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Stratigraphic sections and correlation of beds
in the Inyan Kara Group and Morrison Formation,
north end of the Black Hills, Crook County
Wyoming, and Butte County, South Dakota

by

William J. Mapel and Charles L. Pillmore



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2. TEI-830. X-ray crystallographic data for minerals, by R. A. Robie, P. M. Bethke, M. S. Toulmin, and J. L. Edwards. 38 p., 1 table. 345 Middlefield Rd., Menlo Park, Calif.

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Stratigraphic sections and correlation of beds in the Inyan Kara
Group and Morrison Formation, north end of the Black Hills,
Crook County, Wyoming, and Butte County, South Dakota

by

William J. Mapel and Charles L. Pillmore

Abstract

Descriptions of 47 stratigraphic sections of the Inyan Kara Group and Morrison Formation are given for an area extending from bluffs on the west side of the Belle Fourche River in T. 56 N., R. 64 W., Crook County, Wyo., southeastward across the Bear Lodge Mountains to a point in T. 8 N., R. 1 E., Butte County, S. Dak.--a distance of about 35 miles. Also given are four sections measured farther southeast in the area between Belle Fourche and Rapid City, South Dakota. The Morrison, Lakota, and Fall River Formations are each subdivided into two parts and the subdivisions are correlated for most of the area.

Introduction

Location of the area and purpose of the work

The Inyan Kara Group of Early Cretaceous age and the underlying Morrison Formation and Unkpapa Sandstone of Late Jurassic age make up a sequence several hundred feet thick of sandstone, siltstone, claystone, local limestone, and intermediate rock types whose outcrops encircle the Black Hills uplift in northeastern Wyoming and western South Dakota. Stratigraphic sections of these rocks were measured mostly at the northern end of the uplift in an area that extend from bluffs on the west side of the Belle Fourche River in T. 56 N., R. 64 W., Crook County, Wyo., southeastward for about 35 miles to T. 8 N., R. 1 E., Butte County, S. Dak.

(fig. 1). This area is along the crest and on the east flank of the Bear Lodge Mountains, west of the city of Belle Fourche, South Dakota. The village of Aladdin lies inside the area near its east side and the cross-roads of Mona are in the northern part of the area about 15 miles northwest of Aladdin. The area lies within the Devils Tower and Aladdin 30'-quadrangles, described by Darton and O'Harra (1905, 1907), and is about 1 mile east of the Strawberry Hill 7½'-quadrangle, described by Davis and Izett (1962).

The purpose of the work was to determine the thickness, continuity, and correlation of stratigraphic units in the Inyan Kara Group and Morrison Formation as an aid to the exploration for uranium in the northern Black Hills. The work was done on behalf of the Division of Raw Materials, U.S. Atomic Energy Commission.

Fieldwork and acknowledgments

Fieldwork consisted of measuring about 60 stratigraphic sections during the summers of 1956 to 1958. Fifty-one of these sections are described here. Forty-seven of them (localities 1-47) are arranged graphically in two lines of section (fig. 2)^{1/} along which units are correlated within the Fall River, Lakota, and Morrison Formations. The distance between these sections ranges from less than 1 mile to about 6 miles; for most pairs of sections it is between 1 and 2 miles. The remaining four stratigraphic sections (localities 48-51) were measured between Belle Fourche and Rapid City on the east side of the Black Hills, and are south of the main area of study. No attempt is made to correlate individual beds among these four sections.

The stratigraphic sections were measured with hand level and steel

^{1/} Figure 2 folded at rear.

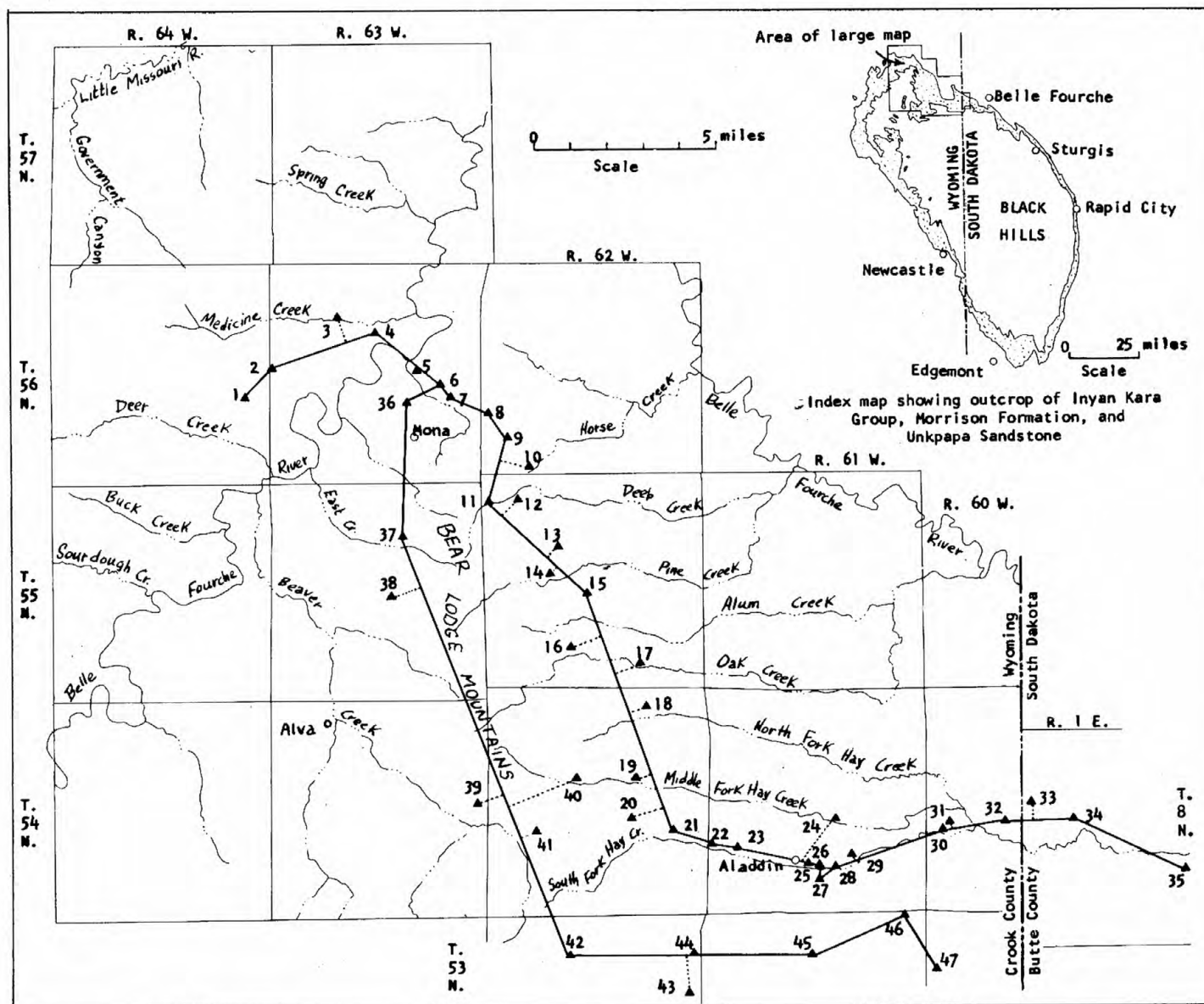


Figure 1.--Map showing locations of measured stratigraphic sections and lines of section, north end of the Black Hills. Dotted line shows projection to the line of section.

tape. The contact between the Fall River and Lakota Formations could be easily recognized in most of the sections and served as a reference surface for correlation. In addition, one or more stratigraphic units within the Fall River or Lakota Formations were traced between most pairs of sections to aid in intraformational correlations.

Three stratigraphic sections given in the present report (localities 25, 27, and 36) are slightly modified from sections measured and described by K. M. Waage¹ and Copeland MacClintock in 1955. The log of core hole NRH-41 (locality 31) and the logs of several other nearby holes not given here were furnished by the U.S. Atomic Energy Commission. W. A. Chisholm assisted in measuring two of the stratigraphic sections (localities 19 and 41). C. S. Robinson and K. M. Waage¹ consulted freely with the writers during the course of the work, and made available the results of mapping and stratigraphic studies done by them in 1955-1956 in the same area.

Stratigraphic relations

Description of the rocks

Graphic sections given on figure 2 show variations in the lithology of the three formations most closely examined. The Unkpapa Sandstone, which is not shown on figure 2, is a friable white sandstone that lies between the Morrison and Sundance Formations along the east side of the Black Hills, and that entirely replaces the Morrison at the south end of the Black Hills northeast of Edgemont (Darton and Paige, 1925, p. 11). The Unkpapa is 70 feet thick at locality 49, southeast of Sturgis, but it is absent farther northwest, in the area shown by figure 1.

The Morrison and Lakota Formations are each subdivided into an upper

and lower part on the correlation diagram, figure 2, and the Fall River Formation is divided into a lower part and the overlying Keyhole Sandstone Member as named by Davis and Izett (1958). Rocks in the Fall River above the Keyhole Sandstone Member are eroded away at most places where the Fall River was examined. Subdivisions of the Morrison and Lakota Formations are unnamed; however, the lower part of the Lakota Formation resembles the Chilson Member of the Lakota Formation, and the upper member resembles the overlying Fuson Member of the Lakota Formation as these two members are described in the southern Black Hills by Post and Bell (1961).

