

TYPE LOCALITY OF DARBY FORMATION,  
WESTERN WYOMING

BY

J. D. LOVE AND W. R. KEEFER

Reprinted for private circulation from  
THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS BULLETIN  
Vol. 53, No. 1, January, 1969

## Type Locality of Darby Formation, Western Wyoming<sup>1</sup>

J. D. LOVE<sup>2</sup> and W. R. KEEFER<sup>2</sup>

Laramie, Wyoming 82070, and Denver, Colorado 80225

**Abstract** A misconception as to the whereabouts of the type locality of the Darby Formation (largely Devonian), introduced in several recent reports, has led to erroneous conclusions regarding the stratigraphic nomenclature and correlation of this unit in parts of western Wyoming. This has come about because some authors interpreted "typical section" to mean "type section." No type section of the Darby Formation has ever been designated, only a type locality, which is in the canyon of Darby Creek in the Teton Range. A typical section is on Sheep Mountain in the Wind River Range, 60 mi southeast.

A misconception as to the whereabouts of the type locality of the Darby Formation has been introduced in several recent reports and has led to erroneous conclusions regarding the stratigraphic nomenclature and correlation of this unit in parts of western Wyoming. The purpose of the present discussion is to call attention to this misconception before it becomes entrenched by further reiteration. Clarification is important because the reasoning responsible for the error could alter easily the status of other well-known formational units in central and northwestern Wyoming.

<sup>1</sup> Manuscript received, May 6, 1968; accepted, June 11, 1968. Publication authorized by the Director, U.S. Geological Survey.

<sup>2</sup> U.S. Geological Survey.

Blackwelder (1918, p. 420-421) defined the Darby Formation as follows.

The Darby formation is apparently equivalent to Peale's Three Forks shale plus the upper part of his Jefferson limestone. The formation rests disconformably on the Leigh dolomite member of the Bighorn [Ordovician] or in some places on the massive member [of Bighorn] and is separated from the overlying Madison [Mississippian] limestone locally, if not generally, by another eroded surface. Lithologically, it consists of a varied sequence of shales and dolomites in many colors from white to gray, green, lavender, buff, red, brown, and black. . . . Fossils are rare . . . indicate Devonian age, but permit no greater refinement in the determination. The name is derived from the canyon of Darby Creek [loc. A, Fig. 1; unsurveyed area], on the west slope of the Teton Range, where the formation is well exposed. It extends over most of northwestern Wyoming . . .

A typical section of the Darby formation is exposed in the east slope of Sheep Mountain [loc. B, Fig. 1; approximately Sec. 6, T. 38N., R. 108W.] near the head of Green River.

Blackwelder (1918, p. 421-422) then described the Sheep Mountain section (loc. B, Fig. 1) at the northwest end of the Wind River Range, approximately 60 mi southeast of the canyon of Darby Creek (loc. A, Fig. 1). Because it was the only section published of those that Blackwelder measured in the Teton, Gros

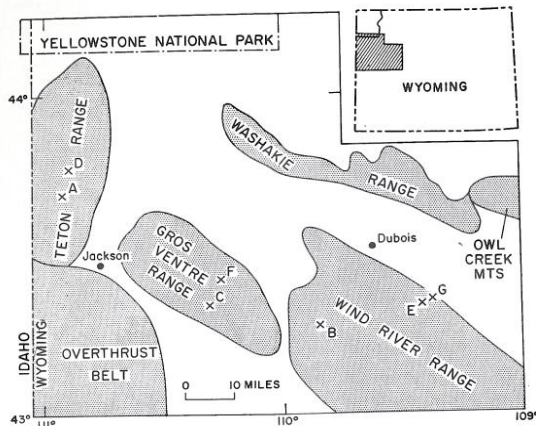


FIG. 1.—Index map of northwestern Wyoming showing type localities and location of typical sections as published by Blackwelder (1918). A, type locality of Darby Formation; B, typical section of Darby Formation; C, type locality and typical section of Gros Ventre Formation (Cambrian); D, type locality of Leigh Dolomite Member of Bighorn Dolomite (Ordovician); E, typical section of Leigh Dolomite Member of Bighorn Dolomite; F, typical section of Park City and Dinwoody Formations (Permian and Triassic, respectively); G, type locality of Dinwoody Formation.

