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SECTION OF MORGAN FORMATION, PENNSYLVANIAN, AT SPLIT MOUNTAIN IN DINOSAUR NATIONAL MONUMENT, UINTAH COUNTY, UTAH

by

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Extension of the oil pool in the Weber sandstone (Pennsylvanian) in the Rangely oil field, Rio Blanco County, Colorado, subsequent to the completion of the field work on which Preliminary Chart 16[1/] is based, has stimulated special interest in the beds beneath that sandstone as potential oil reservoirs. In compliance with the demand for additional information concerning these beds, a detailed description of the sequence immediately underlying the Weber sandstone at Split Mountain, Utah, is here given. That part of Split Mountain where the section was measured is approximately 35 airline miles northwest of the town of Rangely. The section itself is shown graphically and somewhat generalized in column 8, sheet 2, Preliminary Chart 16. A more detailed graphic section is presented in the accompanying columnar section.

1/ Thomas, C. R., McCann, F. T., and Raman, N. D., Mesozoic and Paleozoic stratigraphy in northwestern Colorado and northeastern Utah, U. S. Geological Survey, Oil and gas investigations, preliminary chart 16, in two sheets, 1945.

The beds between the top of the Mississippian and the base of the Weber sandstone are assigned to the Morgan formation. One of the most striking features of the Morgan formation is a three-fold lithologic character which makes it possible to divide it into three distinct members. As indicated on Preliminary Chart 16, these members are represented in adjacent Moffat County, Colorado, at Juniper Mountain, Cross Mountain, Hell's Canyon, and Vermilion Creek Canyon, although the individual beds are highly variable in thickness and extent. The upper member consists mainly of thick beds of Weber-like sandstone with a few thin beds of limestone which commonly carry numerous fusulinids. The middle member consists mainly of relatively thin beds of cherty limestone with some beds of dolomite and marl. This member is usually scarp-forming. It carries only a few fusulinids. The lower member consists mainly of sandstone (not like that of the Weber sandstone), greenish-gray clayey shale, and some beds of black carbonaceous shale. This unit is slope-forming and in this vicinity is mostly covered.

The upper and the middle members of the Morgan formation are clearly of Pennsylvanian age as indicated by the Fusulinidae. The age of the beds at Split Mountain that intervene between the middle member of the Morgan and the Madison limestone, Mississippian, is a question of debate; that is, whether they are Pennsylvanian, Mississippian, or partly both. No fusulinids have been found in this interval, and the poorly preserved invertebrate and plant fossils that were found are not diagnostic.

In 1945, a year after this section in Split Mountain was studied, J. W. Huddle and F. T. McCann collected invertebrate fossils in the Duchesne River drainage, approximately 80 airline miles west of Split

Mountain, from a bed that is regarded by McCann as the probable equivalent of the upper part of the lower member of the Morgan formation. These fossils were identified by James Steele Williams as Mississippian. For reasons given below, however, McCann believes it best to regard the lower member of the Morgan formation, as well as the rest of the beds down to the top of the Madison limestone, as "beds of undetermined age."

On the basis of a brief study in the field, Henbest regards the beds that intervene between the Madison limestone and the lowest marine Pennsylvanian bed (unit 26) on which we have an age determination, as correlating with sections to the northeast where two separate periods of deposition are in evidence. The rocks of the earlier period (units 5 to 18), consist of sandstone, dolomite, and limestone, and appear to be related more to the underlying Mississippian than to the Pennsylvanian. The rocks of the later period (units 19 to 25) appear to correlate with the coal-bearing series of sediments at the base of the Pennsylvanian in the lower end of the Whirlpool Canyon (center, east side, sec. 33, T. 3 S., R. 25 E.), 6½ miles to the northeast, and in the canyon of the Vermilion Creek 36 miles to the northeast, sec. 36, T. 10 N., R. 101 W., Moffat County, Colorado. At these two localities, the coal-bearing, partly terrestrial sediments lie on a karst or deeply weathered surface and locally at the base contain conglomerate that includes chunks of the underlying rocks.

