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Some stratigraphic sections of the Madison Group in the overthrust belt of western Wyoming and southeastern Idaho

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INTRODUCTION

Recent petroleum exploration activity in the Wyoming-Idaho overthrust belt has increased the need for stratigraphic data on Paleozoic rocks in this area. Sando (1977) summarized the stratigraphy of the Madison Group in the overthrust belt and presented graphic sections of and biostratigraphic data on the Madison in that area and correlations with sections in adjacent areas. The present report presents detailed descriptions of the Haystack Peak, Hoback Canyon, Sheep Creek, and Black Mountain sections of the Madison discussed by Sando (1977). Figure 1 shows locations of these sections.

ROCK-UNIT DESCRIPTIONS

The following descriptions of rock units in measured sections were made entirely from observations in the field. Principal carbonate-rock designations (limestone, dolomitic limestone, and dolomite) are based on the amount of effervescence of the rock when a fresh surface is treated with 2N hydrochloric acid. Rock colors on fresh and weathered surfaces were determined mostly by comparison with the rock-color chart (Goddard and others, 1948).

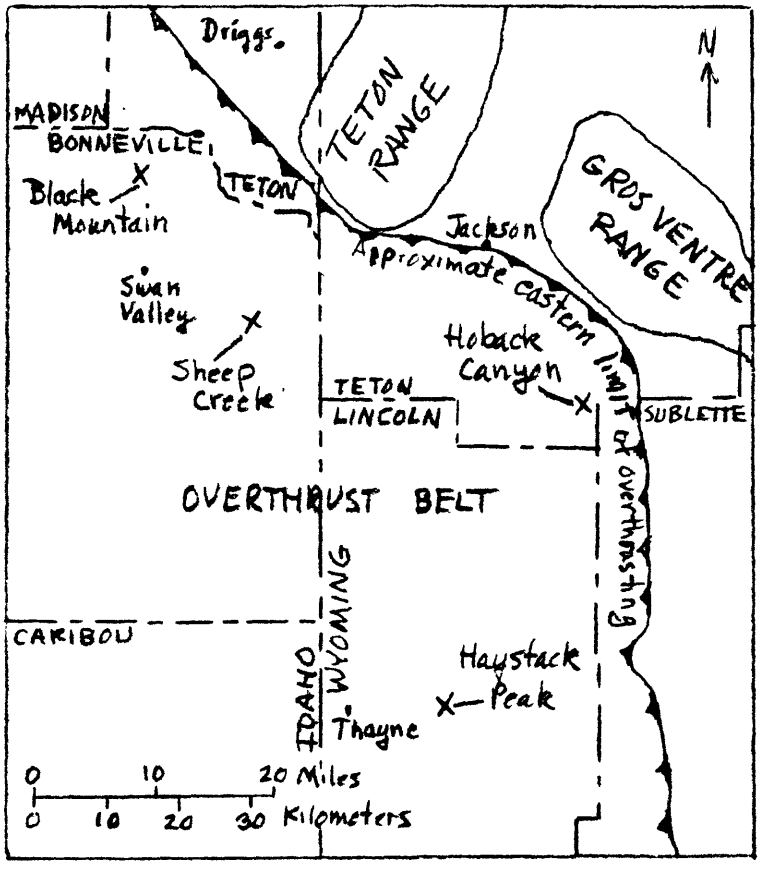

Figure 1.--Map of northern part of Wyoming-Idaho overthrust belt showing locations of stratigraphic sections described in this report in relation to structural and physiographic features.

Fresh rock surfaces, wetted with acid and observed with a hand lens, were compared with a Wentworth grain-size chart in order to describe rock textures. Grain-size terms for terrigenous components refer to the Wentworth scale. The following terminology is used to describe grain size in granular carbonate rocks:

Fine grained: clasts less than 1/8 mm in diameter (clay, silt, and very fine sand of Wentworth scale).

Medium grained: clasts from 1/8 to 1 mm in diameter (fine, medium, and coarse sand of Wentworth scale).

Coarse grained: clasts from 1 to 64 mm in diameter (very coarse sand to pebbles of Wentworth scale).

Grain size in crystalline carbonate rocks is described as follows:

Medium crystalline: crystals 1/8 to 1 mm in diameter.

Coarse crystalline: crystals greater than 1 mm in diameter.

Rock-term modifiers, such as "crinoidal", refer to predominant biogenic constituents of granular carbonate rocks.

Thicknesses of section units and beds were measured in feet and tenths of feet. Measurements were made with an 8-foot steel tape held perpendicular to bedding directly against the outcrop and by Jacob staff. All sections were measured from the base of the sections to the top; instructions concerning changes in traverse direction should be interpreted accordingly.

Positions of fossil collections are recorded for each section unit in the descriptions of the units. The numbers refer to the U. S. Geological Survey upper Paleozoic locality file at the U. S. National Museum of Natural History, Washington, D.C. Where the sample has been thin-sectioned and studied petrographically, the rock is classified in terms of the Folk (1959) classification in parentheses after the sample number. Designations of coral

and foraminiferal-algal (Mamet) zones are given at the end of each unit description where such determinations have been made. The coral zones refer to the zonation for the Mississippian of the Western Interior Province of the United States and Canada by Sando and Bamber (1979, in press). The Mamet foraminiferal-algal zones refer to the zonation described by Mamet and Skipp (1970a,b).

DESCRIPTIONS OF STRATIGRAPHIC SECTIONS

HAYSTACK PEAK SECTION

The Haystack Peak section is located along the west side of the north fork of Strawberry Creek southeast of Haystack Peak as shown on the U. S. Geological Survey topographic map of the Bedford quadrangle (1:62,500), Wyoming. The section traverse begins at the base of the Lodgepole Limestone exposed in cliffs in SE 1/4 sec. 18, T. 34 N., R. 117 W., Lincoln County, Wyoming (Fig. 2). The traverse proceeds along the top of talus piles below cliffs of the Lodgepole Limestone and Mission Canyon Limestone in N 1/2 sec. 19 to top of Mission Canyon Limestone exposed in cliff.

The section was measured in 1957 with an 8-foot steel tape and a Jacob staff. The beds dip about 25^{o}-30^{o} south. A graphic section of the Madison is presented in Sando (1977, pl. 1). Sando and others (1975, pl. 9) published a graphic section of the overlying Amsden Formation. We are indebted to W. W. Rubey for suggesting the location for this section. Section description is by Sando.

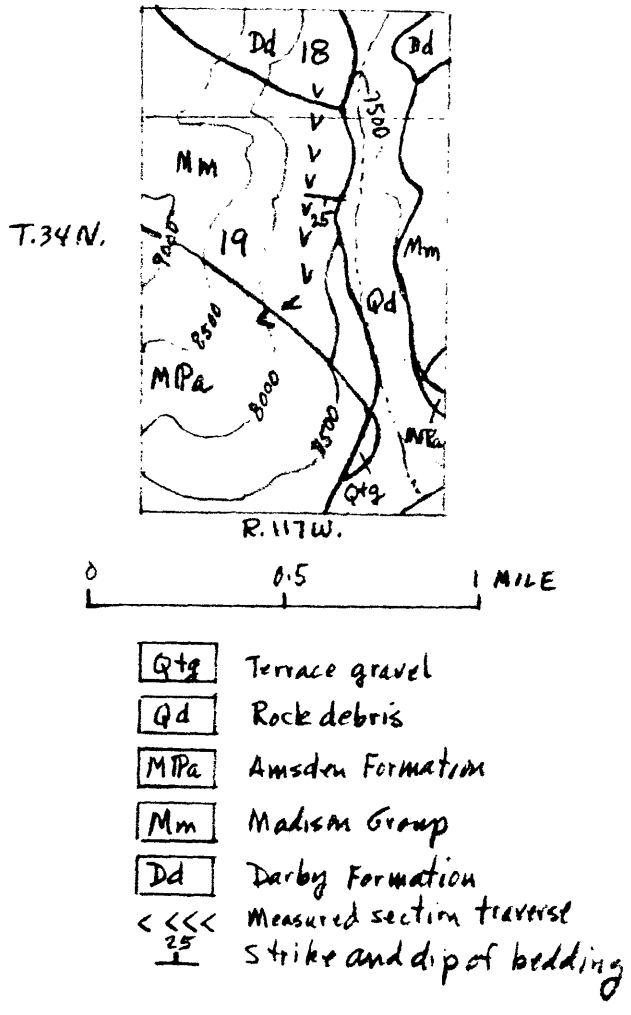

Figure 2.--Geologic sketch map of Haystack Peak section. Geology and base from Rubey (1958).

	Thickness	
	Feet	Meters
Amsden Formation		
Darwin Sandstone Member		
72. Quartzite and quartz sandstone; fine to medium grained; weathers varicolored white, pink and orange; crossbedded.	65.0	19.8
Madison Group		
Mission Canyon Limestone		
71. Breccia; like unit 70 but containing less red siltstone and more quartzite and sandstone like unit above.	12.0	3.7
70. Breccia; clasts consist of red siltstone and white, fine to medium grained quartz sandstone; matrix and clasts are predominantly quartz sandstone; crossbedded, beds 1 to 2 ft. thick; unit forms reddish cliff.	15.0	4.6
69. Breccia; clasts consist of buff-weathered fine to medium grained quartz sandstone, red-weathered quartz siltstone, grayish yellow weathered dolomitic limestone or quartz siltstone; red siltstone and quartz sandstone make up matrix and about 90 percent of clasts; clasts are mostly under 0.3 ft. in diameter but are as much 0.5 ft. in diameter; unit forms red slope.	20.0	6.1

Mission Canyon Limestone-Continued	Thickness Feet	Meters
68. Breccia; clasts consist mainly of fine grained limestone and dolomitic limestone (limestone predominates); size of clasts like those in unit 66; several solution cavities filled with red siltstone breccia in red siltstone matrix.	25.0	7.6
67. Breccia; clasts consist of fine grained limestone, yellowish weathered dolomitic limestone, dark chocolate brown weathered dolomitic limestone and dolomite, fine to medium grained dolomitic quartz sandstone, and red siltstone; predominantly limestone and dolomitic limestone, red siltstone less than 5 percent; size of clasts like those in unit 66.	10.0	3.1
66. Breccia; clasts consist of fine grained limestone (olive black to olive gray weathered medium light gray to light gray), sandy fine grained limestone, fine grained dolomitic limestone (medium dark gray weathered yellowish gray), quartz siltstone weathered moderate reddish brown; matrix is largely fine grained limestone although other lithologies are present in matrix; red siltstone makes up 30 to 40 percent of the unit and produces red-weathered slope; clasts are mostly less than 0.3 ft in diameter.	23.0	7.0

Mission Canyon Limestone-Continued	Thickness Feet	Meters
65. Limestone breccia, like unit 40; clasts as much as 3 to 4 ft in diameter; limestone matrix; some dolomitic limestone clasts in upper 2 ft.	40.0	12.2
64. Limestone; like unit 61 but not brecciated.	1.5	0.5
63. Dolomitic limestone; like unit 60 but a little coarser grained and darker weathered.	6.5	2.0
62. Limestone; fine grained (micrite and calcisiltite); dark gray weathered medium light to light gray; also limestone breccia of same lithology and a few large blocks of fine grained dolomite (10 percent); a lens of fine grained dolomitic limestone 1 ft. thick in lower half; beds 3 to 5 ft. thick; about 40 percent of unit is breccia.	18.5	5.6
61. Breccia; lower 5 ft. consists of clasts of dolomitic limestone like that in unit 60 in fine grained limestone matrix; grades upward into fine grained limestone clasts in fine grained limestone matrix; clasts as much as 0.5 ft. in diameter.	6.0	1.8
60. Dolomitic limestone; fine grained; medium dark gray weathered yellowish gray; much of the unit is a millimeter laminite; somewhat like unit 33.	13.0	4.0
59. Limestone; predominantly fine grained, like that in unit 34 but having calcarenite beds like unit 37 about 2 ft. thick near middle; about 5 percent scattered bioclastic debris.	12.5	3.8

Mission Canyon Limestone-Continued	Thickness Feet	Meters
58. Dolomitic limestone and limestone; like unit 52; fine grained; the two rock types are interbedded in layers that have gradational boundaries; dolomitic limestone predominates in lower half and grades upward into predominantly limestone except for dolomitic limestone beds in upper 3 ft.; a zone of dark brown chert in thin lenses about 15 ft. above base. USGS 17903-PC, float from lower 5 ft. (Coral Zone IIIA).	25.0	7.6
57. Breccia; fine grained limestone and dolomitic limestone clasts in dolomitic matrix.	2.0	0.6
56. Dolomitic limestone; like unit 52.	5.0	1.5
55. Dolomitic limestone; like unit 52 and breccia like unit 53.	1.0	0.3
54. Dolomitic limestone; like unit 52.	3.0	0.9
53. Breccia; clasts of dolomitic limestone like unit 52 as much as 0.3 ft. in diameter in crystalline calcite matrix.	1.0	0.3
52. Dolomitic limestone; like unit 50; beds 0.5-1 ft. thick.	15.0	4.6
51. Limestone; bioclastic, like unit 49; corals, brachiopods, and gastropods; a zone of large spheroids of chert like that in unit 49 12 ft. above base; upper 5 ft. of unit is finer grained than underlying beds. USGS 17902-PC from throughout unit (crinoidal foraminiferal biosparite) (Coral Zone IIIA, Mamet Zone 10-11).	24.0	7.3

Mission Canyon Limestone-Continued	Thickness Feet	Meters
50. Dolomitic limestone; like unit 23 but all weathered pale yellowish brown and dark yellowish brown; bioclastic debris about 20 percent, mainly large spiriferoid brachiopods; upper contact sharp, lower contact gradational through a zone 2 to 3 ft. thick.	12.0	3.7
49. Limestone; medium to coarse grained, crinoidal, bioclastic, very coralliferous, like unit 43; upper 10 ft. contains irregular white-weathered porous chert having concentric bands in spheroidal masses as much as 2.5 ft. in diameter and 0.5 ft. thick. USGS 17900-PC, 5 to 15 ft. above base (crinoidal biomicrite); USGS 17901-PC from upper 2 ft. (Coral Zone IIIA).	35.0	10.7
48. Limestone; medium grained, crinoidal, bioclastic, like unit 43 but a little finer grained on the whole, slightly dolomitic; abundant colonial corals and large spiriferoid brachiopods. USGS 17899-PC from throughout unit (Coral Zone IIIA).	7.0	2.1
47. Limestone; medium grained to very coarse grained bioclastic, like unit 43 but containing about 30 percent banded white porous chert in very irregular lenses as much as 0.5 ft. thick; brachiopods and horn corals. USGS 17898-PC from upper 2 ft. (Coral Zone IIIA).	23.0	7.0

Mission Canyon Limestone-Continued	Thickness Feet	Meters
46. Dolomitic limestone; fine grained, like unit 44; contacts gradational.	3.0	0.9
45. Limestone; medium to coarse grained, crinoidal, bioclastic, like unit 43; brachiopods and corals.	4.5	1.4
44. Dolomitic limestone; fine grained, like unit 42; about 5 percent calcite-filled vugs as much as 0.2 ft. in diameter; abundant corals and brachiopods 1 ft. above base. USGS 17897-PC, 1 ft. above base (crinoidal biosparite) (Coral Zone IIIA).	4.0	1.2
43. Limestone; medium to very coarse grained, crinoidal, bioclastic; beds 0.5-1.5 ft. thick; horn corals, bryozoans, and brachiopods. USGS 17896-PC from upper 5 ft. (partly dolomitized crinoidal biomicrite) (Coral Zone IIIA, Mamet Zone 9/10).	15.0	4.6
42. Dolomitic limestone; fine grained, like unit 23; contacts gradational.	10.0	3.1
41. Limestone; mostly fine grained, like unit 34 but containing about 5 percent scattered coarse bioclastic debris (crinoid columnals and large spiriferoid brachiopods); a lens of coarse grained bioclastic limestone in upper 1.5 ft. USGS 17894-PC, 4 ft. above base; USGS 17895-PC from upper 1.5 ft. (crinoidal foraminiferal brachiopod bryozoan biosparite) (Coral Zone II, Mamet Zone 9).	8.5	2.6