Ventre, and Wind River Ranges, some workers have argued that the Sheep Mountain section should be considered the type section and, hence, the type locality of the Darby Formation. For example, Benson *et al.* (1965, p. A85) stated:

Regional stratigraphic studies of Devonian rocks by A. L. Benson, J. F. Murphy, and C. A. Sandberg in west-central Wyoming have demonstrated that the type Darby Formation on Sheep Mountain, on the west flank of the Wind River Range, includes limestone and shale correlative with the Madison Limestone . . .

Later, in a more detailed discussion, Benson (1966, p. 2588) stated:

The Darby Formation is . . . restricted to the Wind River Mountains, Owl Creek Mountains, Washakie Range, and associated basins.

The term Darby has been applied recently by a few geologists to the entire Devonian section in western Wyoming and eastern Idaho in the supposition that Devonian rocks in the Teton Range, 60 miles northwest of the type section [at Sheep Mountain], are characteristic of the Darby Formation.

Sandberg and Klapper (1967, Fig. 2) excluded the name Darby from the Teton Range. Keefer and Van Lieu (1966, p. B26-B27) stated that "Blackwelder (p. 420) derived the term [Darby Formation] from the canyon of Darby Creek on the west slope of the Teton Range, but he gave a measured section from

Sheep Mountain on the west slope of the Wind River Range . . . as the type." A review of the Code of Stratigraphic Nomenclature (American Commission on Stratigraphic Nomenclature, 1961) regarding procedures in establishing formal rock-stratigraphic units shows that the above-cited concepts of the type locality and type section of the Darby Formation are in error.

The precursor of the Code was published in the 24th Annual Report of the U.S. Geological Survey (1903, p. 23–27). At that time, the concept of the type locality or type area was indicated clearly as follows (p. 24):

All sedimentary formations [*i.e.*, mappable units] shall receive distinctive designations. The most desirable names are binomial, the first part being geographic and the other lithologic. . . . The geographic term should be the name of a river, town, or other natural or artificial feature at or near which the formation is typically developed.

This basic requirement governed the definition of new formations until 1933, when the designation of an actual type section was made a part of the Code (Ashley *et al.*, 1933, p. 436):

Among the details given in the description of a [new] sedimentary formation should be included a summary description of the lithology, a detailed section at or near the geographic feature from which the unit is named. . . .

Thus, as recognized by the present version of the Code (American Commission on Stratigraphic Nomenclature, 1961, p. 654)

. . . the type locality contains the type section, and the type area contains the type locality. Many early definitions of stratigraphic units indicate a type area or type region without specifying a type section.

Therefore, the writers contend that: (1) the type locality of the Darby Formation is in the canyon of Darby Creek (loc. A, Fig. 1) in the Teton Range, and not at Sheep Mountain (loc. B, Fig. 1) in the Wind River Range; and (2) Blackwelder's use of the term "typical section" is not to be interpreted as "type section," for the concept of the "type section" had not yet been introduced (*e.g.*, see Darton, 1904). The validity of the latter contention receives additional support when the similarity of descriptions given by Blackwelder (1918) for the Darby and other formations in the region are recognized, such as:

Gros Ventre Formation (Cambrian)—

The intervening greenish and gray calcareous shales, with gray, striped, conglomeratic and oölitic limestones [between the Flathead Sandstone and the Gal-

latin Limestone], is here called the *Gros Ventre formation*. . . . A typical section of the formation, exposed in the west slope of Doubletop Peak [loc. C, Fig. 1; unsurveyed area within T.39N., R.112W.] in the Gros Ventre Range, is as follows: . . . [Blackwelder, 1918, p. 418].

#### Leigh Dolomite Member of Bighorn Dolomite (Ordovician) —

The member takes its name from Leigh Canyon [loc. D, Fig. 1; unsurveyed area], on the west slope of the Teton Range, for on the south side of that valley there are excellent exposures of the dolomite in its typical condition [Blackwelder, 1918, p. 420].

