopod fragments; light-olive-gray, micrograined with some birdseye calcite from 763.3 to 769 ft.; brachiopod fragments at 756.5 ft.; yellowish to greenish dolomite mottling from 769.2 to 785.9 ft.; scattered shale parting and some dark mottling in basal 4 feet; green bentonite shale from 774.5 to 774.9 ft. with biotite and some calcite.
785.9-788.1	3	Limestone, medium-gray to light-bluish-gray, fine-grained, with light-yellow dolomite mottling; with shaly partings.
788.1-812.6	24	Limestone, light-olive-gray to yellowish-gray, micrograined; fossiliferous; with irregular bodies of yellow dolomite; thin zones of calcarenite; some gastropods; light-olive-gray to yellowish-gray, medium-grained with occasional shale partings from 798.6 to 805 ft.; brownish-gray to olive-gray, micrograined, with birdseye calcite, and dark-gray dolomite-burrow mottling at base.

Chemical Analysis

% $CaCO_3$	% $MgCO_3$	% SiO_2	% Al_2O_3	% Fe_2O_3	% K_2O	% Na_2O	% *Total*
77.02	9.51	9.49	1.32	0.40	0.89	0.61	99.24
80.28	6.26	8.28	1.32	0.48	0.80	0.58	98.00
81.21	8.50	7.07	1.25	0.41	0.65	0.44	99.53
90.56	2.85	3.09	0.72	0.28	0.44	0.21	98.15
84.46	5.44	6.16	1.06	0.35	0.66	0.25	98.38
84.64	5.96	6.23	1.17	0.39	0.69	0.22	99.30
93.60	2.90	2.70	0.45	0.15	0.35	0.14	100.29
94.01	1.80	2.73	0.59	0.20	0.41	0.17	99.91
86.01	4.25	5.52	1.17	0.43	0.66	0.44	98.48
90.97	2.21	3.31	0.55	0.18	0.62	0.35	98.19
86.51	4.50	5.16	0.96	0.27	0.62	0.37	98.39
89.40	3.51	3.99	0.70	0.24	0.60	0.45	98.89
94.04	1.64	1.72	0.25	0.20	0.25	0.13	98.23
93.03	1.56	2.58	0.38	0.15	0.35	0.14	98.19
90.05	1.85	5.32	1.00	0.36	0.64	0.24	99.46
80.95	6.34	8.64	1.59	0.48	0.71	0.39	99.10
84.80	4.56	5.95	0.96	0.32	1.00	0.77	98.36
82.64	6.03	7.85	1.59	0.54	0.90	0.71	100.26
83.07	3.93	9.60	1.70	0.53	0.96	0.54	100.33
73.89	2.90	18.56	1.97	0.49	1.59	0.78	100.18
65.04	3.10	24.96	2.36	0.47	1.81	0.94	98.68
90.30	3.09	4.08	0.49	0.13	0.43	0.20	98.72
84.96	4.38	6.59	0.89	0.28	0.67	0.28	98.05
85.49	3.25	7.20	1.49	0.59	0.90	0.53	99.45
85.94	9.05	2.79	0.55	0.16	0.40	0.11	99.00
89.36	4.68	2.79	0.44	0.38	0.29	0.13	98.07

Description

Footage (feet)	*Thickness (feet)*	*Formation and Lithology*
812.6-838	26	Limestone, light-greenish-gray to brownish-gray, in part olive-black to yellowish-gray; calcilutite and bioclastic calcisiltite; scattered specks of pyrite, chalcopyrite, and veinlets of calcite; scattered shale partings; thin zones of olive-gray, with black mottling, calcilutite; 1-in. green shale with rounded calcilutite fragments at base.

