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Stratigraphy of the Laketown Dolostone, North-Central Utah

David R. Budge
Utah State University

STRATIGRAPHY OF THE LAKETOWN DOLOSTONE, NORTH-CENTRAL UTAH

by

David R. Budge

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David R. Budge

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

Objectives and methods

The main objective of the present study is to provide a greater understanding of the strata referred to as the Silurian System in north-central Utah and southeastern Idaho and to serve as a basis for comparative regional studies in Silurian stratigraphy. It may be properly classified as a detailed reconnaissance of limited areal extent involving a single stratigraphic unit. It is based on field work done intermittently during the summer months of 1963-65 and laboratory and library work accomplished during the intervening winter months.

Silurian strata of north-central Utah are to be discussed generally with respect to composition and petrography, sequence of lithologic units, fossils and their stratigraphic positions, theories pertaining to petrogenesis, age, and regional correlation. An attempt will be made to clarify several of the older investigations in the light of more recent studies.

Seven stratigraphic sections contained in the appendix were selected for measurement on the basis of completeness, degree of exposure, and accessibility. They were restricted to an area of limited geographic extent, or north-central Utah, so the effects of lensing and variation in stratigraphic thickness could be better understood. Incompleteness, or total lack of previous stratigraphic investigations, also made restriction desirable.

Stratigraphic sections were measured with a 100-foot steel tape and a Brunton compass. Rock colors were assigned with the aid of the

color chart prepared in 1951 by the Rock-Color Chart Committee, headed by E. N. Goddard, and distributed by the Geological Society of America. The degree of crystallinity was determined by a comparison with the sedimentary particle size chart, based on the Wentworth grade scale and manufactured by the Geological Speciality Company of Oklahoma City, Oklahoma. After the particle size was established, the terminology developed by T. G. Payne (1942, p. 1706) was applied. The bedding thickness terminology employed was that modified by R. L. Ingram (1954, p. 937-938). The graphical method of J. B. Mertie (1922, p. 44-46) was used in the calculation of stratigraphic thicknesses. Recent investigations by individuals treating the Silurian System in America, as a whole, have considered the European Llandovery, Wenlock, and Ludlow Series of the Silurian more appropriate than the American terminology. The writer is in agreement with this practice because of the confusion regarding Silurian System boundaries, fossil identifications, and lithologic descriptions found in the older American publications; also because eventual standardization of this terminology would be desirable. For these reasons the European Llandovery Series and its subdivisions (Williams, 1951, p. 128-131) have been used in describing the Laketown Dolostone of north-central Utah. The general relationships between the American and European Silurian Series are described as follows: the Lower Silurian or Medinan Series of America contains age equivalents of the Lower and Middle Llandovery Series of Europe. The Middle Silurian, or Niagaran Series, contains age equivalents of Upper Llandovery, Wenlock, and Lower Ludlow. The Upper Silurian, or Cayugan Series of America, contains age equivalents of the Middle and Upper Ludlow Series.

During the early part of this investigation the author gained familiarity with the literature dealing with Silurian stratigraphy in the western United States. This gave him a valuable insight into the evolution of the descriptive terminology used over the course of many years of investigation in the Great Basin. Many of the local areas covered by previous studies were visited by the author. This was done because he felt that too many individuals have briefly discussed Silurian rocks in connection with other work; thus it seemed appropriate for one person to describe the strata in all these areas.

Location and extent of area

The area considered by the author to represent the type locality of the Laketown Dolostone is that of north-central Utah and southeastern Idaho. This area is represented by the Logan, Randolph, Montpelier, and Preston quadrangle maps of the United States Geological Survey. The area covered by these maps lies between parallels 41°30', and 42°30'N., and meridians 111°00' and 112°00'W. This area makes up the greater portion of the Bear River Range, which is a northern extension of the Wasatch Mountains. The relief of the area varies between about 4,400 and 10,000 feet. The climate of the area is semiarid, with an average precipitation of about eighteen inches. Physiographically the area lies at the western edge of the Middle Rocky Mountain Province, near the eastern edge of the Basin and Range Province (Fenneman, 1931, p. 173, 328). Flora of the area consists of sage, juniper, and grasses at the lower elevations; at the higher elevations scrub oak, quaking aspen and pine predominate. The land is used for recreation, farming and grazing.

Geologic features of the area

The stratigraphic sequence of the area is represented by formations ranging in age from Precambrian through Cenozoic. The Paleozoic sequence, the thickest, is represented by approximately 25,000 feet (Williams, 1958, p. 17) of miogeosynclinal sedimentary rocks. These are mostly marine strata composed predominatnly of carbonates, with sandstones, quartzites, and minor amounts of shale. Rocks older than the Cambrian are known in the southwestern part of the Logan quadrangle; their exact age and stratigraphic thickness are not fully understood. Mesozoic strata crop out east of Bear Lake in the Montpelier and Randolph quadrangles. They are represented by marine and terrestrial deposits over 6,000 feet thick. Rocks of Cenozoic age are terrestrial in origin, and have a stratigraphic thickness estimated at 15,000 feet (Williams, 1958, p. 17).

Structural features of the area consist of two major types: the first composed of folds and thrust faults caused by Laramide deformation; the second formed by the truncation of these structural features during Basin and Range faulting.

Previous investigations

The writer considers that the following investigations represent significant contributions to Silurian stratigraphy in north-central Utah. They illustrate some of the changing and added concepts developed through the years in this area.

Hayden (1872, p. 15, 20) noted that in 1871 a halysitid coral, Halysites catenularia, had been found in the last bed of limestone in Box Elder Canyon, 25 miles north of Ogden, Utah. This area is probably

just south of what is known today as Dry Lake, through which U. S. Highways 89 and 91 pass. This fossil was thought to indicate a Silurian (unrestricted) horizon.

Bradley (1873, p. 194, 199), who had discovered the Halysites catenulata described above, considered it as representative of the Niagra Group of the eastern United States. He also considered "The Gates," or narrows, through which the channel of the Bear River passes on leaving Cache Valley, Utah, as being Carboniferous in age. These narrows are presently mapped as Laketown Dolostone (Hardy and Williams, 1953).

King (1876, p. 478-480), the first person to separate the strata in the Great Basin used the "Wahsatch Mountains" as the type locality for several formations. One of these formations, the "Wahsatch limestone," was considered to be Devonian and Carboniferous in age, with a thickness of 7,000 feet. King suggested that the lowermost part of the formation might contain Silurian (unrestricted) fossils. The Laketown Dolostone apparently formed a part of King's original "Wahsatch limestone."

Kindle (1908b, p. 17), while working on the Devonian Jefferson Formation in north-central Utah, accidently collected a brachiopod fauna indicative of a Silurian (restricted) age. The unnamed Silurian formation was noted as greatly resembling the Jefferson in lithologic appearance.

Kindle (1908a, p. 125, 127-129) removed all doubt that Silurian rocks actually existed in the western United States when he stated, "Decisive evidence of the occurrence of Silurian faunas has been obtained in three widely separated regions. They have been found in

northeastern Alaska, in southeastern Alaska, and in northern Utah." The diagnostic Silurian fossils were brachiopods described as Pentamerus oblongus Sowerby. They were associated with favositid, halysitid and rugose corals. The same fauna was described as being present in Logan Canyon twelve miles north of Green Canyon, east of Paradise, Utah, where they were first found. The canyon described as Green Canyon is apparently an error, the geographic position given and the areal distribution of the Laketown place the area in Hyrum Canyon just south of Green Canyon. The author found brachiopods identified by A. J. Boucot as Virgiana sp. in a small road cut about 5 4/5 odometer miles east of the forks of Green and Hyrum Canyons. These fossils came from a light-gray dolostone 200-300 feet thick, which seems to agree with the description given by Kindle. A band of thin-bedded laminated dolostone mentioned by Kindle as lying between the pentamerid zone and the strata with a Devonian fauna apparently is the Water Canyon Formation described by Williams (1948, p. 1138).

Blackwelder (1910, p. 519, 527-528, 542) used the Paradise Limestone named by F. B. Weeks (Tomlinson, 1917, p. 373) from the vicinity of Paradise, Utah, in describing the Silurian strata discovered by Kindle (1908, p. 17). A type section of the formation was not designated and the description came from strata exposed in Wellsville Mountain west of Wellsville, Utah. This was the first attempt at subdividing the "Wahsatch limestone" of King (1876, p. 478) in north-central Utah.

Richardson (1913, p. 406-407, 410-411) subdivided the Paleozoic strata described by King (1876, p. 476-482) in north-central Utah. According to Richardson the described strata were most completely developed and exposed in the Randolph quadrangle. The Laketown

Dolostone was named, described, and restricted to strata of Silurian age. The type section of the formation is located in the SW¼ Sec. 16 and SE¼ Sec. 17, T. 12 N., R. 6 E., which is in the East Fork of Laketown Canyon about 3½ miles southeast of Laketown, Utah. Fossils collected by Richardson included specimens of Halysites catenulatus?, Favosites sp., Cyathophyllum? sp. and Pentamerus cf. oblongus Sowerby. The corals were found in the lower part of the section and the possibility of their being Richmond in age was noted by Richardson. The brachiopods were located in the upper part of the section and were referred to Pentamerus cf. oblongus Sowerby. The brachiopods indicated a Silurian age. The contact between the Jefferson and Laketown Formations was described as being apparently conformable. The Laketown-Fish Haven contact was also thought to be apparently conformable. The lithology of the formation was described as being massive light-gray to whitish dolostone, containing lenses of calcareous sandstone, with a thickness of about 1,000 feet.

Tomlinson (1917, p. 118, 374) measured 755 feet of Silurian strata in Blacksmith Fork Canyon, Utah. He extended the Laketown into the Logan quadrangle in naming these strata.

Mansfield (1927, p. 58-59, 181-182) described strata assigned to the Laketown Dolostone from an unnamed canyon southwest of St. Charles, Idaho, in the Montpelier quadrangle. The contact between the Laketown and Fish Haven Dolostones was thought to be conformable; at the top, the contact was thought to possibly represent a break in sedimentation. The presence of about 15 feet of purple shale was described by Mansfield in the Laketown. The author visited this area and found it to be truncated by several faults. If the shale observed by the author is

the same as described by Mansfield there is a distinct possibility the shale may be a part of another geologic system. The formation was thought to be Niagaran in age.

Richardson (1941, p. 18, 40) reported on the Randolph quadrangle of north-central Utah. He noted that hiatuses existed above and below the Laketown Dolostone because of the lack of diagnostic fossils of Early and Late Silurian age. The Laketown Dolostone was noted as resting on the Fish Haven Dolostone at the type section of the Fish Haven and in a small canyon a mile southwest of St. Charles, Idaho. The difficulty in determining stratigraphic boundaries, because of the lack of fossils, was noted by Richardson. Old Laketown Canyon has been confused with Laketown Canyon by some investigators. Old Laketown Canyon was described by Richardson as being immediately east of Laketown, Utah. This would appear to be the canyon where the present State Highway Three is located and not along the Randolph-Laketown Road in Laketown Canyon.

Williams (1948, p. 1137-1138) in a report on the Paleozoic section in the Logan quadrangle of north-central Utah described the Laketown as being 1,500 feet thick in this area. A printing error (Williams, p. 1138) occurred in the total thickness given for the formation, which should read 1,510 and not 1,150 feet. Williams noted that good fossils were not obtainable from the formation and only the corals were not greatly affected by dolomitization. Halysitid and favositid corals, along with stromatoporids and brachiopods belonging to Pentamerus, indicated a Middle Silurian age for the Laketown. The contacts between the Fish Haven, Laketown, and Water Canyon Formations

were described as showing no apparent angular discordance. Williams thought a considerable hiatus was indicated at both boundaries because of the lack of Lower and Upper Silurian fossils. Three members were recognized by Williams in the formation. The lowest member was a light-gray dolostone 224 feet thick. The middle member was a dark-gray dolostone, containing brachiopod shells, 619 feet thick. The upper member was a light-gray dolostone containing tabulate corals and stromatoporids with a thickness of 667 feet.

Ezell (1953, p. 6, 17-18) in a study of the Rendezvous Peak area south of Cache Valley, Utah, measured 1,250 feet of Fish Haven and Laketown Dolostones together. Apparently difficulty was encountered in trying to separate the two formations. Corals, stromatoporids, and poorly preserved brachiopods were the only fossils found in the Laketown. The lithologic description given of the Fish Haven and Laketown Dolostones is essentially the same as Richardson's.

Berdan and Duncan (1955, p. 48) noted that strata considered by Richardson as Silurian, in the Crawford Mountains of north-central Utah, were actually of Late Ordovician age. They also noted that the Jefferson Formation of Devonian age overlies the Late Ordovician rocks in this area. This locality is only about 14 miles east of the type section of the Laketown Dolostone. The writer visited the more southernly of the two exposures mapped as Silurian by Richardson, and found that the description of the lithology given by Berdan and Duncan could possibly be applied to the lower part of the Laketown at the type section of the formation. In the lower part of the section near Tony Grove Lake, Utah (Appendix, p. 74), the resemblance to strata found in the Crawford Mountains is very great. Berdan and Duncan noted that

in the Afton quadrangle, Wyoming, about 50 miles from the Crawford Mountains, similar strata of Late Ordovician age were referred to the Bighorn Dolostone.

McFarlane (1955, p. 12, 15, 17, 18, 24, 29, 31, 34) thought the absence of pronounced unconformities at the upper and lower contacts of the Silurian System in the Great Basin was a possible indication that strata of Early and Late Silurian age might exist. He described the upper and lower contacts of the system in north-central Utah as appearing to be conformable. McFarlane noted that local disconformities and diastems were present in the Silurian strata of this area. The strata of the eastern Great Basin were described as being darker, denser, and more cherty in the upper and lower parts than in the middle part. The Laketown Dolostone at the type locality was described as being composed of limestone in the upper half. However, from the writer's observation in the area, he considers this conclusion of doubtful validity.

Coulter (1956, p. 28-30) described a section of the Laketown Dolostone from the vicinity of Bloomington Lake, Idaho. The formation in this area was divisible into three members: a lower medium light-gray dolostone, a middle medium-gray dolostone, and an upper medium light-gray dolostone, with a combined thickness of 1,340 feet. The upper member was described as being the most fossiliferous of the three. The fossils were thought to indicate a Middle Silurian age for the formation.

Gelnett (1958, p. 31-32, 34) measured 1,604.5 feet of Laketown Dolostone in the southern part of Wellsville Mountain. Near the boundary between the Laketown and Fish Haven Dolostones, the formation

was described as consisting of alternating light-gray and dark-gray dolostones. A tentative contact was placed between the two formations in this area.

Beus (1958, p. 24, 28) in the northern part of Wellsville Mountain, subdivided the Laketown into three members. The lower member was a dark-gray crystalline dolostone 670 feet thick. The middle member was a light-gray massive dolostone containing some chert with a thickness of 367 feet. The upper member was described as a medium-gray to dark-gray dolostone with some chert and a thickness of 544 feet. The only fossils found in the formation were rugose corals and crinoid stems. Beus measured 140 feet of Fish Haven Dolostone in this area.

Williams (1958, p. 25) described the Laketown Dolostone in the vicinity of Cache Valley, Utah, as being over 90 percent carbonate in this area. He noted that silicification had preserved corals and stromatoporids which dolomitization would have destroyed, and emphasized that Lower and Upper Silurian strata were not known in the area. If their absence could be definitely shown, disconformities would exist at both horizons. Vugs found in the formation were thought to have been caused by dolomitization. Bioherms and biostromes in the formation were found in the Card Canyon area of Logan Canyon and just across the Idaho state line.