Rocks comprising the main subdivisions are briefly described and compared in table 1.

The Morrison Formation consists largely of nonmarine claystone, limestone, and marl, and ranges in thickness from 31 to 85 feet at 8 localities where the formation was completely exposed. The Morrison is thinnest south of Aladdin at locality 43, and it is thickest a few miles west of Aladdin, locality 22, and at Medicine Creek, locality 2. The Morrison rests gradationally on marine beds of the Redwater Shale Member of the Sundance Formation. A distinctive bed generally 2 to 5 feet thick of yellow-weathering sandy limestone or very fine grained calcareous sandstone at the top of the Redwater marks the Sundance-Morrison contact.

The Lakota Formation conformably overlies the Morrison Formation and consists of complexly intertonguing nonmarine sandstone, conglomeratic sandstone, claystone, siltstone, carbonaceous shale, and coal. The Lakota ranges in thickness from about 160 to about 300 feet in the sections measured. It is thickest near the northern end of the Bear Lodge Mountains and in outcrops south of Sturgis; it is thinnest in the vicinity of Aladdin.

Table 1.--Descriptions of the principal stratigraphic subdivisions

Formation, Member, or part		Range in thickness	Characteristic lithologic features
Fall River Formation	Keyhole Sandstone Member	15 - 80	Sandstone, generally weathers tan, mostly fine- to medium-grained, friable; forms ledges and cliffs.
	Lower part	40 - 90	Siltstone and sandstone, generally weathers brown to dark-gray, thin-bedded; thin layers commonly impregnated with dark-brown iron oxides; locally ripple-marked and cross-laminated. Shale, dark-gray, silty. Carbonaceous material common in basal part.
Lakota Formation	Upper part	65 - 265	Sandstone, light-gray, locally highly cross-bedded, contains stringers and thin seams of granule- and pebble-sized chert and quartzite fragments; beds commonly are highly lenticular. Claystone, commonly shades of red, purple, yellow, or bright green. Carbonaceous material scarce or lacking.
	Lower part	0 - 150	Sandstone, light-gray, inconspicuously cross-bedded to tabular bedded, nonconglomeratic; beds generally less highly lenticular than in upper part of the formation. Claystone, generally gray, grayish-green, or dark-gray; some ostracode-bearing shale locally. Carbonaceous material common; local coal beds.
Morrison Formation	Upper part	3 - 25	Claystone, greenish-gray and dark-gray, non-calcareous; no silt or sand.
	Lower part	28 - 58	Claystone, greenish-gray and grayish-red, very calcareous, generally silty or sandy. Limestone, light-gray, argillaceous. Sandstone, grayish-white, very fine-grained, calcareous, crossbedded, ripple-marked.

The Fall River Formation, which overlies the Lakota unconformably, consists of evenly bedded nonmarine or marginal marine siltstone, sandstone, and shale. The unconformity at the base of the Fall River is a smooth even surface made conspicuous by the different lithologies of the rocks above and below. The duration of the hiatus represented is unknown, and possibly hiatuses in the Inyan Kara Group at other horizons less easily traced are just as great. The Fall River attains a thickness of at least 140 feet in a partial exposure along the crest of the Bear Lodge Mountains (locality 40), but the formation is only about 120 feet thick in a complete exposure at Government Canyon (Waage, 1959, p. 81-83) a few miles northwest of locality 1 (fig. 1), and it is no more than 110 feet thick south of Belle Fourche at localities 48 and 51. The Fall River grades upward into the marine Skull Creek Shale.

Special features

Sandstone lens in the Morrison Formation.--A bed 48 feet thick of massive white very friable fine-grained sandstone occupies nearly all the Morrison interval at locality 4, north of Mona. Because of poor exposures, the relations of this sandstone to the claystone that makes up the formation in nearby areas could not be determined; however, similar sandstone bodies in the Morrison farther south in the Black Hills are lenses that grade laterally into claystone in the lower calcareous part of the Morrison (Mapel and Pillmore, 1963, Izett, 1963). The massive sandstone bodies, including the one at locality 4, resemble in lithology and stratigraphic position the Unkpapa Sandstone, but they appear to be local in extent and unconnected to the main body of the Unkpapa.

Sandstone lens in the basal part of the Fall River Formation.--North-west of Aladdin, thin blocky beds of very fine grained sandstone and siltstone in the lower part of the Fall River Formation thicken abruptly and grade laterally into fine- to medium-grained friable locally crossbedded sandstone in a bed as much as 70 feet thick. Outcrops of the thick lenticular sandstone mass are parts of an arcuate northwest-trending sandstone body about 2 miles wide and 15 miles long, as shown on figures 2 and 3. The sandstone generally makes cliffs and ledges that from a distance can easily be mistaken for the stratigraphically higher Keyhole Sandstone Member of the Fall River. The base of the thick sandstone rests sharply on dark-gray carbonaceous siltstone or shale a few feet thick at the base of the Fall River Formation, or, at places, directly on the Lakota Formation. At locality 2, where the basal contact is well exposed, the base of the sandstone truncates about 12 feet of siltstone at the base of the Fall River Formation and about 10 feet of sandstone at the top of the underlying Lakota Formation in a lateral distance of about 150 feet. Lenticular sand bodies in the Fall River Formation similar in size to the one northwest of Aladdin contain oil in the Donkey Creek oilfield along the west side of the Black Hills (Barkley and Gosman, 1958).

Fossils and age

Ostracodes and charophytes occur abundantly in the lower calcareous part of the Morrison. Collections from localities shown on the graphic sections, figure 2, yielded the ostracodes "Metacypris" sp., Darwimula sp., Theriosynoecum wyomingense (Branson), a large smooth form genus undetermined, and a small smooth form genus undetermined, all identified by I. G. Sohn.

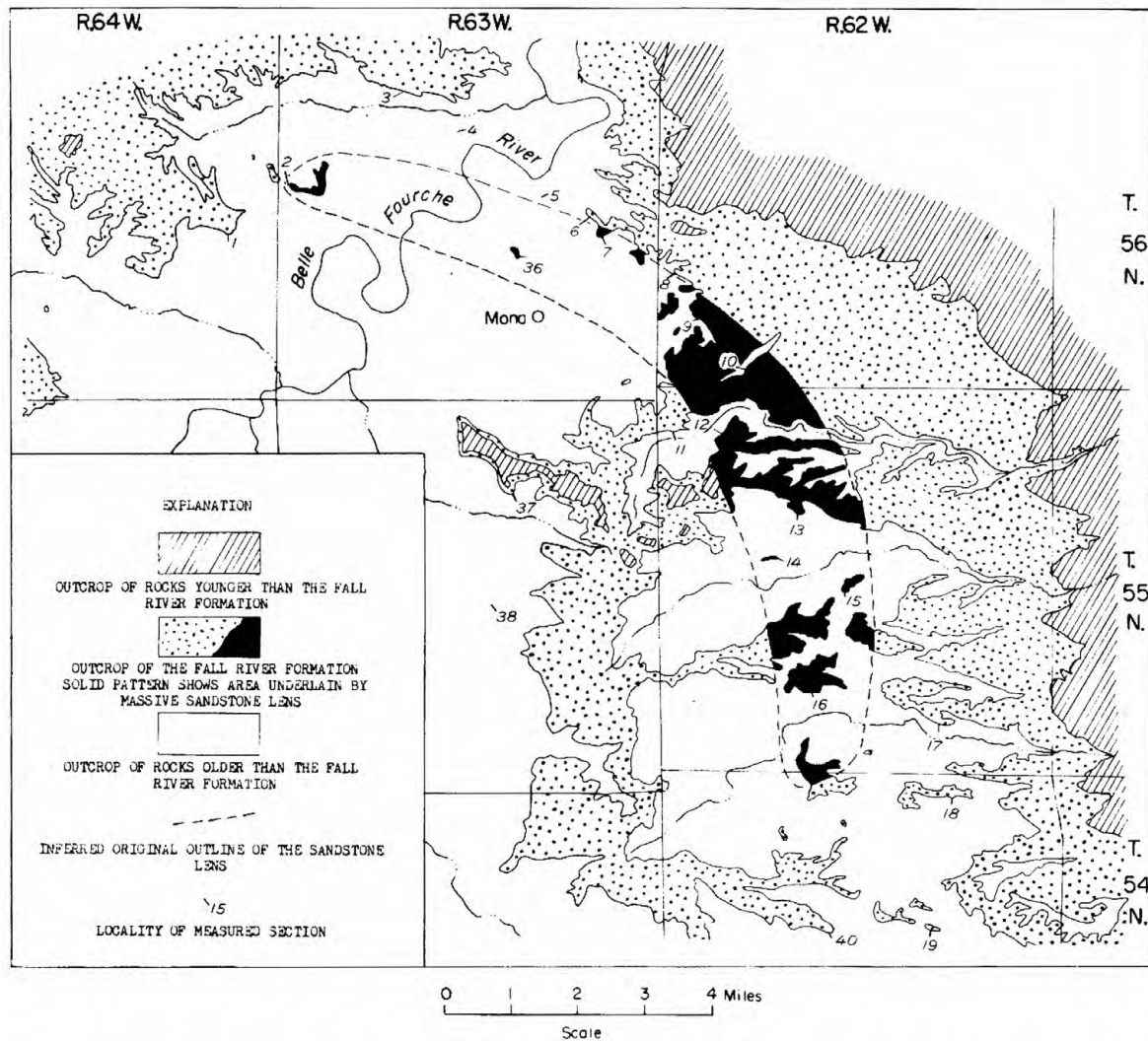


Figure 3.--Areal extent of thick sandstone lens in the basal part of the Fall River Formation. Outcrop of Fall River Formation from Robinson and others (in preparation).