Chemical Analysis

% $CaCO_3$	% $MgCO_3$	% SiO_2	% Al_2O_3	% Fe_2O_3	% K_2O	% Na_2O	% Total
88.84	6.04	2.59	0.53	0.17	0.38	0.12	98.67
90.90	5.70	1.10	0.17	0.13	0.11	0.08	98.19
92.73	3.96	0.95	0.10	0.13	0.10	0.08	98.05
93.07	5.02	0.85	0.09	0.11	0.09	0.06	99.29
79.30	14.88	2.75	0.49	0.26	0.35	0.15	98.18
86.56	9.25	1.80	0.25	0.20	0.18	0.10	98.34
94.27	2.09	1.95	0.34	0.15	0.11	0.07	98.98
93.09	3.41	2.26	0.43	0.20	0.30	0.19	99.88
83.29	9.98	3.74	0.90	0.31	0.52	0.27	99.01
83.69	11.02	3.35	0.94	0.25	0.42	0.22	99.89
89.09	6.60	2.88	0.69	0.25	0.39	0.21	100.11
84.76	5.34	5.25	1.66	0.42	0.85	0.37	98.65
86.70	4.21	4.45	1.42	0.36	0.65	0.25	98.04
83.64	3.80	7.95	2.08	0.55	0.80	0.17	98.99
85.68	3.06	6.25	1.70	0.49	0.80	0.20	98.18
89.62	2.96	3.74	0.94	0.28	0.75	0.30	98.59
85.04	6.55	4.90	1.27	0.39	0.51	0.20	98.86
92.08	3.43	2.00	0.34	0.14	0.20	0.09	98.28
90.02	4.76	2.89	0.57	0.18	0.34	0.05	98.81
87.01	6.89	3.98	1.00	0.28	0.56	0.10	99.82
87.97	5.01	3.79	0.95	0.35	0.53	0.20	98.80
86.91	4.83	3.96	1.10	0.36	0.58	0.37	98.11
82.68	6.33	7.72	2.08	0.53	0.80	0.41	100.55
84.71	5.10	5.59	1.74	0.44	0.68	0.20	98.46
73.99	8.53	10.94	3.21	0.80	1.40	0.20	99.07
86.90	4.58	4.55	1.23	0.33	0.56	0.24	98.39
90.90	5.17	2.00	0.42	0.19	0.24	0.11	99.03
90.45	5.01	2.29	0.70	0.39	0.42	0.27	99.53
92.88	5.11	1.61	0.26	0.17	0.16	0.09	100.28
89.40	6.73	2.97	0.74	0.29	0.44	0.21	100.78
86.19	5.67	4.58	1.32	0.44	0.59	0.37	99.16
86.80	5.30	5.32	1.47	0.42	0.69	0.40	100.40
90.03	3.34	4.30	1.25	0.39	0.52	0.30	100.13
81.14	4.69	9.99	2.46	0.71	1.00	0.35	100.34
83.10	5.65	7.87	1.93	0.61	0.71	0.37	100.24
90.00	2.76	4.31	1.23	0.43	0.49	0.20	99.42
92.66	2.20	2.19	0.64	0.20	0.09	0.10	98.08
84.60	3.98	6.43	2.15	0.63	0.21	0.15	98.15
83.56	6.39	6.17	1.98	0.55	0.17	0.13	98.95
88.61	2.59	5.25	1.72	0.51	0.10	0.05	98.83
88.37	2.79	4.89	1.49	0.41	0.31	0.19	98.45
84.91	6.37	4.41	1.47	0.47	0.29	0.24	98.16
85.17	11.47	0.89	0.38	0.15	0.17	0.07	98.30
86.50	11.90	0.75	0.47	0.16	0.11	0.04	99.93
84.77	11.69	1.35	0.36	0.20	0.17	0.13	98.67
83.70	11.55	2.60	0.82	0.41	0.39	0.05	99.52
91.01	6.00	2.30	0.68	0.29	0.35	0.03	100.66
89.06	5.81	2.06	0.62	0.28	0.32	0.08	98.23
89.33	5.82	3.26	1.09	0.45	0.46	0.05	100.46
91.90	5.50	1.52	0.59	0.22	0.25	0.04	100.02
89.34	7.41	2.02	0.53	0.28	0.35	0.02	99.95
86.14	6.83	4.00	0.38	0.34	0.70	0.03	98.42
88.61	4.39	3.59	1.06	0.36	0.65	0.04	98.70
87.82	10.29	1.00	1.17	0.13	0.20	0.03	100.64
NO ANALYSIS							