Hafen (1961, p. 30-32), in a study of the Sharp Mountain area east of Cache Valley, measured 1,240 feet of Laketown Dolostone. He suggested that the scarcity of organic material showed that dolomitization took place after deposition. He also measured 125 feet of Fish Haven Dolostone in this area.

Beus (1963, p. 20, 21, 24, 205-207), in an investigation of the Blue Spring Hills, of northern Utah, described the boundary between the Fish Haven and Laketown Dolostones in the Randolph and Logan quadrangles as having been drawn on color differences. He noted that the top of the Fish Haven had been taken at the highest dark-gray cherty bed in this area. The thickness of the Fish Haven and Laketown Dolostones measured together in the Blue Spring Hills was 1,540 feet. Streptelasma described as an Ordovician form was found in a medium light-gray dolostone about 300 feet above the base of the Fish Haven Dolostone. The contact between both underlying and overlying formations was described as being a paraconformity in this area. The boundary between the Ordovician and Silurian Systems taken by Beus just above the highest occurring fossils of Ordovician age gave the Laketown a stratigraphic thickness of about 1,240 feet and the Fish Haven a thickness of 300 feet in this area. This appears to extend the Ordovician System's upper limits into strata considered by earlier workers as Silurian on the basis of rock type. Beus noted in a personal communication with Keller in 1960 that the type section of the Fish Haven was faulted and therefore the true thickness of the formation is unknown. He noted that Middle Silurian fossils first appeared 130 feet above the top of the Ordovician and there was no lithologic break between the two geologic systems. The upper limit of the Laketown Dolostone was taken at the lowest very light-gray weathering fine-grained dolostone of the Water Canyon Formation.

Hansen (1964, p. 17-19), in an investigation of the southwestern part of the Randolph quadrangle in north-central Utah, measured 128 feet of Fish Haven Dolostone. The contact between the Laketown and

Fish Haven Dolostones was taken at the first occurrence of light-gray dolostone belonging to the Laketown. Pentamerus, stromatoporids, and crinoid stems were collected from the formation in this area.

Smith (1965, p. 19, 21) in an investigation of the Monte Cristo area in north-central Utah measured 123 feet of Fish Haven Dolostone. The thickness of the Laketown Dolostone was estimated at 1,000 feet in this area.

STRATIGRAPHY

General description

The writer now turns to his field studies (1963-65) in the Silurian strata of north-central Utah.

Silurian strata, in the restricted, or present sense, were discovered in the eastern Great Basin in 1908 by E. M. Kindle, based on the occurrence of pentamerid brachiopods in north-central Utah. G. B. Richardson in 1913 described the Silurian strata of north-central Utah and named them the "Laketown Dolomite," these are referred to by the present writer as the Laketown Dolostone.

Field evidence from seven complete sections of the formation measured in north-central Utah, and several sections visited in southeastern Idaho, show that the formation is divisible into four members. Member A consists of interbedded light-gray and dark-gray, very finely crystalline dolostone which is thin to very thick bedded and laminated in part, with an average thickness of 300 feet. Member B is composed of medium light-gray to grayish-black, very finely crystalline dolostone which ranges from thin to very thick bedded. Some parts are laminated and others contain intraformational conglomerate. This member averages 600 feet in thickness. Member C is a light-gray to medium-gray, medium-crystalline dolostone that is medium to very thick bedded, partly laminated and lenticular, and averages 350 feet thick. Member D is a dark-gray, very finely crystalline dolostone, thick to very thick bedded and with an average thickness of 200 feet. A diagrammatic representation showing the lithology and members of the Laketown

Dolostone is produced in Figure 1.

Invertebrate fossils found in the formation and identified by the writer indicate that the lowest member is probably of Late Ordovician age. The three upper members are considered to be of Early Silurian, or Middle Llandovery C_1-C_2 and possible Middle Llandovery C_1-C_2 age. This conclusion is based on brachiopods identified by A. J. Boucot. The formation appears to have been deposited in neritic and littoral marine environments.

Subdivision of formation

The Laketown Dolostone of north-central Utah and southeastern Idaho is divided on the basis of color, degree of crystallinity, bedding, and fossil content into four major lithologic units or members. This division is based on field evidence and measured sections in Logan Canyon, Laketown Canyon, the East Fork of Laketown Canyon, at Tony Grove Lake, in Blacksmith Fork Canyon, at Portage, and Fourmile Canyon, all in Utah. The location of the measured sections are shown in Figure 2, with a description of each contained in the Appendix. At present the four members have unknown areal extent outside of north-central Utah. Previous investigators in this area have considered the Laketown as that formation lying between the Fish Haven Dolostone of Late Ordovician age and the Water Canyon Formation of Early Devonian age. Most workers have designated as Laketown Dolostone the lowest bed of light-gray dolostone, lying directly above the dark-gray cherty dolostones of the Fish Haven. The contact between the two formations appears, in well-exposed sections, to be gradational. The boundary between the Laketown and Water Canyon Formations, in north-central Utah, has been placed at the first occurrence of the light-gray

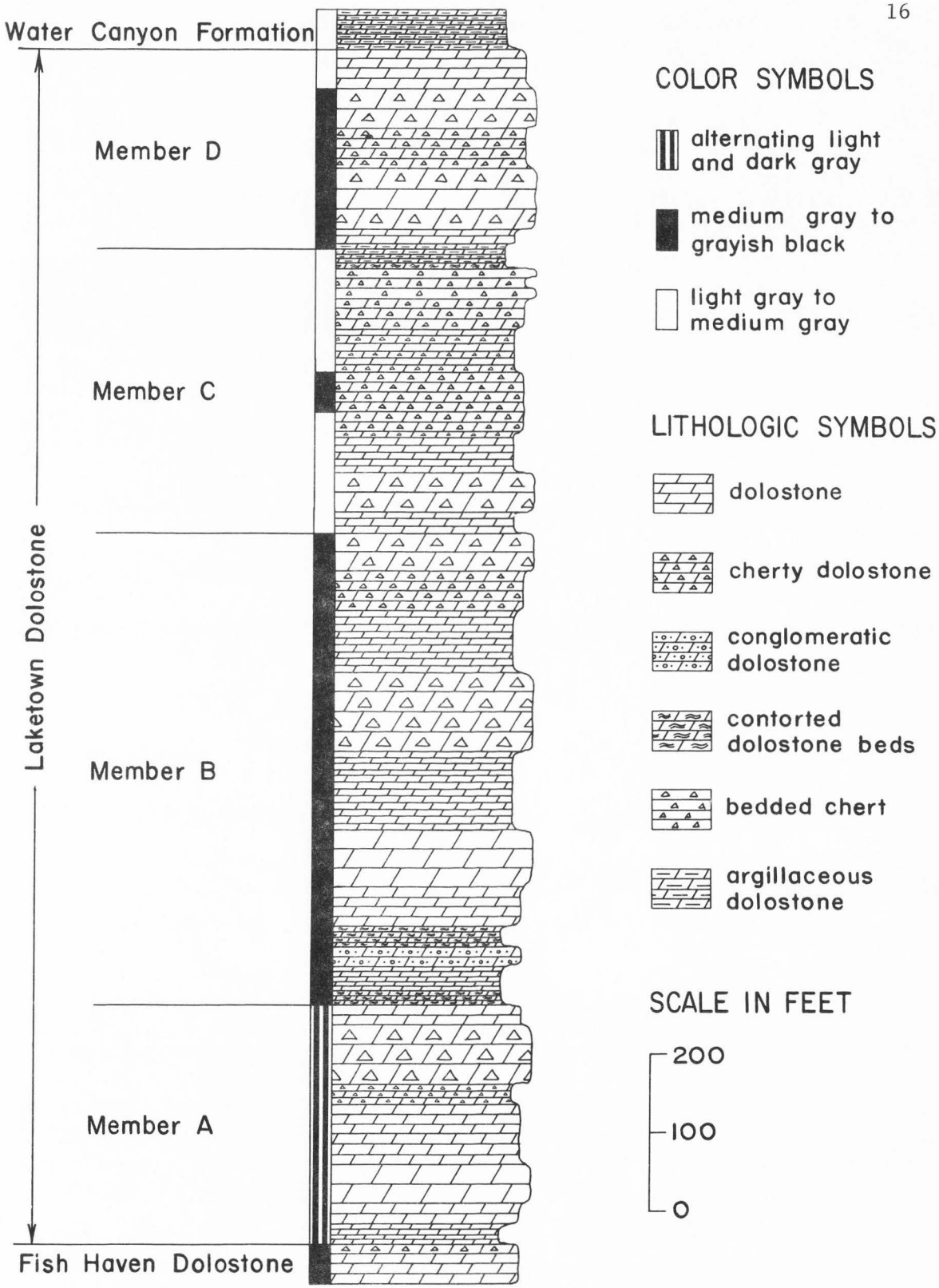
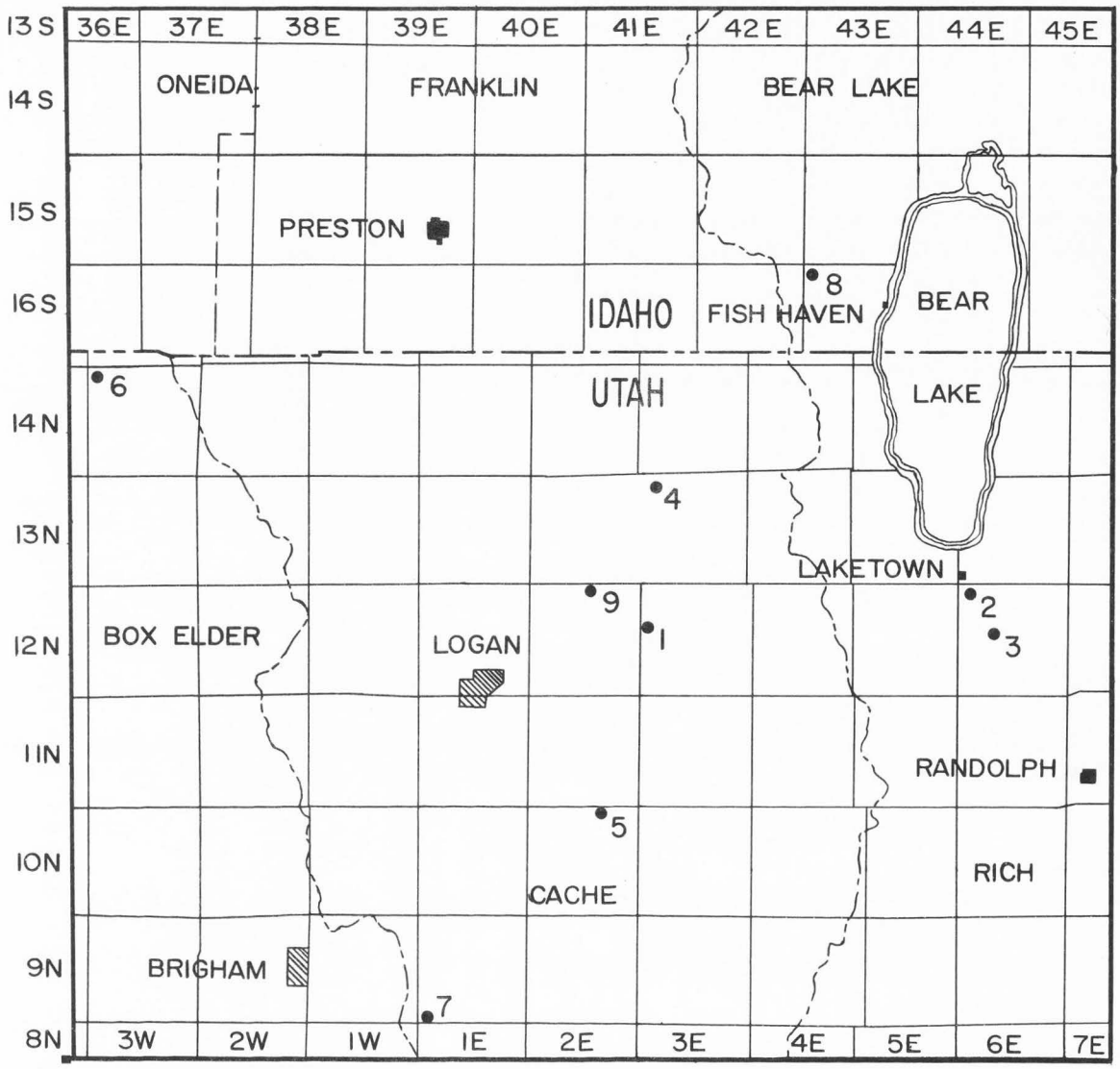


Figure 1. Diagrammatic representation showing the lithology and relationships between the members of the Laketown Dolostone in north-central Utah.



1. Logan Canyon
2. Laketown Canyon
3. East Fork of Laketown Canyon (type section)
4. Tony Grove Lake
5. Blacksmith Fork Canyon
6. Portage Canyon
7. Fourmile Canyon
8. Fish Haven Canyon (type section)
9. Water Canyon (type section)

Figure 2. Index map to north-central Utah showing the location of the type sections of the Fish Haven, Laketown, and Water Canyon Formations and the seven measured sections.

laminated thin-bedded dolostones of the Water Canyon, above the dark-gray very thick-bedded dolostones of the Laketown. The contact between the two formations, as with the lower boundary, appears to be gradational.

Member A

Member A, the lowest member of the formation, lies with conformity upon the Fish Haven Dolostone. This stratigraphic relationship is seen to best advantage in Wellsville Mountain west of Logan, but also appears along the west side of the Promontory Range near Great Salt Lake and in the glacial cirque at Tony Grove Lake. As has been said the contact between the Laketown and Fish Haven Dolostones is gradational. The gradational belt, or layer, is composed of a blending or interbedding of Laketown and Fish Haven rock types, containing beds ranging in thickness from several inches to many feet. The upper contact of Member A was taken at the change from very thick-bedded, interbedded light-gray and dark-gray dolostones, to the darker colored thin-bedded dolostone of Member B which contains some intraformational conglomerate and laminated bedding. Broadly speaking, the entire member is composed of alternating light-gray and dark-gray dense dolostones; however, certain measured sections tend to indicate that the member may be separated on the basis of color into two halves, the lower half being slightly darker in color. It should be pointed out that the separation into halves is considered a tentative subdivision at best. This color variation is displayed best in the measured sections in Logan Canyon, at Tony Grove Lake, and Fourmile Canyon. Weathering may, to some extent, control this color variation.

The degree of crystallinity of the member ranges from sublitho-graphic to finely crystalline, with the intermediate degrees, such as

finely to very finely crystalline, predominating throughout. Thus the texture of the member is quite dense; however, chemical and physical changes caused by weathering have caused parts of Member A to become more porous. This porosity is generally accompanied by an increase in the degree of crystallinity with the development of vugs and small interstices between the crystals of dolomite. The prime examples of the effects of weathering may be seen in the two sections at Laketown, Utah. The section at the mouth of Laketown Canyon is partly covered throughout and is so highly weathered that in the author's opinion it bears little lithologic resemblance to any of the other sections in the area. The type section of the Laketown in the East Fork of Laketown Canyon has suffered the same weathering as the one at the mouth of the canyon. Richardson's type section of the Laketown Dolostone is shown in Figures 3 and 4. Some investigators have suggested that the Laketown in the type locality is composed of limestone in the upper half (McFarlane, 1955, p. 29, 31). It is the author's belief that the combined effects of faulting in the area, the unconformable relationship with the overlying calcareous Wasatch Formation, and the effects of deep weathering have changed the original composition of the rocks in this area. This weathering makes certain parts of the member react with dilute hydrochloric acid. Carefully selected, better preserved samples, showed little or no reaction. A typical exposure of the type section of the Laketown Dolostone is shown in Figure 5.