The lower member of the Morgan formation corresponds in position to and has significant features in common with the Molas formation in

southwestern Colorado, with which it is correlated.2/ On Preliminary Chart 16, cited above, the "beds of uncertain age" between the lower Morgan coal-bearing sediments and the Madison limestone were erroneously indicated as the "Molas (?) formation," whereas a correlation of the lower Morgan with the Molas was intended.

2/ Henbest, L. G., Stratigraphy of the Pennsylvanian in the west half of Colorado and in adjacent parts of New Mexico and Utah (abstract): Oil and Gas Journal, vol. 44, no. 48, p. 93, 1946.

Henbest, L. G., Correlation of the marine Pennsylvanian rocks of northern New Mexico and western Colorado (abstract): Washington Acad. Sci. Jour., vol. 36, p. 134 [1945], 1946.

Section of Morgan formation (Pennsylvanian) in Horsetrail Canyon on north side of Green River Canyon, in the SW. ¼, sec. 9 and the NW. ¼, sec. 16 (projected), T. 4 S., R. 24 E., Split Mountain, Dinosaur National Monument, Uintah County, Utah

		Feet
Weber sandstone, Pennsylvanian		
92	Sandstone, very fine to fine grained, gray to light buff (weathering light gray to brown), massive, friable. Porous and permeable. Lime content variable. Grains clear angular glassy quartz; very few impurities. Well jointed, so that on weathering it tends to form pinnacles and sheer scarps. Cross-bedding prominent. Minor yellow limonite stain along joints together with some brown and white calcite filling.....	1007
Morgan formation, Pennsylvanian		
	Upper member	
91	Limestone; basal 5 feet buff, coarsely crystalline, fossiliferous, massive; upper 11 feet medium-gray, thin-bedded, finely crystalline at base and dense at top.....	16
90	Sandstone, very fine-grained, light-gray, thin-bedded, cross-bedded, limy.....	16
89	Limestone, medium to dark-gray, dense; many lenses reddish-brown, reddish-gray chert near base; Fusulina sp., upper or possibly middle Des Moines form (collection F-5396).....	25

		Feet
88	Sandstone, very fine to fine-grained, light-gray to light-buff, limy, sugary; upper portion massive while basal portion tends to be thin-bedded and cross-bedded.....	60
87	Limestone, medium-gray at base to purplish-gray at top; medium-bedded and dense to crystalline at base to thin-bedded, cross-bedded, and sandy at top; thin lenses and nodules of red and brown chert for about 2 feet near middle and scattered near top; Fusulina sp., apparently an early Des Moines form (collection F-5395).....	15
86	Sandstone, very fine-grained, friable; cross-bedded near top; color light-gray, light-buff, salmon-pink; lowest 30 feet brown on weathered surface; thin-bedded, platy, brick-red for about 10 feet near middle of series; somewhat limy.....	88
85	Limestone, medium-gray, thin-bedded, finely crystalline; Fusulina or Fusulinella sp., Wedekindellina sp., Eoschubertella sp., all early Des Moines forms (collection F-5394).....	2
84	Sandstone, very fine-grained, taffy-colored, sugary, slightly limy.....	30
83	Limestone, medium-gray, thin-bedded, occasionally crystalline but texture variable and irregular.....	2

		Feet
82	Sandstone, very fine-grained, limy, friable; thin to medium-bedded; light-gray to light-buff in color with some brick-red streaking.....	45
81	Limestone, dense, medium-gray (weathering dark-gray); contains orange-colored oolites; one specimen of an unidentifiable genus of Fusulininae found (collection F-5393).....	5
80	Sandstone, very fine-grained, limy, friable, dominantly brick-red, medium-bedded to massive; upper 10 feet light-buff, light-gray, purple-gray, and thin-bedded to medium-bedded; lower 10 feet light-gray to buff, thin-bedded, cross-bedded.....	50
79	Limestone, medium-gray (weathering dark-gray) to purplish-gray; many crinoid stems; texture commonly dense but crystalline where crinoid stems are abundant; medium-bedded; occasional thin sandy streaks; Prismopora; Fusulina sp., Wedekindellina sp., Ozawainella sp., and Millerella?, all early Des Moines forms (collection F-5392).....	5
78	Sandstone, medium-bedded to massive, thin-bedded at top; dominant color orange to brick-red, to lesser extent purplish-brown, light-gray; very fine to fine-grained, limy, friable.....	52
77	Limestone, light-gray, coarsely crystalline; Fusulina sp., and Wedekindellina sp., both early Des Moines forms (collection F-5391).....	2