Charophytes, identified by R. E. Peck, included Aclistochara bransoni Peck, A. jonesi Peck, Stellatochara obovata (Peck), Latochara latitruncata (Peck), Sphaerochara verticillata (Peck), and Praechara voluta (Peck). The fossils are Late Jurassic (Kimmeridgian and early Portlandian, European Stages) (Peck, 1957, p. 1; Sohn, 1958). Sohn and Peck (1963) regard Theriocynoecum wyomingense as a guide to beds equivalent in age to the Salt Wash Member of the Morrison Formation of the Colorado Plateau.

Ostracodes collected from the lower part of the Lakota Formation at locality 34 were identified by I. G. Sohn as "Baridiocypris" spp., Cypridea? sp., "Metacypris"? spp., a large smooth form genus undetermined, and a small smooth form genus undetermined. According to Sohn (1958, p. 122), most species of ostracodes in the subfamily Cyprideinae (which includes the genus Cypridea) are no older than uppermost Portlandian of Europe, and hence are latest Jurassic or Early Cretaceous. Cycad, fern, and conifer foliage of Early Cretaceous age has been collected from the lower part of the Lakota near Aladdin and described by Fontaine (1899).

The Fall River Formation contains abundant plant fossils in the northern part of the Black Hills (Fontaine, 1899) and numerous trails and burrows of organisms, but no identifiable marine fossils. Its age is generally regarded as Early Cretaceous (Albian Stage of Europe).

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Descriptions of the measured sections

Locality 1.--Parts of the Fall River and Lakota Formations on the north side of Deer Creek, NW $\frac{1}{4}$ sec. 24, T. 56 N., R. 64 W., Crook County, Wyo.

	<u>Feet</u>
Fall River Formation (part):	
27. Covered to top of hill; some platy fragments of sandstone--	10
26. Sandstone, yellowish-gray, very fine grained, thin-bedded, fucoidal markings on bedding surfaces, cross-laminated; a few seams cemented with iron oxides; forms ledges-----	15
25. Covered-----	2 $\frac{1}{2}$
24. Shale, dark-gray, silty; some interlaminated light-gray siltstone-----	5
23. Sandstone, yellowish-gray, very fine to fine-grained; lower and middle parts in beds mostly $\frac{1}{2}$ to 3 ft thick; becomes thinner bedded in top 5 ft; forms cliff-----	18 $\frac{1}{2}$
22. Sandstone and siltstone, interbedded; sandstone is light gray to yellowish gray, very fine grained, thin bedded, contains the outlines of vertical tubelike structures, ripple marked; siltstone is medium gray, fucoidal markings on bedding surfaces; unit contains a few thin seams cemented with iron oxides-----	14
21. Mostly covered; some medium-gray silty shale in middle part	24
20. Sandstone, yellowish-gray, fine to very fine grained, micaceous, lenticular; a few nodules cemented with iron oxides-----	6 $\frac{1}{2}$
19. Sandstone, yellowish-gray, fine to very fine grained, thin-bedded, ripple-marked; a few seams cemented with iron oxides-----	4 $\frac{1}{2}$
18. Covered-----	4
17. Sandstone, light grayish-yellow, very fine grained, massive; some nodules cemented with iron oxides; forms ledge-----	7
16. Covered-----	6
15. Shale, dark-gray, silty, locally carbonaceous-----	4

Partial thickness Fall River Formation 121

Section below offset about 200 yards east to the end of the ridge

Unconformity.

Lakota Formation (part):

14. Siltstone, light-gray-----	9½
13. Sandstone, light-gray to light purplish-gray, locally mottled pink and yellow, very fine grained to clayey, irregularly thin-bedded, impregnated with iron oxides in top 3 in., a few ferruginous specks locally-----	3
12. Sandstone, light-gray, fine-grained, friable, inconspicuously crossbedded; forms cliff-----	45
11. Claystone, light olive-gray, sandy in the basal part-----	19
10. Claystone, medium-gray, weathers purplish gray and moderate red, slightly sandy-----	12
9. Covered-----	24
8. Claystone, banded shades of olive-gray, yellow, purplish- gray, green, and grayish-red; sandy-----	52
7. Claystone, medium-gray, sandy to very sandy-----	23
6. Claystone, dark-gray at the base becoming grayish-black at the top, sandy-----	3½
5. Shale, brownish-black, sandy; weathers to large brittle platy fragments-----	<u>1½</u> <i>Klu</i>
4. Sandstone, light-gray, fine-grained; irregularly interbedded with dark-gray sandy claystone-----	2½
3. Shale as in unit 5, above-----	<u>1½</u>
2. Sandstone as in unit 4, above-----	6 <i>Um</i>
1. Sandstone, light-gray, locally stained orange-red, fine- grained, friable-----	<u>10</u>

Partial thickness (rounded) Lakota Formation 210

Base of the exposure.

Locality 2.--Lakota Formation and parts of the Fall River and Morrison
Formations between Deer and Medicine Creeks, SW $\frac{1}{4}$ sec. 18, T. 56 N.,
R. 63 W., Crook County, Wyo.

	<u>Feet</u>
Top of the hill.	
Fall River Formation (part):	
37. Grass-covered slope; much slabby sandstone in the float---	20
36. Sandstone, light-gray to light yellowish-gray, fine-grained, in beds mostly $\frac{1}{2}$ to 1 ft thick; ripple-marked in upper part; some scattered nodules cemented by iron oxides; forms cliff-----	10
35. Sandstone and siltstone, interbedded and interlaminated; sandstone is light gray, very fine grained; siltstone is light to medium gray; fucoidal markings on bedding surfaces; numerous seams impregnated with iron oxides--	5
34. Sandstone, light-gray to light yellowish-gray, fine-grained; contains scattered nodules cemented with iron oxides; forms massive cliff. (This bed thickens southward and its base cuts downward across the underlying units 33 and 32 and into unit 31 so that within about 150 feet laterally this bed rests directly on the Lakota Formation.)-----	25
33. Sandstone and siltstone as in unit 35, above-----	8
32. Siltstone, dark-gray, fissile, carbonaceous-----	<u>4$\frac{1}{2}$</u>
Partial thickness (rounded) Fall River Formation	72

Unconformity.

Lakota Formation:

31. Sandstone and siltstone in alternating beds; sandstone is yellowish gray to grayish orange, fine to very fine grained, cross-laminated, in lenticular beds as much as 3 ft thick; siltstone is grayish white, sandy, massive, contains small ferruginous pellets; numerous seams cemented by iron oxides. (The beds of sandstone coalesce within about 100 feet southward to form a single massive bed of yellowish-gray fine to very fine grained sandstone that cuts downward about 6 ft into the underlying unit.)-----	17
--	----

Lakota Formation--Continued

30. Siltstone, grayish-white to pinkish-gray, massive; contains numerous irregular masses impregnated with iron oxides; abundant small ferruginous spherules; a lens about 3 ft long and 1 ft thick of grayish-orange very fine grained sandstone about the middle of the unit-----	11
29. Sandstone, light-gray to grayish-orange, fine-grained, massive; forms ledge-----	6
28. Claystone, medium-gray, mottled and banded red, silty; a few ferruginous spherules; a few stringers of very fine grained sandstone impregnated with iron oxides-----	3
27. Sandstone, light-gray, stained and mottled pink and yellow, very fine grained to silty, friable; a few seams impregnated with iron oxides-----	12
26. Mostly covered; some dark-gray to black claystone in the lower half-----	18
25. Claystone, light-gray, mottled yellow and red, weathers to a lumpy crust-----	22
24. Sandstone, light-gray, stained faintly pink, fine-grained, friable; forms minor ledge locally-----	4
23. Claystone, light-gray, mottled red and green, weathers to a hard lumpy red and gray crust-----	15
22. Claystone, light-gray, mottled green and red, weathers to a hard lumpy orange crust-----	9½
21. Claystone, dusky-red at the base becoming greenish-gray at the top; very sandy at the base becoming less sandy upward-----	15
20. Sandstone, irregularly mottled greenish-gray, purplish-gray, and yellowish-gray, fine to very fine grained, very clayey, poorly sorted, very friable-----	12
19. Sandstone, light-gray, fine to very fine grained, clayey, poorly sorted, very friable-----	23
18. Claystone, medium- to light-gray, very sandy-----	1½

	<u>Feet</u>
Lakota Formation--Continued	
17. Sandstone, pale greenish-gray, fine to very fine grained, clayey, poorly sorted, very friable-----	5 $\frac{1}{2}$
16. Claystone, dark greenish-gray, locally weathers purplish-gray, sandy-----	16
15. Sandstone, light-gray, calcareous, in beds 1 to 4 in. thick; some interbedded greenish-gray clayey calcareous sandstone-----	2
14. Sandstone, brown, fine to very fine grained, shaly, carbonaceous-----	3 $\frac{1}{2}$
13. Sandstone, light-gray, fine to very fine grained, thin-bedded-----	2
12. Claystone, dark greenish-gray; a few thin sandy partings---	13
11. Sandstone, light-gray, fine-grained, crossbedded, friable, locally carbonaceous; some dark-brown claystone interbedded in the basal 6 ft-----	35
10. Mostly covered; some dark-gray to black carbonaceous shale at the base and top-----	<u>14</u>
Thickness Lakota Formation	
	260

Morrison Formation (part):

9. Covered-----	21
8. Claystone, greenish-gray, calcareous-----	12
7. Sandstone, grayish-white, very fine grained, calcareous, very thin bedded-----	1 $\frac{1}{2}$
6. Claystone, greenish-gray, calcareous; a few nodules of light-gray clayey limestone-----	19
5. Limestone, light-gray, clayey-----	1
4. Claystone, greenish-gray, calcareous-----	$\frac{1}{2}$
3. Limestone, pale greenish-gray, sandy; contains numerous green clay pellets in the upper part-----	1 $\frac{1}{2}$

	<u>Feet</u>
Morrison Formation--Continued	
2. Claystone, greenish-gray at the top, grayish-red at the base, very calcareous-----	8
1. Limestone, light-gray to pale greenish-gray, clayey-----	4
Partial thickness (rounded) Morrison Formation	68

Base of the exposure.