Member A ranges from a grayish-black color to medium light-gray, with the intermediate colors predominating. The original color of the member appears to have been modified also by the effects of weathering. This gives the affected strata a light brownish-gray or olive-gray

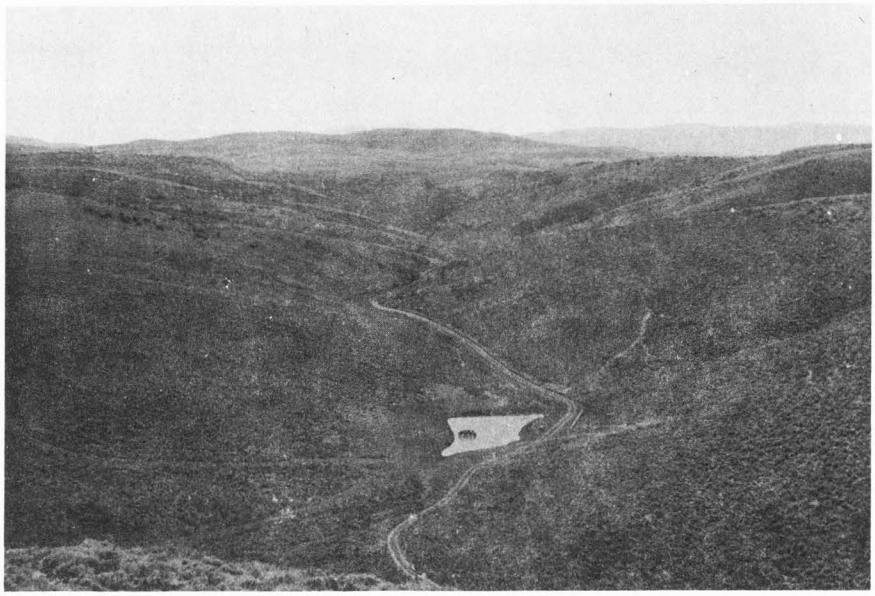


Figure 3. Richardson's type section of the Laketown Dolostone in the SW¼ sec. 16 and SE¼ sec. 17, T. 12 N., R. 6 E., of the Randolph quadrangle. The contact between the Laketown and Fish Haven Dolostones is approximately midway between Kearl Spring, near the pond, and the outcrop at center of the photograph. View to west.

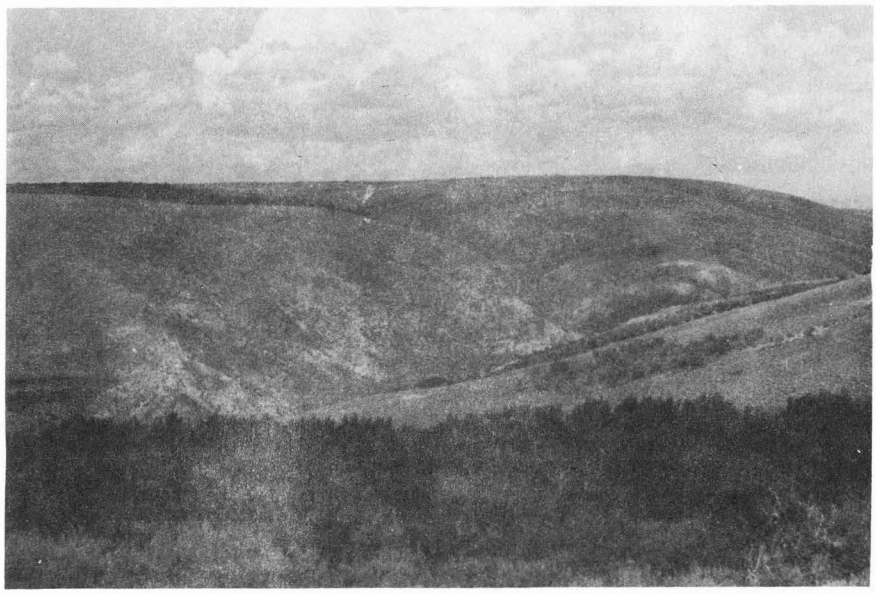


Figure 4. Richardson's type section of the Laketown Dolostone. Section line between secs. 16 and 17, T. 12 N., R. 6 E., is located in the mouth of the small canyon at the right center of the photograph. View to north-northeast.

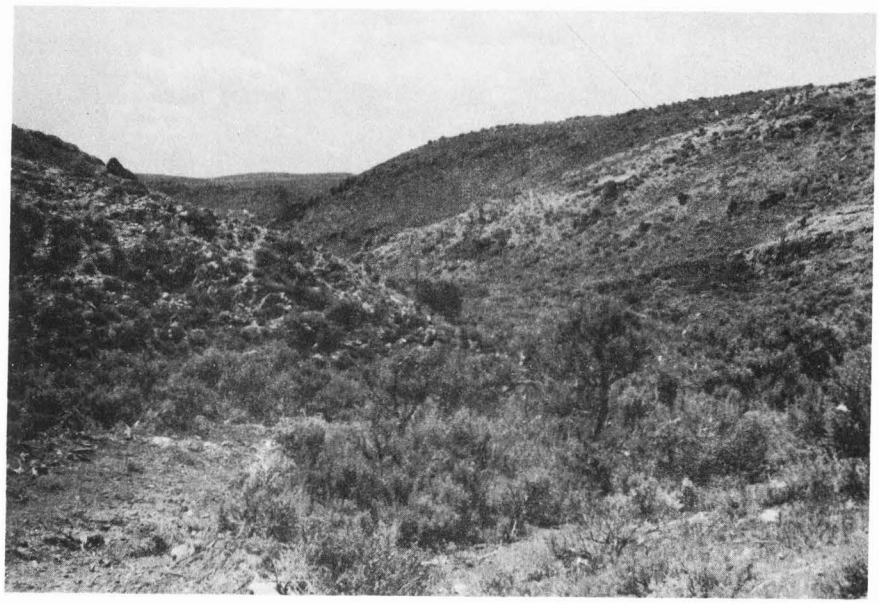


Figure 5. Typical partly covered exposure of the Laketown Dolostone at the type section, near the section line between secs. 16 and 17, T. 12 N., R. 6 E., in the East Fork of Laketown Canyon. View to west.

tinge. In this instance too, the sections near Laketown, Utah, are prime examples of color modification caused by weathering.

The bedding of Member A ranges from thin to very thick, with some parts of the member being laminated. Generally speaking, the lower part of the member appears to contain more laminated beds than the upper part. Some parts have an oolitic or pisolitic nature. These features are shown in the lower part of the member at Tony Grove Lake. The structures are apparent on the weathered surfaces as a mottling of color or on freshly broken surfaces as what may have been called "mud blebs" by Beus (1963, p. 206). Originally these features probably represented pelletized carbonate material, or possibly some type of algal or faecal remains. Since the pellets and the enclosing matrix are of the same composition, color, texture, and degree of crystallinity, their exact origin is difficult to establish.

Some parts of the upper portion of the member contain randomly distributed discontinuous beds of chert, which range in color between light gray and grayish black. With some being colored by a brownish tinge.

Member A also appears to be partly mottled throughout its full extent. This mottling is probably caused by a number of factors, some of which have been suggested by other workers. These causes are: (a) the process of dolomitization being arrested before completion, (b) the sediments accumulating at such a slow rate as to allow selective leaching of previously deposited material, (c) the penecontemporaneous deformation of thinly bedded sediments by slumping or gravitational sliding, the action of turbidity currents, or wave action in shallow water which causes a mixing of the material, which after

lithification gives a mottled appearance.

Numerous small-sized to medium-sized vugs are found scattered throughout the member. Here too, the effects of weathering appear to have made them more numerous. The reduction in volume and the development of intergranular porosity due to dolomitization may be responsible for the development of some of the vugs, many of which are filled with crystals of calcite or dolomite. In some of the measured sections, at Tony Grove Lake in particular, some very large bodies of crystalline calcite were found (Appendix, p. 74). One of these measured 2 by 8 feet, and was oriented perpendicular to the bedding. None of these large bodies are apparently associated with faulting. The bedding underlying and overlying them is not deformed. They seem therefore to be best explained by metasomatism.

Based on measured sections at Logan Canyon, Tony Grove Lake, Blacksmith Fork Canyon, and Fourmile Canyon the thickness of Member A ranges from 278 feet to 341 feet. The measurements were not considered reliable at the other three sections. It is difficult to separate Members A and B at the section in the mouth of Laketown Canyon; in fact, it may be impossible because of the highly modified condition of the rock. This also makes separation of the Fish Haven from Member A difficult in this area. In the East Fork of Laketown Canyon the lower part of the member is covered and its true thickness is unknown. The section at Portage, Utah, is also covered in the area of the contact between Members A and B, and the thickness is unknown.

Thin sections of Member A, examined in connection with the study of fossil material found in the member, indicate that it is composed of

interlocking subhedral and anhedral crystals of dolomite. In some of the slides examined a few of the original characteristics of the sediment could be seen. The original sediment contained bioclastic material composed of sponge spicules and pelletal structures. The pelletal structures may represent faecal and algal remains. The process of dolomitization is thought to have been more complete in some parts of the member than in others, which may have caused some primary characters to be preserved while destroying others.

The fossil material collected from the member indicates that it is probably of Late Ordovician age. Representative forms of tabulate and rugose corals are the most abundant fossils, but cephalopods, gastropods, and indeterminate worm borings and trails are also found in Member A. The better preserved, most diversified, and abundant organic remains are found predominantly in the darker colored, more dense areas of the member. This is thought by the author to indicate that possibly the lighter colored parts of the member were deposited nearer to the shore or in a shallow sea, while the darker, more fossiliferous, sediments accumulated in the deeper waters. Generally the lighter parts of the member are slightly more coarsely crystalline which might indicate they were deposited originally as coarser sediments. The process of silicification does not appear to be a major factor in fossil frequency or abundance since many well-preserved specimens are found in the less cherty beds, but it does have a great effect on the degree of preservation of the specimens. The sparsely scattered fossils found in the lighter beds are generally very poorly preserved. They mainly consist of broken and abraded pieces of rugose and tabulate corals. In cases where some of the internal features have

been preserved, as in the larger rugose corals, their interiors are filled with crushed and broken pieces of themselves and other organisms. These organisms evidently consist largely of sponge spicules. The following organic remains were found in Member A and are described as to location and stratigraphic position as follows:

Annelids:

Worm trails and borings were found at Tony Grove Lake, Utah, 110 feet above the base of the formation and were of indeterminate nature.

Cephalopods:

Orthocerida in a very poor state of preservation was found at Tony Grove Lake, Utah, 110 feet above the base of the formation. Oncocerida, UC loc. D-2136, was found in Hyrum Canyon, Utah, in the area of Kindle's original discovery of Silurian brachiopods. The fossil was located approximately 100 feet above the Fish Haven Dolostone. It was dolomitic and fairly well preserved.

Coelenterates:

cf. Astrocerium venustum Hall was found at Tony Grove Lake, Utah, approximately 290 feet above the Fish Haven Dolostone. It was dolomitic and in a poor state of preservation.

Cladopora aculeata Davis?, UC loc. D-2129, was found at Tony Grove Lake, Utah, approximately 110 feet above the base of the formation. It was silicified and well preserved.

Foerstephyllum sp., UC loc. D-2141, was found in Logan Canyon, Utah, in the talus near the contact between the Fish Haven Dolostone and the base of the Laketown Dolostone. It was dolomitic and fairly well preserved. The matrix enclosing the coral

resembles that found in Member A.

Lichenaria sp., UC loc. D-2129, was discovered at Tony Grove Lake, Utah, 110 feet above the Fish Haven Dolostone. It was silicified and well preserved.

Holophragma? sp., UC loc. D-2137, was found in the East Fork of Laketown Canyon, Utah, 130 feet above the Fish Haven Dolostone. The fossil was dolomitic and fairly well preserved, because of incomplete fossil remains thin sections could not be made.

Palaeophyllum? sp., UC loc. D-2129, was found in the talus at Tony Grove Lake, Utah, approximately 110 feet above the base of the formation. The fossil was dolomitic and poorly preserved.

Streptelasma prolongatum Wilson?, UC loc. D-2128, was found at Tony Grove Lake, Utah, 103 feet above the base of the formation. The fossil was dolomitic and fairly well preserved.

Streptelasma spp. were found scattered throughout Member A. Generally they were poorly preserved so that specific identification was not possible. Small, medium, and large specimens were found about 110 feet above the base of the formation at Tony Grove Lake, Utah. Small corals were also located at 270 feet in the same area. In the East Fork of Laketown Canyon, Utah, medium-sized corals were found 52 feet above the Fish Haven Dolostone. Large corals were found at 139 feet and small ones at 180 feet in the same area.

Stromatoporids and stromatoporid-like organisms were found at Tony Grove Lake, Utah, 62 feet above the base of the formation. Similar material was found at Fourmile Canyon, Utah, 192 feet above the base of the Laketown Dolostone.

Crinoids:

Crinoid stems were discovered at Fourmile Canyon, Utah, 193 feet above the Fish Haven Dolostone.

Member A was thought to have been deposited in a littoral or neritic marine environment. This conclusion is based on fossils, field evidence, and thin sections described in the preceding material. It should be pointed out that the littoral environment is based on the lighter colored coarser material found in the member, which may have been deposited near shore. The sediments were thought to have been originally deposited as a calcareous mud or ooze with possibly some coarser material. Later and maybe to some extent during sedimentation dolomitization occurred.

Member B

Member B appears to lie conformably upon the interbedded light-gray and dark-gray dolostones of Member A. The contact between the two members has been assigned by the author at the change from a very thick-bedded dolostone to a thin-bedded partly laminated dolostone which contains some intraformational conglomerate. It is a darker gray color than the lower member. In fairly well-exposed sections such as in Logan Canyon, Blacksmith Fork Canyon, Fourmile Canyon, and the well-exposed section at Tony Grove Lake, the contact between the members appears to be quite sharp. Just above the contact between the two members at Fourmile Canyon, the section contains a moderate amount of

intraformational conglomerate (Appendix, p. 85). The matrix of the conglomerate contains small fragments of rugose corals and brachiopod (?) shells. A considerable amount of the thinly bedded and laminated material, in this section, is mixed and mottled. Some of the bedding appears to have been deformed to a limited degree shortly after deposition and before lithofication. A photograph showing the intraformational conglomerate found in the lower part of Member B is Figure 6. In the other sections this horizon is represented by thin-bedded partly laminated dolostone. The upper contact of Member B has been placed at the change from a medium-gray to dark-gray dense dolostone to the lighter gray porous dolostones of Member C.

Lithologically, Member B is generally a medium-gray to dark-gray dense dolostone. Like the lowest member, certain measured sections seem to indicate that it is roughly divisible into two parts. The sections showing this relationship are located in Logan Canyon, at Tony Grove Lake, in Blacksmith Fork Canyon, and Fourmile Canyon. The separation is based on the apparent color change to a darker shade of gray in the upper part of the member. This is at best a tentative separation.