Feet

76 Sandstone, very fine-grained, limy, friable; thin-bedded and brick-red to medium-bedded and light-buff..... 36

75 Limestone, medium-gray to purplish-gray, crystalline in part and dense in part..... 8

74 Sandstone, very fine-grained, light-gray, limy, friable, medium-bedded..... 27

73 Limestone, light-gray to purplish-gray, sandy, bedding irregular; Fusulina prima? Thompson, Wedekindellina matura Thompson, Eoschubertella?, Pseudostaffella sp., Millerella sp., all early Des Moines age (collection F-5390). 2

72 Sandstone, very fine to fine-grained, limy, friable, lowest 10 feet is light-gray to light-buff in color and massive; next 7 feet is salmon-pink, thin to medium-bedded; top 37 feet is light-buff to light-gray, medium-bedded to massive..... 54

71 Sandstone, very fine-grained, limy, dominantly brick-red, some reddish-brown, light-gray; mostly medium-bedded, some thin-bedding; Wedekindellina or Fusulinella sp., Fusulina sp., Ozawainella sp., Millerella sp., probably very early Des Moines but might be Lampasas or Atoka age (collection F-5389)..... 35

70 Limestone, medium-gray to purplish-gray; texture irregularly crystalline to dense; thin-bedded and nodular (marly) to medium-bedded; sandy at top; a few thin lenses of gray chert at top; white crinoid stems, brachiopods, Prismopora sp. very abundant at 1 to 2 feet and 9 to 10 feet above base..... 28

		Feet
69	Covered.....	15
68	Limestone, purplish-gray to medium-gray, bedding irregular, medium-bedded to thin-bedded and nodular (marly); brachiopods and crinoid stems near top and bottom; a few nodules and thin lenses of red, gray chert near top.....	9
67	Sandstone, limy, white, resistant, with hackly fracture; probably a lens and not persistent.....	2
66	Limestone, light-gray, purple-gray, purple; thin-bedded and nodular (marly) to medium-bedded; texture variable, dense to coarsely crystalline locally; occasional lenses and nodules of red chert in top; Prismopora abundant, Spirifer occidentalis Girty, Spirifer rockymontanus Marcou (collection F-5387).....	13
65	Sandstone, very fine-grained, limy, friable; upper 17 feet is thin-bedded, cross-bedded, and mottled brick-red and light-gray or light-buff; lower 25 feet is medium-bedded, light-buff, brown, purple in color, occasionally quartzitic but usually friable.....	42
64	Limestone, purplish-gray, sandy streaks, variable texture; Prismopora sp., Spirifer occidentalis Girty, Spirifer rockymontanus Marcou (collection F-5386).....	4
63	Covered, save for 6 feet at top and occasional scattered outcrops below. These indicate that this interval is largely thin-bedded, friable sandstone mottled brick-red, light greenish-gray, purple; very fine-grained, calcareous, silty, bedding irregular.....	23

		Feet
Middle member		
62	Limestone and chert; sandy; limestone is finely crystalline, light to medium-gray, thin to medium-bedded; the chert (gray, red, brown), in thin stringers in base and irregular nodules in top, may form 50 percent of bed.....	16
61	Limestone, dense to finely crystalline, medium-bedded (beds knobby, marly, irregular), light to medium-gray (weathers medium-gray); abundant red, gray chert in irregular nodules.....	16
60	Covered.....	5
59	Limestone, dense to finely crystalline, light to medium-gray (weathering medium-gray), medium-bedded; irregular masses and lenses of gray chert abundant.....	10
58	Limestone, cliff-forming, dense to finely crystalline, light-gray (weathering gray to brown), medium-bedded; lenses of gray, brown chert abundant in the top foot-and-a-half and sparse elsewhere.....	17
57	Dolomite, dense to finely crystalline, thin to medium-bedded and bedding irregular, hackly fracture, abundant calcite in joints; weathers greenish-gray to brown.....	4
56	Limestone, finely crystalline, light-gray, medium-bedded; nodules of gray chert abundant top 2 feet.....	5
55	Limestone, dense to finely crystalline, medium-bedded to massive, sugary, light-gray (weathering gray to brown).....	7