Locality 3.--Parts of the Fall River and Lakota Formations on the north side of Medicine Creek, NE $\frac{1}{4}$ sec. 8, T. 56 N., R. 63 W., Crook County, Wyo.

Top of the ridge.

Fall River Formation (part):

25. Sandstone, yellowish-gray, fine-grained, locally impregnated with dark-brown iron oxides, slabby; forms ledges-----	3
24. Covered-----	25
23. Sandstone, light yellowish-gray, very fine grained, in beds mostly $\frac{1}{2}$ to 1 ft thick, fucoidal markings on bedding surfaces, locally ripple-marked; much ferruginous cement in thin seams in the basal 1 ft; forms blocky ledges----	9
22. Sandstone, light yellowish-gray, very fine grained, cross-laminated, fucoidal markings in lower part; a seam $\frac{1}{2}$ ft thick about 2 ft above the base impregnated with dark-brown iron oxides; forms prominent ledge-----	8
21. Siltstone, medium-gray massive-----	1 $\frac{1}{2}$
20. Sandstone, light-gray to light yellowish-gray, very fine grained, cross-laminated-----	1
19. Partly covered; upper part is dark-gray silty shale-----	3 $\frac{1}{2}$
18. Sandstone, light-gray to light yellowish-gray, very fine grained, mostly thin-bedded, cross-laminated, fucoidal markings on bedding surfaces; thin seams impregnated with iron oxides; forms ledges locally-----	6
17. Siltstone, dark-gray, shaly; grades upward to dark-gray silty shale that weathers pinkish gray-----	5

Fall River Formation--Continued

Feet

- | | |
|---|-----|
| 16. Sandstone, light-gray, very fine grained, cross-laminated; some interlaminated medium- to dark-gray silty shale--- | 4 |
| 15. Sandstone, light-gray, fine to very fine grained; in beds as much as 1 ft thick at the base of the unit becoming thinner bedded in the upper part; vertical tubelike structures in the upper part; some seams and nodules impregnated with dark-brown iron oxides; forms ledges-- | 14½ |
| 14. Sandstone, medium-gray, very fine grained; grades to dark-gray silty shale in bottom ½ ft; unit truncated by overlying unit within a few feet to the west----- | 5 |
| 13. Sandstone, light-gray, very fine grained, fucoidal markings on the bedding surfaces; a few seams cemented by dark-brown iron oxides----- | 1½ |
| 12. Mostly covered; some interbedded dark-gray silty shale and light-gray very fine grained sandstone in the bottom half----- | 4 |
| 11. Sandstone, light-gray to light yellowish-gray, very fine grained, thin-bedded, fucoidal markings on the bedding surfaces; some seams impregnated by dark-brown iron oxides----- | 4½ |
| 10. Siltstone, medium- to dark-gray, shaly, slightly carbonaceous----- | 1½ |
| 9. Sandstone, light yellowish-gray, fine to very fine grained; a bed 2 ft thick at the base, unit becomes thinner bedded at the top; a few seams impregnated with dark-brown iron oxides; forms ledge----- | 9 |
| 8. Sandstone and siltstone, interbedded and interlaminated; sandstone is light gray, very fine grained, thin bedded, cross laminated, fucoidal markings on the bedding surfaces; siltstone is light- to medium-gray; many thin seams impregnated with dark-brown iron oxides----- | 3 |
| 7. Shale, dark-gray, silty; some dark-gray shaly siltstone; carbonaceous in the lower 2 ft; upper 3 ft weathers slightly pinkish gray----- | 5 |
| 6. Siltstone, light-gray, carbonaceous, hard; forms blocky ledge----- | 2 |

	<u>Feet</u>
Fall River Formation--Continued	
5. Siltstone, medium- to dark-gray, very carbonaceous-----	2 $\frac{1}{2}$
Partial thickness (rounded) Fall River Formation	118

Unconformity.

Lakota Formation (part):

4. Siltstone, medium- to light-gray; contains vertical brown stringers that resemble root casts-----	2
3. Siltstone, medium-gray, weathers yellowish gray to yellowish-orange; contains many small ferruginous spherules-----	2 $\frac{1}{2}$
2. Siltstone, dark-gray, clayey, slightly carbonaceous; a few thin partings of light-gray to yellowish-gray very fine grained sandstone-----	12
1. Sandstone, light-gray, fine to very fine grained, clayey, carbonaceous in top few in.-----	2

Partial thickness (rounded) Lakota Formation 18

Base of the exposure.

Locality 4.--Morrison and part of the Lakota Formations along the Belle Fourche River, SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 9, T. 56 N., R. 63 W., Crook County, Wyo.

Top of the hill.

Lakota Formation (part):

15. Siltstone, medium-gray to yellowish-gray, locally mottled pink; some interbedded light-gray to yellowish-gray very fine grained sandstone locally cemented with iron oxides; speckled with a few small ferruginous spherules; non-resistant. Top of unit is near top of the Lakota Formation-----	10
14. Sandstone, light-gray, weathers light tan, medium-grained, friable, crossbedded; a bed 1 ft thick 25 ft above the base contains reworked fragments of siltstone; a few seams cemented with iron oxides; forms massive cliff----	50
13. Covered-----	6
12. Partly covered; appears to be mostly medium-gray claystone mottled purple and red; sandy in the middle part-----	57

	<u>Feet</u>
Lakota Formation--Continued	
11. Claystone, medium-gray to greenish-gray, locally mottled purple and red, slightly sandy becoming very sandy in the basal 5 ft; grades into unit below-----	25
10. Sandstone, grayish-white, mostly fine-grained with a few scattered coarser grains, very friable-----	11
9. Sandstone, light-gray, fine-grained, friable; partings and thin lenses of brown to black carbonaceous shale; nonresistant-----	3½
8. Sandstone, light-gray to grayish-white, locally stained yellow, fine- to medium-grained, slightly clayey in upper half, very friable, nonresistant-----	6½
7. Sandstone, very light gray, locally weathers brown, mostly medium-grained; a seam of granule sandstone about 2 in. thick at the base; calcareous; friable; weathers to knobby surface; forms local ledges-----	<u>6</u>
Partial thickness Lakota Formation	175

Unconformity.

Morrison Formation:

6. Sandstone, grayish-white, mostly fine-grained becoming fine- to medium-grained at the top, locally calcareous, very friable, nonresistant-----	48
5. Claystone, green, sandy, nonealcareous-----	6
4. Limestone, light-gray to light yellowish-gray, sandy, in thin contorted beds-----	3
3. Sandstone, light-gray, very fine grained, calcareous; interlaminated green sandy shale-----	<u>8</u>

Thickness Morrison Formation 65

Sundance Formation (part):

Redwater Shale Member (part):

2. Sandstone, yellow, very fine grained, very calcareous; grades locally to sandy limestone; thin-bedded; forms local ledge-----	3
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Sundance Formation--Continued

Redwater Shale Member--Continued

1. Sandstone, light-gray, very fine grained; some interlam-
inated green shale----- 10

Partial thickness Sundance Formation 13

Locality 5.--Morrison and parts of the Lakota and Sundance Formations near
Mona Butte, SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 14, T. 56 N., R. 63 W., Crook County, Wyo.

Top of the hill.