Description

Footage (feet)	*Thickness (feet)*	*Formation and Lithology*
838-881.3	43	Limestone, light-brownish-gray to yellowish-gray to light-olive-gray, with irregular black mottling, micrograined; in part with irregular bodies of light-olive-gray dolomite and thin zones of bioclastic calcarenite and calcilutite with floating bioclastic grains; birdseyes and veinlets of calcite; scattered pyrite and shale partings; medium-gray to brownish-gray micrograined, with scattered shaly dolomitic zones in lower 18 ft.
881.3-892.1	10	Limestone, yellowish-gray to olive-gray, with black mottling, micrograined; in part with irregular bodies of dark-yellowish-gray dolomite; birdseyes and veinlets of calcite; stylolites.
892.1-896.1	4	Core loss.

Chemical Analysis

% $CaCO_3$	% $MgCO_3$	% SiO_2	% Al_2O_3	% Fe_2O_3	% K_2O	% Na_2O	% Total
84.02	12.01	1.70	0.44	0.21	0.33	0.05	98.76
84.13	12.17	2.14	0.59	0.30	0.40	0.07	99.80
85.49	11.08	0.98	0.18	0.14	0.17	0.07	98.11
84.81	12.05	0.80	0.09	0.29	0.12	0.06	98.22
88.70	9.70	0.83	0.08	0.10	0.09	0.05	99.55
84.18	11.28	1.61	0.75	0.11	0.11	0.07	98.11
82.74	12.98	1.88	0.17	0.14	0.16	0.05	98.12
82.43	14.39	1.90	0.49	0.24	0.36	0.11	99.92
83.36	13.48	1.53	0.50	0.18	0.09	0.05	99.19
86.15	12.08	0.85	0.15	0.13	0.14	0.04	99.54
83.68	12.98	0.98	0.10	0.15	0.10	0.07	98.06
84.51	12.45	0.93	0.08	0.13	0.09	0.05	98.24
83.99	13.15	0.66	0.06	0.11	0.08	0.04	98.09
85.09	11.86	0.75	0.09	0.13	0.09	0.06	98.07
86.20	10.12	1.24	0.25	0.15	0.25	0.07	98.28
85.20	11.30	1.59	0.08	0.19	0.28	0.04	98.68
81.17	12.40	3.39	0.16	0.35	0.61	0.11	98.19
84.87	12.03	1.52	0.31	0.16	0.23	0.09	99.21
85.55	11.49	0.89	0.14	0.13	0.12	0.07	98.39
85.72	11.66	0.58	0.08	0.11	0.11	0.05	98.31
85.97	11.13	0.59	0.09	0.11	0.10	0.07	98.06
83.64	12.95	1.60	0.45	0.12	0.25	0.10	99.11
83.22	12.58	1.55	0.21	0.13	0.29	0.09	98.07