A typical section from the west slope of Dinwoody canyon [loc. E, Fig. 1; approximately Sec. 11, T.4N., R.6W.], on the north side of the Wind River Range is as follows: . . . [Blackwelder, 1918, p. 419].

#### Park City Formation (Permian, named by Boutwell [1907, p. 443] from type area in Utah) —

A typical and centrally located section of this formation, together with the one next to be described [Dinwoody], is exposed in the mountains at the head of the Gros Ventre River [loc. F, Fig. 1; unsurveyed area within T.40N., R.112W.] . . . [Blackwelder, 1918, p. 424].

#### Dinwoody Formation (Triassic) —

The name is derived from the canyon of Dinwoody Lakes [loc. G, Fig. 1; approximately Sec. 1, T.4N., R.6W.], in the Wind River Range, where the formation is completely exposed, and has been measured in detail [Blackwelder, 1918, p. 426].

A typical and centrally located section . . . is exposed in the mountains at the head of the Gros Ventre River [loc. F, Fig. 1] . . . [Blackwelder, 1918, p. 424].

If we were to construe that "typical section" in each of the above descriptions meant "type section" (the only coincidence is with the Gros Ventre Formation), the results would be not only ludicrous but perplexing! For example, the type Leigh would have to be shifted 80 mi southeast from D to E (Fig. 1) and the type Dinwoody 40 mi west from G to F. The distinction between "type" and "typical" section is implicit in the statement in the present Code (American Commission on Stratigraphic Nomenclature, 1961, art. 13h, p. 654) that, "There may be more than one typical section, but only one type section." In modern terminology, a "typical section" would best be labeled a "reference section."

The conclusion is inescapable that no type section of the Darby Formation has ever been designated, only a type locality. If a type section were to be designated, it would, by definition, need to be located at or near the type locality in the canyon of Darby Creek. Blackwelder (1912) measured a section of the for-

mation 5 mi north of the canyon of Darby Creek, but this section was never published. Reeves (1964, p. 221) proposed that his measured section on the south side of the canyon of Teton Creek (about 4 mi north of Darby Creek) be considered the type but, as Benson (1966, p. 2588) pointed out, Reeves misinterpreted the stratigraphy and did not include all the rocks normally assigned to the unit. Benson (1966, Fig. 8) presented a detailed composite section from the canyons of Darby and Teton Creeks that serves as an excellent reference close to the type locality.

Disagreement regarding the proper type locality has seriously affected the concept of which rocks should be called Darby and in what localities the Darby occurs. Blackwelder's initial definition and observations in the correct type locality in the canyon of Darby Creek indicate that the formation includes *all* the rocks between the dolomites in the underlying Bighorn Dolomite (Ordovician) and the limestones in the overlying Madison Limestone (Mississippian); the Darby Formation has for the past 50 years been mapped in this sense throughout the Washakie, Wind River, Gros Ventre, and Teton Ranges, the Owl Creek Mountains, and parts of the overthrust belt. The sequence forms a natural cartographic unit, because the strata constitute a comparatively nonresistant and generally poorly exposed sequence between the overlying cliff-forming Madison Limestone and the underlying Bighorn Dolomite.

As shown by Benson (1966, Fig. 8), the sequence at the type locality of the Darby contains equivalents of the following units, in descending order: (1) dark shale 7 ft thick, equivalent to the Cottonwood Canyon Member of the Madison Limestone as recently defined by Sandberg and Klapper (1967) from exposures at the north end of the Bighorn Mountains; (2) Three Forks Formation; and (3) Jefferson Formation. Although these units are recognizable, they are not all mappable—that is, distinguishable—at ordinary mapping scales such as 1:24,000. Some of the beds thin and disappear eastward from the canyon of Darby Creek, owing to erosion and/or nondeposition. At Sheep Mountain in the Wind River Range, for example, only the lower and the upper units appear to be present in the Darby Formation.