Lakota Formation (part):

22. Sandstone, light-gray, mottled yellow, fine to very fine
grained, friable, slightly carbonaceous locally; forms
ledge----- 3
21. Shale, brownish-gray, silty, very carbonaceous----- 2 *1 c la*
20. Claystone, dark-gray to brownish-gray, sandy and silty,
slightly carbonaceous locally----- 4 $\frac{1}{2}$ *? m*
Jm
19. Sandstone, light-gray, fine to very fine grained, lenticular;
forms blocky ledge----- 1 $\frac{1}{2}$
18. Claystone, brownish-gray, sandy to silty, lenticular----- 2
17. Sandstone, light-gray, fine to very fine grained; bottom
2 to 3 ft calcareous, remainder noncalcareous; cross-
bedded; mostly in beds less than 3 ft thick; a few
carbonaceous laminae in the basal part; forms ledges----- 11
16. Sandstone, light-gray, fine to very fine grained, calcareous,
thin-bedded; contains thin seams of brown and olive-gray
carbonaceous shale----- 3
15. Claystone, greenish-gray, noncalcareous, sandy at the base-- 3
14. Sandstone, light-gray, very fine grained; a few laminae of
green sandy claystone; mostly very friable and non-
resistant but contains a few slabby calcareous beds
locally----- 7

Partial thickness Lakota Formation 37

Morrison Formation:

13. Claystone, greenish-gray, noncalcareous----- 4

	<u>Feet</u>
Morrison Formation--Continued	
12. Claystone, greenish-gray, calcareous; a few discontinuous lenses of grayish-white clayey limestone at top; limestone contains scattered pyrite cubes-----	2
11. Limestone, light-gray, clayey, brecciated-----	3½
10. Claystone, mostly greenish-gray, band of grayish-red claystone at top, calcareous; lenses and thin beds of grayish-white clayey limestone; green clay pellets in thin beds of claystone near top. Contains ostracodes identified by I. G. Sohn as <u>Darwinula</u> sp., " <u>Metacypris</u> " sp., <u>Theriosynoecum wyomingense</u> (Branson), large smooth form genus indet., and small smooth form genus indet., and charophytes identified by R. E. Peck as <u>Stellatochara obovata</u> (Peck), <u>Latochara latitruncata</u> (Peck), and <u>Praechara voluta</u> (Peck) (USGS loc. 26921, 26922, 26456, and 26457)-----	30½
9. Sandstone, light-gray to grayish-white, very fine grained, calcareous, thin-bedded, ripple-marked; laminae of green claystone in top ½ ft; forms minor ledge-----	3
8. Claystone, greenish-gray, slightly sandy, calcareous-----	3½
7. Sandstone, light-gray, very fine grained, friable-----	2½
6. Sandstone, light yellowish-gray, very calcareous; forms lenticular ledge-----	1
5. Shale, dark greenish-gray, locally weathers yellowish-gray, sandy-----	1
4. Sandstone, light-gray, very fine grained, very calcareous; grades locally into sandy limestone; thin and irregularly bedded; forms ledge-----	2
Thickness Morrison Formation	
	53

Sundance Formation (part):

Redwater Shale Member (part):

3. Sandstone, moderate-yellow, very fine grained, friable, calcareous; a few partings of dark greenish-gray sandy shale-----	2
2. Shale, dark greenish-gray, noncalcareous; laminae of light-gray very fine grained sandstone-----	2

Sundance Formation--Continued

Redwater Shale Member--Continued

1. Sandstone, light-gray, very fine grained, calcareous;
partings of dark greenish-gray shale----- 2

Partial thickness Sundance Formation 6

Locality 6.--Parts of the Fall River and Lakota Formations about 1 mile east of Mona Butte, NE 1/4 sec. 23, T. 56 N., R. 63 W., Creek County, Wyo.

Top of the ridge.

Fall River Formation (part):

25. Sandstone, grayish-yellow, very fine grained, thin-bedded, cross-laminated; a few seams cemented with brown-weathering iron oxides; forms ledge----- 4
24. Shale, dark-gray, silty; interlaminated dark-gray shaly siltstone----- 6
23. Siltstone, medium- to light-gray, fissile, nonresistant---- 5
22. Sandstone, light-gray, very fine grained, very thin and irregularly bedded; top 4 in. impregnated with iron oxides; fucoidal markings on bedding surfaces; cross-laminated; locally ripple-marked----- 1 1/2
21. Shale, dark-gray, silty----- 1
20. Sandstone, light-gray, stained pink locally in the lower part, very fine grained to silty, fucoidal markings on bedding surfaces; weathers to pitted cavernous surface-- 4
19. Shale, dark-gray, weathers grayish red, silty----- 1/2
18. Sandstone, light-gray to grayish-yellow, very fine grained, thin and irregularly bedded; closely spaced seams cemented with iron oxides, fucoidal markings on bedding surfaces, cross-laminated, locally ripple-marked----- 6 1/2
17. Sandstone, light-gray, very fine grained, massive; upper surface impregnated with dark-brown iron oxides; locally forms ledge----- 3 1/2
16. Sandstone, orange-yellow, medium- to coarse-grained, cross-bedded, friable, lenticular----- 2

	<u>Feet</u>
Fall River Formation--Continued	
15. Sandstone, light-gray, very fine grained, in beds $\frac{1}{2}$ to 1 ft thick, cross-laminated; a few scattered nodules cemented with iron oxides; forms persistent ledge-----	6 $\frac{1}{2}$
14. Siltstone, medium- to light-gray, shaly-----	3
13. Sandstone, light-gray, weathers grayish yellow, very fine grained, thin-bedded at base becoming thicker bedded at top, ripple-marked in lower part; some seams impregnated with dark-brown iron oxides in the middle and upper parts; forms persistent ledge-----	9
12. Siltstone, medium-gray, locally weathers pinkish gray; some interbedded light-gray very fine grained sandstone; a few seams impregnated with dark-brown iron oxides; nonresistant-----	4
11. Siltstone, dark-gray, shaly; slightly carbonaceous in bottom half-----	5
10. Siltstone, light-gray, blocky, cross-laminated, fucoidal markings on bedding surfaces, slightly carbonaceous; a few nodules cemented with iron oxides; forms ledge--	1
9. Claystone, medium-gray, very silty, carbonaceous becoming clay in top 1 in.; many vertical brown stringers resembling root casts-----	<u>1</u>
Partial thickness (rounded) Fall River Formation	63

Unconformity.

Lakota Formation (part):

8. Claystone, dark-gray at base becoming medium-gray to olive-gray at top, mottled pink, red, and yellow; silty and sandy at base; tiny ferruginous spherules in the middle and upper parts-----	18
7. Siltstone, very light gray, mottled yellow and pink, friable-----	2
6. Sandstone, light-gray, faintly stained pink and yellow, fine to very fine grained, locally clayey; seam in upper part $\frac{1}{4}$ in. thick impregnated with iron oxides; locally forms ledge-----	4 $\frac{1}{2}$

Lakota Formation--Continued

Feet

5. Claystone, mostly dark-gray becoming dark brownish-gray in top $\frac{1}{2}$ ft, silty, carbonaceous at the top----- 2
4. Sandstone, light- to dark-gray, mostly fine to very fine grained becoming coarse-grained in bottom 2 ft; some irregular dark-gray clayey zones; friable; nonresistant 12
3. Claystone, grayish-purple at base becoming green at top, silty----- 2
2. Siltstone, very light gray, mottled shades of yellow, green, and purple at the top, friable----- 7
1. Claystone, grayish-red, becoming purplish-gray in top $\frac{1}{2}$ ft, silty----- 2

Partial thickness (rounded) Lakota Formation 49

Base of the exposure.

Locality 7.--Parts of the Fall River and Lakota Formations about 1 mile east of Mona Butte, NW $\frac{1}{4}$ sec. 24, T. 56 N., R. 63 W., Creek County, Wye.

Top of the hill.

Fall River Formation (part):

9. Sandstone, light-gray, weathers orange-brown, fine to very fine grained, thin-bedded; forms ledge----- 2
8. Covered----- 10
7. Sandstone, yellowish-gray, weathers tan, mostly fine-grained, some scattered medium grains and a few coarser fragments of light-gray siltstone and sandstone mostly in the bottom 10 ft, crossbedded; scattered nodules cemented with iron oxides; forms massive cliff----- 60

Partial thickness Fall River Formation 72

Unconformity.

Lakota Formation (part):

6. Covered----- 6
5. Claystone, medium-gray, mottled red, slightly silty, tough; scattered small ferruginous spherules----- 4 $\frac{1}{2}$

	<u>Feet</u>
Lakota Formation--Continued	
4. Claystone, dark-gray-----	2
3. Siltstone, dark-gray, weathers grayish-red, mottled green and gray; abundant ferruginous spherules-----	4
2. Sandstone, yellowish-gray, stained yellow in top 1 ft; medium-grained in basal part becoming fine-grained at top; friable; top surface impregnated with iron oxides	10
1. Siltstone, medium- to dark-gray, sandy at base-----	7
Partial thickness (rounded) Lakota Formation	33

Base of the exposure.

Locality 8.--Parts of the Fall River and Lakota Formations east of Mena,
center NW $\frac{1}{4}$ sec. 30, T. 56 N., R. 62 W., Creek County, Wyo.

Top of the hill.

Fall River Formation (part):

12. Sandstone, light yellowish-gray, fine to very fine grained, friable, cross-laminated; scattered nodules cemented by iron oxides; forms massive ledge-----	14
11. Sandstone, very light gray, very fine grained; beds mostly less than 1 in. thick; thin seams cemented by iron oxides; nonresistant-----	2
10. Mostly covered; lower part contains gray shaly siltstone interlaminated with some very fine grained sandstone; slightly carbonaceous locally-----	50
9. Sandstone, light yellowish-gray, very fine grained; some thin seams cemented by iron oxides; forms blocky to slabby ledge-----	$\frac{1}{2}$
8. Covered-----	10
7. Sandstone as in unit 9, above-----	4
6. Partly covered; mostly gray shaly siltstone-----	2
5. Sandstone, light yellowish-gray, very fine grained, beds mostly less than $\frac{1}{2}$ ft thick, cross-laminated, ripple- marked; a few thin seams cemented with iron oxides; forms ledges-----	9

	<u>Feet</u>
Fall River Formation--Continued	
4. Siltstone, medium-gray, shaly, slightly carbonaceous-----	9
Partial thickness (rounded) Fall River Formation	100

Unconformity.