Mission Canyon Limestone-Continued		Thickness Feet	Meters
40.	Breccia, very angular fine grained limestone fragments as much as 0.3 ft. in diameter like unit 34 in fine grained limestone matrix; grades upward into overlying unit.	5.0	1.5
39.	Breccia; very angular fragments as much as 0.3 ft. in diameter of fine grained dolomitic limestone like unit 38 in fine grained limestone matrix like unit 34; grades upward into overlying unit.	8.0	2.4
38.	Dolomitic limestone; predominantly fine grained, like unit 36; upper contact erosional.	5.0	1.5
37.	Limestone; mostly medium to very coarse grained; olive gray weathered medium light gray; single bed.	2.0	0.6
36.	Dolomitic limestone; mostly fine grained like unit 33 but having about 40 percent laminated beds and 30 percent layers of coarse grained bioclastic debris.	9.0	2.7
35.	Dolomitic limestone; fine grained; weathered yellowish gray; both contacts gradational; single bed.	2.0	0.6
34.	Limestone; fine grained; olive black weathered medium light gray; a micrite having about 10 percent birdseye structure; single bed.	2.0	0.6
33.	Dolomitic limestone; fine to medium grained; light olive gray weathered yellowish gray; beds about 1 ft. thick; birdseye structure in upper 1 ft.	5.0	1.5

Mission Canyon Limestone-Continued	Thickness Feet	Thickness Meters
32. Dolomitic limestone and limestone; limestone mostly coarse grained bioclastic like unit 12; dolomitic limestone mostly fine grained like underlying unit; beds about 0.5-1 ft. thick; about 50 percent of each lithology interbedded. USGS 17893-PC from lower 2 ft. (Coral Zone II).	7.5	2.3
31. Dolomite (or dolomitic limestone); fine to medium grained; medium dark gray weathered pale yellowish brown; scattered 10 percent bioclastic debris (mostly crinoidal) in fine grained dolomite matrix; beds 0.2 to 0.8 ft. thick; about 5 percent calcite filled vugs as much as 0.4 ft. in diameter; cherty zone about 3 ft. thick 30 ft. above base; syringoporoids and horn corals rare. USGS 17891-PC, 20 ft. above base; USGS 17892-PC from upper 5 ft. (Coral Zone II).	39.0	11.9
30. Limestone; medium to very coarse grained, crinoidal, like unit 28 but contains about 25 to 30 percent chert in thicker lenses than in units below. USGS 17890-PC, 3 ft. above base (Coral Zone II).	21.0	6.4
29. Limestone; medium to very coarse grained, crinoidal, like unit 28 but thicker bedded (beds 0.5 to 1.5 ft. thick) and less cherty (15 percent); bryozoans, brachiopods, and corals. USGS 17888-PC float from lower 5 ft. (crinoidal biosparite), USGS 17889-PC at top (Coral Zone II).	12.0	3.7

Mission Canyon Limestone-Continued	Thickness Feet	Meters
28. Limestone; medium to very coarse grained, crinoidal, like unit 12 but thinner bedded (beds 0.3-1 ft. thick) and containing about 40 percent irregular, white-weathered, fossiliferous chert like that of unit 24; a few beds of dolomitic limestone like unit 27; fauna like that in overlying unit.	15.0	4.6
27. Chert and fine grained dolomitic limestone, like unit 25; bryozoans. USGS 17887-PC, 14 ft. above base.	20.0	6.1
26. Dolomitic limestone; medium grained; medium dark gray weathered yellowish gray to pale yellowish brown; bioclastic debris 5 percent or less; faintly laminated; about 20 percent chert like that in unit 24; beds mostly 1 ft. thick.	37.0	11.3
25. Chert and dolomitic limestone or dolomite; chert is very porous, gray weathered white, including patches of dolomite, comprising 50 percent of unit; dolomitic limestone is mostly fine grained, medium gray weathered pale yellowish brown, laminated; a zone of banded black chert nodules at base; beds 0.1 to 0.5 ft. thick.	13.5	4.1

Mission Canyon Limestone-Continued	Thickness Feet	Meters
24. Dolomitic limestone; fine grained, medium dark gray weathered yellowish gray to pale yellowish brown; about 10 percent scattered bioclastic debris (crinoids, brachiopods, bryozoans, corals); beds 0.3 to 2 ft. thick; about 5 percent very irregular lenses and nodules of white-weathered porous fossiliferous chert; upper 2 ft. is medium to coarse grained bioclastic; fossils mostly molds and casts. USGS 17886-PC, float throughout unit (Coral Zone II).	14.0	4.3
23. Dolomitic limestone and dolomite; mostly fine grained having 10 percent or less scattered bioclastic debris (crinoids and brachiopods), medium dark gray weathered pale yellowish brown and yellowish gray; beds 0.2 to 0.5 ft. thick; fossils silicified and calcareous.	7.0	2.1
22. Limestone and dolomitic limestone; medium to very coarse grained, crinoidal, like unit 12; lower 5 ft. is medium grained dolomitic limestone having 20 percent bioclastic debris; upper 9.5 ft. is limestone grading upward from medium grained at base to very coarse grained and crossbedded at top. USGS 17885-PC from upper 9.5 ft. (crinoidal intrasparite) (Coral Zone II).	14.5	4.4

Mission Canyon Limestone-Continued	Thickness Feet	Meters
21. Dolomite and dolomitic limestone; fine to medium grained, like unit 17; sand-sized calcitic grains in finer dolomite matrix; upper 14.5 ft. massive fine grained dolomite having scattered bioclastic debris; about 5 percent vugs, many calcite filled.	24.5	7.5
20. Limestone; crinoidal, like unit 12 but finer grained; a bed of dolomitic limestone at base and pods of dolomitic limestone having gradational borders within limestone; dolomite replaces fine grained matrix. USGS 17884-PC from lower 2 ft. (Coral Zone II).	10.0	3.1
19. Dolomite and dolomitic limestone; medium grained, like unit 17	10.0	3.1
18. Limestone; fine grained (micrite and calcisiltite), light olive gray weathered medium light gray to light gray; about 20 to 30 percent porous buff-and white-weathered chert in small irregular nodules and large irregular lenses.	4.0	1.2
17. Dolomite and dolomitic limestone; like unit 15 but medium grained, pelletal.	8.0	2.4

Mission Canyon Limestone-Continued	Thickness Feet	Thickness Meters
16. Dolomitic limestone and limestone; medium to very coarse grained, crinoidal, like unit 12; lower half medium grained and dolomitic and upper half coarse grained and pure limestone; lithologies gradational; horn corals. USGS 17883-PC from upper half (Coral Zone II, Mamet Zone 8).	9.0	2.7
15. Dolomite and dolomitic limestone; fine to medium grained, mostly medium dark gray weathered pale to dark yellowish brown; finer grained beds are dolomite and coarser grained beds are dolomitic limestone; vugs and pods of crystalline white calcite common; fossils rare.	12.0	3.7
14. Limestone and dolomitic limestone; medium to coarse grained, crinoidal, like unit 12; lower half contains about 50 percent of each lithology; upper half about 90 percent pure limestone; dolomitic limestone occurs in thin fine grained lenses and forms matrix of bioclastic beds; cross-bedded; gradational internal contacts. USGS 17881-PC, 18 ft. above base (dolomitized crinoidal oosparite); USGS 17882-PC, 24 to 28 ft. above base (crinoidal foraminiferal superficial oosparite) (Coral Zone II, Mamet Zone 8).	34.0	10.4

Mission Canyon Limestone-Continued	Thickness Feet	Meters
13. Dolomitic limestone; fine grained; medium gray to light olive gray and olive gray weathered light olive gray to pale yellowish brown and dark yellowish brown; structures and textures like unit 11 but contains no shaly partings; upper 6 ft. gradational into unit above by increase in thickness of bioclastic lenses and presence of fine-grained limestone in lenses as much as 0.3 ft. thick and irregular nodules having gradational boundaries; silicified horn corals. USGS 17880-PC, 4 ft. below top (Coral Zone II).	42.0	12.8
12. Limestone; medium to very coarse grained, crinoidal, bioclastic; mostly dark gray weathered medium light gray to light gray; beds 1.5 to 15 ft. thick; contains 3 or 4 thin (0.3 to 0.5 ft.) lenses of fine grained dolomitic limestone weathered pale yellowish brown in lower half; lower boundaries of dolomitic lenses are gradational and upper boundaries are sharp and marked by deep burrows or channels. USGS 17879-PC from float throughout unit (partly dolomitized crinoidal bryozoan foraminiferal oosparite) (Coral Zone II, Mamet Zone 8).	30.0	9.1
Total Mission Canyon Limestone	823.0	250.9

	Thickness	
Lodgepole Limestone	Feet	Meters
Woodhurst Member		
11. Limestone; about 40 percent fine to coarse grained, crinoidal, bioclastic, laminated, crossbedded, dark gray weathered medium light gray to light gray and 40 percent dolomitic limestone, fine grained, medium dark gray weathered yellowish gray to light olive gray and 20 percent silty yellowish weathered shaly partings like those in underlying units; beds 0.1 to 0.5 ft. thick, irregular, nodular, and lenticular; dolomitic pseudobreccia common in upper half; dolomitic limestone content increases progressively upward; most contacts between limestone and dolomitic limestone are sharp and represent primary discontinuities; Zoophycus and other trails common. USGS loc. 17877-PC, 3 ft. above base; USGS loc. 17878-PC, 12 ft. above base (partly dolomitized crinoidal brachiopod biopelsparite). (Coral Zone II).	30.0	9.1

	Thickness	
Lodgepole Limestone-Continued	Feet	Meters
Woodhurst Member-Continued		
10. Limestone; predominantly fine grained but having about 30 percent lenses of bioclastic debris, like unit 7; silty partings about 30 percent; several thin beds of intraformational conglomerate and many beds of medium to coarse grained crinoidal limestone in beds as much as a foot thick; small scale crossbedding; rare small nodules of punky brown chert; Zoophycus and other trails abundant; abundantly fossiliferous. USGS 17862-PC at base; USGS 17863-PC, 2 to 5 ft above base; USGS 17864-PC, 7 ft. above base; USGS 17865-PC, 9 ft. above base; USGS 17866-PC, 18 ft. above base; USGS 17867-PC, 22 ft above base (crinoidal biopelsparite); USGS 17868-PC, 38 ft. above base; USGS 17869-PC, 98 ft. above base (partly dolomitized crinoidal foraminiferal brachiopod biosparite); USGS 17870-PC, 64 ft. above base; USGS 17871-PC, 84 ft. above base; USGS 17872-PC, 96 ft. above base (interbedded spicular micrite and crinoidal brachiopod bryzoan biopelsparite); USGS 17873-PC, 103 to 108 ft. above base; USGS 17874-PC, 114 ft. above base (partly dolomitized crinoidal brachiopod gastropod biomicrite); USGS 17875-PC, 137 ft. above base (crinoidal brachiopod micrite); USGS 17876-PC, 3 ft. below top (Coral Zone II, Mamet Zone 7).	146.0	44.5

Lodgepole Limestone-Continued	Thickness Feet	Meters
Woodhurst Member-Continued		
9. Limestone; silty mostly fine grained but having about 20 percent bioclastic debris, like unit 7; moderately fossiliferous.	25.0	7.6
8. Limestone; intraformational flat pebble conglomerate; pebbles as much as 0.3 ft. long.	0.6	0.2
7. Limestone; predominantly fine grained but having about 20 percent coarse bioclastic debris in lenses and thin beds; dark gray weathered medium light gray to light gray; yellowish-weathered silty partings comprise about 30 percent of the unit; many beds laminated; bedding irregular, lenticular, and nodular, beds 0.1 to 1 ft. thick; much scour and fill; Zoophycus and other trails common; very fossiliferous. USGS 17861-PC, 18 ft. above base (silty crinoidal bryozoan brachiopod gastropod biopelsparite).	25.0	7.6
6. Limestone; fine grained; dark gray weathered medium light gray to light gray; poorly fossiliferous, fossils occur mainly in silty partings, which make up about 40 percent of the unit; beds a little more regular than in unit 5, 0.1 to 0.4 ft. thick; trails common.	16.0	4.9

	Thickness	
Lodgepole Limestone-Continued	Feet	Meters
Woodhurst Member-Continued		
5. Limestone; fine to coarse grained; dark gray weathered medium light gray to light gray; yellowish and purplish weathered silty partings as much as 0.2 ft. thick make up about 30 percent of the unit; bedding irregular, beds 0.1 to 0.3 ft. thick; very fossiliferous; Zoophycus and other trails abundant in silty partings, where most other fossils occur. USGS 17859-PC from lower half (foraminiferal brachiopod gastropod biopelsparite), USGS 17860-PC from upper half (Coral Zone II, Mamet Zone 7).	10.0	3.0
4. Limestone; medium to very coarse grained, crinoidal; dark gray to brownish gray weathered medium gray to very light gray; beds 0.2 to 1 ft. thick; very fossiliferous; top surface of unit exposes a prolific layer of silicified corals. USGS 17857-PC 3 ft. below top, USGS 17858-PC at top (Coral Zone II).	7.0	2.1
Total Woodhurst Member	259.6	79.1

Lodgepole Limestone-Continued	Thickness Feet	Meters
Paine Member		
3. Limestone; mostly fine grained, cherty, like unit 1; fossils relatively common in thin bioclastic lenses and scattered through limestone beds; punky-weathered chert increases to 10 to 15 percent from 25 ft. above base to top and fossils become progressively more abundant in this interval; bryozoans, brachiopods, and horn corals; ichnofossils abundant; evenly bedded. USGS 17853-PC, 13 to 16 ft. above base; USGS 17854-PC, 22 to 25 ft. above base; USGS 17855-PC, 30 to 34 ft. above base (chertified fossiliferous pelsparite); USGS 17856-PC, 37 to 42 ft. above base (crinoidal brachiopod bryozoan biopelsparite) (Coral Zone IC, Mamet Zone pre-7).	42.0	12.8
2. Limestone; mostly fine grained, cherty, like unit 1 but contains about 20 to 30 percent punky pale to dark yellowish orange weathered chert in lenses 0.2 to 0.3 ft. thick and 1 to 4 ft. wide parallel to bedding; evenly bedded; rare bryozoans, brachiopods, and corals.	23.0	7.0

	Thickness	
Lodgepole Limestone-Continued	Feet	Meters
Paine Member-Continued		
1. Limestone; mostly fine grained, cherty; dark gray weathered medium light gray to light gray; a few lenses and beds containing scattered coarse crinoidal and other bioclastic debris; beds 0.2 to 0.5 ft. thick, separated by buff-weathered silty partings as much as 0.3 ft. thick; small irregular black and brown chert masses and lenses comprise about 5 to 10 percent of the unit; rare bryozoans and brachiopods; ichnofossils common in silty partings; lower 22 ft. contains scattered crinoidal and other bioclastic debris, is coarser grained than beds above, and contains rare small horn corals and brachiopods. USGS 17848-PC, 6 ft. above base (silty crinoidal ostracode biomicrite); USGS 17849-PC, 18 to 22 ft. above base (crinoidal ostracode biomicrite); USGS 17850-PC, 51 ft. above base; USGS 17851-PC, 57 to 62 ft. above base; USGS 17852-PC, 71 to 73 ft. above base (Coral Zones IB and IC, Mamet Zone pre-7).	106.0	32.3
Total Paine Member	171.0	52.1
Total Lodgepole Limestone	430.6	131.2
Total Madison Group	1253.6	382.1

Darby Formation

Buff-weathered unfossiliferous calcareous mudstone and argillaceous limestone containing a few thin beds of sandstone and limonite concretions; upper contact sharp, seemingly conformable.