The degree of crystallinity occurring in the member ranges from the extremes of sublithographic to medium crystalline. The intermediate degrees such as finely to very finely crystalline appear to be predominant throughout the member. The lower part of the member is more coarse than toward the top. This condition is best seen at Fourmile Canyon and may be enhanced some by weathering. The texture of the member is quite dense on the whole. Weathering has in some instances caused parts of the member to become more porous, which, as in Member

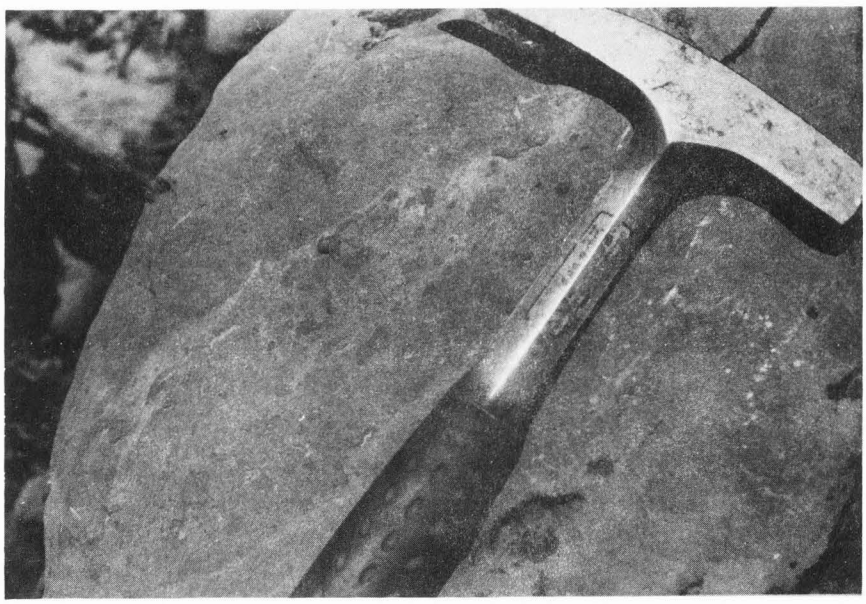


Figure 6. Typical sample of the intraformational conglomerate found in the lower part of Member B at Fourmile Canyon, Utah.

A, is generally accompanied by an increase in the number of vugs and in the degree of crystallinity. This effect is developed best at the sections in Laketown Canyon, the East Fork of Laketown Canyon, and to some extent near Tony Grove Lake. Weathering also causes a moderate reaction with dilute hydrochloric acid; however, carefully selected samples show a very limited reaction or none at all.

The color of Member B ranges from the maximum values of medium light gray to grayish black, with the intermediate color values predominant throughout. Weathering has clearly played a very important part in the modification of the original color. This effect characteristically shows itself as a light brownish or olive-gray tinge on the exposed surfaces of the outcrop. The sections at Laketown and Logan Canyon are the best examples of weathering and color change.

The bedding of Member B ranges from very thin to very thick, with the lower part of the member containing more laminated material than the upper part. The average thickness of the bedding is intermediate between the maximum and minimum limits.

In the upper part of the member randomly distributed discontinuous beds of chert and quartz are found. The chert ranges in color from brownish gray to dark yellowish orange. Near the top of the member at Tony Grove Lake (Appendix, p. 73), Blacksmith Fork Canyon (Appendix, p. 78), Portage (Appendix, p. 82), and Fourmile Canyon (Appendix, p. 84), small randomly oriented seams of quartz or dolomite are found. These roughly resemble a large spider web network. A possible explanation of their origin is that they might represent penecontemporaneous fracturing of the sediments with subsequent filling of the breaks with quartz or dolomite.

The member is also partly mottled throughout most of its extent. Arrested dolomitization, selective leaching, and penecontemporaneous deformation described in an earlier section are thought to represent the principal causes of this condition.

Vugs, some of them filled with crystals of quartz, appear to be more abundant in the upper parts of the member. They have been made more numerous by weathering.

The thickness of Member B ranges from 550 feet to 656 feet, based on the measured sections in Logan Canyon, at Tony Grove Lake, in Blacksmith Fork Canyon, and Fourmile Canyon. The sections at Laketown are, as mentioned before, in such a poor state of exposure and preservation that the separation of Member A from B is very difficult if not impossible. As the section at Portage is covered in the area of the contact between the two members, the thicknesses are unknown.

No thin sections of Member B were examined; nevertheless, dolomitization is thought to have occurred, for the most part, after deposition.

The brachiopods collected from the member and identified by A. J. Boucot point to a possible Middle Llandovery C_1-C_2 age for Member B. Specimens of tabulate and rugose corals, brachiopods, crinoid stems, stromatoporids, and worm trails were found in the member. The fossil remains are fairly abundant throughout the member, but because of dolomitization most of the diagnostic features have been destroyed. This made identification difficult. The following fossils, their locations, and stratigraphic positions, are described from Member B as follows:

Annelids:

Worm trails were found at 406 feet and 631 feet above the base of the Laketown Dolostone in Laketown Canyon.

Brachiopods:

Virgiana? sp., USNM 12556, was found at Tony Grove Lake, Utah, about 346 feet and 398 feet above the base of the formation. The fossil was found in the talus and bed rock near the bottom of Member B. It was dolomitic and in a fair state of preservation. The material is considered by A. J. Boucot to represent a possible Middle Llandovery C_1-C_2 age.

Coelenterates:

Astrocerium cf. A. venustum Hall, UC loc. D-2140, was found in the East Fork of Laketown Canyon, Utah, 270 feet above the top of the Fish Haven Dolostone. It was dolomitic and in a fair state of preservation.

Favositid corals were found 521 feet above the Fish Haven Dolostone at Fourmile Canyon, Utah; also at 498 feet above the base of the Laketown near Tony Grove Lake, Utah.

Heliolites sp. was found in Logan Canyon, Utah, approximately 700 feet above the base of the formation. It was dolomitic and poorly preserved.

Streptelasmid corals were found in the following places: (a) at 341, 408, and 506 feet above the base of the formation in Logan Canyon, Utah; (b) in Laketown Canyon, Utah, at 333 feet above the top of the Fish Haven Dolostone; (c) at 270 and 808 feet above the lowest exposed outcrop of the Laketown in the East Fork of Laketown Canyon, Utah; (d) at Fourmile Canyon,

Utah, at 286, 373 and 482 feet above the base of the Laketown; (e) 351 feet above the base of the formation in Blacksmith Fork Canyon, Utah; (f) 498 and 601 feet above the base of the Laketown at Tony Grove Lake, Utah.

Stromatoporids were found 653 feet above the base of the formation at Fourmile Canyon, Utah. They were also discovered at 646, 710, and 826 feet above the highest outcrop of the Fish Haven in the East Fork of Laketown Canyon, Utah.

Crinoids:

Crinoid stems were located in the following places: (a) 914 feet above the base of the formation in Laketown Canyon, Utah; (b) 710 feet above the highest outcrop of the Fish Haven in the East Fork of Laketown Canyon, Utah; (c) near Tony Grove Lake, Utah, 856 feet above the base of the Laketown; (d) at 871 feet above the base of the formation in Blacksmith Fork Canyon, Utah; (e) at Fourmile Canyon, Utah, 482 feet and 782 feet above the base of the formation.

The original sediments of Member B were probably made up of calcareous ooze and mud with the possibility of some material of a coarser nature. They were thought to have been deposited in a neritic marine sea, and were dolomitized possibly during and after deposition. This conclusion is based on field evidence and fossil material.

Member C

Member C appears to conformably overlie the medium-gray to dark-gray, dense, dolostones of Member B. The contact between Member B and Member C has been placed by the author at the first occurrence of lighter gray porous dolostone. It is more extensively weathered than

the member below because of its coarser nature. The contact appears to be quite sharp where it is exposed, as may be seen at the measured sections at Fourmile Canyon and Tony Grove Lake; also near Portage. Member C's upper contact was taken at the change in lithology from a medium light-gray porous dolostone to the dark-gray dense dolostones of Member D. The member appears to be absent at the sections in Laketown Canyon and the East Fork of Laketown Canyon; however, it should be remembered that due to the extensive effects of weathering, separation of the strata in this area is difficult. Their apparent absence is based on the lithology and stratigraphic thickness shown in the above sections. Several known faults in the area may also be a possible cause of the absence of strata to be expected in Member C.

Member C is composed predominantly of medium light-gray porous dolostone which in most measured sections has a brownish tinge caused by extensive weathering. The member is divisible into two parts by a layer which is considered to be a tongue or lens of dolostone similar to that found in Member B. The layer was found in the measured sections at Tony Grove Lake (Appendix, p. 72) and Fourmile Canyon (Appendix, p. 84). The other sections were not well enough exposed to show whether a similar situation existed in them.

The texture of Member C varies between the extremes of finely to coarsely crystalline, with the average crystallinity lying between these limits. This gives the strata a more porous appearance than the two lower members. As in the other parts of the formation, weathering has enhanced the development of a coarser degree of crystallinity. This has also caused the development of interstices between the individual crystals of dolomite and small vugs. Many parts of the

member react mildly with dilute hydrochloric acid because of the effects of extensive weathering.

The color of Member C ranges from the limits of light gray to medium gray; this is based on the exclusion of the layer separating the two parts of the member. The intermediate colors seem to predominate throughout the member. The original color has apparently been altered extensively by weathering, giving the member a light-brown or olive color. The sections at Logan Canyon, Tony Grove Lake, Blacksmith Fork Canyon, Portage, and Fourmile Canyon all show this effect.

The bedding of the member ranges from medium to very thick with thick predominating. The upper parts of the member contain laminated bedding with some small laminated lenses. The laminated lenses are thought by the author, based on their relationships in the measured sections, possibly to represent small channel-fill deposits formed in very shallow water which may have been near shore.

One of the most interesting features of Member C is the fairly thick beds of chert found interbedded with the dolostones in the upper half. The chert is found in beds 1 to 4 inches thick and ranges in color from light gray to dark gray. Generally the dolostone beds intercalcated with the chert are a few inches to several feet in thickness. The cherty nature of the member is best exposed in Blacksmith Fork Canyon (Appendix, p. 77) and to a limited extent at Portage (Appendix, p. 81). In the lower part of Member C, chert is found but is less abundant.

Mottling does not seem to be as prominent as in other members and is noted in only a limited number of beds.

Vugs are discovered randomly distributed throughout much of the member, some of them filled with crystals of quartz. They are generally of small to medium size and have been made more abundant by weathering.

Member C, of all the members, appears to have the greatest variation in thickness. The thickness of the member ranges from 287 feet to 417 feet, judging by the sections at Logan Canyon, Tony Grove Lake, Blacksmith Fork Canyon, and Fourmile Canyon. The section at Portage is faulted and the character of the rock is so homogeneous that correlation of the faulted parts of the member is unreliable.

Thin sections were not made of Member C, but due to the larger degree of crystallinity, the author believes the original sedimentary accumulation was composed of carbonate material of coarser nature. This would probably allow complete dolomitization, with the penecontemporaneous development of larger euhedral and subhedral crystals of dolomite, interstices, vugs, and the possible destruction of organic material. These features have been enhanced to a greater degree by weathering.

The fossil material collected from Member C indicates that it is Middle Llandovery C_1-C_2 in age. This is based on the occurrence of brachiopods identified as Virgiana sp. by A. J. Boucot. The most abundant fossils found in the member consists of brachiopods and crinoids. The measured section at Fourmile Canyon and the area of Kindle's discovery contain the most brachiopods observed in north-central Utah by the author. The following organisms are described with respect to their stratigraphic positions and locations:

Brachiopods:

Virgiana sp., USNM 12555, was found near the section line between secs. 22 and 23, T. 10 N., R. 2 E., of the Logan quadrangle,

in Hyrum Canyon, Utah, about two-thirds of the way through the section. In the sections at Tony Grove Lake (Appendix, p. 73), Logan Canyon (Appendix, p. 58), and Fourmile Canyon (Appendix, p. 84), all in Utah, brachiopods thought to be Virgiana by the author were found in Member C at 968, 847, and 856 feet respectively above the Fish Haven Dolostone. They were most abundant at Hyrum Canyon and Fourmile Canyon, Utah. They were rather poorly preserved and dolomitic in nature. Photographs of these brachiopods are Figures 7 and 8. As described in an earlier section of this report there appears to be an error in Kindle's location of the fossil discovery in Hyrum Canyon, Utah. This is not difficult to understand when it is realized that the Logan quadrangle map had not been published and the sections were located for Kindle by F. B. Weeks, who could have made the error (Kindle, p. 127).

Crinoids:

Crinoid stems were found at 968 feet and 1018 feet above the base of the formation at Tony Grove Lake, Utah; at 926, 1106, and 1399 feet above the Fish Haven Dolostone at Portage, Utah; at 1093 feet above the Fish Haven in Logan Canyon, Utah; and 856 feet above the base of the formation at Fourmile Canyon, Utah.

Member D

Member D is the uppermost major lithologic subdivision of the strata assigned to the Laketown Dolostone. It appears to lie with conformity upon the medium light-gray porous dolostones of Member C. The separation of Member C from Member D is based on the change in lithology from the light-gray porous dolostones of Member C to the

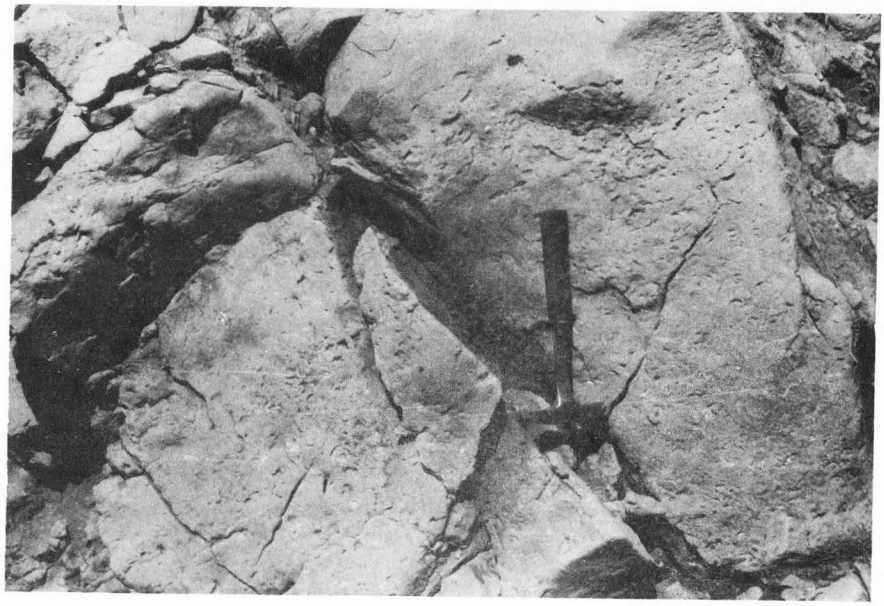


Figure 7. Photograph of Virgiana sp., USNM 12555, located in Hyrum Canyon, Utah. Found in a small road cut near the section line between secs. 22 and 23, T. 10 N., R. 2 E., of the Logan quadrangle.

Figure 8. Enlargement of Figure 7 just to the right of the hammer, showing the preservation of Virgiana sp.

dark-gray, dense dolostones of Member D. The contact between the two members usually appears to be quite sharp; however, in some sections, such as Fourmile Canyon and Portage, there is apparently a layer of gradation. In this layer there is a blending of the two rock types.