82.82	13.15	1.04	0.39	0.22	0.27	0.19	98.08
84.25	12.36	0.70	0.16	0.13	0.30	0.13	98.03
88.01	7.89	1.63	0.07	0.21	0.31	0.19	98.31
86.89	7.87	3.26	0.11	0.09	0.05	0.05	98.32
89.24	7.99	1.13	0.08	0.24	0.05	0.10	98.83
89.31	6.83	2.07	0.09	0.24	0.36	0.23	99.13
89.08	6.53	1.90	0.20	0.17	0.12	0.15	98.15
84.48	12.62	0.68	0.18	0.10	0.07	0.10	98.23
86.55	11.62	0.39	0.08	0.10	0.07	0.03	98.84
77.39	19.80	0.50	0.06	0.13	0.11	0.07	98.06
82.23	17.07	0.52	0.07	0.15	0.11	0.05	100.20
84.98	9.95	2.28	0.11	0.32	0.30	0.15	98.09
88.02	4.78	3.68	0.17	0.49	0.59	0.34	98.07
85.41	8.25	3.73	0.11	0.25	0.22	0.14	98.11
87.31	8.10	4.03	0.03	0.18	0.17	0.11	99.93
88.75	7.03	3.36	0.05	0.11	0.06	0.05	99.41
89.01	6.62	3.55	0.03	0.10	0.10	0.06	99.47
82.05	14.03	3.57	0.02	0.12	0.11	0.04	99.94
81.77	14.65	3.59	0.02	0.17	0.09	0.02	100.31
87.65	8.01	3.45	0.04	0.08	0.07	0.03	99.33
83.75	11.45	4.03	0.03	0.16	0.18	0.10	99.70
75.46	18.82	4.11	0.04	0.18	0.20	0.10	98.91
82.88	13.68	3.50	0.04	0.14	0.15	0.03	100.42
79.40	17.60	1.71	0.07	0.16	0.10	0.03	99.07
80.83	16.03	1.37	0.04	0.07	0.03	0.03	98.40
82.30	16.77	0.42	0.03	0.10	0.06	0.05	99.73
81.93	18.08	0.54	0.02	0.13	0.07	0.05	100.82
81.64	15.59	0.59	0.09	0.13	0.08	0.05	98.17
80.49	16.57	0.77	0.09	0.14	0.11	0.10	98.27
81.36	15.83	0.69	0.05	0.11	0.08	0.05	98.17
79.15	18.26	0.47	0.04	0.14	0.05	0.05	98.16
86.38	12.21	0.36	0.03	0.11	0.03	0.01	99.13
81.15	18.08	0.54	0.02	0.15	0.08	0.04	100.06
81.55	16.92	0.79	0.03	0.16	0.10	0.07	99.62
93.20	3.21	1.04	0.10	0.23	0.15	0.09	98.02
93.86	2.06	1.59	0.08	0.37	0.09	0.06	98.11
93.92	1.72	2.00	0.09	0.23	0.27	0.10	98.33
86.31	4.80	5.90	0.05	0.65	1.34	0.67	99.72
90.06	4.24	5.23	0.04	0.53	0.59	0.13	100.82
89.99	5.07	1.76	0.08	0.57	0.46	0.16	98.09
90.48	4.87	1.89	0.06	0.49	0.19	0.09	98.07
91.39	4.65	1.46	0.06	0.21	0.18	0.15	98.10