HOBACK CANYON SECTIONS

Two stratigraphic sections of the upper part of the Mission Canyon Limestone were measured on the north slope of Hoback Canyon in N 1/2 sec. 2 (unsurveyed), T. 38 N., R. 115 W., Teton County, Wyoming (Fig. 3). Traverse I begins at the base of a limestone cliff in the Mission Canyon and proceeds up a nose to the contact with the Darwin Sandstone Member of the Amsden Formation. Traverse II, on a nose about a quarter mile west of Traverse I, begins at the base of a limestone cliff that is lower in the Mission Canyon than the cliff of Traverse I and proceeds up the nose to the top of the formation. Both traverses go across extraordinary exposures of an evaporite sequence in the Mission Canyon Limestone.

The sections were measured in 1959 with a Jacob staff and an 8-foot steel tape. The beds dip about 2^{o} southeast. A composite graphic section of the Mission Canyon Limestone is presented in Sando (1977, pl. 1). Sando and others (1975, pl. 9) published a graphic section of the overlying Amsden Formation. We are indebted to David Love for guiding us to these sections. Wanless and others (1955, p. 27-29) published a description of this section and referred the beds described herein to the Amsden and Brazer Formations. Section descriptions are by Dutro.

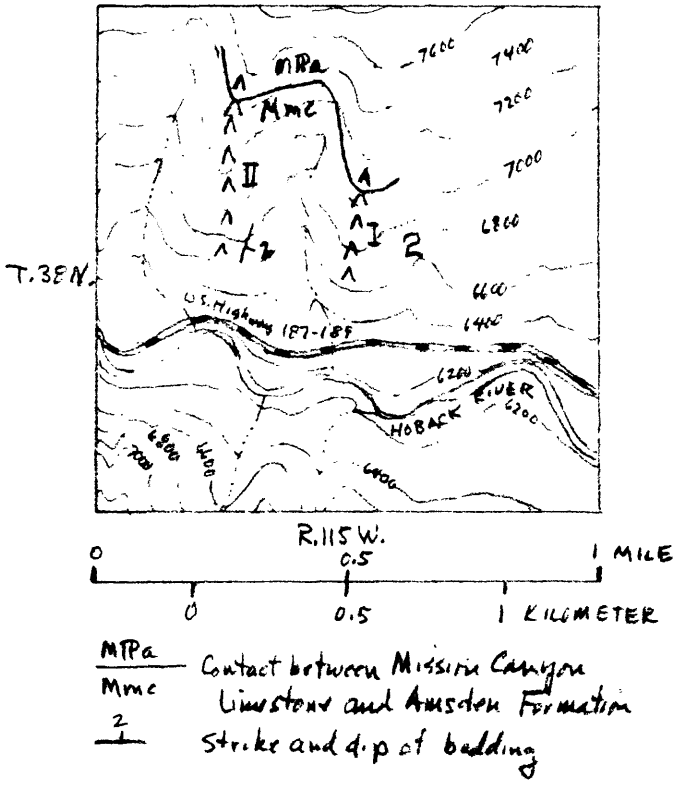

Figure 3.--Geologic sketch map of Hoback Canyon sections. Geology by W. J. Sando and J. T. Dutro, Jr. Base from U.S. Geological Survey Bull Creek quadrangle (1:24,000).

HOBACK CANYON SECTION I

Amsden Formation	Thickness	
Darwin Sandstone Member	Feet	Meters
Quartz sandstone, fine grained, platy, weathered red; grades up into yellowish and whitish weathered sandstone; slumping of beds makes thickness uncertain here but better exposures 250 ft. west of traverse can be measured accurately.		
Madison Group		
Mission Canyon Limestone		
74. Dolomite; fine grained, silty; light olive gray weathered yellowish gray to light brown, beds 0.2 to 0.5 ft. thick, thickness variable.	4.0	1.2
73. Covered; yellowish soil overlies black soil; possible fault gouge or slump zone.	1.5	0.5
72. Dolomitic limestone; fine grained; black; weathers to black soil.	0.2	0.1
71. Covered and a few beds of gypsum and dolomite, like unit 66.	1.0	0.3
70. Gypsum; white, massive; highest gypsum bed.	0.5	0.2
69. Quartz siltstone; blocky beds weathered to thin platy fragments yellowish gray to light olive gray; probably dolomitic; contains gypsiferous partings.	1.5	0.5
68. Gypsum; white, massive, highest ledge former.	2.0	0.6
67. Interbedded gypsum, white, massive; and thin layers of olive gray clay shale in stringers and pockets; gypsum about 75 to 80 percent of unit.	2.5	0.7

Mission Canyon Limestone-Continued	Thickness Feet	Thickness Meters
66. Dolomite; fine grained; pale yellowish brown weathered grayish orange to dark yellowish orange; blocky fractured; contains about 20 percent orange-weathered fractured gypsum and 0.8 ft. of dolomitic greenish claystone.	3.0	0.9
65. Interbedded pink gypsum and greenish gray clay shale or claystone; gypsum is about 75 to 80 percent of the unit.	3.0	0.9
64. Interbedded pink gypsum and red mudstone; gypsum is about 70 percent of the unit; lower part is massive gypsum.	2.5	0.7
63. Quartz sandstone; very fine grained; grayish red, weathered moderate reddish brown; very slightly calcareous; a single bed; greenish gray shale parting at base.	0.6	0.2
62. Gypsum; pink, friable; contains about 10 percent red mudstone and green shale; similar to unit 58 but gypsum not splintery.	2.5	0.7
61. Quartz sandstone and mudstone; sandstone is fine grained, ferruginous, calcareous, yellowish gray to dusky yellow weathered dark yellowish orange; about 0.5 ft. of mudstone as in unit 59.	1.5	0.5
60. Gypsum; massive; a white bed in upper half separated from a lower pink bed by red mudstone 0.5 ft. thick.	3.0	0.9
59. Mudstone; grayish red, like unit 57; about 30 percent interbedded gypsum.	2.0	0.6
58. Gypsum; splintery, cavernous; contains partings and pockets of red and green clay; thickens along strike by 50 percent at expense of unit below.	2.5	0.7

Mission Canyon Limestone-Continued	Thickness Feet	Meters
57. Mudstone; grayish red weathered pale yellowish brown but grades to greenish in upper 0.1 ft.; blocky fractured; beds 0.1 ft. thick; contains 2 gypsum zones 0.1 ft. thick.	3.0	0.9
56. Gypsum; massive; white; contains 20 percent interbedded red mudstone and grayish green shale in pockets and stringers; ledge-forming unit.	5.5	1.7
55. Interbedded claystone, mudstone, and gypsum; claystone is olive gray to grayish green; mudstone is dark reddish brown; gypsum (20 percent) is pink; beds 0.3 to 1 ft. thick; one punky, very fine grained sandstone bed 0.3 ft. thick 1.5 ft. below top.	6.0	1.8
54. Gypsum; massive, white, ledge former.	2.5	0.8
53. Interbedded claystone and gypsum; claystone is olive gray weathered pale olive to light brown in zones 0.3 to 0.5 ft. thick, shaly; gypsum is pink, granular, vuggy, in beds 0.2 to 0.4 ft. thick, makes up 30 to 40 percent of unit.	6.5	2.0
52. Gypsum; massive, white, ledge former; contains olive clay shale partings 0.1 to 0.2 ft. thick spaced about 1 ft. apart in upper half and in one zone 3 ft. above base.	12.0	3.7
51. Claystone; olive gray, gypsiferous, shaly, like unit 49.	0.8	0.2

Mission Canyon Limestone-Continued	Thickness Feet	Thickness Meters
50. Gypsum; massive, white; some claystone layers in upper 1.5 ft.	5.0	1.5
49. Interbedded gypsum and gypsiferous claystone; gypsum is massive, white, comprises about 60 percent of the unit in 0.5 ft. thick zones; claystone is olive gray weathered light olive gray, in 0.2 to 0.3 ft. zones. (Traverse offset about 200 ft. east to spur on which red and green shale and gypsum are exposed).	3.0	0.9
48. Dolomite; fine grained, like unit 45; beds 0.2 to 0.3 ft. thick; blocky fractured; interfingers with limy zone along strike of beds.	3.5	1.1
47. Limestone; fine grained; grayish black weathered medium gray; beds 0.3 to 0.5 ft. thick; about 20 percent interbedded dolomitic limestone.	2.5	0.8
46. Coral bioherm; Diphyphyllum colonies pinching out laterally into dolomite like that in unit below. USGS 18782-PC (Coral Zone IIIA).	3.0	0.9
45. Dolomite; fine grained, like that in unit 42; grades into dolomitic limestone in lower 2 ft.	5.0	1.5
44. Gypsum; massive, white; grayish orange on fresh surfaces.	0.2	0.1
43. Limestone; fine grained; dark gray to black; contains vugs that may be leached anhydrite crystals.	7.5	2.3

Mission Canyon Limestone-Continued	Thickness Feet	Meters
42. Dolomite and dolomitic limestone; dolomite is fine grained, like unit 39, blocky fractured beds 0.3 to 0.5 ft. thick; dolomitic limestone is dark gray weathered olive gray and intergrades with dolomite, mostly 3 to 6 ft. above base.	14.0	4.3
41. Limestone; intraformational conglomerate; scattered rounded limestone pebbles and platy fragments in light brownish gray pelletal micrite.	0.7	0.2
40. Limestone and gypsum; three fine grained massive limestone beds like unit 34, each about 1 ft. thick interbedded with gypsiferous limestone; gypsum about 5 percent.	5.0	1.5
39. Dolomite; fine grained; light olive gray to olive gray weathered pale olive to yellowish gray and light brown; blocky fractured, beds 0.1 to 2 ft. thick; irregular bedding surfaces; faintly laminated in places.	6.5	2.0
38. Gypsum; white and massive in upper 2 ft., contains layers of platy-bedded light olive gray siltstone in lower part; about 20 percent siltstone.	3.5	1.1
37. Limestone and gypsum; like unit 34; limestone is fragmented.	0.7	0.2
36. Gypsum; massive, white; contact with underlying unit is sharp but irregular.	7.0	2.1
35. Breccia; angular fragments of fine grained limestone in gypsum matrix; about 40 percent limestone fragments; basal contact gradational.	0.8	0.2

Mission Canyon Limestone-Continued	Thickness Feet	Thickness Meters
34. Limestone and gypsum; limestone is fine grained, calcarenite, laminated and crossbedded, contains small vugs that may be leached anhydrite crystals, dark gray to black weathered light olive gray to pale yellowish brown, beds 0.1 to 0.3 ft. thick; interbedded gypsum (about 40 percent) is laminated and vuggy and contains small fragments of limestone.	6.5	2.0
33. Dolomite; fine grained; blocky fractured; pale yellowish brown weathered yellowish gray to light olive gray; beds 0.2 to 0.4 ft. thick.	4.0	1.2
32. Gypsum; massive, white.	3.0	0.9
31. Limestone; fine grained; micritic above lower 3 ft.; brownish black to grayish black weathered medium dark gray to dusky blue; beds 0.5 to 2 ft. thick, becoming thinner in upper 10 ft.; contains 1 ft. thick banded fossiliferous chert layer 20 ft. above base and less than 5 percent black banded chert nodules 0.2 ft. in diameter in upper part. Unit forms first cliff above unit 3. USGS 18780-PC, 20 ft. above base (fossiliferous micrite); USGS 18781-PC, 27 ft. above base (Coral Zone IIIA).	33.0	10.1
30. Gypsum; white, contains about 20 percent thin zones of platy limestone like that in unit 27; 1 ft. of relief at top.	4.0	1.2

Mission Canyon Limestone-Continued	Thickness Feet	Thickness Meters
29. Limestone; fine grained, platy, like that in unit 27.	1.5	0.5
28. Mudstone; massive, grayish red.	0.2	0.1
27. Limestone; fine grained, micritic; brownish black; beds 0.1 to 0.2 ft. thick; top beds have red-weathered surface.	1.0	0.3
26. Gypsum; clay and calcareous siltstone laminae in middle part.	7.5	2.3
25. Limestone; fine grained; brownish black to grayish black; platy beds as much as 0.1 ft. thick; interbedded with grayish gypsum; limestone beds broken along strike.	4.0	1.2
24. Gypsum; white; contains silt and clay impurities.	2.0	0.6
23. Claystone; gypsiferous, like unit 12.	2.5	0.7
22. Quartz siltstone, calcareous, like unit 20; beds thin, platy, broken along strike; interbedded with about 40 percent white gypsum in thin layers as much as 0.2 ft. thick.	4.0	1.2
21. Gypsum; massive, white.	8.5	2.6
20. Quartz siltstone; calcareous; dark yellowish brown; beds 0.1 ft. thick; forms slope between massive gypsum beds.	1.5	0.5
19. Gypsum; massive, white; lower 1 ft. is light olive gray weathered light brown.	8.0	2.4
18. Claystone; gypsiferous, like unit 12.	7.5	2.3
17. Gypsum; like unit 13.	6.0	1.8
16. Claystone; gypsiferous, like unit 12.	3.0	0.9
15 Gypsum; like unit 13.	4.5	1.4
14. Claystone; gypsiferous, like unit 12.	2.5	0.8

Mission Canyon Limestone-Continued	Thickness Feet	Meters
13. Gypsum; light gray to medium light gray; beds 0.2 to 0.4 ft. thick; contains isoclinally folded gray clay seams.	3.0	0.9
12. Claystone; gypsiferous; light olive gray weathered pale olive to yellowish gray; weathered to chunky blocks.	7.0	2.1
11. Gypsum; massive, white.	5.0	1.5
10. Quartz siltstone and very fine grained quartz sandstone; calcareous; grayish red and light olive gray; forms red-weathered slope.	2.5	0.7
9. Breccia; very irregular platy fragments of light brownish gray fine grained limestone in matrix of dusky yellowish green calcareous siltstone; a few angular olive gray and brown chert fragments in upper 0.5 ft.; forms unbedded crumpled mass; some reddish silty fillings.	12.0	3.7
8. Limestone; fine grained; light gray to medium gray weathered light brownish gray; beds 0.2 to 0.3 ft. thick; fractured into blocky fragments a few inches in diameter.	3.5	1.1
7. Limestone, dark gray weathered medium gray; contains calcite blebs; single massive bed.	2.2	0.7
6. Limestone breccia; fine grained to slightly crystalline; brownish gray, medium gray, and brownish black; angular fragments like unit below; some dolomitic limestone in middle.	26.0	7.9

Mission Canyon Limestone-Continued	Thickness Feet	Meters
5. Breccia; angular fragments of fine grained dark gray limestone as much as 0.3 ft. in diameter in matrix of similar composition; less brecciated, better bedded near top.	9.0	2.7
4. Breccia; angular fragments of black, gray, brown, and white chert of granule to cobble size in matrix of fine grained light brownish gray to brownish gray limestone; beds extremely irregular, some quartz crystals in irregular stringers.	6.5	2.0
3. Limestone and breccia; limestone is fine grained, brownish black weathered dark gray to brownish gray, thinbedded, platy, and contains 15 to 20 percent black chert nodules and flat lenses; breccia consists of limestone and chert fragments in calcite matrix. Top of unit is top of main cliff. USGS 18779-PC, 11 ft. above base (Coral Zone II).	16.3	5.0
2. Dolomite and dolomitic limestone, dolomite is fine grained, pale yellowish brown weathered dark yellowish brown; dolomitic limestone is fine grained, brownish gray weathering medium gray; beds 0.1 to 0.3 ft. thick, having planar surface; dolomite comprises about 70 percent of the unit.	13.0	4.0