The member is composed for the most part of dark-gray, dense, cherty, dolostone. It is lithologically fairly homogeneous in the lower nine-tenths. The upper one-tenth of Member D has lithologic characters which resemble both the overlying Water Canyon Formation and the Laketown Dolostone. These characters consist of bedding which is closely related to the Laketown Dolostone and color characters which resemble the Water Canyon Formation above. The lighter colored upper one-tenth of the member is best seen at Tony Grove Lake (Appendix, p. 72), Logan Canyon (Appendix, p. 57), and Portage (Appendix, p. 80). The contact between the two formations is best seen at Portage, Tony Grove Lake, Logan Canyon, and Blacksmith Fork Canyon. The section at Fourmile Canyon may possibly be in fault contact with the Water Canyon Formation. The contact between the Laketown and Water Canyon Formations was placed at the top of the highest thick-bedded, lighter gray, dense dolostones of the Laketown below the lighter gray laminated beds of the Water Canyon, and is in the author's opinion conformable. The sections at Tony Grove Lake, Portage, and Fourmile Canyon show the lithologic character of Member D the best.

The degree of crystallinity of Member D ranges from very fine to medium, with the average consistently leaning toward very finely crystalline. The texture is very dense. As in the case of the members described before, weathering has, to a more limited degree, caused Member D to become porous and vuggy, with an increase in the inter-

granular porosity and degree of crystallinity. Weathering also causes some parts of the member to react mildly with dilute hydrochloric acid.

The color ranges from medium light gray to dark gray, with the color values tending predominantly toward the latter. Weathering does not appear to have had as great an effect in color changes of a secondary nature as in the lower members. The reason for this coloring seems to be that in the measured sections the exposure of Member D is very complete, most of the float being removed, indicating that weathering is not so extensive. The member is usually exposed along a ridge which also does not allow the accumulation of much loose material.

Member D's bedding characteristics range from medium to very thick. The medium-bedded part of the member appears to be toward the bottom.

Chert in the form of thin seams and irregular nodules is fairly abundant throughout the member. The seams and nodules appear to follow bedding planes in the member. The chert is of medium-gray to light-gray color. The member appeared to be more cherty in some of the sections measured than in others, for the measured sections at Portage and Tony Grove Lake apparently are more cherty than those sections at Fourmile Canyon or Blacksmith Fork Canyon.

Mottling is not a major feature of Member D, as in the lower members. It is thought by the author that either the dolomitization was more complete in the upper member, giving a more uniform appearance, or that deep weathering enhances the mottling observed in the lower members. There is also the possibility that dolomitization of the Laketown occurred during the shallow sea period of the lower part of the Water Canyon Formation. If this is the situation, probably dolomitization was more complete in the upper part of the Laketown

Dolostone, giving a more uniform appearance to Member D.

Vugs do not appear to be as extensively developed in Member D as in the lower members.

The thickness of Member D ranges from 195 feet to 237 feet, based on measurements of the sections at Tony Grove Lake, Logan Canyon, Portage, and Fourmile Canyon. The thickness of the member at Blacksmith Fork Canyon is an estimate because the contact between Members C and D is covered. The member cannot be recognized at the sections in Laketown Canyon.

Thin sections, made in connection with the study of the fossils found in the member, indicate the dolostone of Member D consists of a mosaic of interlocking anhedral and subhedral dolomite crystals. This is based on a limited number of slides. Apparently dolomitization of the member was most complete. This conclusion is based on thin sections and field evidence. The original sediments are thought to have been composed of calcareous mud or ooze with a small amount of coarser material. Some of the original textures of the sediment are preserved. These consist of bioclastic material possibly made up of algal and faecal pellets, and sponge spicules.

The organic material collected from Member D certainly is the most diversified of the four members found in the formation. Well-preserved specimens of tabulate corals are very abundant, with some rugose corals, nautiloids, and crinoids having a more limited occurrence. The abundance of chert and the uniformity with which it is scattered throughout the member, is probably responsible for the variety of faunal types. Many of the internal features found in the organisms are preserved by silicification that otherwise would have been destroyed.

The fossils collected from the member point to a possible Middle Llandovery C_1-C_2 age. The following fossils, with their stratigraphic positions and locations, are described as follows:

Brachiopods:

Virgiana? sp., USNM 12553, was found at Portage, Utah, about 1,699 feet above the Fish Haven Dolostone. It was silicified, scarce, and in a fair state of preservation. The fossils identified by A. J. Boucot assign a possible Middle Llandovery C_1-C_2 age to the member.

Cephalopods:

Orthocerida was discovered in the section at Portage, Utah, 1,638 feet above the Fish Haven; also at Fourmile Canyon, Utah, approximately 1,342 feet above the base of the formation.

Coelenterates:

Astrocerium cf. A. venustum Hall, UC loc. D-2143, was found at Portage, Utah, about 1,699 feet above the Fish Haven Dolostone. The coral was silicified and in a very good state of preservation. Many of the internal features were as well preserved as those in fossils from the eastern United States.

Chaetetes? sp., UC loc. D-2143, was found at Portage, Utah, approximately 1,699 feet above the Fish Haven. The fossil was silicified and in a fair state of preservation. The internal features were very poorly preserved.

Cladopora reticulata Hall?, UC loc. D-2142, was discovered at Portage, Utah, about 1,638 feet above the Fish Haven Dolostone. It was silicified and in a fair state of preservation; however, only insufficient amounts of the fossil were removable.

Cystihalysites cf. C. magnitubes (Buehler), UC loc. D-2144, was found at Portage, Utah, 1,699 feet above the Fish Haven Dolostone. The coral was silicified and well preserved; many of the internal features were as good or better than those on which the species is based.

cf. Cystihalysites sp. no. 2 Nordford, UC loc. D-2142, and UC loc. D-2135, was discovered at Portage, Utah, and Fourmile Canyon, Utah; it was located at elevations above the Fish Haven Dolostone of 1,638 and 1,430 feet respectively. Similar material was found at the same sections at 1,699 and 1,372 feet respectively. Fossils probably belonging to the same taxon were found in Logan Canyon, Utah, at 1,367 feet. The fossils were silicified and dolomitic, and the state of preservation was only fair.

?Cystihalysites sp. no. 2 Nordford, UC loc. D-2131, was found at Tony Grove Lake, Utah, 1,262 feet above the base of Laketown Dolostone. The fossil was silicified and in a fair state of preservation.

Cystihalysites aff. C. brownsportensis (Amsden), UC loc. D-2133, was found at Tony Grove Lake, Utah, 1,362 feet above the Fish Haven Dolostone. The coral was silicified and well preserved. Many of the internal features were as completely developed as those found in fossils from the eastern United States.

?Emmonsia tuberosa (Rominger), UC loc. D-2143, was discovered at Portage, Utah, about 1,699 feet above the base of the formation. The fossil was silicified and fairly well preserved, but weathering had removed many of the diagnostic features.

Favosites cf. F. brownsportensis Amsden, UC loc. D-2132, was found at Tony Grove Lake and Portage, Utah, at 1,342 and about 1,699 feet respectively. It was silicified and in a very good state of preservation. Material of a similar nature was found 1,272 feet above the Fish Haven Dolostone at Fourmile Canyon, Utah.

Fletcheria? sp., UC loc. D-2144, was found at Portage, Utah, about 1,699 feet above the base of the formation. The fossil was silicified and poorly preserved.

Platyaxum cf. P. orthosoleniskum (Werner), UC loc. D-2143, was found at Portage, Utah, about 1,650 feet above the Fish Haven Dolostone. It was silicified and well preserved.

Pleurodictyum cf. P. louisvillensis (Greene), UC loc. D-2143, was discovered at Portage, Utah, approximately 1,650 feet above the Fish Haven Dolostone. The fossil was silicified and in a very good state of preservation.

Pycnactactis sp., UC loc. D-2143, was found at Portage, Utah, approximately 1,650 feet above the base of the Laketown Dolostone. The coral was silicified and in a fair state of preservation.

Syringopora S. verticillata Goldfuss?, UC loc. D-2144, was found at Portage, Utah, about 1,699 feet above the Fish Haven Dolostone. It was silicified and fairly well preserved. Similar material occurred at Fourmile Canyon, Utah, 1,322 feet above the base of the formation.

Rugose corals were found at the sections at Fourmile Canyon and Portage, Utah, 1,247 and 1,638 feet respectively above the base of the formation. The corals were silicified and dolomitic and

too poorly preserved for identification.

Crinoids:

Crinoid stems were found in the section at Fourmile Canyon, Utah. They were dolomitic in nature and poorly preserved. Their location was 1,247 feet above the Fish Haven Dolostone.

Algae:

Calcareous algae, UC loc. D-2134, was found at Tony Grove Lake, Utah, about 1,370 feet above the Fish Haven Dolostone. Similar material was located at 1,262 feet in the same area. It was silicified and in a good state of preservation.

The environment of deposition of Member D based on the foregoing material is thought by the author to be diagnostic of a neritic marine sea. The sedimentary rocks of the member are considered to have been originally deposited as a fine calcareous mud or ooze which later was dolomitized.

AGE

Member A

Member A, based on fossil material, seems to be of Late Ordovician age. There is the possibility that the upper parts of the member are Silurian in age. The Silurian age of the upper part depends on one poorly preserved species of what appears to be Astrocerium. Very few identifiable fossils are found in this part of the member. It is proposed, on the basis of lithologic similarities between the lower part of Late Ordovician age and in view of the uncertain age of the upper part, to assign all of Member A to the Upper Ordovician in north-central Utah. A distinct lithologic break occurs at the top of Member A in the measured sections at Tony Grove Lake and Fourmile Canyon. It is proposed to take this as the Ordovician-Silurian boundary. Future investigation may indicate a plane of separation lower in the member which is probably the case. In other words, a broad interpretation must be used at the present time to assign the contact between the two systems on paleontologic evidence as was done previously. If the lithologic break between the members is used as the boundary it would increase the known thickness of Upper Ordovician rocks in north-central Utah about 300 feet.

In similar situations where the Upper Ordovician Series was found to extend higher in the Paleozoic section, investigators in north-central Utah and the Great Basin, have apparently solved the problem of naming these strata by extending the underlying formation's name upward, or by considering the Fish Haven and Laketown Dolostones

as a unit. This interpretation has caused some confusion in north-central Utah and throughout the Great Basin. The writer prefers to consider the Fish Haven Dolostone as that formation exposed at the type section in Fish Haven Canyon, Idaho; recognizing that the Laketown Dolostone in north-central Utah contains a fauna of both Late Ordovician and Early Silurian age.

Member B

The age of Member B, based on the possible presence of a Virgiana zone, is possibly Middle Llandovery C_1-C_2. The brachiopods collected from the member were identified by A. J. Boucot. Some of the corals found in the member are considered in the eastern United States as Middle Silurian in age; however, the stratigraphic range of these fossils is not well-known. For this reason the author prefers to rely on the possible Virgiana zone.

Member C

The fossils found in the member indicates a Middle Llandovery C_1-C_2 age. This is based on the occurrence of Virgiana sp. identified by A. J. Boucot. The fossil was found in the Hyrum Canyon, Utah, at the north side of the road, near the section line between secs. 22 and 23, T. 10 N., R. 2 E., of the Logan quadrangle (Figures 7 and 8, p. 38). The stratigraphic section is rather poorly exposed in this area but the brachiopods in the member can be correlated with the measured sections at Logan Canyon, Tony Grove Lake, Blacksmith Fork Canyon, Portage, and Fourmile Canyon. Member C is also correlated with the Hyrum Canyon area on the basis of the similarities in lithology and stratigraphic position with respect to the Water Canyon and Fish

Haven Formations. This is thought to be the area where E. M. Kindle in 1908 made the first discovery of a definite Silurian taxon in the eastern Great Basin. If this is the correct area then the brachiopods referred to Pentamerus cf. P. oblongus Sowerby, in north-central Utah, actually belong to Virgiana.

Member D

The age of the Member D, based on the possible presence of a Virgiana zone, is possibly Middle Llandovery C_1-C_2. If this is the case it would leave about 100 feet of strata between the Water Canyon Formation of Early Devonian age and the highest known occurrence of the brachiopods thought to be Virgiana, for the Wenlock and Ludlow Series of the Silurian System. It may be possible to include the upper 100 feet in the Wenlock Series, but strata belonging to the Ludlow Series are not probable at the present time; however, future investigations may prove or disprove their presence.

An alternate approach to the age of Member D is that approximately 500 feet of strata overlies the Virgiana zone found in Member C of Middle Llandovery C_1-C_2 age. The great variety of tabulate corals found in the possible Virgiana zone of Member D are known to occur in strata of Middle Silurian age in the eastern United States; however, their stratigraphic range is not well known at present. The writer prefers to rely on the possible presence of Virgiana for this reason.

CORRELATION

Some confusion concerning the lithology, boundaries, sequence, genesis, and correlation exists regarding the Silurian System in the Great Basin. This is due to the fact that many of the investigators who used formational names, in the basin, lacked a clear and complete understanding of the regional aspects of the system. Their personal opinion as to the delimitation and naming of a formation has resulted in the introduction of several names which might be considered by others to represent a single stratigraphic unit. In some cases, they have included strata of one formation in the lithologic description of a formation in another area. Changing faunal relationships and stratigraphic terminology regarding geologic time, due to improved knowledge, has further confused stratigraphic studies of the Silurian strata in the Great Basin.

In the western United States various formational names for Silurian equivalents and correlatives have been proposed. These are represented by the Fusselman Formation of the southwest, the Hidden Valley Dolostone, Montgomery Limestone, and the Gazelle Formation of the California area. In Nevada, the Lone Mountain, and Roberts Mountains Formations, and in Utah, Idaho, and a portion of Nevada, the Trail Creek and the Laketown Formations.

Generally speaking, Silurian strata in the Great Basin may be described from north-central Utah westward to the area of the Antler orogenic belt by the following lithologic types: bedded dolostone grading into massive dolostone, followed by limestone, and finally

ending in a shale. This would represent the Laketown, Lone Mountain, Roberts Mountains, and unnamed shale formations of the Great Basin. The conclusion of the lateral variation of these formations is based on the lithologic descriptions found in previous publications on the area.

The Silurian Laketown Dolostone and strata referred to the Laketown are known from scattered outcrops from south-central Idaho southward to southwestern Utah, and from central Utah westward to eastern Nevada. This formation and its equivalents cover an area of approximately 100,000 square miles in the Great Basin. The average thickness of the Laketown Dolostone throughout much of this area is about 1,000 feet. Lower, Middle, and Upper Silurian rocks are represented by the formation. The areal extent of the Lower and Upper Silurian strata is, at the present time, not well known. The recognition of these series has been principally in the area of previous, but less intensively studied western Utah and eastern Nevada.

Correlation of the Laketown Dolostone in north-central Utah, at the present, with similar strata in the Great Basin is very difficult. This conclusion is based on the confusion regarding rock-stratigraphic units, time-stratigraphic units, and fossil identifications found in the descriptions of Silurian formations and their boundaries in the basin. This has caused strata underlying and overlying the Silurian System to be separated from the system on either lithology or paleontology; in cases where the two criteria have not been used together confusion has resulted. The Laketown Dolostone of north-central Utah is correlated on a paleontologic basis with the strata of Middle Llandovery C_1-C_2 age in Europe and the Great Basin. Future

stratigraphic investigations in the Great Basin will probably make correlation of the Laketown outside of north-central Utah on a lithologic basis possible. Correlation of the formation, in north-central, can be made on both lithology and paleontology.