Lakota Formation (part):

3. Claystone, medium-gray, mottled yellow and red, silty; small ferruginous spherules scattered abundantly in upper part-----	19
2. Sandstone, light-gray to light brownish-gray, fine to very fine grained, friable, inconspicuously crossbedded; forms local rounded ledges-----	40
1. Claystone, medium- to dark-gray, plastic-----	2
Partial thickness Lakota Formation	61

Base of the exposure.

Locality 9.--Parts of the Fall River and Lakota Formations about $2\frac{1}{2}$ miles
southeast of Mena, NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 31, T. 56 N., R. 62 W., Creek County, Wyo.

Top of the hill.

Fall River Formation (part):

4. Covered-----	30
3. Sandstone, yellowish-brown to reddish-brown, medium- to coarse-grained, friable, crossbedded; a few seams and nodules cemented by iron oxides; forms massive cliff----	43
Partial thickness Fall River Formation	73

Unconformity.

Lakota Formation (part):

2. Siltstone, very light gray, sandy, lenticular; a few ferruginous spherules scattered in top 1 to 2 in., nonresistant-----	1
1. Sandstone, very light gray, locally stained light yellowish- gray, fine- to medium-grained in lower part becoming fine-grained at top, friable, crossbedded; a few nodules cemented by iron oxides; forms ledges and cliffs-----	65
Partial thickness Lakota Formation	66

Locality 10.--Parts of the Fall River and Lakota Formations along a
tributary to Horse Creek, SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 32, T. 56 N., R. 62 W.,
Creek County, Wyo.

Feet

Top of the hill.

Fall River Formation (part):

3. Sandstone, light-gray to light-brown, fine-to medium-grained,
friable, crossbedded; a few seams and nodules cemented
by iron oxides; form massive cliff----- 70

Lakota Formation (part):

2. Covered. Contact between the Fall River and Lakota
Formations probably near top of this interval----- 50±
1. Sandstone, light-gray to light orange-brown, fine to very
fine grained, friable, crossbedded; scattered nodules
cemented by iron oxides; forms ledge----- 20

Partial thickness Lakota Formation 70±

Base of the exposure.

Locality 11.--Parts of the Fall River and Lakota Formations near the head
of Deep Creek, SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 6, T. 55 N., R. 62 W., Creek County, Wyo.

Top of the ridge.

Fall River Formation (part):

11. Covered----- 20
10. Sandstone, yellowish-gray, very fine grained to silty, thin-
bedded, cross-laminated; fucoidal markings on bedding
surfaces; a few seams cemented by iron oxides; forms
slabby ledges----- 6
9. Covered----- 14
8. Siltstone, brown, impregnated with iron oxides; forms ledge- ½
7. Covered----- 8
6. Siltstone, gray, shaly----- 3

4-8

	<u>Feet</u>
Fall River Formation--Continued	
5. Siltstone, red, impregnated with iron oxides-----	<u>1</u> <u>2</u>
Partial thickness Fall River Formation	52

Unconformity.

Lakota Formation (part):

4. Poorly exposed; appears to be mostly gray siltstone and silty claystone, weathers pink and red; small ferruginous spherules scattered in upper part; forms tough gumbe soil	18
3. Covered-----	5
2. Sandstone, very light gray, mostly fine- to medium-grained; some coarse-grained to granule sandstone in bottom 4 ft; friable; crossbedded; forms ledges-----	<u>44</u>
1. Sandstone, very light gray, mostly fine- to medium-grained, friable, crossbedded; scattered nodules cemented by iron oxides; forms ledges-----	<u>15</u>
Partial thickness Lakota Formation	82

Base of the exposure.

Locality 12.--Part of the Fall River Formation along the south side of Deep Creek, SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 6, T. 55 N., R. 62 W., Creek County, Wyo.

Top of the ridge.

Fall River Formation (part):

2. Covered grassy slope-----	25
1. Sandstone, light yellowish-gray to brown, mostly medium-grained at base, medium- to fine-grained at top, scattered coarse to very coarse grains in bottom 5 ft, in tabular beds mostly 1 to 6 ft thick, locally crossbedded, average dip of crossbeds about N. 30° E.; a few thin lenses and concretions impregnated with dark-brown iron oxides; forms almost vertical cliff-----	<u>70</u>
Partial thickness Fall River Formation	95

Base of the exposure.

Locality 13.--Parts of the Fall River and Lakota Formations on the north side of Pine Creek, NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 16, T. 55 N., R. 62 W., Creek County, Wyo.

	<u>Feet</u>
Top of the hill.	
Fall River Formation (part):	
14. Covered-----	15
13. Sandstone, very light gray, fine-grained, friable; scattered nodules cemented with iron oxides; forms rounded ledges--	7
12. Sandstone, light yellowish-gray, very fine grained, cross-laminated; local seams cemented with iron oxides; forms hard blocky ledges-----	13
11. Siltstone, light yellowish-gray and medium-gray, locally ripple-marked; a few lenses and nodules cemented by iron oxides; base and top form blocky ledges; middle part nonresistant-----	9
10. Siltstone, medium-gray, shaly, nonresistant-----	6
9. Sandstone, light yellowish-gray, fine to very fine grained, in beds as much as 3 ft thick separated by thinner bedded sandstone and partings of medium-gray siltstone; fusoidal markings on bedding surfaces; a few seams cemented by iron oxides; forms ledges-----	50
8. Siltstone, medium-gray, slightly shaly, slightly carbonaceous, nonresistant-----	6
7. Siltstone, light yellowish-gray, locally cemented by iron oxides; forms hard blocky ledge-----	<u>$\frac{1}{2}$</u>
Partial thickness (rounded) Fall River Formation	106

Unconformity.

Lakota Formation (part):

6. Claystone, medium-gray, weathers red and purple in top half; small ferruginous spherules in upper part-----	30
5. Siltstone, very light gray, friable; grades locally to very fine grained sandstone; nonresistant-----	5

	<u>Feet</u>
Lakota Formation--Continued	
4. Covered-----	3
3. Sandstone, very light gray to light brownish-gray, mostly fine-grained at top grading to coarse-grained at base; some granule sandstone in lower part; friable; crossbedded; forms ledge-----	15
2. Covered-----	4
1. Claystone, medium-gray, slightly silty-----	<u>8</u>
Partial thickness Lakota Formation	65

Base of the exposure.

Locality 14.--Parts of the Fall River and Lakota Formations south of Pine Creek, SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 17, T. 55 N., R. 62 W., Creek County, Wyo.

Top of the ridge.

Fall River Formation (part):

6. Sandstone, light-gray to light yellowish-gray, weathers brown, fine to very fine grained, friable; thin seams and scattered nodules cemented by iron oxides; forms ledge-----	18
5. Siltstone, medium-gray, shaly-----	2 $\frac{1}{2}$
4. Siltstone, white, hard, blocky-----	<u>1</u>

Partial thickness (rounded) Fall River Formation 21

Unconformity.

Lakota Formation (part):

3. Claystone, medium-gray, weathers white, pink, and red, silty to locally sandy; forms tough gumbo soil-----	35
2. Sandstone, light-gray, weathers light gray to pink, mostly fine to very fine grained in upper part becoming mostly medium- to coarse-grained with stringers of granule sandstone in basal 5 ft; friable; crossbedded; forms ledges-----	27
1. Poorly exposed; appears to be mostly medium-gray claystone-----	<u>30</u>

Partial thickness Lakota Formation 92

Base of the exposure.

Locality 15.--Parts of the Fall River and Lakota Formations south of Pine Creek, near center NE $\frac{1}{4}$ sec. 21, T. 55 N., R. 62 W., Creek County, Wyo.

	<u>Feet</u>
Top of the hill.	
Fall River Formation (part):	
22. Covered-----	3
21. Sandstone, yellowish-gray, fine-grained, friable, cross-bedded; scattered nodules cemented by iron oxides; forms cliff-----	26
20. Siltstone, gray, thin-bedded; a few seams cemented by iron oxides-----	4
19. Sandstone, light-gray to light yellowish-gray, very fine grained to silty, cross-laminated; a few seams and nodules cemented by iron oxides; in blocky beds about 1 ft thick; forms local ledges-----	19
18. Siltstone, light-gray, in beds as much as 2 ft thick separated by partings of thinner bedded gray and yellowish-gray siltstone; a few seams cemented by iron oxides; forms local ledges-----	9
17. Siltstone, medium-gray, shaly; a few thin beds of light-gray very fine grained sandstone; some thin seams cemented by iron oxides; nonresistant-----	11
16. Sandstone, light yellowish-gray, fine to very fine grained, in beds mostly about $\frac{1}{2}$ ft thick separated by partings of olive-gray shaly siltstone; a few seams cemented by iron oxides; forms slabby ledges-----	11
15. Sandstone, light-gray to light yellowish-gray, fine- to medium-grained, crossbedded; a few thin seams and scattered nodules cemented by iron oxides; forms cliff---	24
14. Siltstone, medium-gray, weathers grayish-red, shaly; a few seams cemented by iron oxides at base of unit; nonresistant-----	7
13. Siltstone, light yellowish-gray; scattered nodules cemented by iron oxides; slightly carbonaceous; forms blocky ledge	2 $\frac{1}{2}$

Feet

Fall River Formation--Continued

12. Siltstone, medium-gray, weathers gray and grayish red, shaly,
slightly carbonaceous, nonresistant----- 4

Partial thickness (rounded) Fall River Formation 120

Unconformity.