Mission Canyon Limestone-Continued	Thickness	
	Feet	Meters
1. Limestone; fine grained, micritic; brownish gray weathered medium light gray to medium gray with bluish cast; beds 15-25 ft. thick; calcite veins and blebs common; corals, gastropods, and brachiopods common. USGS 18777-PC, 45 ft. above base (fossiliferous micrite), 18778-PC at top (Coral Zone II).	80.0	24.4
Measured thickness of Mission Canyon Limestone (incomplete).....	438.7	133.7

HOBACK CANYON SECTION II

	Thickness	
	Feet	Meters
Amsden Formation		
Darwin Sandstone Member		
Quartz sandstone and quartzite; mostly fine grained, platy to massive, crossbedded; weathered orange and red.		
Madison Group		
Mission Canyon Limestone		
78. Dolomite; fine grained; laminated; medium dark gray to pale yellowish brown weathered medium yellowish brown to dark yellowish brown; beds 0.1 to 0.4 ft. thick. Same as unit 74 of Section I.	10.0	3.1
77. Dolomitic limestone; fine grained; light brownish gray to light brown weathered medium yellowish brown to dark yellowish orange.	5.0	1.5
76. Dolomitic limestone; fine grained, micritic; laminated; weathered to platy pale yellowish brown to grayish orange fragments; beds 0.2 to 0.4 ft. thick; dark gray chert in upper 0.3 ft.	6.0	1.8
75. Quartz sandstone and siltstone; unit begins with siltstone that grades up into very fine grained to fine grained sandstone that comprises about 70 percent of the unit; yellowish gray to pale yellowish orange weathered dark yellowish orange; beds about 0.4 ft. thick.	4.0	1.2

Mission Canyon Limestone-Continued	Thickness Feet	Thickness Meters
74. Interbedded gypsum (60 percent), fine grained quartz sandstone (20 percent), and silty dolomite (20 percent) as in unit 70; 2 sandstone zones in lower 3 ft.; dolomite in upper 3 ft.	6.0	1.8
73. Gypsum; massive, white; some dolomitic siltstone in upper ft. along strike.	4.0	1.2
72. Interbedded pinkish gypsum and dolomite; like unit 70 but contains no sandstone.	2.5	0.7
71. Gypsum; massive, white.	3.5	1.1
70. Interbedded gypsum (70 percent), silty dolomite (20 percent), and quartz sandstone (10 percent); dolomite is light olive gray, in thin beds; sandstone is calcareous, fine grained, pale olive to yellowish gray, in one zone 0.4 ft. thick.	3.5	1.1
69. Quartz siltstone, red and about 40 percent interbedded gypsum.	3.0	0.9
68. Gypsum; massive, pinkish to white.	1.0	0.3
67. Interbedded red quartz siltstone (70 percent) as in unit 64, green shale (10 percent), and pink gypsum (20 percent); siltstone beds 0.1 ft. thick.	1.5	0.5
66. Interbedded gypsum (70 percent), red quartz siltstone (20 percent), and green shale (10 percent) as in unit 64.	2.5	0.7
65. Gypsum; massive, white.	2.0	0.6

Mission Canyon Limestone-Continued	Thickness Feet	Meters
64. Interbedded quartz siltstone (40 percent), gypsum, (40 percent), and shale (20 percent); siltstone is grayish red to dark reddish brown; shale is grayish green to dusky yellowish green; gypsum is thinbedded and pinkish.	4.0	1.2
63. Gypsum; in 2 massive, granular white beds; separated by 0.3 ft. of dusky yellowish green claystone about 2 ft. above base.	4.0	1.2
62. Interbedded gypsum (40 percent) and olive gray, gypsiferous, dolomitic(?) siltstone.	3.5	1.1
61. Gypsum; massive, white, in beds 2 to 3 ft. thick having about 10 percent interbedded gypsiferous claystone or quartz siltstone in lower 5 ft. and 7 and 10 ft. above base.	12.0	3.7
60. Quartz siltstone; laminated, gypsiferous; light olive gray; beds 0.1 ft. thick. Base of unit marks top of cliffy unit below red-bed evaporite sequence. Altitude 7275 ft.	2.0	0.6
59. Dolomite; fine grained; gypsiferous; like unit 54.	3.0	0.9
58. Limestone; fine grained; vuggy; like unit 55; grades upward into unit 59.	3.0	0.9
57. Dolomite; fine grained; gypsiferous; like unit 54; beds 0.3 to 0.8 ft. thick; some vugs (crystal molds) in upper ft.	3.0	0.9
56. Breccia; aligned fragments of fine-grained limestone, like unit 53 in matrix of gypsum (about 60 percent of unit).	0.5	0.2
55. Limestone; mostly fine grained, like unit 53; vuggy in upper 0.5 ft.	1.5	0.5

Mission Canyon Limestone-Continued	Thickness Feet	Meters
54. Dolomite; fine grained; gypsiferous; like units 48, 50, and 52; most beds laminated; some gypsum-filled cavities 0.5 to 1 ft. in diameter in upper 2 ft. Base of unit is base of last cliff below red-bed sequence.	6.5	2.0
53. Limestone; fine grained; like units 46 and 49 but having thicker beds (0.8 to 2 ft. thick); one vuggy bed about 4 ft. above base but generally not as vuggy as units 46 and 49; grades upward into overlying unit through an interval of about a ft.	9.0	2.7
52. Dolomite; fine grained; gypsiferous; like units 48 and 50; some beds laminated; beds crossbedded, 0.2 to 0.8 ft. thick.	9.0	2.7
51. Limestone; fine grained; like unit 46; having a similar breccia bed 1 ft. above base.	4.0	1.2
50. Dolomite; fine grained; like unit 48.	4.5	1.4
49. Limestone; fine grained; vuggy; like unit 46; two thick zones of vugs (crystal molds) comprising 25 to 40 percent of beds; grades upward into overlying unit.	6.5	2.0
48. Dolomite; fine grained; like units 38 and 45; beds 0.5 to 0.8 ft. thick.	5.0	1.5
47. Breccia; fragments of light brownish gray fine grained calcareous siltstone or dolomitic limestone in crystalline calcite matrix; whole bed weathered light brown to pale yellowish brown.	2.0	0.6

Mission Canyon Limestone-Continued	Thickeness Feet	Meters
46. Limestone and limestone breccia; lower 4 ft. is fine grained limestone, gray black weathered medium gray, vuggy (crystal molds), beds 0.2 to 0.5 ft. thick; upper 8 ft. is brecciated limestone like that below recemented in place. (Traverse offset 200 ft. west across transverse fault at base of unit 46).	12.0	3.7
45. Dolomite; fine grained; silty; as in unit 38; beds 0.3 to 0.5 ft. thick; partly covered.	4.0	1.2
44. Breccia; fragments 0.25 to 0.5 inch in diameter of dark yellowish orange to yellowish gray siltstone in pale yellowish brown calcareous matrix (about 60 percent); weathered pale yellowish brown, light orange, and pale reddish brown.	1.0	0.3
43. Breccia; fragments (75 percent) as much as 0.3 ft. diameter (average 0.05 to 0.1 ft.) of pale yellowish brown fine grained dolomite and brownish gray dolomitic limestone in calcareous matrix weathered yellowish gray to light brownish gray; forms rugged cliff top.	4.0	1.2
42. Limestone; fine grained; light brownish gray weathered medium light gray; contains about 20 percent tabular molds of anhydrite (?) crystals partly aligned along bedding.	1.5	0.5

Mission Canyon Limestone-Continued	Thickness Feet	Meters
41. Limestone; fine grained; medium dark gray to dark gray weathered medium gray to yellowish brown; beds 0.1 to 0.4 ft. thick; laminated and crossbedded; some platy fragments in thin beds.	2.0	0.6
40. Breccia; fragments as much as 0.25 inches in diameter of fine grained dolomitic limestone like that in unit 39 in a fine grained brownish gray calcareous matrix; bed is very even-textured.	1.0	0.3
39. Dolomite; fine grained; silty; like unit 38 but beds 0.1 to 0.2 ft. thick; interbedded with medium dark gray fine grained dolomitic limestone weathered medium gray and having vugs that are probably molds of anhydrite crystals.	3.5	1.1
38. Dolomite; fine grained; silty; pale yellowish brown weathered yellowish gray to light olive gray; beds 0.5 to 1 ft. thick; weathered to irregular blocks.	2.0	0.6
37. Breccia; fragments as much as 0.1 ft. in diameter of fine grained limestone like unit 36 in matrix of pale yellowish brown to moderate yellowish brown limestone; irregular contacts above and below.	1.0	0.3
36. Limestone; fine grained; grayish black to brownish black weathered dark gray; beds 2 to 3 ft. thick; some beds micritic; bed of fossiliferous chert 1 ft. thick 10 ft. above base is same bed as in unit 31 of Section I; corals, gastropods, and brachiopods USGS 18797-PC 10 to 11 ft. above base (chertified crinoidal brachiopod coral biosparite) (Coral Zone IIIA).	28.0	8.5

Mission Canyon Limestone-Continued	Thickness Feet	Meters
35. Breccia; fragments (40 percent) as much as 0.1 ft. in diameter of pale yellowish brown dolomitic limestone in brownish gray gray dolomitic limestone matrix; bed weathered medium light gray to yellowish gray.	1.0	0.3
34. Limestone, fine grained, grayish black; laminated; platy; vuggy (molds of anhydrite crystals?).	3.0	0.9
33. Gypsiferous claystone; like unit 30; mostly covered; exposed by trenching.	7.0	2.1
32. Gypsum; massive, white.	4.0	1.2
31. Dolomite; fine grained; gypsiferous; pale yellowish brown weathered medium gray to light brownish gray; beds 0.2 to 0.4 ft. thick.	4.0	1.2
30. Gypsiferous claystone; as in unit 31; partly covered.	7.0	2.1
29. Gypsum; massive, white, interbedded with argillaceous gypsum and about 40 percent gypsiferous claystone, pale olive weathered yellowish gray.	39.0	11.9
28. Limestone and dolomitic limestone; limestone in lower 20 ft. is fine grained, laminated, gypsiferous, brownish black to dark gray weathered brownish gray to medium gray and contains less than 5 percent grayish black lenses of chert; upper 10 ft. is mostly fine grained dolomite, brownish gray weathered pale yellowish brown; one bed contains vugs that appear to be crystal molds. Base of unit is base of cliff.	30.0	9.1

Mission Canyon Limestone-Continued	Thickness Feet	Meters
27. Covered	2.0	0.6
26. Gypsum; massive, white and some beds of fine grained dolomitic limestone like unit 25; a 2 ft. zone 6 to 8 ft. above base contains 60 percent dolomitic limestone; another zone of dolomitic limestone 1 ft. thick about a ft. below top; boudinage structure in dolomitic limestone zones.	16.0	4.9
25. Dolomitic limestone and gypsum; dolomitic limestone is fine grained, laminated, light brownish gray and dark black weathered medium gray to pale yellowish brown, containing thin nodules of black chert in upper ft.; about 20 percent interbedded white granular gypsum; beds 0.2 ft. thick. (Traverse offset to nose about 100 ft. west at base of unit).	3.5	1.1
24. Limestone; fine grained; laminated; brownish black; contains black chert. Same as unit 3 of Section I.	14.0	4.3
23. Dolomite; fine grained; laminated; pale yellowish brown weathered dark yellowish brown; some dolomitic limestone in upper part. Same as unit 2 of Section I.	13.0	4.0

Mission Canyon Limestone-Continued	Thickness Feet	Meters
22. Limestone; fine grained (micritic); light brownish gray to medium dark gray weathered medium light gray with bluish cast; beds 1 to 3 ft. thick; laminae in lower 2 ft. less persistent than in unit 21 and die out upward; rare horn corals. USGS 18795-PC, 3 ft. above base (fossilferous micrite); USGS 18796-PC, upper 6 ft. (fossiliferous micrite) (Coral Zone II). Top of unit is probably top of unit 1 of Section I.	18.6	5.7
21. Limestone; fine to medium grained; silty; laminated, dolomitic or silty laminae show ripple marking and intraformational brecciation; light brownish gray weathered medium light gray.	4.0	1.2
20. Limestone; fine grained (micritic); light brownish gray to medium dark gray weathered medium light gray; beds 2 to 3 ft. thick; grades upward into laminated beds above.	15.5	4.7
19. Dolomitic limestone; fine grained; brownish gray weathered pale yellowish brown; beds 0.2 to 0.3 ft. thick; contains dark brown chert weathered pale yellowish brown to yellowish gray in lower 5 ft. (about 20 percent of that interval).	15.0	4.6

Mission Canyon Limestone-Continued	Thickness Feet	Meters
18. Limestone; predominantly fine grained; about 30 percent medium to coarse crinoidal debris in micrite matrix; light brownish gray to medium gray weathered medium light gray; beds 1 to 3 ft. thick.	10.0	3.0
17. Limestone; medium grained; crinoidal; brownish gray to brownish black weathered dark gray to dusky brown; intraformational conglomerate in lower ft; corals. USGS 18794-PC, 3 ft. above base (dolomitized crinoidal biomicrite) (Coral Zone II).	7.0	2.1
16. Dolomite; medium crystalline; vuggy; dark yellowish brown weathered chocolate brown; lower 7 ft. contains gypsiferous zones; upper 6 ft. partly covered.	15.0	4.6
15. Breccia; angular fragments as much as 0.1 ft. in diameter of mostly fine grained (micritic), yellowish gray limestone; some fine grained dolomite and calcareous quartz siltstone; contains gypsum veinlets throughout; entire unit weathered pale yellowish brown, dark yellowish orange, and grayish orange.	3.0	0.9
14. Gypsum; massive, white; containing thin zones of medium gray quartz siltstone (less than 10 percent) weathered yellowish gray less than 0.5 ft. thick and broken along bedding.	2.0	0.6
13. Gypsum; massive, white; lower 2 to 3 ft. in beds 0.1 to 0.2 ft. thick; forms cliff.	13.5	4.1

Mission Canyon Limestone-Continued	Thickness Feet	Meters
12. Gypsum; fine grained, brownish gray, and very argillaceous in upper 2 ft. and lower 9 ft.; massive and white in middle 2 ft.; beds platy, 0.05 to 0.1 ft. thick; weathered yellowish gray to light olive gray.	13.0	4.0
11. Gypsum; massive, white; single bed.	6.5	2.0
10. Dolomite and dolomitic limestone; dolomitic limestone in lower 5 ft. grades up into dolomite; dolomitic limestone is fine grained, brownish black weathered brownish gray; dolomite is dusky brown to dark yellowish brown; contains large, elongate black chert nodules parallel to bedding; nodules are 2-3 ft. in diameter in lower 10 ft. and smaller and spheroidal in upper part; upper 5 ft. is laminated and crossbedded pure dolomite that has vugs (probably anhydrite crystal molds) in upper ft.; beds are 0.5 to 0.8 ft. thick in lower 5 ft. and 0.2 to 0.3 ft. in upper 10 ft.	32.0	9.8
9. Limestone; medium to coarse grained; crinoidal, dark gray weathered medium gray; coarse crinoidal debris in 0.2 to 0.3 ft. layers; beds 0.5 to 1 ft. thick; rare corals.	4.0	1.2
8. Limestone; fine to medium grained; dark gray to brownish black weathered dark yellowish brown; banded gray and black chert 10 to 15 percent; beds 2 to 3 ft. thick; rare corals.	9.0	2.7