The author feels that a new evalution and investigation of the stratigraphic relationships between the Upper Ordovician part of the Laketown, the Fish Haven, and Bighorn Dolostones in north-central Utah is justified. This conclusion is based on the lithologic similarities, in north-central Utah, between what may be the Bighorn Dolostone in the Crawford Mountains and the Laketown Dolostone near Tony Grove Lake. The knowledge that the type section of the Fish Haven is faulted, thus the true thickness is unknown (Beus, 1963, p. 20); plus the discovery by Flower (1952, p. 25) that fossils considered as diagnostic of the Upper Ordovician Richmond Stage in the western United States, were also found in the Middle Ordovician of the eastern United States, strengthens the conclusion that more investigation is needed. The author believes that until the relationship between the Fish Haven and Bighorn Dolostones is better understood the possibility should be considered that the lower part of the Laketown and part of the Bighorn may be equivalent. Only future investigations will prove or disprove this supposition.

In the author's opinion the existence of a readily recognizable disconformity between the Laketown and Water Canyon Formations has not been adequately demonstrated in north-central Utah at any of the measured sections. There are just as significant lithologic breaks between the members of the Laketown Dolostone as between the Laketown and Water Canyon Formations. It should be noted that Johnson and Reso

(1964, p. 74) have discovered brachiopods of probable Late Silurian age in strata belonging to the Lower Devonian Sevy Dolostone. Based on the above discovery and the apparent age of the Laketown in north-central Utah, it is not beyond the realm of possibility to consider that the lower member of the Water Canyon Formation may be Silurian in part. This interpretation is substantiated by the fact that at the present time, to the author's knowledge, diagnostic fossils of Early Devonian age are unknown in the lower member of the Water Canyon Formation in north-central Utah.

LITERATURE CITED

Berdan, Jean M., and Helen Duncan. 1955. Ordovician age of the rocks mapped as Silurian in western Wyoming. Wyoming Geol. Assoc. Guidebook, 10th Ann. Field Conf. p. 48.

Beus, Stanley S. 1958. Geology of the northern part of Wellsville Mountain, northern Wasatch Range, Utah. Unpublished MS thesis, Utah State University Library, Logan.

Beus, Stanley Spencer. 1963. Geology of the central Blue Springs Hills, Utah-Idaho. Unpublished PhD dissertation, University of California Library, Los Angeles.

Blackwelder, Eliot. 1910. New Light on the geology of the Wasatch Mountains, Utah. Geol. Soc. America Bull. 21:517-542.

Bradley, Frank H. 1873. Snake River Division. U. S. Geol. Survey Terr. (Hayden), 6th Ann. Rept. p. 190-271.

Coulter, Henry W. 1956. Geology of the southeast portion of the Preston quadrangle, Idaho. Idaho Bur. Mines and Geology Pamph. 107 p. 28-30.

Ezell, Robert L. 1953. Geology of the Rendezvous Peak area, Cache and Box Elder Counties, Utah. Unpublished MS thesis, Utah State University Library, Logan.

Fenneman, Nevin M. 1931. Physiography of western United States. McGraw-Hill Book Co., Inc., New York and London. 534 p.

Flower, Rousseau H. 1952. New Ordovician cephalopods from eastern North America. Jour. Paleontology 26:24-59.

Gelnett, Ronald H. 1958. Geology of the southern part of Wellsville Mountain, Wasatch Range, Utah. Unpublished MS thesis, Utah State University Library, Logan.

Goddard, E. M., et al. 1951. Rock-Color Chart. Nat. Res. Council, Washington, D. C.

Hafen, Preston L. 1961. Geology of the Sharp Mountain area, southern part of the Bear River Range, Utah. Unpublished MS thesis, Utah State University Library, Logan.

Hansen, Steven C. 1964. Geology of the southwestern part of the Randolph quadrangle, Utah-Wyoming. Unpublished MS thesis, Utah State University Library, Logan.

Hardy, Clyde T., and J. Stewart Williams. 1953. Geologic map of the northern Wasatch Mountains, Utah and Idaho. Intermountain Assoc. Petroleum Geologists, Guide to the Geology of Northern Utah and Southeastern Idaho, 4th Ann. Field Conf.

Hayden, F. V. 1872. Report of F. V. Hayden. U. S. Geol. Survey Terr., 5th Ann. Rept. p. 1-204.

Ingram, Roy L. 1954. Terminology for the thickness of stratification and parting units in sedimentary rocks. Geol. Soc. America Bull. 65:937-938.

Johnson, J. G and Anthony Reso. 1964. Probable Ludlovian brachiopods from the Sevy Dolomite of Nevada. Jour. Paleontology 38:74-84.

Kindle, E. M. 1908a. Occurrence of the Silurian Fauna in Western America. Am. Jour. Sci., 4th ser. 25:125-129.

Kindle E. M. 1908b. The fauna and stratigraphy of the Jefferson limestone in the northern Rocky Mountain region. Bull. Am. Paleontology 4(2). 39 p.

King, Clarence. 1876. Paleozoic subdivision on the 40th Parallel. Am. Jour. Sci. 3d ser. 11:475-482.

Mansfield, George Rogers. 1927. Geography, geology, and mineral resources of part of southeastern Idaho. U. S. Geol. Survey Prof. Paper 152. 453 p.

Mertie, J. B., Jr. 1922. Graphic and mechanical computation of thickness of strata and distance to a stratum. U. S. Geol. Survey Prof. Paper 129 p. 39-52.

McFarlane, James J. 1955. Silurian strata of the eastern Great Basin. Brigham Young University Research Studies, Geol. ser. 2 (5). 53 p.

Payne, Thomas G. 1942. Stratigraphical analysis and environmental reconstruction. Am. Assoc. Petroleum Geologists Bull. 26:1697-1770.

Richardson, G. B. 1913. The Paleozoic Section in Northern Utah. Am. Jour. Sci., 4th ser. 36:406-416.

Richardson, G. B. 1941. Geology and mineral resources of the Randolph quadrangle, Utah-Wyoming. U. S. Geol. Survey Bull. 923. 54 p.

Smith, Robert B. 1965. Geology of the Monte Cristo area, Bear River Range, Utah. Unpublished MS thesis, Utah State University Library, Logan.

Tomlinson, C. W. 1917. The Middle Paleozoic stratigraphy of the central Rocky Mountain region. Jour. Geology 25:112-134, 244-257, 373-394.

Williams, Alwyn. 1951. Llandovery brachiopods from Wales with special reference to the Llandovery district. Geol. Soc. London Quart. Jour. 107:85-136.

Williams, J. Stewart. 1948. Geology of the Paleozoic rocks, Logan quadrangle, Utah. Geol. Soc. America Bull. 59:1121-1164.

Williams, J. Stewart. 1958. Geologic Atlas of Utah, Cache County. Utah Geol. and Mineralog. Survey Bull. 64. 98 p.

APPENDIX

Laketown Dolostone

Section 1

Section measured about half a mile southwest of the junction of the Right Fork and Logan Canyon, Utah; beginning in the NW¼SE¼ sec. 18, T. 12 N., R. 3 E.; ending in the NE¼NW¼ sec. 18 T. 12 N., R. E., Salt Lake base and meridian.

	Thickness (feet)
Water Canyon Formation.	
Laketown Dolostone:	
Member D:	
19. Dolostone, dark-gray, weathers medium gray, mottled, finely to very finely crystalline, medium-bedded to thick-bedded; chert in seams about 2 mm thick scattered throughout; poorly preserved halysitid corals in upper half; medium-bedded in lower part; medium-gray dolostone at top; forms steep semicovered ledgy slope.....	195
Total.....	195
Member C:	
18. Dolostone, medium-gray, weathers medium light gray, medium-crystalline, medium-bedded; thickly laminated; contains poorly preserved crinoid stems; forms ledgy outcrop along ridge.....	83
17. Dolostone, medium-gray, weathers medium light gray, finely crystalline, very thick-bedded; abundant poorly preserved crinoid stems; forms ledgy outcrop along ridge.....	88
16. Dolostone, light brownish-gray, weathers medium light gray, medium-crystalline, very thick-bedded, porous texture; small vugs abundant on weathered and fresh surfaces; forms steep semicovered ledgy slope.....	56

		Thickness (feet)
15.	Covered; light-gray dolostone float.....	70
14.	Dolostone, medium-gray, weathers light gray, finely to coarsely crystalline, very thick-bedded, porous texture; contains sparsely scattered vugs, 0.5-1 mm in diameter; remains of poorly preserved brachiopods in talus; forms steep semicovered slope with small cliffs.....	120
	Total.....	417

Member B:

13.	Dolostone, dark-gray, weathers medium gray, very finely crystalline, very thick-bedded; chert or dolomite in nodules or grains from 0.5-1 mm in diameter sparsely scattered throughout; forms steep semicovered slope with cliffs.....	125
12.	Dolostone, medium dark-gray, weathers medium gray, finely crystalline, very thick-bedded; small vugs in lower part; darker and more dense near top; forms steep semicovered slope with cliffs...	162
11.	Dolostone, dark-gray, weathers medium gray, mottled , very finely crystalline, very thick-bedded; light brownish-gray chert in irregular nodules throughout; contains fairly well-preserved rugose corals; forms steep semicovered slope with small cliffs.....	54
10.	Dolostone, medium dark-gray, weathers medium light gray, very finely crystalline, medium-bedded to very thick-bedded; mottled toward top; small vugs, some filled with calcite, found throughout; well-preserved rugose corals in lower half; medium-bedded near top; forms steep semicovered slope with cliffs.....	115
9.	Covered; medium dark-gray dolostone float, contains some large pieces of calcite.....	41

	Thickness (feet)
8. Dolostone, medium dark-gray, weathers medium gray, finely crystalline, thick-bedded to very thick-bedded; thickly laminated; contains poorly preserved rugose corals and small crinoid stems; gray-brown chert in small irregular nodules throughout; forms steep semicovered slope with small cliffs.....	19
7. Dolostone, medium dark-gray, weathers medium gray, very finely crystalline, thin-bedded to medium-bedded; thinly laminated; forms steep semicovered ledgy slope.....	34
Total.....	550

Member A:

6. Dolostone, dark-gray, weathers medium light gray, very finely crystalline, very thick-bedded; brownish-black chert in irregular nodules, less chert near top; forms steep semicovered ledgy slope.....	75
5. Covered; dark-gray dolostone float.....	41
4. Dolostone, dark-gray, weathers medium light gray, very finely crystalline, medium-bedded to thick-bedded; contains abundant medium-gray to brownish-black chert in small nodules and discontinuous beds 1-2 in. thick; forms steep semicovered slope.....	70
3. Covered; medium dark-gray dolostone float.....	41
2. Dolostone, medium dark-gray, weathers medium light gray, very finely crystalline, very thick-bedded; contains vugs 0.5-1 mm in diameter, some filled with calcareous nodules; forms steep semicovered ledgy slope.....	42

	Thickness (feet)
1. Dolostone, medium dark-gray, weathers medium light gray, finely crystalline, very thick-bedded; forms small cliff next to road.....	28
Total.....	297
Total Laketown Dolostone.....	1,459

Fish Haven Dolostone.

Laketown Dolostone

Section 2

Section measured in Laketown Canyon about three-fourths of a mile south from the mouth, near Laketown, Utah; beginning in the NW¼SE¼ sec. 6, T. 12 N., R. 6 E.; ending in the SW¼SE¼ sec. 6, T. 12 N., R. 6 E., Salt Lake base and meridian.

		Thickness (feet)
Water Canyon Formation.		
Laketown Dolostone:		
Member B:		
45.	Covered; medium light-gray dolostone float.....	13
44.	Dolostone, medium light-gray, weathers light gray, very finely crystalline, bedding indistinct; contains small vugs some filled with calcareous nodules; fresh and weathered surfaces react mildly with dilute HCl; forms dip slope.....	1
43.	Covered; medium-gray dolostone float.....	4
42.	Dolostone, medium-gray, weathers medium gray, finely crystalline, porous texture, very thick bedded; contains seams of calcite; fresh and weathered surfaces react actively with dilute HCl; forms dip semicovered slope.....	2
41.	Covered; medium-gray dolostone float.....	17
40.	Dolostone, medium light-gray, weathers light gray, very finely crystalline, fracture cleavage, very thick-bedded; contains sparsely scattered small vugs; fault cuts unit; fresh and weathered surfaces react mildly with dilute HCl; forms steep semicovered ledgy slope.....	65
39.	Covered; medium-gray to brownish-gray dolostone float.....	13

		Thickness (feet)
38.	Dolostone, brownish-gray, weathers medium light gray, very finely to finely crystalline, fracture cleavage, very thick-bedded; some fresh and weathered surfaces react mildly with dilute HCl; forms steep semicovered ledgy slope.....	3
37.	Dolostone, light olive-gray to light-gray, weathers light gray, very finely crystalline, fracture cleavage, very deeply weathered, very thick-bedded; most fresh and weathered surfaces react actively with dilute HCl; forms steep semicovered ledgy slope.....	29
36.	Dolostone, olive-gray, weathers medium light gray, finely crystalline, fracture cleavage, very thick-bedded; contains small vugs some filled with calcareous nodules; some fresh and weathered surfaces react mildly with dilute HCl; forms steep semicovered ledgy slope.....	17
35.	Covered; light olive-gray to olive-gray dolostone float.....	15
34.	Dolostone, light olive-gray, weathers light olive gray, very finely crystalline, very thick-bedded; deeply weathered surfaces react mildly to actively with dilute HCl; contains small vugs some filled with calcareous nodules; forms steep semicovered ledgy slope.....	8
33.	Covered; light-gray dolostone float.....	16
32.	Dolostone, medium dark-gray, weathers medium light gray, very finely crystalline, very thick-bedded; contains small sparsely scattered crinoid stems; some small nodules of dolomite throughout; forms steep semicovered slope with small cliffs.....	35
31.	Covered; medium-gray dolostone float.....	37

		Thickness (feet)
30.	Dolostone, medium light-gray to light olive-gray, weathers light olive gray, finely to medium-crystalline, very thick-bedded; some fresh surfaces react actively with dilute HCl; forms steep semicovered ledgy slope.....	24
29.	Dolostone, medium-gray, weathers medium light gray, very finely crystalline, very thick-bedded; some fresh surfaces react mildly with dilute HCl; forms steep semicovered ledgy slope.....	32
28.	Covered; light olive-gray to medium-gray dolostone float.....	92
27.	Dolostone, light olive-gray, weathers yellowish gray, very finely crystalline, fracture cleavage, very thick-bedded; some fresh and weathered surfaces react mildly with dilute HCl; forms steep semicovered ledgy slope.....	28
26.	Dolostone, olive-gray, weathers light olive gray, very finely to finely crystalline, very thick-bedded; some fresh and weathered surfaces react actively with dilute HCl; forms steep semicovered slope.....	22
25.	Covered; light olive-gray dolostone float.....	18
24.	Dolostone, same as No. 22, forms small cliff.....	5
23.	Covered; light olive-gray dolostone float.....	42
22.	Dolostone, light olive-gray, weathers light olive gray, very finely crystalline, thick-bedded to very thick-bedded; some fresh and weathered surfaces react mildly with dilute HCl; contains small vugs some filled with calcareous nodules; "worm trails" on some weathered surfaces; forms steep semicovered ledgy slope.....	48
21.	Covered; light olive-gray dolostone float.....	12