		Feet
54	Dolomite, finely crystalline, massive, medium-bedded, hard; top 6 inches black, dense, brecciated, with white calcite and thin smears of very fine-grained gray sandstone in fractures.....	3
53	Dolomite, dense, white; powders easily.....	2
52	Covered; presumed marl or dolomite.....	8
51	Limestone, finely crystalline, light-gray, medium-bedded; bottom foot has a six-inch bed of red chert; marly 1 to 5 feet above base with some nodular red chert there.....	9
50	Dolomite, dense, light-gray, thin-bedded, hackly fracture....	3
49	Limestone, dense to finely crystalline, light-gray (weathering medium-gray).....	7
48	Limestone, dolomitic, sandy, dense to finely crystalline, medium-gray with minor amounts of light and dark-gray; dominantly thin-bedded but massive at top.....	10
47	Limestone, dense to finely crystalline, light-gray (weathering gray to brown), medium-bedded.....	6
46	Limestone, dense to finely crystalline, medium-gray, slightly oolitic; abundant red chert in nodules and in one six-inch bed.....	3
45	Covered; presumed marl or dolomite.....	5
44	Limestone, dense to finely crystalline, thin to medium-bedded, medium gray (weathering dark-gray to brown).....	11
43	Covered; presumed marl or dolomite.....	3

		Feet
42	Dolomite, dense at base to finely crystalline at top; light-gray at base to medium-gray at top; calcareous at top; medium-bedded	8
41	Covered; presumed marl or dolomite	2
40	Limestone, dense to finely crystalline, medium-bedded, medium-gray (weathering same); fossiliferous	2
39	Covered; presumed marl or dolomite	4
38	Dolomite, dense to finely crystalline, medium-bedded, medium-gray (weathering medium-gray to greenish-brown), hackly fracture	2
37	Covered; presumed marl or dolomite	8
36	Limestone, crystalline, massive, medium-gray (weathering dark-gray)	1
35	Covered; presumed marl or dolomite	9
34	Limestone breccia; small pebbles of limestone ($\frac{1}{4}$ inch in diameter) in a limestone matrix; medium-gray, marly	1
33	Limestone, dolomitic, dense, light-gray (weathering dove-gray), hackly fracture	2
32	Covered; presumed marl or dolomite	8
31	Limestone, dense to finely crystalline, medium-bedded, medium-gray (weathering medium to dark-gray); very oolitic	4
30	Dolomite, dense, light-gray, hard, hackly fracture	3
29	Covered; presumed marl or dolomite	9

		Feet
28	Limestone (approximately 1/3 of this unit covered), dense to finely crystalline, medium-gray (weathering medium to dark-gray); top 7 feet oolitic; red, gray chert abundant in nodules and in irregular layers up to one foot in thickness; Millerella sp. (collection F-5383).....	50
27	Limestone, dense to finely crystalline, thin to medium-bedded, medium-gray (weathering gray to brown), ledge-forming; fossiliferous; some gray chert in thin layers and nodules.....	12
26	Limestone, dense to finely crystalline, massive, medium-gray (weathering gray to brown), ledge-forming, dolomitic basal 3 feet; some thin layers and nodules gray chert near top.....	21
Lower member		
25	Covered. Digging exposes blocky, clayey shale; dominantly gray or greenish-gray with minor yellow; variegated purple and gray 20 to 30 feet above base; some black carbonaceous material basal 3 feet; occasional beds thin nodular limestone (dense, medium-gray) in the gray shale.....	40
24	Sandstone, scarp-forming, very fine to fine-grained, thin to medium-bedded, white (weathering greenish-gray to dark-brown) with tiny spots of limonite, sugary.....	15