Mission Canyon Limestone-Continued	Thickness Feet	Meters
7. Limestone; fine to medium grained; brownish gray to medium gray weathered medium light gray and bluish; contains coarse crinoidal debris in faintly crossbedded layers; a 1 ft. zone of brownish gray chert nodules weathered pale yellowish brown 4 ft. above base; beds 1 to 2 ft. thick.	19.0	5.8
6. Dolomite and dolomitic limestone; dolomite is fine grained, silty, pale yellowish brown weathered yellowish gray to pinkish gray; dolomitic limestone is fine to medium grained, crinoidal, light brownish gray weathered medium gray, comprises about 30 percent of unit; basal 3 ft. contains abundant masses of gray-weathered light brown or tan chert 0.1 ft. in diameter; beds 0.5 to 1 ft. thick.	11.0	3.4
5. Limestone; fine to medium grained; containing 15 to 25 percent scattered crinoidal debris; dark gray to brownish black weathered medium dark gray; some beds dolomitic; beds 3 to 5 ft. thick; corals, brachiopods. USGS 18793-PC from throughout unit (crinoidal biomicrite) (Coral Zone II).	7.0	2.1
4. Dolomitic limestone; fine grained; like unit 2 but not cherty.	3.0	0.9
3. Limestone; medium to coarse grained; crinoidal; like unit 1 but not cherty; grades upward into overlying unit; basal contact irregular.	4.0	1.2

Mission Canyon Limestone-Continued	Thickness Feet	Meters
2. Dolomitic limestone; fine grained; pale yellowish brown to light brownish gray weathered grayish orange pink to dark yellowish brown; blacky fragments; beds 0.5 to 1.5 ft. thick; as much as 30 percent scattered crinoidal debris; more calcareous in lower 5 to 8 ft.; less than 5 percent chert nodules like those in unit 1 in lower part.	12.0	3.7
1. Limestone; medium to coarse grained; crinoidal; brownish gray to medium dark gray weathered medium light gray with bluish tinge; beds 1 to 3 ft. thick; medium to dark gray chert in irregular patches and silicified limestone in irregular lacy network weathered light brown to dark yellowish orange; abundant horn corals. USGS 18792-PC from lower 3 ft. (crinoidal bryozoan biosparite) (Coral Zone II).	49.0	14.9
Measured thickness of Mission Canyon Limestone (incomplete).....	614.1	187.2

BLACK MOUNTAIN SECTION

The Black Mountain section is located on a ridge southeast of Black Mountain as shown on the U.S. Geological Survey topographic map of the Garns Mountain quadrangle (1:62,500), Idaho. The section traverse begins at the base of the Lodgepole Limestone exposed along a trail in SE 1/4 sec. 14, T. 3 N., R. 43 E., Bonneville County, Idaho (Fig. 4). The traverse proceeds along the trail on the crest of the ridge across the Lodgepole Limestone in NE 1/4 sec. 23 and NW 1/4 sec. 24 to the top of the Lodgepole. The section is then offset southeastwards along the top of the Lodgepole and proceeds across the Mission Canyon Limestone exposed on a nose in SW 1/4 sec. 24. The section terminates against a thrust fault within the Mission Canyon Limestone, which prevents measurement of a complete thickness of the Mission Canyon. More limestone and breccia crop out on the other side of the fault above unit 90. There may also be some repetition by faulting in units 76 to 90.

The section was measured in 1961 with a Jacob staff and an 8-foot steel tape. The beds dip 30^{o}-47^{o} southwest. A graphic section of the Madison is presented in Sando (1977, pl. 1). We are indebted to H. F. Albee for guiding us to this section. Section description is by Sando.

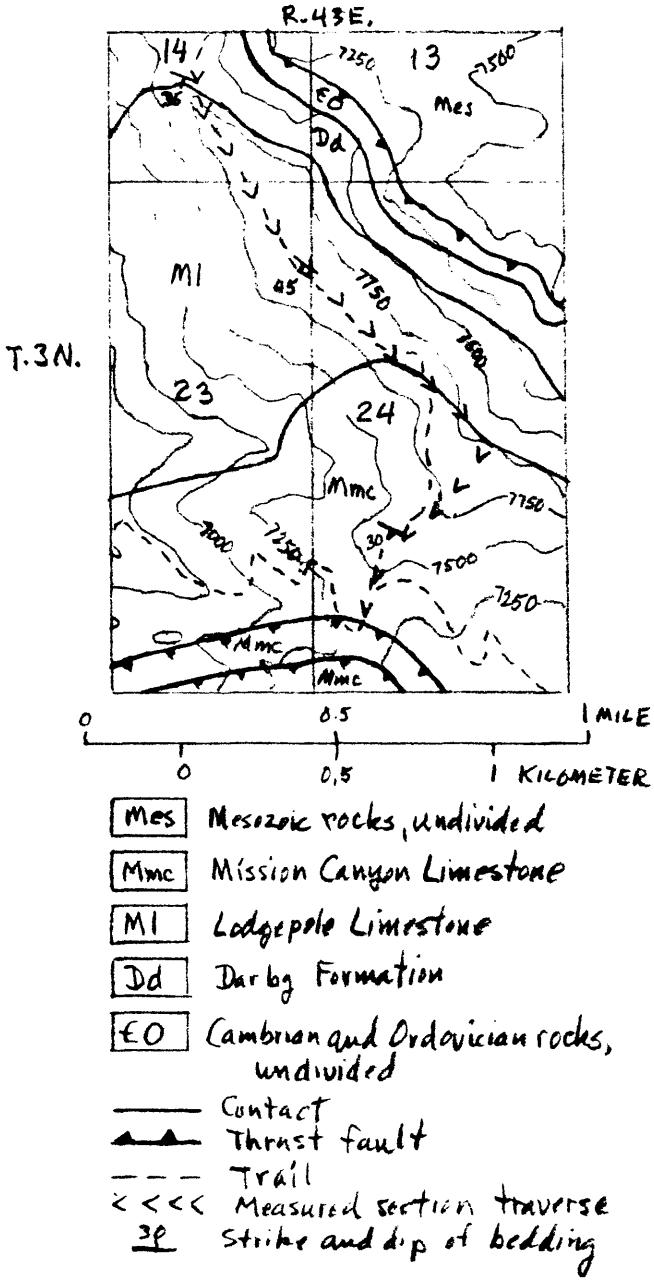

Figure 4.--Geologic sketch map of Black Mountain section. Geology (modified) and base from Staatz and Albee (1963).

Madison Group	Thickness Feet	Meters
Mission Canyon Limestone (top not attained owing to fault)		
90. Dolomite and dolomitic limestone; fine grained; weathered yellowish gray and pale yellowish brown, beds 0.3 to 0.5 ft. thick.	10.0	3.1
89. Limestone; medium grained; oolitic; like unit 75 (may be repeated by faulting).	3.0	0.9
88. Dolomitic limestone; fine grained; like unit 82; poorly exposed; possible bedding plane faulting.	5.0	1.5
87. Limestone breccia; like unit 71 but contains no fossils.	9.0	2.7
86. Breccia; fragments of limestone, dolomitic limestone, and chert; like unit 80; limestone fragments as much as 1 ft. in diameter in yellowish-weathered matrix; well exposed on nose.	45.0	13.7
85. Limestone and limestone breccia; fine to medium grained, like unit 71; some tectonic fracturing; well exposed on nose.	45.0	13.7
84. Dolomitic limestone; fine grained; like unit 82; poorly exposed.	5.0	1.5
83. Limestone and limestone breccia; fine to medium grained; like unit 71; moderately well exposed on knob.	40.0	12.2
82. Dolomitic limestone; fine grained; like unit 62 but contains many linear markings as much as 1/8 by 1 inch, probably worm trails; poorly exposed.	3.0	0.9

Mission Canyon Limestone-Continued	Thickness Feet	Meters
81. Limestone breccia; fine to medium grained; like unit 71; poorly exposed.	7.0	2.1
80. Breccia; fragments of limestone, dolomitic limestone, and chert; like unit 65 but yellowish and pink weathered matrix and fragments are dominant and chert fragments are more abundant (about 10 to 20 percent); poorly exposed.	25.0	7.6
79. Limestone breccia; fine to medium grained; like that in unit 71; upper half in place on knob; lower half loose blocks. Possible fault at base of unit.	35.0	10.7
78. Covered; soil and small pieces of breccia and fine grained limestone; probably mostly breccia.	22.0	6.7
77. Covered and an outcrop of breccia like unit 65; breccia also in float. Trail marker at top of unit.	8.0	2.4
76. Covered; float consists of dolomitic limestone like unit 74; possible fault in unit. Trail crosses unit. Base of unit marks top of graphic section published by Sando (1977, pl. 1.).	14.0	4.3
75. Limestone; medium grained; oolitic, ooids 0.5 mm or less in diameter; olive black weathered medium light gray; poorly exposed. Trail crosses unit.	3.0	0.9
74. Covered; soil and float like unit 73 but also contains some fine grained dolomitic limestone like unit 62 in float. Trail crosses unit.	15.0	4.6

Mission Canyon Limestone-Continued	Thickness Feet	Thickness Meters
73. Covered; soil and small-sized float of breccia like unit 72 and limestone, like unit 71; no beds seen in place. Trail crosses unit, which occupies swale.	22.0	6.7
72. Breccia; fragments of limestone, dolomitic limestone, and chert like unit 65; beds 1 ft. thick; about 70 percent covered. Trail crosses unit.	20.0	6.1
71. Limestone and limestone breccia; limestone is fine to medium grained, like unit 68; breccia (75 percent of unit) consists of fragments (as much as 0.5 ft. in diameter) of limestone like that in unbrecciated limestone in a matrix of fine grained whitish-weathered calcareous material; some of the matrix is crystalline calcite; beds 3 to 5 ft. thick; unit is exposed on dipslope as irregular massive outcrops; rare corals. USGS 20104-PC from float from upper half (fossiliferous oolitic grapestone intrasparite) (Coral Zone IIIA, Mamet Zone 10-11).	40.0	12.2
70. Limestone; fine to medium grained; oolitic; like unit 68; about 10 to 20 percent crinoidal debris; brecciated in part; forms prominent ledges.	9.0	2.7
69. Dolomitic limestone; fine grained; like unit 62; poorly exposed in swale.	5.0	1.5

Mission Canyon Limestone-Continued	Thickness Feet	Meters
68. Limestone; fine to medium grained; oolitic; olive black weathered medium light gray to light gray; beds 1-3 ft. thick; brecciated in part; makes prominent ledge on nose.	20.0	6.1
67. Breccia; limestone, dolomitic limestone, and chert; like unit 65; mostly covered.	8.0	2.4
66. Covered; a few outcrops at base and rubble on the surface indicate that the unit is predominantly limestone, fine to medium grained, oolitic and crinoidal in part, olive black weathered medium light gray; probably thin bedded; sedimentary structures largely obscure; many vugs about 1 to 2 mm in diameter, mostly tabular in cross section.	15.0	4.6
65. Breccia; angular fragments of limestone, dolomitic limestone, and white chert (rare) mostly less than 0.1 ft. in diameter; fragments are fine grained, weathered mostly medium light gray to light gray; matrix is calcareous siltstone(?) weathered pale yellowish orange and dark yellowish orange (rare); in some beds matrix and clasts reversed from as noted above; beds mostly 1 ft. thick; poorly exposed. Trail crosses unit.	22.0	6.7

Mission Canyon Limestone-Continued	Thickness Feet	Meters
64. Limestone; fine grained (micrite); olive gray weathered medium light gray to light gray; contains many irregular vugs 1 mm in diameter; probably brecciated in part; beds 0.5 to 1 ft. thick; poorly exposed where traverse crosses trail.	12.0	3.7
63. Dolomite and dolomitic limestone; fine grained; laminated; olive gray weathered light gray to yellowish gray; some beds have about 10 to 20 percent linear calcite flecks as much as 3 mm long; beds 0.3 to 0.5 ft. thick; poorly exposed.	10.0	3.1
62. Dolomite and dolomitic limestone; fine grained; olive gray weathered pale yellowish brown; mostly faintly laminated; contains scour and fill structures, worm burrows, a few flat pebble conglomerates (clasts as much as 0.1 ft. in diameter), and irregular mud flowage structures; beds 0.3 to 1 ft. thick mostly covered.	12.0	3.7
61. Covered; talus from unit 60; interval probably occupied by limestone and dolomitic limestone.	8.0	2.4
60. Limestone and dolomitic limestone; like unit 58; beds 1 ft. thick; large spiriferoid brachiopods; poorly exposed on low knob.	4.5	1.4

Mission Canyon Limestone-Continued	Thickness Feet	Meters
59. Limestone; fine to medium grained; crinoidal; like unit 56; lower 2 ft. dolomitic; beds 0.5 to 2 ft. thick; brecciated in part; horn corals and large spiriferoid brachiopods; top poorly exposed; unit moderately well exposed on low knob. USGS 20103-PC from lower 2 ft. (dolomitized fossiliferous micrite) (Coral Zone II).	27.0	8.2
58. Dolomite and dolomitic limestone; fine grained; like unit 55 but contains no chert; poorly exposed in swale.	5.0	1.5
57. Covered; talus all limestone like unit 56; interval in part a continuation of unit 56. USGS 20102-PC from float at top (Coral Zone II).	10.0	3.1
56. Limestone; fine to medium grained; brownish black weathered medium light gray and light gray; composed of about 40 percent crinoidal debris, 20 percent intraclasts, and 10 percent coarse bioclastic debris in micrite matrix; beds 0.5 to 1 ft. thick; lower 2 ft. dolomitic; corals and large speriferoid brachiopods; poorly exposed on low knob. USGS 20100-PC from lower half (foraminiferal biopelsparite), USGS 20101-PC from upper half (Coral Zone II, Mamet Zone 9).	8.0	2.4

Mission Canyon Limestone-Continued	Thickness Feet	Meters
55. Covered and a few outcrops of dolomite and dolomitic limestone, fine grained, olive gray weathered pale yellowish brown, faintly laminated; containing about 20 percent white weathered chert as in unit 22, beds 0.3 to 0.5 ft. thick; float consists of about 90 percent dolomite and dolomitic limestone like that seen in place; at least two beds of limestone and dolomitic limestone like unit 28 are indicated by float noted 20 to 25 and 35 to 40 ft. above base; large spiriferoid brachiopods seen in float of upper 5 ft. USGS 20099-PC from float in upper 5 ft.	52.0	15.8
54. Covered; interval occupied by talus from unit 53.	10.0	3.1
53. Limestone; coarse grained; crinoidal; like unit 49; pock marked weathering; moderately well exposed on low knob except for top, which is poorly exposed.	12.0	3.7
52. Dolomitic limestone; fine grained; like unit 46; very poorly exposed on slope.	3.0	0.9
51. Dolomite and dolomitic limestone; coarse grained; crinoidal; like unit 28; poorly exposed on slope.	4.0	1.2
50. Covered; talus consists of crinoidal limestone like that in unit 49 comming down from that unit and fine grained dolomitic limestone like unit 46 but having about 10 to 20 percent white-weathered irregular chert like that in unit 22; interval probably occupied by cherty dolomitic limestone.	6.0	1.8

Mission Canyon Limestone-Continued	Thickness Feet	Meters
49. Limestone; coarse grained; crinoidal; like that in unit 47 but somewhat purer, having very little dolomitic material; difference is expressed in weathered color, which is medium light gray; exposed on knob.	7.0	2.1
48. Dolomitic limestone breccia; like unit 40.	0.5	0.2
47. Dolomitic limestone and limestone; coarse grained; crinoidal; like unit 28; beds 1 ft. thick; exposed on knob.	5.0	1.5
46. Dolomitic limestone and dolomite; predominantly fine grained but having about 20 to 30 percent medium to coarse grained calcareous crinoidal debris in thin beds and lenses; olive gray weathered pale yellowish brown; beds 0.3 to 0.5 ft. thick; unit forms saddle; poorly exposed.	8.0	2.4
45. Limestone and dolomitic limestone; coarse grained; crinoidal; like unit 28; beds 1 ft. thick; exposed on knob.	2.5	0.7
44. Dolomitic limestone; oolitic; medium grained; olive black weathered dark yellowish brown; calcareous ooids in fine grained matrix; two beds; grades into unit above; exposed on knob.	2.0	0.6
43. Dolomite and dolomitic limestone; like unit 41 but contains about 10 percent coarse bioclastic debris; beds 0.3 to 1 ft. thick; poorly exposed on saddle.	15.0	4.6
42. Dolomitic limestone breccia; like unit 40; poorly exposed on knob.	7.5	2.3