		Thickness (feet)
20.	Dolostone, olive-gray to light olive-gray, weathers light olive gray, very finely crystalline, fracture cleavage, very thick-bedded; some fresh and weathered surfaces react actively with dilute HCl; lower part deeply weathered; fault cuts unit; more dense and darker near top; contains small vugs, some filled with calcareous nodules; forms steep semicovered ledgy slope.....	56
19.	Covered; medium-gray dolostone float.....	61
18.	Dolostone, olive-gray, weathers light olive gray, finely to very finely crystalline, very thick-bedded; contains small vugs 0.1-1 cm in diameter, some filled with calcareous nodules; some fresh surfaces react mildly with dilute HCl; "worm trails" on some weathered surfaces; forms steep semicovered slope with small cliffs.....	10
17.	Dolostone, brownish-gray, weathers light brownish gray, very finely crystalline, thick-bedded to very thick-bedded; some fresh surfaces react actively with dilute HCl; very deeply weathered; small nodules of calcite throughout; vugs some filled with calcareous nodules abundant; "worm trails" on some weathered surfaces; small vertically oriented seams of calcite sparsely scattered throughout; forms steep semicovered slope with small cliffs.....	28
16.	Covered; brownish-gray dolostone float.....	39
15.	Dolostone, brownish-black to brownish-gray, weathers light brownish gray, very finely to medium-crystalline, fracture cleavage, very thick-bedded; some fresh and weathered surfaces react mildly with dilute HCl; very deeply weathered in upper part; small nodules of calcite throughout; poorly preserved rugose corals in upper part; vugs 1-10 cm in diameter sparsely scattered throughout; forms steep semicovered slope with small cliffs.....	23
14.	Covered; brownish-gray dolostone float.....	3

		Thickness (feet)
13.	Dolostone, light olive-gray, weathers light olive gray, finely crystalline, thick-bedded; some fresh surfaces react mildly with dilute HCl; forms steep semicovered slope with small cliffs.....	1
12.	Dolostone, same as No. 10.....	2
11.	Covered; light olive-gray dolostone float.....	2
10.	Dolostone, brownish-black to brownish-gray, weathers olive gray to light olive gray, very finely crystalline, fracture cleavage, very thick-bedded; contains medium-gray chert in small irregular nodules and seams; more dense and darker in upper part; some fresh surfaces react mildly with dilute HCl; forms steep semicovered slope with small cliffs.....	11
9.	Covered; brownish-gray dolostone float.....	4
8.	Dolostone, brownish-gray, weathers light olive gray, sublithographic, very thick-bedded; grayish-black to dark-gray chert in irregular nodules throughout; deeply weathered surfaces react mildly with dilute HCl; forms steep semicovered slope with small cliffs.....	2
7.	Chert, grayish-black, forms bed.....	1
6.	Covered; brownish-gray dolostone float.....	3
5.	Dolostone, brownish-black, weathers brownish gray, sublithographic to very finely crystalline, thin-bedded to medium-bedded; laminated in upper part; lightly mottled; contains small randomly oriented seams of quartz or dolomite; seams of calcite in upper part; forms steep semicovered ledgy slope.....	15
4.	Dolostone, olive-gray, weathers light olive gray, sublithographic, fracture cleavage, thin-bedded to medium-bedded; weathered surfaces react mildly with dilute HCl; forms steep semicovered ledgy slope.....	5
	Total.....	864

	Thickness (feet)
Member A:	
3. Dolostone, brownish-black, weathers brownish gray, very finely to finely crystalline, fracture cleavage, very thick-bedded; highly weathered chert nodules in upper part; some fresh and weathered surfaces react mildly with dilute HCl; small seams and nodules of calcite throughout; forms steep semicovered slope with small cliffs.....	199
2. Covered; brownish-gray dolostone float.....	71
1. Dolostone, olive-gray, weathers light olive gray, very finely to finely crystalline, thick-bedded; iron stained in some parts; some weathered surfaces react mildly with dilute HCl; forms steep semicovered ledgy slope.....	13
Total.....	283
Total Laketown Dolostone.....	1,147

Garden City Limestone.

Laketown Dolostone

Section 3

Section measured in the East Fork of Laketown Canyon about 3½ miles southeast of Laketown, Utah; beginning in the NW¼SW¼ sec. 16, T. 12 N., R. 6 E.; ending in the NW¼SE¼ sec. 17, T. 12 N., R. 6 E., Salt Lake base and meridian.

		Thickness (feet)
Water Canyon Formation.		
Laketown Dolostone:		
Member B:		
41.	Covered; light-gray to medium-gray dolostone float.....	11
40.	Dolostone, medium-gray, weathers medium light gray, very finely crystalline, fracture cleavage, thick-bedded to very thick-bedded; some fresh surfaces react mildly with dilute HCl; small vugs some filled with calcareous nodules in upper half; forms moderately steep ledgy slope near canyon bottom.....	22
39.	Covered; light brownish-gray to medium-gray dolostone float.....	87
38.	Dolostone, light brownish-gray, weathers light brownish gray to light olive gray, finely crystalline, porous texture, thick-bedded to very thick-bedded; vugs 1-3 mm in diameter throughout; contains stromatoporid-like organisms; some fresh and weathered surfaces react actively with dilute HCl; forms moderately steep ledgy slope near canyon bottom.....	12
37.	Covered; light-gray dolostone float.....	13
36.	Dolostone, light-gray, weathers light olive gray, very finely crystalline, porous texture, deeply weathered, very thick-bedded; small vugs on fresh surfaces; contains very poorly preserved rugose corals; some fresh and weathered surfaces react actively with dilute HCl; forms moderately steep ledgy slope near canyon bottom.....	3

		Thickness (feet)
35.	Covered; light olive-gray dolostone float.....	29
34.	Dolostone, same as No. 32, only thick-bedded to very thick-bedded.....	13
33.	Covered; brownish-gray dolostone float.....	50
32.	Dolostone, brownish-gray, weathers medium gray, lightly mottled, very finely crystalline, fracture cleavage, thin-bedded to medium-bedded; contains stromatoporid-like organisms, some small crinoid stems; forms moderately steep ledgy slope near canyon bottom.....	4
31.	Covered; medium light-gray to brownish-gray dolostone float.....	40
30.	Dolostone, medium light-gray, weathers medium light gray, very finely crystalline, fracture cleavage, bedding indistinct; contains some small nodules of calcite; highly fractured.....	1
29.	Dolostone, brownish-gray, weathers pale brown to light olive gray, lightly mottled, very finely crystalline, fracture cleavage, dense texture, very thick-bedded; stromatoporid-like organisms near top; some weathered surfaces react mildly with dilute HCl; forms moderately steep ledgy slope near canyon bottom.....	21
28.	Covered; light pale-brown to light olive-gray dolostone float.....	20
27.	Dolostone; light olive-gray, weathers light olive gray, medium-crystalline, porous texture, very thick-bedded; most fresh surfaces react actively with dilute HCl; forms moderately steep ledgy slope at canyon bottom.....	6
26.	Covered; light olive-gray to brownish-gray dolostone float.....	87

		Thickness (feet)
25.	Dolostone, brownish-gray, weathers medium light gray, sublithographic, very thick-bedded; some fresh surfaces react mildly with dilute HCl; vugs less than 2 mm in diameter sparsely scattered throughout; forms moderately steep ledgy slope near canyon bottom.....	32
24.	Covered; light brownish-gray to light olive-gray dolostone float.....	28
23.	Dolostone, same as No. 13, except very thick-bedded.....	2
22.	Covered; light brownish-gray to light olive-gray dolostone float.....	19
21.	Dolostone, same as No. 13.....	13
20.	Covered; light brownish-gray to light olive-gray dolostone float.....	16
19.	Dolostone, brownish-gray to olive-gray, weathers light olive gray, very finely crystalline, porous texture, deeply weathered, thick-bedded; some fresh and weathered surfaces react mildly with dilute HCl; forms canyon bottom at fork in road.....	9
18.	Covered; light brownish-gray to light olive-gray dolostone float.....	29
17.	Dolostone, same as No. 13, thinly laminated; forms canyon bottom.....	13
16.	Covered; light brownish-gray to light olive-gray dolostone float.....	4
15.	Dolostone, same as No. 13.....	2
14.	Covered; light brownish-gray to light olive-gray dolostone float.....	46

		Thickness (feet)
13.	Dolostone, light brownish-gray to light olive-gray, weathers light brownish gray to light olive gray, very finely crystalline, deeply weathered, medium-bedded to thick-bedded; contains poorly preserved rugose and favositid corals, "worm trails" and stromatoporid-like organisms; thinly laminated; some fresh and weathered surfaces react actively with dilute HCl; forms moderately steep ledgy slope near canyon bottom.....	84
	Total.....	716

Member A:

12.	Covered; brownish-gray dolostone float, some very small outcrops.....	46
11.	Dolostone, brownish-gray to dark brownish-gray, weathers medium gray to light brownish gray, mottled, very finely crystalline, porous texture, deeply weathered, very thick-bedded; contains small vugs filled with calcareous nodules; fairly well-preserved rugose corals, and stromatoporid-like organisms throughout; fresh and weathered surfaces react mildly with dilute HCl; forms moderately steep ledgy slope.....	14
10.	Covered; brownish-gray dolostone float.....	34
9.	Dolostone, medium dark-gray to brownish-gray, weathers light brownish gray, mottled, fracture cleavage, very finely crystalline, very thick-bedded; medium-gray to dark-gray chert in seams and discontinuous beds abundant throughout; one well-preserved gastropod found in chert nodule; some fresh surfaces react mildly with dilute HCl; forms moderately steep ledgy slope near canyon bottom.....	6
8.	Covered; brownish-gray dolostone float.....	29
7.	Dolostone, light brownish-gray, weathers medium light gray, very finely crystalline, fracture cleavage, bedding indistinct; medium-gray chert sparsely scattered throughout; some fresh surfaces react with dilute HCl; forms moderately steep ledgy slope near canyon bottom.....	1

		Thickness (feet)
6.	Covered; brownish-gray dolostone float.....	14
5.	Dolostone, same as No. 3, forms moderately steep ledgy slope near canyon bottom.....	2
4.	Covered; brownish-gray dolostone float, some medium-gray chert.....	35
3.	Dolostone, brownish-gray, weathers light brownish gray, lightly mottled, very finely crystalline, fracture cleavage, very thick-bedded; poorly preserved rugose corals; some fresh and weathered surfaces react actively with dilute HCl; forms moderately steep ledgy slope.....	3
2.	Covered; brownish-gray dolostone float.....	43
1.	Dolostone, brownish-gray, weathers brownish gray, very finely crystalline, very deeply weathered, very thick-bedded; contains small seams of calcite; most fresh and weathered surfaces react actively with dilute HCl; small vugs; forms moderately steep ledgy slope near canyon bottom.....	9
	Total.....	236
	Total Laketown Dolostone.....	952

Fish Haven Dolostone.

Laketown Dolostone

Section 4

Section measured beginning in the SW¼SW¼ of unsurveyed sec. 5, T. 13 N., R. 3 E.; ending in the SW¼SW¼ of unsurveyed sec. 6, T. 13 N., R. 3 E., near Tony Grove Lake, Utah, Salt Lake base and meridian.

	Thickness (feet)
Water Canyon Formation.	
Laketown Dolostone:	
Member D:	
27. Dolostone, medium-gray, weathers light gray, very finely crystalline, very thick-bedded; forms steep slope with small cliffs.....	15
26. Dolostone, dark-gray, weathers medium gray, very finely crystalline, very thick-bedded; medium-gray to light-gray chert in irregular nodules and seams, follows bedding; well-preserved halysitid, favositid, and syringoporid corals abundant in upper half; forms a steep semicovered slope with cliffs.....	197
Total.....	212
Member C:	
25. Dolostone, light-gray, weathers light gray, finely crystalline, very thick-bedded; small thinly laminated lenses, some deformed, some react with dilute HCl; weathered halysitid corals in float, probably from above; forms steep semicovered slope.....	123
24. Dolostone, dark-gray, weathers medium gray, very finely crystalline, very thick-bedded; contains seams of light-gray chert; thin-bedded in part; halysitid corals in lower half; forms steep semicovered ledgy slope.....	41

		Thickness (feet)
23.	Dolostone, light-gray, weathers light gray, finely crystalline, medium-bedded to very thick-bedded; contains some chert in irregular nodules; very poorly preserved brachiopod and crinoid remains sparsely scattered throughout; contains vugs 0.5-1 mm in diameter; more dense in upper part and darker in color, medium dark-gray, weathers medium gray; forms steep semicovered ledgy slope.....	123
	Total.....	287

Member B:

22.	Dolostone, medium dark-gray, weathers medium light gray, lightly mottled, very finely crystalline, very thick-bedded; contains poorly preserved crinoid stems; small randomly oriented seams of dolomite or quartz throughout; small chert nodules follow bedding in upper half; forms steep semicovered ledgy slope.....	67
21.	Covered; medium-gray dolostone float; forms moderate slope.....	51
20.	Dolostone, dark-gray, weathers medium gray, mottled, very finely to finely crystalline, medium-bedded to very thick-bedded; contains highly weathered brownish-gray chert in irregular randomly oriented nodules, some nodules contain small vugs filled with crystals of quartz; thickly laminated; some well-preserved rugose corals in lower half; small seams of dolomite or quartz in upper part; forms moderately flat ledgy slope.....	243
19.	Dolostone, medium light-gray, weathers light gray, very finely crystalline, thin-bedded; forms moderately steep ledgy slope.....	9
18.	Dolostone, dark-gray, weathers medium gray, mottled, very finely to finely crystalline, thin-bedded to thick-bedded; poorly preserved brachiopods and rugose corals in lower half, corals well-preserved near top; vugs 1-3 cm in diameter some filled with crystals of quartz or dolomite in upper part; forms moderately steep ledgy slope.....	157

		Thickness (feet)
17.	Dolostone, medium light-gray, weathers light gray, very finely crystalline, thin-bedded; weathered surfaces react mildly with dilute HCl; forms steep semicovered ledgy slope.....	60
	Total.....	587

Member A:

16.	Dolostone, dark-gray, weathers medium gray, very finely crystalline, thick-bedded; very large bodies of calcite, some oriented perpendicular to bedding; mottled in upper part; forms steep semicovered slope.....	41
15.	Dolostone, dark-gray, weathers medium gray, mottled, very finely crystalline, medium-bedded to very thick-bedded; light brownish-gray chert in irregular nodules in lower half; contains well-preserved rugose corals; forms steep ledgy slope.....	105
14.	Dolostone, medium dark-gray, weathers medium gray, mottled, very finely crystalline, very thick-bedded; contains indistinct very poorly preserved brachiopod shells; forms moderate ledge slope.....	7
13.	Dolostone, medium dark-gray, weathers medium light gray, very finely crystalline, very thick-bedded; numerous vugs 0.5-1 mm in diameter, some filled with calcite; forms moderate ledgy slope.....	24
12.	Dolostone, dark-gray, weathers medium gray, very finely crystalline, thick-bedded; contains vugs 0.5-1 mm in diameter; some irregular nodules of quartz or dolomite and calcite throughout; closely spaced randomly oriented joints in some beds, joints react mildly with dilute HCl.....	15
11.	Dolostone, medium-gray, weathers light gray, sublithographic, thick-bedded; forms moderately flat ledgy slope.....	8

		Thickness (feet)
10.	Dolostone, medium dark-gray, weathers medium gray, appears to be mottled, very finely crystalline, thick-bedded; contains rugose and favositid corals, some stromatoporid-like organisms; small seams of dolomite or quartz throughout; forms moderately flat slope.....	26
9.	Dolostone, medium-gray, weathers medium light gray, very finely crystalline, medium-bedded to thick-bedded; weathered surfaces have salt and pepper like texture caused by numerous small vugs; forms moderately flat ledgy slope.....	27
8.	Dolostone, brownish-black, weathers brownish gray, very finely crystalline, thick-bedded; contains seams of dolomite or quartz.....	1
7.	Dolostone, light-gray, weathers light gray, very finely crystalline, thick-bedded; contains rugose corals; vugs 0.5-1 mm in diameter, some filled with calcite; forms moderately flat ledgy slope.....	7
6.	Dolostone, medium dark-gray, weathers medium light gray, very finely crystalline, very thick-bedded; calcite nodules 0.5-2 cm in diameter; poorly preserved rugose corals near top; forms moderately steep ledgy slope.....	13
5.	Dolostone, medium light-gray, weathers light gray, very finely crystalline, medium-bedded; thickly laminated; contains vugs 0.5 mm in diameter, some filled with calcite; very poorly preserved brachiopod remains and some stromatoporid-like organisms.....	9
4.	Dolostone, medium light-gray, weathers medium light gray, finely crystalline, thick-bedded; small calcite seams throughout; some areas react mildly with dilute HCl; forms moderately flat ledgy slope.....	28
3.	Covered; medium light-gray dolostone float.....	11
2.	Dolostone, medium-gray, weathers medium light gray, finely crystalline, thick-bedded; forms moderately flat ledgy slope.....	4

	Thickness (feet)
1. Dolostone, medium dark-gray, weathers medium gray, very finely crystalline, thick-bedded, mottled; forms moderately flat ledgy slope.....	10
Total.....	336
Total Laketown Dolostone.....	1,422

Fish Haven Dolostone.