Lakota Formation (part):

11. Claystone, medium-gray, weathers pink and yellow, silty;
small ferruginous spherules in top 6 ft----- 30
10. Sandstone, light orange-brown, fine to very fine grained;
scattered nodules cemented by iron oxides; forms blocky
ledge----- 1
9. Siltstone, yellow and gray, friable----- 2
8. Sandstone, light-gray, very fine grained, friable; in top
part a few scattered nodules cemented by iron oxides;
nonresistant----- 13
7. Covered----- 5
6. Claystone, medium-gray, weathers gray and olive gray, silty
and sandy; upper part partly covered----- 32
5. Mostly covered; a few scattered exposures of medium-gray
sandy claystone----- 25
4. Siltstone, medium-gray, clayey----- 5
3. Covered----- 10
2. Claystone, medium-gray, mottled red and purple near top, silty 11
1. Sandstone, medium- to light-gray, very fine to medium grained,
clayey, poorly sorted, nonresistant----- 16

Partial thickness Lakota Formation 150

Base of the exposure.

Locality 16.--Parts of the Fall River and Lakota Formations on the north side of Oak Creek, SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 28, T. 55 N., R. 62 W., Creek County, Wyo.

	<u>Feet</u>
Top of the ridge.	
Fall River Formation (part):	
17. Covered-----	4
16. Sandstone, light-gray, fine-grained, friable, crossbedded; forms rounded ledges-----	10
15. Covered-----	5
14. Sandstone, light yellowish-gray, very fine grained, cross-laminated; forms slabby ledges-----	16
13. Covered-----	22
12. Sandstone, orange-brown, fine- to medium-grained, friable, crossbedded; a few seams and nodules cemented by iron oxides; upper and lower parts form ledges-----	50
11. Siltstone, medium-gray, locally stained pink, shaly; thin seams cemented by iron oxides at top of unit; nonresistant	3
10. Sandstone, very light gray, very fine grained to silty, carbonaceous, hard-----	<u>1</u> <u>2</u>
Partial thickness (rounded) Fall River Formation	
	110

Unconformity.

Lakota Formation (part):

9. Claystone, gray, weathers red and purple, sandy in lower part becoming silty in upper part; a lens 3 ft thick of light-gray very fine grained sandstone 10 ft above base; small ferruginous spherules in top 5 ft-----	26
8. Sandstone, light-gray to light orange-brown, mostly fine- to medium-grained, some coarse-grained to granule sandstone in middle part; friable; crossbedded; forms ledges	40
7. Covered-----	24
6. Claystone, medium-gray, mottled red and purple in upper half, sandy in basal 5 ft; a few small ferruginous nodules in upper part-----	35

	<u>Feet</u>
Lakota Formation--Continued	
5. Sandstone, light-gray to light yellowish-gray, fine- to medium-grained with a few scattered coarser grains; hard; forms cavernous ledge-----	2
4. Sandstone, medium-gray to olive-gray, sandy; grades locally into sandy claystone-----	8
3. Sandstone, very light gray, fine-grained, hard; weathers to rough cavernous ledge-----	4
2. Siltstone, dark-gray, clayey, sandy, nonresistant-----	8
1. Sandstone as in unit 3, above-----	<u>4</u>
Partial thickness Lakota Formation	151

Base of the exposure.

Locality 17.--Parts of the Fall River and Lakota Formations on the north side of Oak Creek, near center NW $\frac{1}{4}$ sec. 35, T. 55 N., R. 62 W., Creek County, Wyo.

Top of the ridge.

Fall River Formation (part):

16. Sandstone, yellowish-gray, very fine grained, cross-laminated; a few nodules cemented with iron oxides; forms prominent cliff-----	15
15. Covered-----	37
14. Sandstone, light yellowish-gray, very fine grained, in beds mostly less than $\frac{1}{2}$ ft thick; a few seams cemented with iron oxides; fusoidal markings on bedding surfaces; forms persistent ledge-----	5
13. Covered-----	4
12. Sandstone, light yellowish-gray, very fine grained; top surface impregnated with iron oxides; forms ledge-----	$\frac{1}{2}$
11. Siltstone, medium-gray, shaly; thin seams of light-gray very fine grained carbonaceous sandstone; nonresistant-----	<u>8</u>

Partial thickness (rounded) Fall River Formation 70

	<u>Feet</u>
Unconformity.	
Lakota Formation (part):	
10. Siltstone, medium-gray, mottled yellow and red in top half; clayey; small ferruginous spherules in top 10 ft; non-resistant-----	26
9. Sandstone, light-gray, locally stained light-yellow and pink, mostly fine-grained, some coarse-grained sandstone in lower 3 ft, friable, crossbedded; scattered nodules cemented by iron oxides; forms prominent cliff locally---	25
8. Claystone, gray, mottled red, silty becoming more silty at base-----	16
7. Sandstone, very light gray, stained yellow, very fine grained, cross-laminated; forms ledge-----	1
6. Poorly exposed; scattered outcrops of gray silty claystone mottled purple; sandy to very sandy in top 5 ft-----	22
5. Claystone, red and green; contains a few scattered sand grains-----	27
4. Covered-----	4
3. Sandstone, grayish-white, weathers brown, very fine grained, calcareous; forms local ledge-----	2
2. Sandstone, grayish-white, locally stained yellow, pale green, and red, very fine grained, friable, nonresistant-----	7
1. Claystone, green and red, sandy-----	5
Partial thickness Lakota Formation	135

Base of the exposure.

Locality 18.--Parts of the Fall River and Lakota Formations along the North Fork of Hay Creek, SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 2, T. 54 N., R. 62 W., Creek County, Wyo.

Top of the ridge.

Fall River Formation (part):

17. Covered-----	11
16. Sandstone, light yellowish-gray, fine-grained, friable; forms ledge-----	1

	<u>Feet</u>
Fall River Formation--Continued	
15. Covered-----	11
14. Sandstone, light yellowish-gray, very fine grained; forms slabby ledges-----	13
13. Covered-----	26
12. Sandstone, light yellowish-gray, fine-grained; a few seams and nodules cemented with iron oxides; friable; forms ledge-----	5
11. Covered-----	19
10. Sandstone, light yellowish-gray, very fine grained, slightly carbonaceous, thin-bedded; some thin seams impregnated with iron oxides-----	2
9. Siltstone, medium-gray, shaly, slightly carbonaceous-----	5
8. Siltstone, yellowish-gray, hard, locally cemented with iron oxides-----	<u>1</u>
Partial thickness Fall River Formation	94

Unconformity.

Lakota Formation (part):

7. Claystone, medium-gray, mottled pink and yellow in upper part, silty; small ferruginous spherules at top-----	16
6. Sandstone, light-brown, fine-grained, friable, in irregular lenticular beds; forms ledge-----	20
5. Claystone, medium-gray, silty-----	5
4. Sandstone, very light gray, mostly fine- to medium-grained, a few lenses of coarse-grained to granule sandstone throughout; fragments of light-gray siltstone in basal part; friable; conspicuously crossbedded; forms ledges and cliffs-----	27
3. Sandstone, grayish-white, mostly fine-grained with some medium-grained to coarse-grained stringers in bottom 1 ft, friable, crossbedded; scattered nodules cemented with iron oxides; forms ledges and cliffs-----	24

	<u>Feet</u>
Lakota Formation--Continued	
2. Claystone, medium-gray, mottled red locally, sandy-----	12
1. Sandstone, very light gray, locally stained yellow and red, fine-grained, very friable, nonresistant-----	13

Partial thickness Lakota Formation 117

Base of the exposure.

Locality 19.--Parts of the Fall River and Lakota Formations along the Middle Fork of Hay Creek, NW $\frac{1}{4}$ sec. 14, T. 54 N., R. 62 W., Creek County, Wyo.

Top of the hill.

Fall River Formation (part):

17. Sandstone, light-gray to yellowish-gray, weathers pinkish gray in bottom half, very fine grained, thin-bedded; some dark-gray siltstone laminae in basal 1 ft; forms cliff---	25
16. Mostly covered; some grayish-red silty shale about the middle-----	20 $\frac{1}{2}$
15. Sandstone, yellowish-gray, fine to very fine grained, micaceous, in beds mostly 1 to 1 $\frac{1}{2}$ ft thick, cross-laminated; forms ledge-----	4
14. Mostly covered; gray silty carbonaceous shale in basal 1 ft; unit weathers to red soil-----	7 $\frac{1}{2}$
13. Sandstone, yellowish-gray, fine to very fine grained, micaceous, in beds as much as 2 ft thick; contains thin seams impregnated with iron oxides; forms ledge-----	9
12. Siltstone, medium-gray, a few pink-weathering laminae-----	3
11. Sandstone, yellowish-gray, very fine grained, in beds mostly $\frac{1}{2}$ to 1 ft thick, fucoidal markings on the bedding surfaces; a few seams cemented with iron oxides; top 4 ft makes ledge-----	9 $\frac{1}{2}$
10. Siltstone, laminated light and dark-gray, middle part weathers pink, shaly; a few lenses 1 to 2 in. thick of very fine grained sandstone-----	7 $\frac{1}{2}$
9. Sandstone, yellowish-gray, very fine grained, fucoidal markings on the bedding surfaces; a few seams impregnated with iron oxides-----	11 $\frac{1}{2}$

	<u>Feet</u>
Fall River Formation--Continued	
8. Sandstone, light-gray, mottled pink, fine-grained; contains a few clay pellets; friable-----	<u>1½</u>
Partial thickness Fall River Formation	89

Unconformity.