Mission Canyon Limestone-Continued	Thickeness Feet	Meters
41. Dolomite or dolomitic limestone; fine grained; light olive gray weathered pale yellowish brown; beds 0.3 to 0.5 ft. thick; poorly exposed.	6.0	1.8
40. Dolomitic limestone breccia; clasts are angular fragments of dolomitic limestone as much as 0.05 ft. in diameter, fine grained, brownish black weathered dark yellowish brown; matrix is medium grained dolomitic limestone of the same type, crystalline calcite, and fine grained dolomitic limestone weathered yellowish gray; beds 0.3 to 0.5 ft. thick; poorly exposed.	9.0	2.7
39. Limestone; fine grained (micrite); olive gray weathered medium light gray to light gray; some beds at top have about 40 percent irregular vugs 1 to 2 mm in diameter; beds 1 ft. thick; poorly exposed at base of slope.	12.0	3.7
38. Dolomitic limestone; predominantly fine grained but having about 10 to 20 percent scattered medium to coarse grained bioclastic debris; some beds faintly laminated; brownish black weathered light olive gray to dark yellowish brown; beds 0.3 to 1 ft. thick; corals and brachiopods; poorly exposed on slope. USGS 20097-PC, 15 to 20 ft. above base (partly dolomitized fossiliferous micrite); USGS 20098-PC, 35 to 45 ft. above base (partly dolomitized fossiliferous micrite) (Coral Zone II).	51.0	15.6

Mission Canyon Limestone-Continued	Thickness Feet	Meters
37. Dolomitic limestone and limestone; coarse grained, crinoidal, like unit 35; forms crest of main ridge with dip slope at top of unit. (Traverse proceeds down nose that runs approximately perpendicular to strike of beds at top of unit).	15.0	4.6
36. Dolomitic limestone; medium grained; crinoidal; crossbedded; like unit 34 but calcitic components unleached; well exposed on ridge crest.	5.5	1.7
35. Dolomitic limestone and limestone; coarse grained; crinoidal; like unit 28; crinoid columnals as much as 0.5 inch in diameter; beds 1 to 4 ft. thick; grades into unit 36; well exposed on ridge crest.	12.0	3.7
34. Dolomite; medium grained; crinoidal; olive gray; consists of leached calcareous crinoidal debris (40 to 50 percent) in dolomite matrix; beds 1 to 3 ft. thick; weathers to crumbly rounded surfaces; moderately well exposed on ridge.	27.0	8.2

Mission Canyon Limestone-Continued	Thickness Feet	Meters
33. Dolomitic limestone and limestone; coarse grained; crinoidal; like unit 28; crinoid columnals as much as 0.5 inch in diameter; crossbedded; beds 1 to 3 ft. thick; unit well exposed on slope of prominent cliff; rare brachiopods and corals. USGS 20095-PC from float 20 to 25 ft. above base (partly dolomitized crinoidal biomicrite), USGS 20096-PC, 37 ft. above base (partly dolomitized crinoidal biomicrite) (Coral Zone II). (Traverse proceeds along ridge that parallels strike of beds at top of unit; units measured by a series of small offsets).	52.0	15.8
32. Dolomite and dolomitic limestone; predominantly fine grained, like unit 31; more than 50 percent covered; interval occupied by grove of small, scraggly aspen.	75.0	22.9
31. Dolomite and dolomitic limestone; predominantly fine grained but containing 10 to 20 percent scattered crinoidal debris occurring as vugs; light olive gray weathered yellowish gray; beds 0.3 to 1.5 ft. thick; moderately well exposed.	30.0	9.1
30. Dolomitic limestone and limestone; coarse grained; crinoidal; like unit 28; poorly preserved brachiopods and horn corals; moderately well exposed in prominent ledges. USGS 20094-PC from lower 5 ft. (dolomitized fossiliferous micrite?).	15.0	4.6

Mission Canyon Limestone-Continued	Thickness Feet	Meters
29. Dolomitic limestone; medium grained; like unit 27; poorly exposed.	12.0	3.7
28. Dolomitic limestone and limestone; coarse grained; crinoidal; calcitic crinoidal debris in dolomite matrix; light olive gray weathered dark yellowish brown; cross bedded, beds 0.5 to 1 ft. thick; horn corals and brachiopods; moderately well exposed in prominent ledge. USGS 20093-PC from throughout unit (partly dolomitized crinoidal biomicrite).	6.0	1.8
27. Dolomite; like unit 26 but predominantly medium grained, having about 20 to 30 percent bioclastic debris occurring as vugs; beds 0.3 to 0.5 ft.; one small Syringopora near top; poorly exposed.	12.0	3.7
26. Dolomite; predominantly fine grained, having about 10 percent scattered calcitic coarse grained indeterminate bioclastic debris occurring as vugs; brownish gray weathered pale yellowish brown and dark yellowish brown; faintly laminated, beds 0.3 to 0.5 ft. thick; poorly exposed.	26.0	7.9

Mission Canyon Limestone-Continued	Thickness Feet	Meters
25. Dolomitic limestone; predominantly medium to coarse grained; oolitic and bioclastic, having about 20 percent calcitic organic debris; brownish gray weathered dark yellowish brown; poorly preserved, strongly recrystallized corals, brachiopods, and gastropods; poorly exposed. USGS 20091-PC, 2 ft. above base (partly dolomitized foraminiferal micrite); USGS 20092-PC, 6 ft. above base (partly dolomitized crinoidal biomicrite) (Coral Zone II).	18.0	5.5
24. Dolomitic limestone; predominantly medium crystalline, having about 10 percent calcitic bioclastic(?) debris; a few beds fine grained like unit 22; brownish gray weathered dark yellowish brown; beds 0.3 to 0.5 ft. thick; poorly exposed.	12.0	3.7
23. Dolomite; fine grained; pale yellowish brown weathered yellowish gray; faintly laminated; beds 0.1 to 0.3 ft. thick; poorly exposed.	4.0	1.2
22. Dolomite; fine grained; brownish gray weathered pale yellowish brown; contains about 20 percent calcite and silica filled vugs up to 0.1 ft. in diameter and about 10 percent irregular chert weathered yellowish gray to very pale orange; beds 0.3 to 0.5 ft. thick; faintly laminated; poorly exposed.	17.0	5.2

Mission Canyon Limestone-Continued.	Thickness Feet	Meters
21. Dolomite; fine grained; brownish black weathered dark yellowish brown; sedimentary structures obscure; beds 0.3 to 0.5 ft. thick; contact with unit 20 seems to vary 1 ft.; poorly exposed.	2.0	0.6
20. Limestone; coarse grained; oolitic and crinoidal; like unit 18; weathered pockmarked; forms massive cliff; corals and gastropods. USGS 20090-PC from upper 5 ft. (partly dolomitized crinoidal micrite and foraminiferal crinoidal oolitic biosparite) (Coral Zone II). (Traverse offset about 100 yards at top of unit to ridge that runs almost perpendicular to strike of bedding and proceeds down this ridge from top of unit).	30.0	9.1
19. Limestone, dolomitic limestone, and dolomite; lower 3 ft. is dolomitic limestone having texture of unit 18 and weathered pale yellowish brown in beds 1 to 2 ft. thick; next 2 ft. is limestone like unit 18; then 2 ft. of fine grained dolomite weathered pale yellowish brown; then dolomitic limestone like lower 3 ft.; horn corals; unit forms notch in cliff and trail follows this notch for 40 yards. USGS 20088-PC from lower 3 ft. (partly dolomitized crinoidal foraminiferal oomicrite), USGS 20089-PC from upper 3 ft. (foraminiferal crinoidal oosparite) (Coral Zone II, Mamet Zone 8).	12.0	3.7

	Thickness	
Mission Canyon Limestone-Continued	Feet	Meters
18. Limestone; medium to coarse grained; oolitic and crinoidal; olive black weathered medium light gray; strongly cross bedded, beds 3 to 5 ft. thick; a few scattered horn corals and brachiopods;forms prominent massive cliff.	35.0	10.7
Measured thickness of Mission Canyon Limestone (incomplete and thickened by faulting)	1181.5	360.1
Lodgepole Limestone		
Woodhurst Member		
17. Limestone and dolomitic limestone; limestone (60 percent) is medium to coarse grained, crinoidal, in beds 0.1-0.5 ft. thick, crossbedded; dolomitic limestone (40 percent) is fine grained, weathered pale yellowish brown, containing calcitic fossils; contains horn corals; unit forms slight notch.	18.0	5.5
16. Limestone; interbedded fine grained, olive black weathered medium light gray, beds 0.1 to 0.3 ft. thick (50 percent) and medium to coarse grained, crinoidal; olive black weathered medium light gray, beds 0.1 to 0.6 ft. thick, cross bedded, regular; contains corals, brachiopods, crinoids, and gastropods; unit forms massive cliff. USGS 20087-PC from upper 1 ft. (crinoidal foraminiferal biomicrite) (Coral Zone II).	9.0	2.7

Lodgepole Limestone-Continued	Thickness Feet	Meters
15. Limestone; interbedded fine and coarse grained; like unit 14 but bedding is more nodular and there is a larger amount of dolomite or dolomitic limestone weathered pale yellowish brown; contains brachiopods, corals, gastropods, and crinoids.	11.0	3.4
14. Limestone; interbedded fine and coarse grained; like unit 12 but silty partings may be more dolomitic and weather light olive gray; abundant corals, brachiopods, gastropods, and crinoids; unit is exposed in cliffy saddle. USGS 20084-PC from lower 5 ft. (fossiliferous pelmicrite), USGS 20085-PC, 35 to 40 ft. above base (crinoidal foraminiferal pelbiosparite); USGS 20086-PC from upper 5 ft. (spicular fossiliferous micrite) (Coral Zone II, Mamet Zone 8). (Two transverse faults 35 ft. above base drop east block down approximately 4 ft. stratigraphically).	53.0	16.2
13. Limestone; predominantly medium to coarse grained, crinoidal, olive black weathered medium light gray, beds 0.5-3 ft. thick, crossbedded, forming lower and upper cliffs; notch between cliffs is fine to coarse grained limestone in beds 0.1 to 0.5 ft. thick containing abundant coarse bioclastic debris and about 10 to 20 percent dolomitic silty partings weathered light olive gray and 0.1 to 0.3 ft. thick; unit forms	16.0	4.9

	Thickness	
Lodgepole Limestone-Continued	Feet	Meters
Woodhurst Member-Continued		
prominent cliff at crest of ridge; contains horn corals and brachiopods. USGS 20080-PC, 2 ft. above base (crinoidal oolitic grapestone biosparite); USGS 20081-PC, 8 ft. above base (crinoidal foraminiferal pelbiosparite); USGS 20082-PC, 12 ft. above base (crinoidal biomicrite); USGS 20083-PC from upper 5 ft. (Coral Zone II) (Traverse offset 50 yards at base of unit).		
12. Limestone; interbedded fine grained (micrite), beds regular to nodular and 0.1 to 0.3 ft. thick (50 percent) and medium to coarse grained, crinoidal, crossbedded, containing flat pebble conglomerate beds 0.3 to 1 ft. thick (50 percent); a few yellowish weathered silty partings as much as 0.5 inch thick containing Zoophycus and other ichnofossils; corals, brachiopods, and gastropods. USGS 20079-PC, 5 to 10 ft. above base (crinoidal foraminiferal pelbiosparite) (Coral Zone II, Mamet Zone 8) (Traverse offset 150 yards 5 ft. above base).	10.0	3.1
11. Limestone; interbedded fine and coarse grained; like unit 6 but crinoidal beds comprise about 20 percent of the unit; corals, brachiopods, and gastropods; poorly exposed in saddle; tight anticline and syncline near base avoided by tracing bedding plane around.	25.0	7.6

	Thickness	
Lodgepole Limestone-Continued	Feet	Meters
Woodhurst Member-Continued		
10. Limestone; interbedded fine and coarse grained; like unit 6; corals and gastropods; moderately well exposed on knob having dead tree on top. USGS 20078-PC from upper 2 ft. (crinoidal pelbiosparite) (Coral Zone II).	17.0	5.2
9. Limestone; interbedded fine and coarse grained; like unit 6 abundant corals, brachiopods and gastropods; poorly exposed in saddle.	25.0	7.6
8. Limestone; interbedded fine and coarse grained; like unit 6; abundant corals, brachiopods, and gastropods. USGS 20075-PC, 15 ft. above base (crinoidal pelbiosparite); USGS 20076-PC, 32 ft. above base (brachiopod bryozoan crinoidal biomicrite); USGS 20077-PC, 38 ft. above base (crinoidal pelbiosparite) (Coral Zone II).	40.0	12.2
7. Limestone; interbedded fine and coarse grained; like unit 6; orange-weathered chert nodules at top; abundant brachiopods and gastropods; poorly exposed on slope of knob; tight anticline and and syncline at top was avoided by tracing bedding plane around and continuing on other side.	35.0	10.7
6. Limestone; interbedded fine and coarse grained; like unit 5 but crinoidal limestone beds comprise about 30 to 40 percent of unit and are 0.3 to 2 ft. thick; fine grained limestone beds contain many lenses of coarse bioclastic	70.0	21.3

	Thickness	
Lodgepole Limestone-Continued	Feet	Meters
Woodhurst Member-Continued		
debris; silty partings are 0.1 to 0.3 ft. thick and comprise only about 10 percent of the unit; beds are regular to nodular; brachiopods, corals, and gastropods abundant; moderately well exposed in saddle on ridge. USGS 20066-PC, 2 ft. above base (fossiliferous pelsparite); USGS 20067-PC, 7 ft. above base (crinoidal foraminiferal biomicrite); USGS 20068-PC, 9 ft. above base (crinoidal foraminiferal pelbiosparite); USGS 20069-PC, 13 ft. above base (fossiliferous pelsparite); USGS 20070-PC, 20 ft. above base (crinoidal foraminiferal pelbiosparite); USGS 20071-PC, 27 ft. above base (crinoidal pelbiosparite); USGS 20072-PC, 37 ft. above base (gastropod crinoidal pelbiosparite); USGS 20073-PC, 50 ft. above base (crinoidal pelbiosparite); USGS 20074-PC, float 58 ft. above base (Coral Zone II, Mamet Zone 7).		
5. Limestone; interbedded fine and coarse grained; like unit 4 but crinoidal beds comprise about 20 percent of the unit; brachiopods and gastropods; about 50 percent covered on ridge. USGS 20063-PC, 20 ft. above base (crinoidal brachiopod pelbiosparite); USGS 20064-PC, 35 ft. above base (crinoidal brachiopod pelbiosparite); USGS 20065-PC, 50 ft. above base (crinoidal brachiopod pelbiosparite) (Mamet Zone 7).	90.0	27.4