Description

Footage (feet)	*Thickness (feet)*	*Formation and Lithology*
896.1-962.6	67	Limestone, yellowish-gray to light-olive-gray, micrograined to fine-grained with irregular bodies of yellowish-gray to greenish-gray, medium-grained dolomite; in part with floating bioskeletal debris and some birdseye calcite; stylolites; in part medium-dark-gray, micrograined with traces of organic matter from 922.5 to 925.6 ft.; brownish-gray micrograined with birdseye texture at 955.2 ft.

Chemical Analysis

% $CaCO_3$	% $MgCO_3$	% SiO_2	% Al_2O_3	% Fe_2O_3	% K_2O	% Na_2O	% Total
90.00	4.88	2.39	0.03	0.33	0.74	0.39	98.76
87.05	6.09	5.08	0.01	0.58	0.90	0.26	99.97
79.50	9.85	8.10	0.02	0.79	1.12	0.50	99.88
93.82	5.02	1.40	0.02	0.21	0.16	0.07	100.70
84.50	11.41	3.20	0.02	0.74	0.11	0.05	100.03
85.60	8.72	4.69	0.08	0.51	0.19	0.09	99.88
82.13	8.75	6.87	0.15	0.52	0.22	0.13	98.77
75.50	6.25	12.46	2.77	1.01	0.63	0.51	99.13
66.40	15.43	13.60	3.09	1.11	0.48	0.32	100.43
74.57	8.21	13.66	0.39	1.09	0.32	0.24	98.48
75.75	8.42	12.71	0.27	1.09	0.25	0.11	98.60
85.86	5.72	6.79	0.10	0.66	0.09	0.07	99.29
70.94	8.86	13.99	3.49	1.39	0.79	0.53	99.99
95.01	3.40	1.84	0.02	0.26	0.05	0.03	100.61
94.91	3.52	1.57	0.04	0.30	0.05	0.04	100.43
95.95	2.20	1.50	0.09	0.22	0.04	0.03	100.03
93.20	4.18	1.11	0.30	0.17	0.00	0.00	99.00
92.00	4.71	1.40	0.36	0.17	0.00	0.00	98.70
93.40	3.02	1.50	0.47	0.17	0.00	0.00	98.60
88.20	5.41	2.86	0.82	0.27	0.00	0.00	97.60
55.80	12.00	16.20	2.79	1.67	0.00	0.00	88.50
92.20	3.73	1.89	0.49	0.18	0.00	0.00	98.50
85.50	5.91	4.34	1.17	0.42	0.00	0.00	97.30
67.60	11.30	11.20	2.60	1.04	0.00	0.00	93.70
76.80	8.86	7.47	1.84	0.64	0.00	0.00	95.60
91.90	3.69	1.82	0.45	0.17	0.00	0.00	98.00
66.30	12.50	11.20	2.36	1.00	0.00	0.00	93.40
59.80	14.80	13.50	2.40	1.22	0.00	0.00	91.70
61.90	9.62	14.10	2.48	1.20	0.00	0.00	89.30
65.80	8.64	13.30	2.84	1.24	0.00	0.00	91.80
85.80	4.25	4.57	1.12	0.38	0.00	0.00	96.20
85.70	4.25	4.96	1.15	0.37	0.00	0.00	96.40
87.70	3.83	4.11	0.95	0.29	0.00	0.00	96.90
76.80	6.72	8.10	1.76	0.62	0.00	0.00	94.00
85.50	4.33	5.14	1.01	0.29	0.00	0.00	96.30
81.40	5.35	7.20	1.30	0.43	0.00	0.00	95.70
76.00	9.66	7.84	1.40	0.54	0.00	0.00	95.40
62.30	25.30	7.57	1.07	0.53	0.00	0.00	96.70