		Feet
23	Covered. Digging exposes black carbonaceous shale, occasionally sandy; a few small limonite concretions (size of pocket watch); plant fossils in top 3 feet.....	32
22	Sandstone, very fine to fine-grained, thin-bedded, white to yellow (weathering greenish-gray to yellow), sugary, resistant; bed probably lenticular; occasional streaks black or brown carbonaceous material.....	6
21	Covered. Digging exposes black carbonaceous sandy shale and very fine-grained, thin-bedded, friable white sandstone containing finely divided black carbonaceous material.....	20
20	Sandstone, fine-grained, thin to medium-bedded and irregularly-bedded, white to light-gray (weathering gray to brown), glassy, resistant; where this unit crosses the dry bed of Horsetrail Canyon it shows slickensiding parallel to bedding.....	47
19	Sandstone, shale, boulders of limestone in sandstone matrix; primarily irregularly-bedded sandstone and sandy shale; heavily mineralized so that colors are bright-yellow, bright-red, purple; large boulders gray limestone (up to 3 feet); this unit apparently deposited on sinkhole topography; separated from underlying limestone by unconformity which may be local.....	5
	Total thickness of the Morgan formation.....	1,186

		Feet
Beds of undetermined age		
18	Limestone, dense to finely crystalline, thin to medium-bedded and occasionally nodular, medium-gray (purplish cast) to dark-gray (weathering gray to buff with rough surface); occasionally sandy; macrofossils near base poorly preserved and not collected; apparently eroded to karst topography prior to deposition of No. 19 as beds pinch from 18 feet on point to 5 feet in valley tributary to Horsetrail Canyon.....	12
17	Sandstone, fine to medium-grained (grains well-rounded), thin to medium-bedded, light-gray (weathering brown).....	3
16	Limestone, crystalline (fine to medium), thin to medium-bedded, medium-gray (weathering dark-gray) with some purple; oolitic; some very sandy lenses.....	3
15	Sandstone, fine-grained, thin-bedded, buff (weathering yellow), calcareous.....	6
14	Limestone, dense to finely crystalline, dark-gray, hard, sandy, medium-bedded.....	1
13	Sandstone, very fine-grained, thin-bedded, calcareous (top foot is very calcareous and weathers like a limestone), color reddish-purple and light-gray (weathering same colors and brown).....	6
12	Sandstone (good marker), very fine to fine-grained, massive, white to light-gray (weathering same colors), friable.....	35

		Feet
11	Sandstone (forms brink of waterfall), fine to medium-grained, thin-bedded and cross-bedded but weathers as a single massive scarp; irregularly-bedded; color purplish-gray, light-gray, yellow (weathering dark-gray to buff).....	40
10	Dolomite, finely crystalline, irregularly bedded, purplish-gray (weathering pinkish-buff).....	3
9	Sandstone and sandstone breccia with pink and buff dolomite at base; dominantly sandstone, fine to medium-grained (grains subangular to subrounded), irregularly-bedded, color gray, purple, yellow; some of sandstone is a breccia with fragments (average one inch in diameter, maximum 6 inches) of gray sandstone and pink to buff dolomite; in lower part of unit are irregular lenticular beds of pink to buff dolomite 2 to 3 feet thick.....	27
8	Limestone, very sandy; finely crystalline, medium bedded, medium-gray with purplish cast (weathering dark-gray).....	6
7	Sandstone (forms brink of waterfall), fine to medium-grained, medium-bedded and cross-bedded but weathering in massive scarp; buff in color (weathering brown), irregularly-bedded; upper 2 feet very fine-grained, thin-bedded, light-gray and purple.....	17
6	Dolomite, finely crystalline, medium-gray (weathering gray to brown with rough irregular surface), thin-bedded....	3

Feet

5 Sandstone, dolomitic; very fine-grained (fine to medium-grained at base), irregularly-bedded, light-gray with purplish cast; contains some thin streaks of carbonaceous material..... 12