	Thickness	
Lodgepole Limestone-Continued	Feet	Meters
Woodhurst Member-Continued		
4. Limestone; predominantly fine grained (micrite and calcisiltite), dark gray to brownish black weathered medium light gray, beds 0.1 to 0.5 ft. thick having yellowish-weathered silty partings 0.1 to 0.3 ft. thick, lenses of partly silicified coarse bioclastic debris as much as 0.3 ft. thick, and about 10 percent interbeds of very fossiliferous coarse grained crinoidal limestone in beds 0.3 to 1 ft. thick; beds regular to nodular; some crinoidal beds contain flat pebbles as much as 0.1 ft. in diameter; brachiopods, bryozoans, gastropods, and corals; Zoophycus and linear trails common in silty partings; moderately well exposed on ridge. USGS 20055-PC from lower 5 ft. (silty biomicrite); USGS 20056-PC, 7 ft. above base; USGS 20057-PC, 10 ft. above base; USGS 20058-PC, 15 ft. above base; USGS 20059-PC, 22 ft. above base (silty crinoidal biopelmicrite); USGS 20060-PC, 25 ft. above base; USGS 20061-PC, 52 ft. above base (crinoidal brachiopod bryozoan pelbiosparite); USGS 20062-PC, float 50 to 60 ft. above base (crinoidal pelbiosparite) (Coral Zone II, Mamet Zone 7) (Traverse offset 75 yards south along strike 100 ft. above base and 50 yards south along strike 57 ft. above base).	100.0	30.5
Total Woodhurst Member.....	519.0	158.2

Lodgepole Limestone-Continued	Thickness	
Paine Member	Feet	Meters
3. Limestone; predominantly fine grained (micrite), silty; argillaceous; mostly finely laminated; dark gray weathered light gray to yellowish gray; beds regular, 0.3 to 2 ft. thick; forms splintery hackly outcrops on ridge; rare corals, bryozoans, and brachiopods becoming progressively more abundant in thin bioclastic lenses from 100 ft. above base to top; small spaghetti-like worm trails abundant on bedding planes; a few beds of sandy limestone 0.1 to 0.3 ft. thick. USGS 20051-PC, 155 ft. above base (silty fossiliferous micrite); USGS 20052-PC, 177 to 182 ft. above base (silty fossiliferous micrite); USGS 20053-PC, 189 to 194 ft. above base (silty spicular fossiliferous micrite); USGS 20054-PC from upper 5 ft. (brachiopod gastropod biopelsparite; this sample probably came from overlying Woodhurst Member) (Coral Zone IC).	205.0	62.5
2. Limestone; fine grained but having about 40 percent vugs, 1 to 2 mm in diameter, some with shape of crinoid columnals; dark weathered medium light gray.	0.5	0.2
Total Paine Member	205.5	62.6
Total Lodgepole Limestone	724.5	220.8
Measured thickness of Madison Group (incomplete).....	1906.0	580.9

Darby Formation

1. Quartz sandstone; very fine grained; moderate yellowish brown weathered dark yellowish orange; beds 0.5 to 2 ft. thick, well exposed along trail; at least 23 ft. thick. (Remainder of Darby Formation is poorly exposed below this unit).

SHEEP CREEK SECTION

The section traverse begins in the upper part of the Woodhurst Member of the Lodgepole Limestone on the west slope of a gully on the north side of Sheep Creek in W 1/2 sec. 28, T. 1 N., R. 45 E., Bonneville County, Idaho (Fig. 5). The area is shown on the U.S. Geological Survey topographic map of the Thompson Peak quadrangle (1:24,000). The traverse proceeds across exposures of the Mission Canyon Limestone to a thin capping of Amsden Formation. Complex structure prevents accurate measurement of the entire thickness of the Lodgepole Limestone, but the section affords a complete, structurally uncomplicated sequence of the Mission Canyon Limestone.

The section was measured in 1961 with an 8-foot steel tape and Jacob staff. The beds dip 5^{o}-15^{o} north. A graphic section of the Madison is presented in Sando (1977, pl. 1). We are indebted to D. A. Jobin for guiding us to this section. Section description is by Sando.

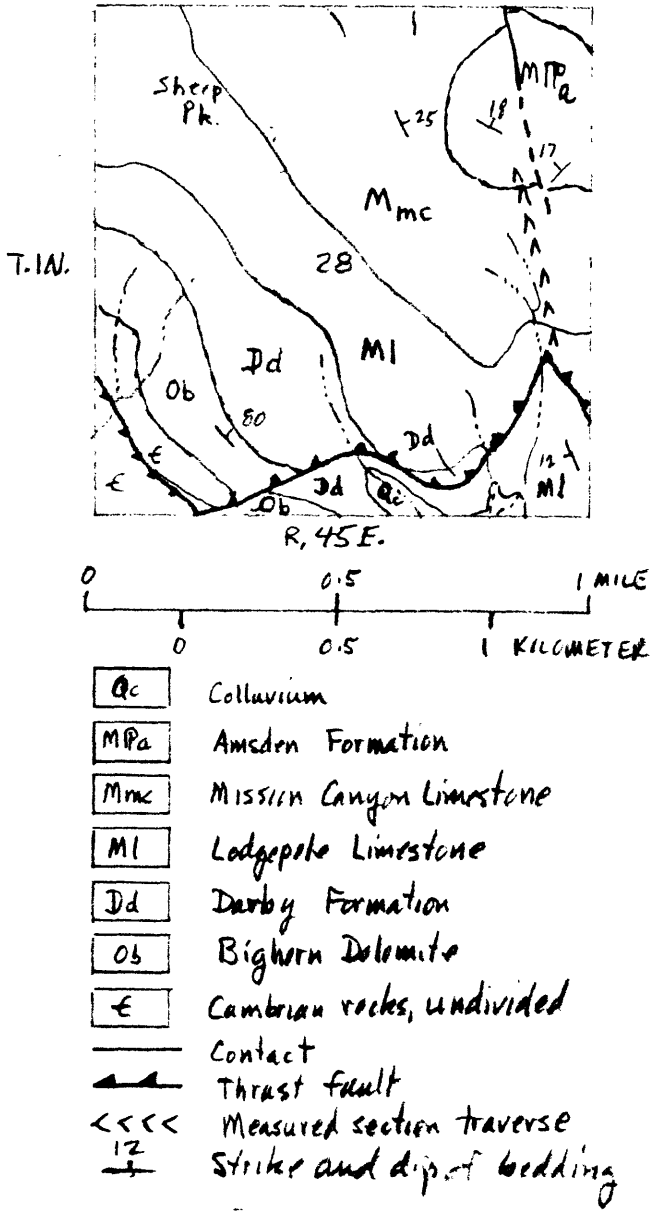

Figure 5.--Geologic sketch map of Sheep Creek section. Geology and base from Jobin and Soister (1964).

Amsden Formation	Thickness Feet	Meters
114. Breccia; clasts mostly less than 1 inch in diameter of red siltstone (like unit 107), fine grained limestone (like unit 113), and fine to medium grained quartz sandstone (like unit 103) in fine to coarse grained quartz sandstone matrix.	2.0	0.6
113. Limestone breccia and fine grained limestone, like unit 90; predominantly yellowish matrix.	12.5	3.8
112. Quartz sandstone, fine grained, and siltstone weathered moderate reddish brown; calcareous.	1.0	0.3
111. Quartz siltstone; brownish gray weathered grayish red to moderate reddish orange; like unit 107.	6.5	2.0
110. Quartz siltstone breccia; like unit 108; exposed by trenching.	5.5	1.7
109. Quartz siltstone; like unit 107.	1.0	0.3
108. Quartz siltstone breccia; clasts mostly less than 0.1 ft. in diameter; weathered yellowish gray but having some clasts dark yellowish brown to moderate reddish orange in upper 0.5 ft.	2.5	0.7
107. Quartz siltstone and very fine grained sandstone; weathered grayish red to moderate reddish orange with whitish blotches; beds 0.1 to 0.2 ft. thick.	2.0	0.6
106. Quartz siltstone, olive gray weathered yellowish gray.	2.0	0.6

	Thickness	
Amsden Formation-Continued	Feet	Meters
105. Quartz sandstone; fine to medium grained; dolomitic; weathered yellowish gray; beds 0.1 to 0.3 ft. thick.	1.5	0.5
104. Mudstone; slightly silty; olive gray.	0.5	0.2
103. Quartz sandstone; fine to medium grained; calcareous; weathered yellowish gray to pale yellowish orange; beds 0.2 to 0.5 ft. thick. (Traverse offset about 100 yards west to deep draw at base of unit).	2.5	0.7
Measured thickness of Amsden Formation (incomplete).....	39.5	12.0
Madison Group		
Mission Canyon Limestone		
102. Limestone and limestone breccia; like unit 70; about 5 ft of relief on upper surface; moderately well exposed.	3.0	0.9
101. Dolomitic limestone; predominantly fine grained; like unit 76; poorly exposed.	3.5	1.1
100. Limestone; fine grained; like unit 96.	4.0	1.2
99. Dolomitic limestone; fine grained; like unit 78 but having limestone pebbles at base; poorly exposed.	0.5	0.2
98. Limestone; fine grained; like unit 85; poorly exposed.	1.5	0.5
97. Dolomitic limestone, predominantly fine grained; like unit 76; poorly exposed.	3.0	0.9
96. Limestone; fine grained (predominantly micrite); like unit 70; autobrecciated in part; poorly exposed.	3.0	0.9

Mission Canyon Limestone-Continued	Thickness Feet	Meters
95. Covered and a few outcrops of limestone breccia, dolomitic limestone, and dolomite; talus is the same plus fine grained limestone; interval probably mostly brecciated like unit 92; matrix of breccia seemingly predominantly yellow in lower half and gray (limestone) in upper half.	38.0	11.6
94. Covered and a few outcrops of dolomite and dolomitic limestone, like unit 78; talus consists of same plus fine grained limestone and limestone breccia; interval probably mostly dolomite.	12.0	3.7
93. Limestone; oolitic; ooids 0.5 mm in diameter, well sorted; light olive gray weathered medium light gray and light gray; single bed.	1.5	0.5
92. Covered; talus mostly dolomitic limestone and breccia as in unit 88; interval probably occupied mostly by breccia.	19.0	5.8
91. Limestone, fine grained; seemingly crystalline; like unit 51; brecciated in part as if shattered in place.	9.0	2.7
90. Limestone breccia; clasts are fine grained limestone as much 0.5 ft. in diameter, mostly greater than 0.2 ft. in diameter; matrix difficult to distinguish in places but weathered orange in others; some clasts weathered orange.	8.5	2.6

Mission Canyon Limestone- Continued	Thickness Feet	Thickness Meters
89. Limestone; predominantly fine grained; like unit 68; brecciated in part.	2.0	0.6
88. Covered and a few outcrops of limestone breccia having yellowish matrix; like unit 67; float consists of breccia and dolomitic limestone like unit 76; interval probably mostly breccia.	13.0	4.0
87. Limestone; oolitic; like unit 82; beds 0.3 to 0.5 ft. thick.	3.0	0.9
86. Limestone; fine grained; crystalline; vuggy; like unit 51; single bed.	0.5	0.2
85. Limestone; fine grained; micrite and fine calcarenite with worm burrows or fucoids; olive black weathered medium light gray to light gray; beds 0.3 ft. thick.	1.0	0.3
84. Limestone; predominantly fine grained; like unit 79 but contains about 20 percent medium to coarse grained crinoidal debris; rare corals and brachiopods. USGS 20123-PC from thoughout unit (crinoidal biomicrite) (Coral Zone IIIA, Mamet Zone 11).	2.0	0.6
83. Limestone; fine grained (predominantly micrite); olive black weathered medium light gray to light gray; single bed; forms prominent cliff.	5.0	1.5

Mission Canyon Limestone-Continued	Thickness Feet	Meters
82. Limestone; medium to coarse grained; oolitic and conglomeratic; olive gray to light olive gray weathered medium light gray and light gray; weathers pockmarked.	1.5	0.5
81. Limestone; predominantly fine grained; like unit 79; beds 0.3 to 1 ft. thick; forms stair steps leading to cliff.	4.5	1.4
80. Dolomite and dolomitic limestone; fine grained; like unit 78.	5.0	1.5
79. Limestone; predominantly fine grained; oolitic; olive black weathered medium light gray to light gray.	2.5	0.7
78. Dolomite and dolomitic limestone; fine grained; olive gray weathered pale yellowish brown to yellowish gray; some beds faintly laminated; beds 0.5 to 1 ft. thick; contains about 20 percent limestone pebbles (like unit 77) in lower ft.	9.0	2.7
77. Limestone; predominantly fine to medium grained; olive black weathered medium light gray and light gray; some beds slightly dolomitic and containing about 20 percent coarse crinoidal debris; beds 0.3 to 1 ft. thick; poorly exposed.	11.5	3.5
76. Dolomitic limestone; predominantly fine grained but having about 10 percent calcitic crinoidal debris; olive black weathered pale yellowish brown; beds 0.5 to 1 ft. thick; poorly exposed.	7.0	2.1

Mission Canyon Limestone-Continued	Thickness	
	Feet	Meters
75. Covered.	6.0	1.8
74. Limestone; predominantly fine grained; like unit 51; poorly exposed.	2.0	0.6
73. Covered and a few outcrops of dolomitic limestone like unit 55 but no chert.	2.5	0.7
72. Limestone; fine grained (micrite); olive black weathered medium light gray to light gray; beds 0.3 to 0.5 ft. thick; poorly exposed.	4.0	1.2
71. Covered.	2.0	0.6
70. Limestone; fine grained (predominantly micrite); like unit 56; brecciated in lower ft.	3.5	1.1
69. Limestone breccia; like unit 67; fragments 0.1 ft. or less in diameter.	1.0	0.3
68. Limestone; predominantly fine grained; like unit 51; brecciated in part throughout, having poorly defined fragments as much as 0.3 to 0.4 ft. in diameter.	5.5	1.7
67. Limestone breccia; like unit 66 but matrix and clasts are clearly defined on color (matrix weathers yellowish).	3.0	0.9
66. Limestone breccia; clasts are like unit 51 but not vuggy; matrix is barely distinguishable, a little darker than clasts; also about 10 percent broken chert nodules; clasts mostly 0.5 inch in diameter or less.	2.5	0.8
65. Limestone; fine grained; seemingly crystalline; vuggy; like unit 51.	3.0	0.9

Mission Canyon Limestone-Continued	Thickness Feet	Meters
64. Dolomite and dolomitic limestone; fine grained; like unit 62; some beds contain as much as 15 to 20 percent coarse crinoidal debris but most of the unit is laminated and fine grained; black chert bed 0.3 ft. thick at top.	9.5	2.9
63. Limestone; fine grained; predominantly laminated like unit 62.	2.5	0.8
62. Dolomite and dolomitic limestone; fine grained; silty; olive gray weathered yellowish gray and pale yellowish brown to yellowish gray; laminated and having penecontemporaneous deformation and worm burrows; laminae are alternating calcitic and dolomitic layers.	4.0	1.2
61. Limestone; fine grained but having less than 5 percent bioclastic debris; some beds laminated; olive black to light olive gray weathered medium light gray and light gray; some beds pockmarked; rare horn corals; forms small cliff. USGS 20121-PC, 3 ft. above base (grapestone pelsparite) (Coral Zone IIIA, Mamet Zone 11).	10.0	3.1
60. Limestone; medium to coarse grained; crinoidal (20 to 40 percent) and oolitic (40 percent); olive black weathered medium light gray and light gray; beds 0.3 to 1 ft. thick; some beds slightly dolomitic in upper half; rare horn corals and large spiriferoid brachiopods; forms slope	12.5	3.8