Description

Footage (feet)	*Thickness (feet)*	*Formation and Lithology*
962.6-999.9	38	Limestone, light-olive-gray to brownish-gray, with black mottling, micrograined; in part laminated with thin shale partings, interbedded with several 2- to 4-in. green dolomitic shales; dolomitic in basal foot.

Chemical Analysis

% $CaCO_3$	% $MgCO_3$	% SiO_2	% Al_2O_3	% Fe_2O_3	% K_2O	% Na_2O	% Total
52.20	22.10	14.80	2.18	1.20	0.00	0.00	92.50
28.30	4.34	5.32	15.90	1.55	0.00	0.00	55.40
47.90	30.60	13.90	1.49	1.02	0.00	0.00	94.90
44.40	29.90	15.90	1.61	1.45	0.00	0.00	93.30
51.80	32.90	11.10	1.21	0.68	0.00	0.00	97.70
53.70	34.90	9.04	0.99	0.66	0.00	0.00	99.30
56.10	34.40	7.53	0.78	0.57	0.00	0.00	99.40
50.40	36.90	10.00	1.01	0.78	0.00	0.00	99.10
47.50	32.50	12.90	1.48	1.19	0.00	0.00	95.60
53.30	35.10	8.81	1.07	0.71	0.00	0.00	99.00
45.90	28.40	16.00	1.62	1.44	0.00	0.00	93.30
55.40	31.80	9.73	1.01	0.76	0.00	0.00	98.80
60.90	32.10	5.22	0.59	0.49	0.00	0.00	99.20
53.40	31.90	11.60	0.88	0.67	0.00	0.00	98.50
55.80	32.00	8.66	0.70	0.56	0.00	0.00	97.70
52.40	34.10	9.62	1.19	0.86	0.00	0.00	98.20
50.40	36.00	9.22	1.30	0.91	0.00	0.00	97.80
41.80	28.10	17.50	1.54	2.03	0.00	0.00	91.00
50.60	33.70	10.40	1.49	0.93	0.00	0.00	97.10
47.50	29.50	13.90	1.73	1.18	0.00	0.00	93.90
47.40	30.00	14.20	1.81	1.27	0.00	0.00	94.80
49.50	31.30	12.90	1.67	1.18	0.00	0.00	96.60
50.80	32.50	12.40	1.32	0.96	0.00	0.00	97.90
51.00	31.40	13.10	1.03	0.84	0.00	0.00	97.40
50.90	31.60	11.30	1.43	0.82	0.00	0.00	96.10
49.40	31.80	12.70	1.62	1.07	0.00	0.00	96.70
49.80	32.70	11.10	1.34	0.89	0.00	0.00	95.80
53.40	32.60	10.50	0.85	0.67	0.00	0.00	98.00
49.90	32.30	11.30	1.37	0.91	0.00	0.00	95.80
47.20	30.90	13.40	1.60	1.13	0.00	0.00	94.30
51.00	31.80	11.90	1.14	0.80	0.00	0.00	96.70
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47.70	31.50	13.50	1.68	1.19	0.00	0.00	95.50
38.40	25.10	19.60	1.02	2.61	0.00	0.00	86.70
46.10	30.70	15.10	1.72	1.48	0.00	0.00	95.10
51.00	34.80	10.90	1.09	0.87	0.00	0.00	98.60
43.60	26.60	17.70	1.75	1.77	0.00	0.00	91.30
40.70	22.70	20.90	1.50	2.18	0.00	0.00	88.00
48.80	29.20	15.90	1.53	1.22	0.00	0.00	96.60
47.90	26.00	17.30	1.85	1.44	0.00	0.00	94.40
46.70	26.60	16.60	1.86	1.38	0.00	0.00	93.20
46.80	28.60	15.90	1.86	1.44	0.00	0.00	94.60
42.90	24.10	19.10	1.71	1.86	0.00	0.00	89.70
46.30	27.90	15.20	1.62	1.13	0.00	0.00	92.20
46.30	30.80	14.00	1.62	1.34	0.00	0.00	94.00
43.10	27.00	17.30	1.65	1.84	0.00	0.00	90.80
49.40	31.10	13.30	1.39	0.92	0.00	0.00	96.20
47.10	32.00	14.80	1.60	1.20	0.00	0.00	96.60
45.50	29.50	15.80	1.65	1.30	0.00	0.00	93.70
42.80	26.80	17.10	1.52	1.65	0.00	0.00	89.90
41.20	28.30	18.30	1.54	2.17	0.00	0.00	91.50
46.40	31.20	14.90	1.71	1.27	0.00	0.00	95.50
50.20	33.90	11.80	1.17	0.90	0.00	0.00	98.00
50.10	34.40	12.10	1.16	0.90	0.00	0.00	98.60
47.20	30.40	14.90	1.47	1.11	0.00	0.00	95.10
43.30	27.60	17.40	1.63	1.62	0.00	0.00	91.50
45.50	32.90	14.40	1.75	1.49	0.00	0.00	96.00
48.00	32.40	13.00	1.65	1.32	0.00	0.00	96.30
47.10	31.80	13.90	1.48	1.33	0.00	0.00	95.60
41.50	28.90	18.50	1.44	2.03	0.00	0.00	92.30
34.10	21.30	23.20	0.07	3.15	0.00	0.00	81.80
46.80	33.10	13.70	1.34	1.29	0.00	0.00	96.20
45.20	31.60	15.20	1.51	1.33	0.00	0.00	94.90

Description

Footage (feet)	Thickness (feet)	Formation and Lithology
999.9–1073.5	73	**Wells Creek Formation** Dolomite, light-gray to olive-gray to greenish-gray to light-bluish-gray, with black mottling, micrograined to fine-grained, earthy, porcelaneous chert, irregularly laminated with shale and argilla ceous partings; dolomite of upper 1.75 ft. grades downward into green shale from 1001.9 to 1003.3 ft.; in part intercalated with green silty shales; interbedded with several 2- to 12-in. green silty shales; scattered quartz sand from 1037 to 1038 ft.; argillaceous with scattered quartz sand in lower 4 ft.; clasts of Knox dolomite and abundant quartz sand in basal foot.