Total thickness, beds of undetermined age..... 184

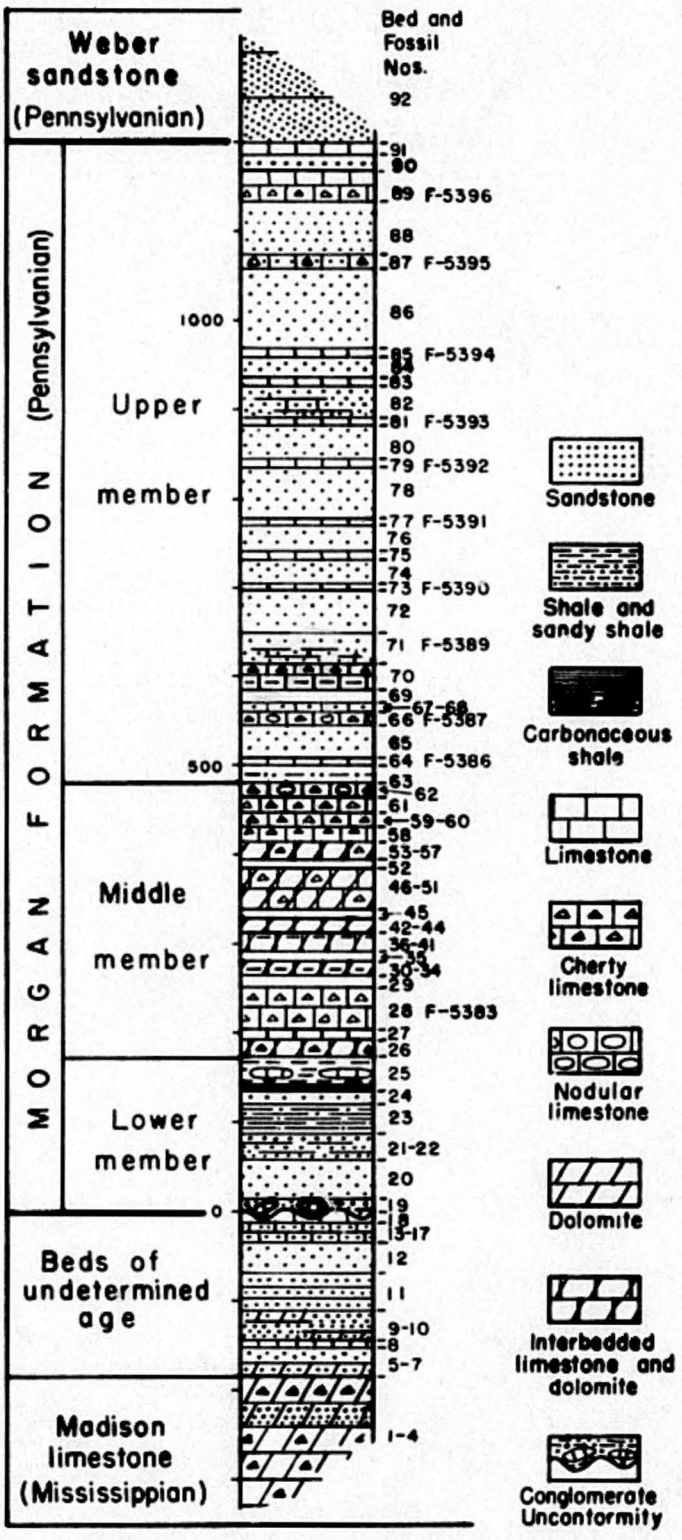
Madison limestone, Mississippian

4 Dolomite, dense to finely crystalline, light-gray to medium-gray (weathering greenish-gray); breaks out in angular wedge-shaped fragments; contains scattered nodules of banded gray chert..... 30

3 Dolomite, dolomite breccia, sandstone. Dolomite is dense to finely crystalline, light-gray to medium-gray (weathering gray to brown), rough irregular surface weathering out in angular wedge-shaped fragments. Dolomite breccia consists of angular to subangular fragments (average diameter 1 to 2 inches, maximum diameter 6 inches) of dolomite in dolomitic ground-mass. Sandstone is fine-grained, light-gray (weathering gray to brown). All three are irregularly-bedded and lenticular; sandstone beds up to 6 feet thick may pinch out in 20 feet laterally..... 26

2 Dolomite, sandy, medium-bedded to thin-bedded at top, color light-gray and purple; sand grains abundant and very fine to fine..... 6

		Feet
1	Dolomite, finely crystalline, medium-gray generally but at top light greenish-gray to purplish-gray (weathering gray to brown), thin-bedded; weathers out in small angular wedge-shaped fragments; a few nodules of chert banded light-gray and dark-gray; weathered surface rough and hackly; petroliferous (?) odor.....	(not measured)



Graphic representation of the Morgan formation, and adjacent beds in the SW. 1/4, sec. 9, and the NW. 1/4, sec. 16, T.4S., R.24E., Uintah County, Utah.