Laketown Dolostone

Section 5

Section measured near the junction of the Left Fork and Blacksmith Fork Canyon, Utah; beginning in the NW¼SW¼ sec. 2, T. 10 N., R. 2 E.; ending in the NE¼SW¼ sec. 3, T. 10 N., R. 2 E., Salt Lake base and meridian.

		Thickness (feet)
Water Canyon Formation.		
Laketown Dolostone:		
Member D:		
19.	Dolostone, dark-gray, weathers medium gray, very finely crystalline, very thick-bedded; contains one lens of conglomerate 6 in. thick and about 60 ft long composed of fragments of very coarse sand to medium-sized pebbles of dark-gray dolostone, in matrix of moderate reddish-orange calcareous cement; semicovered in upper part; forms massive cliff by small tributary to Blacksmith Fork River.....	131
18.	Covered; small alluvial plain.....	95
	Total.....	226
Member C:		
17.	Covered; small alluvial plain.....	95
16.	Covered; medium light-gray dolostone float; forms steep slope.....	55
15.	Dolostone, medium light-gray, weathers medium light gray, medium-crystalline, very thick-bedded; contains light-gray to yellowish-gray chert in beds 2-4 in. thick, interbedded with dolostone beds 2 in. to several feet thick; small lenses of thickly laminated dolostone near top; forms steep semicovered slope.....	86
14.	Covered; medium light-gray dolostone float; forms steep slope.....	104

		Thickness (feet)
13.	Dolostone, medium light-gray, weathers light gray, finely crystalline, very thick-bedded; small seams and nodules of pale yellowish-brown chert; vugs 0.1-5 cm in diameter containing well-developed crystals of quartz in lower half; forms steep ledgy slope.....	47
	Total.....	387

Member B:

12.	Dolostone, dark-gray, weathers medium gray, finely crystalline, thick-bedded; poorly preserved crinoid stems; small randomly oriented seams of dolomite or quartz sparsely scattered throughout; forms steep semicovered slope with cliffs.....	124
11.	Covered; dark-gray dolostone float; forms slope under cliffs.....	122
10.	Dolostone, dark-gray, weathers medium light gray, very finely crystalline, thick-bedded; contains thick seams and nodules of pale yellowish-brown chert; forms steep semicovered slope with cliffs.....	62
9.	Dolostone, medium-gray, weathers medium gray, lightly mottled, very finely crystalline, thick-bedded; contains moderate yellowish-brown to dark yellowish-orange chert, in irregular nodules; vugs filled with crystals of quartz near top; forms steep ledgy slope.....	98
8.	Dolostone, dark-gray, weathers medium gray, finely crystalline, thick-bedded; abundant chert in seams and nodules; nodules of dolomite about 2 mm in diameter sparsely scattered throughout; forms steep semicovered ledgy slope.....	113
7.	Dolostone, medium-gray, weathers light gray, very finely crystalline, medium-bedded; forms steep semicovered ledgy slope.....	19
6.	Covered; medium light-gray dolostone float; forms small talus slope.....	87

		Thickness (feet)
5.	Dolostone, medium-gray, weathers light gray, sublithographic, very thin-bedded to thin-bedded; thinly laminated in part, lenticular; poorly preserved rugose corals in talus from unit; forms steep ledgy slope.....	31
	Total.....	656

Member A:

4.	Dolostone, dark-gray, weathers medium light gray, very finely crystalline, medium-bedded; small vugs 0.5-2 mm in diameter; forms steep semicovered slope.....	9
3.	Covered; lower part forms an alluvial fan composed of several types of dolostone, at top dark-gray dolostone in float; poorly preserved rugose corals near west edge of fan.....	261
2.	Dolostone, dark-gray, weathers medium light gray, very finely crystalline, medium-bedded; forms steep semicovered ledgy slope.....	29
1.	Dolostone, medium-gray, weathers medium light gray, very finely crystalline, medium-bedded to thick-bedded; medium-bedded near top; mottled in lower 6 ft; fresh surfaces react mildly with dilute HCl; forms steep ledgy slope.....	42
	Total.....	341
	Total Laketown Dolostone.....	1,610

Fish Haven Dolostone.

Laketown Dolostone

Section 6

Section measured 2 miles west of Portage, Box Elder County, Utah; half a mile north of the canyon road, at the mouth of Portage Canyon in T. 14 N., R. 4., Salt Lake base and meridian.

	Thickness (feet)
Water Canyon Formation.	
Laketown Dolostone:	
Member D:	
15. Dolostone, medium-gray, weathers medium light gray, very finely crystalline, thick-bedded; forms level semicovered ridge.....	27
14. Dolostone, medium light-gray, weathers light gray, medium-crystalline, thick-bedded; forms level semicovered ridge.....	5
13. Dolostone, dark-gray, weathers medium dark gray, very finely crystalline, thick-bedded; lower half contains well-preserved halysitid, favositid, syringoporid, and rugose corals, some crinoid stems; weathers medium gray near top; forms ledgy outcrop along ridge.....	131
12. Dolostone, medium light-gray, weathers light gray, medium-crystalline, thick-bedded; fresh surfaces react mildly with dilute HCl; forms semicovered ledgy outcrop along ridge.....	26
11. Dolostone, dark-gray, weathers medium dark gray, very finely crystalline, thick-bedded; well-preserved halysitid and rugose corals, nautiloids in lower half; thin seams of chert scattered throughout; forms ledgy outcrop along ridge.....	48
Total.....	237
Member C:	
10. Dolostone, light-gray, weathers light gray, medium-crystalline, thick-bedded, porous texture; small vugs 0.5-1 mm in diameter near top; some fresh surfaces react mildly with dilute HCl; forms moderately flat ledgy slope parallel to ridge.....	89

		Thickness (feet)
9.	Dolostone, medium light-gray, weathers light gray, finely crystalline, very thick-bedded; abundant crinoid stems; fault cuts unit; some areas react mildly with dilute HCl; forms slope parallel to ridge, with ledges.....	159
8.	Dolostone, medium light-gray, weathers medium light gray, medium-crystalline, very thick-bedded, porous texture; talus contains pieces of calcite in lower half; some deeply weathered surfaces react mildly with dilute HCl; more dense near top; mottled in upper half; moderate yellowish-brown chert near top; fault cuts unit; forms moderately flat ledgy slope parallel to ridge.....	161
7.	Dolostone, medium light-gray, weathers light gray, medium-crystalline, very thick-bedded; abundant crinoid stems; forms steep slope with small cliffs.....	185
6.	Dolostone, medium light-gray, weathers light gray, finely crystalline, very thick-bedded; light-gray to dark-gray chert in beds 1-4 in. thick, interbedded with beds of dolostone 8-12 in. thick abundant; small vugs 1-7 mm in diameter sparsely scattered throughout; some deeply weathered surfaces react mildly with dilute HCl; forms moderately steep semicovered ledgy slope.....	81
5.	Dolostone, light-gray, weathers light gray, finely crystalline, very thick-bedded; crinoid stems sparsely scattered throughout; some areas react mildly with dilute HCl; forms moderately steep semicovered ledgy slope.....	14
4.	Dolostone, medium light-gray, weathers light gray, finely crystalline, very thick-bedded; texture is more dense than that above or below; forms steep semicovered ledgy slope.....	87
	Total.....	786

	Thickness (feet)
Members A and B undivided:	
3. Dolostone, dark-gray, weathers medium light gray, very finely crystalline, thick-bedded; light-gray chert in float from upper part; highly weathered areas lighter in color and react mildly with dilute HCl; small seams of quartz or dolomite near top; forms steep semicovered ledgy slope.....	388
2. Covered; medium dark-gray, weathers medium gray, very finely crystalline dolostone float, mottled in part; at 174 ft an outcrop containing stromatoporid-like organisms and well-preserved halysitid, favositid, and rugose corals; some fresh weathered surfaces react mildly with dilute HCl; forms moderately steep slope.....	381
1. Dolostone, medium-gray, weathers medium light gray, very finely crystalline, bedding indistinct; mottled near top, cherty at top; weathered surfaces react mildly with dilute HCl; forms moderately steep semicovered slope.....	70
Total.....	839
Total Laketown Dolostone.....	1,862

Fish Haven Dolostone.

Laketown Dolostone

Section 7

Section measured at the head of Fourmile Canyon, east of Mantua, Utah; beginning in the SW¼SE¼ sec. 31, T. 9 N., R. 1 E.; ending in the SW¼NE¼ sec. 31, T. 9 N., R. 1 E., Salt Lake base and meridian.

	Thickness (feet)
Water Canyon Formation	
Laketown Dolostone:	
Member D:	
23. Dolostone, dark-gray, weathers medium gray, lightly mottled, very finely crystalline, thick-bedded; highly weathered favositid, halysitid, and syringoporid corals in upper half, brachiopod and nautiloid remains in lower half, forms moderately flat semicovered ledgy slope.....	172
22. Dolostone, medium dark-gray, weathers medium light gray, lightly mottled, finely crystalline, very thick-bedded; poorly preserved rugose corals and crinoid stems; small seams of quartz or dolomite near top; forms level semicovered ridge.....	27
Total.....	199
Member C:	
21. Dolostone, medium-gray, weathers medium light gray, coarsely crystalline, very thick-bedded, porous texture; weathers to dolostone sand along ridge.....	12
20. Dolostone, medium-gray, weathers medium light gray, medium-crystalline, very thick-bedded; forms level semicovered ridge.....	17
19. Covered; medium-gray dolostone float; forms level ridge.....	55

		Thickness (feet)
18.	Dolostone, medium-gray, weathers medium light gray, medium-crystalline, very thick-bedded, porous texture; contains very highly weathered laminated beds; forms steep slope with cliffs.....	66
17.	Covered; medium-gray dolostone float; forms moderately steep slope.....	56
16.	Dolostone, dark-gray, weathers medium dark gray, mottled, finely crystalline, bedding indistinct; contains small randomly oriented seams of dolomite or quartz; forms moderately steep semicovered ledgy slope.....	27
15.	Covered; medium-gray dolostone float; forms moderately steep slope.....	129
14.	Dolostone, medium-gray, weathers medium light gray, finely crystalline, very thick-bedded, porous texture; poorly preserved brachiopods and crinoid stems near bottom; vugs 0.1-3 cm in diameter; forms moderately steep ledgy slope....	33
	Total.....	395

Member B:

13.	Covered dark-gray dolostone float, contains crinoid stems; forms saddle along ridge.....	49
12.	Dolostone, dark-gray, weathers medium dark gray, very finely to finely crystalline, medium-bedded; abundant crinoid stems; vugs 0.5-10 mm in diameter, filled with crystals of dolomite scattered throughout; small randomly oriented seams of dolomite or quartz throughout; forms moderately steep semicovered ledgy slope.....	112
11.	Dolostone, dark-gray, weathers medium dark gray, mottled, very finely crystalline, thick-bedded; stromatoporids in upper half; vugs 1-3 cm in diameter throughout; small randomly oriented seams of quartz or dolomite; forms semicovered ledgy ridge.....	38

		Thickness (feet)
10.	Dolostone, grayish-black, weathers dark gray, very finely crystalline, thick-bedded; vugs 0.2-2 cm in diameter very abundant, orientated with bedding, near top filled with crystals of quartz, some so abundant they give a bedded appearance up to 4 in. thick; light brownish-gray chert in highly weathered nodules abundant throughout; small randomly oriented seams of quartz or dolomite in upper half; one poorly preserved favositid coral in lower half; forms moderately flat ledgy slope.....	161
9.	Dolostone, grayish-black, weathers dark gray, very finely to finely crystalline, thin-bedded to medium-bedded; rugose corals and crinoid stems in a matrix of coarse material, interbedded with thickly laminated beds of finer nature; weathered surfaces react mildly with dilute HCl; forms moderately flat ledgy slope.....	70
8.	Dolostone, medium dark-gray, weathers medium dark gray, highly mottled, very finely crystalline, thick-bedded; remains of favositid and rugose corals along the deformed surfaces of thickly laminated beds; intraformational conglomerate containing bioclastic material in lenses 0.5-10 cm thick, and interbedded with the thickly laminated beds; forms moderately flat ledgy slope.....	112
7.	Dolostone, dark-gray, weathers dark gray, finely to medium-crystalline, thick-bedded, thickly laminated; laminations appear as bands of lighter finer material; rugose corals throughout; contains much detrital material; forms moderately flat ledgy slope.....	26
	Total.....	568

Member A:

6.	Covered; medium dark-gray, weathers medium gray, very finely crystalline dolostone float; forms moderately flat slope.....	27

		Thickness (feet)
5.	Covered; dark-gray, weathers medium gray, very finely crystalline, mottled dolostone float; contains stromatoporids; forms moderately flat slope.....	70
4.	Dolostone, grayish-black, weathers dark gray, mottled, very finely crystalline, thick-bedded; dark-gray chert in irregular nodules abundant; contains crinoid stems; small seams and nodules of quartz or dolomite throughout; forms steep ledgy slope.....	78
3.	Dolostone, dark-gray, weathers medium gray, sublithographic, thick-bedded, thinly to thickly laminated; forms steep semicovered slope.....	15
2.	Covered, medium dark-gray dolostone float.....	60
1.	Dolostone, medium dark-gray, weathers medium light gray, very finely crystalline, thick-bedded; some thickly laminated beds interbedded with plain beds; forms steep semicovered slope.....	28
	Total.....	278
	Total Laketown Dolostone.....	1,440

Fish Haven Dolostone.