Chemical Analysis

% $CaCO_3$	% $MgCO_3$	% SiO_2	% Al_2O_3	% Fe_2O_3	% K_2O	% Na_2O	% Total
43.50	28.50	17.20	1.74	1.58	0.00	0.00	92.50
45.30	30.30	15.70	1.63	1.41	0.00	0.00	94.40
45.40	31.60	14.80	1.48	1.19	0.00	0.00	94.50
44.20	28.00	16.30	1.74	1.32	0.00	0.00	91.50
44.70	29.10	15.90	1.61	1.23	0.00	0.00	92.50
47.20	32.60	13.10	1.37	0.98	0.00	0.00	95.30
44.80	30.00	15.20	1.52	1.19	0.00	0.00	92.70
46.20	32.10	13.80	1.29	1.11	0.00	0.00	94.50
44.10	31.40	15.40	1.71	1.29	0.00	0.00	93.90
47.70	32.60	13.30	1.03	0.71	0.00	0.00	95.40
53.80	42.30	3.02	0.53	0.46	0.00	0.00	100.10
53.60	41.30	3.19	0.69	0.48	0.00	0.00	99.30
51.10	36.70	8.93	0.91	0.61	0.00	0.00	98.30
48.30	32.70	13.10	1.12	0.65	0.00	0.00	95.90
51.50	38.60	7.48	0.70	0.44	0.00	0.00	98.70
50.40	34.10	12.00	0.90	0.53	0.00	0.00	98.00
50.40	33.90	11.30	0.97	0.50	0.00	0.00	97.10
51.60	39.10	6.98	0.77	0.51	0.00	0.00	98.90
51.50	38.20	8.46	0.77	0.54	0.00	0.00	99.50
52.60	36.80	7.73	0.92	0.48	0.00	0.00	98.50
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
53.70	42.90	2.37	0.66	0.48	0.00	0.00	100.10
52.60	40.70	4.83	0.84	0.49	0.00	0.00	99.40
50.60	35.50	11.40	0.81	0.52	0.00	0.00	98.80
49.00	34.50	12.80	0.74	0.48	0.00	0.00	97.60
47.30	29.20	17.80	1.00	0.61	0.00	0.00	95.90
48.70	31.20	14.20	0.94	0.52	0.00	0.00	95.50
49.90	33.50	12.00	0.73	0.50	0.00	0.00	96.70
50.90	34.60	10.30	0.79	0.41	0.00	0.00	97.00
50.70	35.10	9.95	0.94	0.38	0.00	0.00	97.00
51.20	37.10	7.49	0.81	0.28	0.00	0.00	96.80
51.40	36.00	7.95	0.75	0.32	0.00	0.00	96.50
50.70	33.20	10.50	0.86	0.38	0.00	0.00	95.70
48.60	33.70	13.10	0.98	0.58	0.00	0.00	96.90
47.80	32.20	14.10	1.09	0.69	0.00	0.00	95.90
48.80	31.80	14.90	0.95	0.63	0.00	0.00	97.20
50.70	34.20	12.20	0.69	0.41	0.00	0.00	98.20
48.30	30.00	17.90	0.87	0.72	0.00	0.00	97.80
52.80	40.80	4.25	1.13	0.52	0.00	0.00	99.50
52.90	40.60	3.70	0.94	0.32	0.00	0.00	98.50
52.30	39.30	4.92	1.04	0.33	0.00	0.00	97.90
51.90	39.60	6.23	0.83	0.41	0.00	0.00	99.00
53.20	41.40	3.02	0.49	0.19	0.00	0.00	98.20
54.10	41.30	1.55	0.24	0.16	0.00	0.00	97.30
53.80	39.80	2.94	0.33	0.18	0.00	0.00	97.10
53.10	38.00	5.25	0.28	0.19	0.00	0.00	96.80
51.80	37.70	8.08	0.29	0.24	0.00	0.00	98.10
51.00	34.30	11.60	0.42	0.32	0.00	0.00	97.40
48.90	31.40	16.10	0.45	0.47	0.00	0.00	97.32

Bottom of sampled interval

Description

Footage (feet)	Thickness (feet)	Formation and Lithology
		Wells Creek Formation (continued)
1073.5-1113.6	40	**Knox Group** **Kingsport Formation** Dolomite, very light-gray to light-gray, in part light-olive-gray, finely crystalline; scattered quartz sand; abundant quartz sand in upper 2 ft.; tripolitic chert with dolomoldic texture; clasts of Wells Creek and Knox dolomite at top; stylolites; in part vuggy and fractured; some oil staining and pyrite; scattered shale laminations at 1089.2, 1099, and 1101.4 ft.

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