Regional studies of the Darby and equivalent strata (e.g., Andrichuk, 1951; Benson, 1966; Sandberg, 1963; Sandberg and Klapper, 1967:

and Sandberg and McMannis, 1964), however, amply demonstrate the need for a classification of rock-stratigraphic units that is flexible enough to be of value both to the stratigrapher for deciphering the complex sedimentary history of the Devonian, and to the geologic mapper for delineating structure. To achieve these aims it may be desirable in some areas of western Wyoming to elevate the Darby to group status and designate formations within it. In other areas where detailed subdivision is not practical, formational status can be retained.

The Darby Formation, at some localities, is wholly Devonian in age. At other places, the thin dark shale unit that unconformably overlies the main mass of the Darby contains Devonian and Early Mississippian fossils (Benson, 1966, p. 2601; Sandberg and Klapper, 1967, p. B36-B37).

In summary, the case history of the Darby Formation is a good example of what can happen when "typical section" is misconstrued as the "type" rather than as a "representative" or "reference" section. Such misconceptions are no longer as likely to occur as in the past because the present Stratigraphic Code provides for both type and reference sections.

#### REFERENCES CITED

- American Commission on Stratigraphic Nomenclature, 1961, Code of stratigraphic nomenclature: Am. Assoc. Petroleum Geologists Bull., v. 45, no. 5, p. 645-665; correction, v. 45, no. 6, p. 1001.
- Andrichuk, J. M., 1951, Regional stratigraphic analysis of Devonian system in Wyoming, Montana, southern Saskatchewan, and Alberta: Am. Assoc. Petroleum Geologists Bull., v. 35, no. 11, p. 2368-2408.
- Ashley, G. H., *et al.*, 1933, Classification and nomenclature of rock units: Geol. Soc. America Bull., v. 44, pt. 2, p. 423-459.
- Benson, A. L., 1966, Devonian stratigraphy of western Wyoming and adjacent areas: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 12, p. 2566-2603.
- Benson, A. L., J. F. Murphy, and C. A. Sandberg, 1965, Regional correlations of the Darby Formation, p. A85, in Geological Survey research 1965: U.S. Geol. Survey Prof. Paper 525-A, 376 p.
- Blackwelder, Eliot, 1912, Unpub. field notes, U.S. Geological Survey.
- \_\_\_\_\_, 1918, New geological formations in western Wyoming: Washington Acad. Sci. Jour., v. 8, no. 13, p. 417-426.
- Boutwell, J. M., 1907, Stratigraphy and structure of the Park City mining district, Utah: Jour. Geology, v. 15, p. 434-458.
- Darton, N. H., 1904, Comparison of the stratigraphy of the Black Hills, Bighorn Mountains, and Rocky Mountain front range: Geol. Soc. America Bull., v. 15, p. 379-448.
- Keefer, W. R., and J. A. Van Lieu, 1966, Paleozoic formations in the Wind River basin, Wyoming: U.S. Geol. Survey Prof. Paper 495-B, 60 p.
- Reeves, C. C., Jr., 1964, New Cambrian, Ordovician, Devonian, and Mississippian measured sections, west flank Teton Mountains, Wyoming: Mtn. Geologist, v. 1, no. 4, p. 213-225.
- Sandberg, C. A., 1963, Dark shale unit of Devonian and Mississippian age in northern Wyoming and southern Montana, in Short papers in geology and hydrology: U.S. Geol. Survey Prof. Paper 475-C, p. C17-C20.
- Sandberg, C. A., and Gilbert Klapper, 1967, Stratigraphy, age, and paleotectonic significance of the Cottonwood Canyon Member of the Madison Limestone in Wyoming and Montana: U.S. Geol. Survey Bull. 1251-B, 70 p.
- Sandberg, C. A., and W. J. McMannis, 1964, Occurrence and paleogeographic significance of the Maywood Formation of Late Devonian age in the Gallatin Range, southwestern Montana, in Geological Survey research 1964: U.S. Geol. Survey Prof. Paper 501-C, p. C50-C54.
- U.S. Geological Survey, 1903, 24th Annual report of the director of the United States Geological Survey, 1902-3, Charles D. Walcott, director: 302 p.