Mission Canyon Limestone-Continued	Thickness Feet	Thickness Meters
between cliffs. USGS 20120-PC, 5 to 10 ft. above base (fossiliferous grapestone oosparite) (Coral Zone IIIA, Mamet Zone 10-11).		
59. Limestone; predominantly fine grained (micrite), like unit 56; beds 2 to 5 ft. thick; forms massive cliff. USGS 20119-PC from upper 2 ft. (fossiliferous intramicrite) (Coral Zone IIIA).	25.0	7.6
58. Limestone; predominantly medium grained; like unit 54 but contains no chert; part of slope to base of cliff.	6.0	1.8
57. Dolomitic limestone; predominantly fine grained; like unit 55; forms slope between limestone cliffs.	22.5	6.9
56. Limestone; predominantly fine grained (micrite with bioclastic debris 10 percent or less); olive black to olive gray weathered medium light gray to light gray; beds 2 to 4 ft. thick; rare corals; forms massive cliff. USGS 20122-PC from float throughout unit (crinoidal foraminiferal biomicrite) (Coral Zone IIIA, Mamet Zone 10-11).	10.0	3.1
55. Dolomitic limestone; predominantly fine grained; some beds without bioclastic debris, others with as much as 10 to 20 percent (mostly crinoidal); olive black to olive gray weathered pale yellowish brown; about 10 percent white-weathered chert lenses in lower half, black chert in upper 10 ft; forms cliffy slope under massive cliff.	17.5	5.3

Mission Canyon Limestone-Continued	Thickness	
	Feet	Meters
54. Limestone; predominantly medium grained; crinoidal debris about 20 to 40 percent; some beds slightly dolomitic; olive gray weathered medium light gray to pale yellowish brown; beds 0.5 to 1 ft. thick; about 10 percent white-weathered chert lenses; rare horn corals and brachiopods; forms slope.	22.5	6.9
53. Limestone like unit 51 (80 percent) and dolomitic limestone like unit 50; poorly exposed, upper half mostly covered.	18.0	5.5
52. Dolomitic limestone; fine grained; like unit 50.	2.0	0.6
51. Limestone; predominantly fine grained; olive gray to light olive gray weathered medium light gray and light gray; beds 0.3 to 0.5 ft. thick; contains many rectangular vugs 1 to 3 mm in diameter; fabric of the rock is obscure, probably owing to recrystallization; some beds contain about 10 to 30 percent bioclastic debris; about 10 percent white-weathered chert lenses.	23.0	7.0
50. Dolomitic limestone; fine grained; like unit 48 but contains no chert; single bed.	2.0	0.6
49. Limestone; fine grained; like unit 46; contains rectangular vugs 1 to 3 mm in diameter; chert like that in unit 48 about 20 percent; weathered pockmarked.	2.5	0.7

Mission Canyon Limestone-Continued	Thickness Feet	Meters
48. Dolomitic limestone; fine grained; olive gray weathered pale yellowish brown; beds 0.5 to 2 ft. thick; about 20 percent thin lenses of black chert.	6.0	1.8
47. Limestone; coarse grained; crinoidal; oolitic (?); like unit 41; upper 2 ft. slightly dolomitic; rare horn corals and large spiriferoid brachiopods. USGS 20118-PC, 2 ft. below top (crinoidal bryozoan biomicrite) (Coral Zone IIIA).	10.0	3.1
46. Limestone; fine grained; olive gray weathered medium light gray and light gray; beds 0.3 to 0.5 ft. thick; pockmarked.	3.5	1.1
45. Limestone; coarse grained; crinoidal; like unit 41 but slightly oolitic (less than 20 percent); beds 2 to 3 ft. thick; upper foot dolomitic; white-weathered chert nodules at top; forms slightly cliffy slope.	9.5	2.9
44. Limestone, interbedded medium to coarse grained, crinoidal and oolitic, olive black weathered medium light gray and light gray, beds 0.5 to 2 ft. thick, and limestone, fine grained (micrite), light olive gray weathered medium light gray and light gray, beds 0.1 to 0.5 ft. thick, and breccia of the two rock types; breccia units difficult to define, perhaps 20 percent of the unit crinoidal oolitic limestone about 50 percent of the unit; fine grained limestone about 30 percent; rare horn corals; forms slope.	19.5	5.9

Mission Canyon Limestone-Continued	Thickness Feet	Meters
43. Breccia; predominantly limestone; clasts are: (1) limestone fine grained (micrite), olive black weathered medium light gray to light gray (20 percent); (2) limestone, coarse grained, crinoidal, olive black weathered medium light gray and light gray (40 percent); (3) limestone, medium grained, oolitic, olive black weathered medium light gray (20 percent); (4) dolomitic limestone, fine grained, laminated, olive gray weathered pale yellowish brown (20 percent); matrix of breccia is calcareous quartz siltstone weathered grayish orange (80 percent) and grayish weathered fine grained calcareous material; matrix comprises about 30 to 40 percent of the unit; clasts are very angular, mostly less than 0.5 ft. but attain a diameter of as much as 4 ft.; horn corals and brachiopods in clasts of lithology (2). USGS 20117-PC from throughout unit (crinoidal biomicrite) (Coral Zone IIIA?, Mamet Zone 10?).	24.0	7.3
42. Covered and a few outcrops of dolomite and dolomitic limestone, predominantly fine grained but having about 20 percent scattered bioclastic debris, olive black weathered dark yellowish brown to yellowish gray, beds 0.3 to 1 ft. thick, about 5 percent or less chert; corals. USGS 20115-PC from float 25 to 35 ft. above base (fossiliferous intrasparite); USGS 20116-PC,	51.0	15.5

Mission Canyon Limestone-Continued	Thickness Feet	Thickness Meters
10 ft. below top (partly dolomitized biomicrite) (Coral Zone II, Mamet Zone 9?).		
41. Limestone; coarse grained; crinoidal; olive gray to olive black weathered medium light gray to light gray; crossbedded, beds 3 to 5 ft. thick; contains crinoid columnals as much as 0.5 inch in diameter and rare spiriferoid brachiopods and bryozoans; forms prominent massive cliff.	62.5	19.1
40. Interbedded coarse grained crinoidal limestone like unit 30 and predominantly fine grained dolomite like unit 33 (no chert); beds 2 to 3 ft. thick.	11.0	3.4
39. Dolomite; predominantly fine grained, like unit 35; about 10 percent chert; beds 0.3 to 1 ft. thick.	13.0	4.0
38. Limestone; coarse grained; crinoidal; crossbedded, beds 3 to 4 ft. thick; like unit 30; slightly dolomitic.	5.5	1.7
37. Dolomite and dolomitic limestone; predominantly fine to medium grained; like unit 35; chert about 40 percent, predominantly dolomite; bryozoans.	16.5	5.1
36. Dolomitic limestone and chert; dolomitic limestone is coarse grained, crinoidal; chert is like that in unit 35; unit is seemingly a lens in dolomite sequence.	2.5	0.7

Mission Canyon Limestone-Continued	Thickness Feet	Meters
35. Dolomite and dolomitic limestone; predominantly fine to medium grained; like unit 33; about 40 percent irregular lenses and nodules of varicolored black, gray, white, orange, and pink chert, some of which is geodal; beds 0.3 to 1 ft. thick; bryozoans.	16.0	4.9
34. Limestone; coarse grained; crinoidal; like unit 30; upper 3 ft. dolomitic; beds 1 to 3 ft. thick; brachiopods and horn corals; forms slight cliffy slope. USGS 20114-PC from upper 3 ft. (partly dolomitized crinoidal biomicrite) (Coral Zone II).	7.5	2.3
33. Dolomite and dolomitic limestone; predominantly fine to medium grained; containing about 20 to 30 percent bioclastic debris (mostly crinoidal); olive gray weathered yellowish gray; beds 0.2 to 1 ft. thick; about 10 to 20 percent geodal milky white and brown chert nodules mostly 0.3 ft. or less in diameter; bryozoans and brachiopods; forms slight recess in slope. USGS 20113-PC, 9 ft. above base (fossiliferous dolomite).	13.5	4.1
32. Limestone; coarse grained; crinoidal; like unit 30; about 10 percent buff-weathered subspheroidal chert nodules as much as 0.3 ft. in diameter; beds 2 to 5 ft. thick; horn corals and large spiriferoid brachiopods; forms strongly cliffy slope. USGS 20112-PC from upper 3 ft. (crinoidal biomicrite) (Coral Zone II).	16.0	4.9

Mission Canyon Limestone-Continued	Thickness Feet	Meters
31. Dolomitic limestone and limestone; like unit 28 but medium to coarse grained, crinoidal; beds 1 to 2 ft. thick; forms slight recess in cliffy slope.	12.0	3.7
30. Limestone; coarse grained; crinoidal; dark gray weathered medium light gray and light gray; crinoid columnals as much as 0.25 inch in diameter; some beds very slightly dolomitic; crossbedded, beds 1 to 3 ft. thick; horn corals. USGS 20111-PC from upper 10 ft. (partly dolomitized crinoidal biomicrite) (Coral Zone II).	20.0	6.1
29. Limestone and dolomitic limestone; medium to coarse grained; crinoidal; like unit 28 but a little coarser grained and less dolomitic; beds 1 to 2 ft. thick; horn corals; forms slightly stair-stepped slope. USGS 20110-PC from lower 5 ft. (partly dolomitized crinoidal biomicrite) (Coral Zone II).	12.0	3.7
28. Dolomitic limestone and limestone (slightly dolomitic); fine to medium grained (about 20 percent coarse bioclastic debris); olive gray weathered pale yellowish brown to medium light gray; beds 0.5 to 1 ft. thick; gradational from unit 27 by increase in grain size and decrease in dolomite; horn corals. USGS 20109-PC from upper 1 ft. (partly dolomitized crinoidal biomicrite) (Coral Zone II).	11.0	3.4

Mission Canyon Limestone-Continued	Thickness Feet	Meters
27. Dolomitic limestone; predominantly fine grained; like unit 25.	20.0	6.1
26. Limestone; predominantly fine grained (probably micrite); dark gray weathered medium light gray; beds 1.5 to 1 ft. thick, some with faint lamination; contains about 30 percent coarsely crystalline white calcite bodies as much as 0.25 inch in diameter, probably relict fossils; forms slight knob in slope.	7.0	2.1
25. Dolomitic limestone; predominantly fine grained; sedimentary structures obscure; olive gray weathered dark yellowish brown to pale yellowish brown; beds 0.3 to 1 ft. thick; poorly exposed on slope.	13.0	4.0
24. Limestone; fine to coarse grained; alternating layers of micrite, calcarenite, and conglomerate; olive black weathered medium light gray; conglomerate is mostly algal oncolites as much as 0.5 inch in diameter having nucleii of euomphalid gastropods; forms small cliff. USGS 20106-PC from throughout unit (crinoidal foraminiferal grapestone biosparite) (Coral Zone II, Mamet Zone 8). (Traverse offset at top of unit about 120 yards west along strike to take advantage of better exposure of overlying units in prominent gully).	17.0	5.2
23. Covered; talus from unit above.	5.0	1.5

Mission Canyon Limestone-Continued	Thickness Feet	Meters
22. Dolomitic limestone; fine grained; olive black to olive gray weathered pale yellowish brown and having irregular silty layers weathered yellowish brown; many worm burrows and wispy, irregular layering; some laminated beds; white weathered layers are partly replaced by very irregular chert weathered grayish orange and comprising 30 to 40 percent of the unit; forms slope.	14.0	4.3
21. Limestone; medium to coarse grained; oolitic and crinoidal like unit 19; rare horn corals; forms massive cliff. USGS 20108-PC from upper 10 ft. (crinoidal foraminiferal oosparite) (Coral Zone II, Mamet Zone 8).	48.0	14.6
20. Dolomitic limestone; fine grained; contains about 40 percent nodular masses of fine grained limestone; olive black to olive gray weathered pale yellowish brown; beds nodular, 0.1 to 0.3 ft. thick; poorly exposed in notch.	12.0	3.7
19. Limestone; medium to coarse grained; oolitic and crinoidal; olive black weathered medium light gray to light gray; strongly crossbedded, beds 3 to 5 ft. thick except in lower 6 ft. where they are 1 to 3 ft. thick; forms massive cliff.	22.0	6.7
Total Mission Canyon Limestone	899.0	274.0

Lodgepole Limestone	Thickness	
Woodhurst Member	Feet	Meters
18. Limestone; predominantly fine to medium grained; silty; like unit 4; corals and gastropods. USGS 20105-PC from float in upper 5 ft. (crinoidal biomicrite) (Coral Zone II) (Unit 18 is repeated by a thrust fault; offset east of fault to check thickness on duplication).	13.0	4.0
17. Limestone; predominantly fine to medium grained; like unit 10; forms small cliff.	11.0	3.4
16. Limestone; predominantly fine to medium grained; like unit 4; crinoidal beds about 30 percent; abundant brachiopods, horn corals, and gastropods; forms slope between cliffs.	66.0	20.1
15. Limestone; coarse grained; oolitic and crinoidal; like unit 1; crossbedded, beds 3 to 5 ft thick; forms small cliff.	10.0	3.1
14. Limestone; predominantly fine to medium grained; like unit 10; horn corals and gastropods; forms notch in small cliff.	9.5	3.0
13. Limestone; coarse grained; crinoidal; like unit 6; horn corals.	2.0	0.6
12. Covered and a few outcrops of limestone like unit 4; upper 5 ft. forms lower half of small cliff. (Section below this unit is not very trustworthy because of structural complications.)	65.0	19.8

Lodgepole Limestone-Continued	Thickness Feet	Meters
Woodhurst Member-Continued		
11. Limestone; oolitic and crinoidal; like unit 1; forms upper part of massive cliff. (Traverse offset west across thrust fault at top of unit.)	20.0	6.1
10. Limestone, predominantly fine to medium grained; like unit 4 but crinoidal beds 0.3 to 1 ft. thick comprise about 50 percent of the unit; corals; forms base of massive cliff. USGS 20107-PC from float in upper half (foraminiferal crinoidal biopelsparite) (Coral Zone II, Mamet Zone 7) (graphic section of Sando, 1977, terminates at base of this unit).	8.0	2.4
9. Limestone; predominantly fine to medium grained; like unit 4.	10.0	3.1
8. Limestone; prodominantly fine to medium grained; like unit 4; contains corals; forms massive cliff.	11.0	3.4
7. Limestone; predominantly fine to medium grained; like unit 3; tabulate corals; obvious faulting has probably thickened this unit by 10 to 20 percent.	18.5	5.6
6. Limestone; coarse grained; crinoidal; beds 1 to 3 ft. thick; forms prominent ledge.	3.0	0.9
5. Limestone; predominantly fine to medium grained; like unit 3.	4.5	1.4
4. Limestone; predominantly fine to medium grained; like unit 3 in texture but without thick silty partings; beds 0.2 to 1 ft. thick; upper 4 ft. predominantly coarse grained crinoidal limestone; horn corals and gastropods; forms massive cliff.	20.0	6.1

	Thickness	
Lodgepole Limestone-Continued	Feet	Meters
Woodhurst Member-Continued		
3. Limestone; fine to medium grained, with scattered coarse bioclastic debris; like unit 2 but silty beds comprise only 30 percent of unit; beds 0.1 to 0.3 ft. thick; about 20 percent coarse crinoidal interbeds 0.5 to 1.5 ft. thick; horn corals, brachiopods, and gastropods; dip reversal near middle.	42.0	12.8
2. Limestone; fine to medium grained with much scattered coarse bioclastic debris; dark gray to olive black weathered medium light gray; beds regular, 0.1 to 0.4 ft. thick; interbedded with about 40 percent silty dolomitic beds 0.1 to 0.5 ft. thick; contains brachiopods, corals, and many ichnofossils.	13.5	4.1
1. Limestone; coarse grained; crinoidal and oolitic; olive black to olive gray weathered medium light gray and light gray; beds 3 to 5 ft. thick; horn corals; forms top of massive cliff underlying thinbedded limestone of units above. (More of Lodgepole Limestone is exposed below unit 1 but accurate measurements cannot be made because of structural complications.)	9.0	2.7
Measured thickness of Lodgepole Limestone (incomplete).....	336.0	102.4
Measured thickness of Madison Group (incomplete).....	1235.0	376.4

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