Lakota Formation (part):

7. Partly covered; appears to be mainly medium-gray siltstone and silty claystone, mottled yellow and red in middle and upper parts; basal 5 ft slightly carbonaceous; contains small ferruginous spherules in middle and upper parts-----	22
6. Sandstone, light-gray, mottled pink and yellow, fine to very fine grained, massive, friable-----	4
5. Covered-----	40
4. Sandstone, light- to medium-gray, locally mottled red and yellow, fine to very fine grained, clayey, friable; grades into unit below-----	9½
3. Claystone, medium-gray, sandy; contains stringers of poorly sorted sandstone; grades into unit below-----	13
2. Sandstone, light yellowish-gray to pink, medium- to coarse-grained with stringers and lenses of very coarse grained to pebbly sandstone; polished pebbles as much as ¼ in. long in the float; forms rounded ledges-----	24
1. Sandstone, light yellowish-gray, stained faintly pink locally, fine- to medium-grained, some scattered ferruginous concretions, crossbedded, friable; forms cliff-----	<u>64</u>

Partial thickness (rounded) Lakota Formation 176

Base of the exposure.

Locality 20.--Parts of the Fall River and Lakota Formations north of
Wyoming State Highway 111 about ¼ miles west of Aladdin, NW¼ sec. 23,
T. 54 N., R. 62 W., Creek County, Wyo.

Top of the hill.

Fall River Formation (part):

19. Sandstone, light yellowish-gray, fine-grained, friable, crossbedded; some nodules cemented by iron oxides; forms cliff-----	50
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Fall River Formation--Continued

Feet

18.	Mestly covered; some gray shaly siltstone and silty shale about the middle-----	17
17.	Sandstone, orange-brown, fine to very fine grained, in beds as much as 1 ft thick; a few seams cemented with iron oxides; forms ledges-----	15
16.	Siltstone, light-gray; a few thin beds of pink-weathering very fine grained cross-laminated sandstone; some seams and nodules cemented by iron oxides; nonresistant-----	5
15.	Sandstone, yellowish-gray, very fine grained to silty; forms ledge-----	2
14.	Siltstone, gray, silty, nonresistant-----	3
13.	Siltstone, yellowish-gray, locally carbonaceous, fusoidal markings on the bedding surfaces; thin-bedded; a few seams cemented with iron oxides; locally crossbedded; forms ledges-----	8
12.	Siltstone, light- to medium-gray, shaly; a few pink-weathering seams cemented by iron oxides-----	6

Partial thickness Fall River Formation 106

Unconformity.

Lakota Formation (part):

11.	Claystone, gray, mottled yellow and red, silty, locally sandy; contains many small ferruginous spherules-----	13
10.	Siltstone, light-gray, mottled yellow, clayey; grades locally to silty sandstone; nonresistant-----	8
9.	Siltstone and silty claystone, medium-gray, nonresistant---	18
8.	Covered-----	5
7.	Claystone, medium-gray, silty; a few sandy seams-----	22
6.	Sandstone, very light gray, fine- to medium-grained, clayey, hard; top surface impregnated with iron oxides; forms ledge-----	2
5.	Covered-----	9

	<u>Feet</u>
Lakota Formation--Continued	
4. Claystone, medium-gray, sandy to very sandy; a few lenticular beds of light-gray poorly sorted clayey sandstone; nonresistant-----	6
3. Sandstone, light-gray, locally stained pink, fine- to coarse-grained, local lenses of granule and pebble conglomerate, many fragments of white very fine grained sandstone and siltstone, very friable, nonresistant-----	15
2. Sandstone, light-gray to light yellowish-gray, mostly fine-grained; lenses of coarse-grained to granule sandstone in top half; local seams containing fragments of white siltstone and very fine grained sandstone; friable; crossbedded; forms cliff-----	43
1. Sandstone, light-gray to light yellowish-gray, fine-grained, friable, locally crossbedded; forms cliff-----	<u>32</u>
Partial thickness Lakota Formation	173

Base of the exposure.

Locality 21.--Parts of the Fall River and Lakota Formations north of Wyoming State Highway 111 about $3\frac{1}{2}$ miles west of Aladdin, NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 24, T. 54 N., R. 62 W., Creek County, Wyo.

Top of the hill.

Fall River Formation (part):

23. Sandstone, yellowish-gray, very fine grained; forms prominent ledge-----	13
22. Siltstone, gray; interbedded yellowish-gray very fine grained sandstone; very thin bedded to shaly; locally carbonaceous; nonresistant-----	16
21. Sandstone, light yellowish-gray, fine to very fine grained, friable; thin seams and nodules cemented with iron oxides; cross-laminated; fucoidal markings on the bedding surfaces in upper and lower parts; forms ledges-----	10
20. Shale, olive-gray, silty, carbonaceous-----	4
19. Sandstone, light yellowish-gray, very fine grained, thin-bedded at the base becoming thicker bedded at the top; forms prominent ledge-----	6

	<u>Feet</u>
Fall River Formation--Continued	
18. Siltstone, gray, weathers pink and gray, shaly; a few seams cemented with iron oxides-----	5
17. Sandstone, light yellowish-gray, very fine grained, very fine-grained , very thin bedded at base becoming thicker bedded at top, cross-laminated; scattered nodules cemented by iron oxides; ripple-marked at top; forms ledges-----	9
16. Sandstone, light yellowish-gray, very fine grained; scattered nodules cemented by iron oxides; forms a single blocky bed-----	2
15. Siltstone, gray, shaly; thin seams of light-gray very fine grained sandstone; locally carbonaceous; nonresistant---	<u>5</u>
Partial thickness Fall River Formation	70
Unconformity.	
Lakota Formation (part):	
14. Partly covered; upper half mostly gray claystone mottled red; numerous small ferruginous spherules at top-----	29
13. Sandstone, light-gray, local yellow and orange stain, mostly fine- to medium-grained; some stringers of coarse-grained to granule sandstone in bottom 5 ft; scattered nodules cemented by iron oxides; friable; crossbedded; forms cliff-----	24
12. Partly covered; mostly medium-gray sandy claystone-----	8
11. Sandstone, yellowish-gray, fine- to coarse-grained, poorly sorted; seams of gray chert and a few seams cemented by iron oxides; forms ledge-----	2
10. Sandstone, mostly light-gray, mottled yellow and pink, fine- to coarse-grained, very poorly sorted, clayey; a few seams cemented by iron oxides; mostly nonresistant; forms a few ledges locally-----	9
9. Sandstone, yellowish-gray, fine- to medium-grained with scattered coarser grains, poorly sorted; basal part irregularly cemented by iron oxides; forms hard blocky ledge-----	2
8. Claystone, gray and reddish-purple, sandy; grades locally to clayey sandstone-----	6

Lakota Formation--Continued

Feet

7. Mostly covered; some gray friable fine- to medium-grained sandstone in basal part, nonresistant----- 10
6. Sandstone, light-gray to light yellowish-gray, locally mottled pink, mostly medium-grained becoming coarser grained at top; a few stringers of coarse-grained to granule sandstone in top half; a bed 1 ft thick at base contains reworked fragments of grayish-white siltstone and very fine grained sandstone; friable; forms cliff--- 43
5. Sandstone, light-gray to light yellowish-gray, mostly fine-grained becoming fine- to medium-grained in top 10 ft; a few seams containing fragments of grayish-white siltstone; friable; crossbedded; forms ledges----- 28
4. Partly covered; some dark-gray carbonaceous shale----- 3
3. Sandstone, light-gray to light yellowish-gray, fine to very fine grained, friable, crossbedded; a seam of medium-gray sandy shale about 6 ft above the base; a few scattered nodules cemented by iron oxides; forms ledges----- 10
2. Covered----- 5
1. Partly covered; appears to be mostly medium- to dark-gray claystone with a few interbedded seams of yellowish-gray fine-grained sandstone; locally carbonaceous; non-resistant----- 38

Partial thickness Lakota Formation 217

Base of the exposure.

Locality 22.--Lakota and Morrison Formations and part of the Fall River Formation north of Wyoming State Highway 111 about 2½ miles west of Aladdin, NW¼ NW¼ sec. 30, T. 54 N., R. 61 W., Creek County, Wyo.

Top of the ridge.

Fall River Formation (part):

22. Covered----- 7
21. Sandstone, yellowish-gray to reddish-brown, fine-grained, friable, crossbedded; a few scattered nodules cemented by iron oxides; forms ledges and cliffs----- 40
20. Covered----- 22

	<u>Feet</u>
Fall River Formation--Continued	
19. Sandstone, light-gray, weathers light brown, very fine grained, in slabby beds mostly less than $\frac{1}{2}$ ft thick, local fucoidal markings on bedding surfaces, ripple-marked; a few seams cemented by iron oxides; forms local ledges-----	11
18. Siltstone, dark-gray, shaly-----	4
17. Sandstone, light-gray, weathers yellowish-gray, thin-bedded at top becoming thicker bedded at base; a few seams cemented by iron oxides; forms ledges-----	9
16. Partly covered; some dark-gray shaly siltstone-----	2
15. Sandstone, light-gray and light yellowish-gray, very fine grained, thin-bedded; many thin seams cemented by iron oxides; carbonaceous in lower part; forms ledges-----	8
14. Covered-----	7

Partial thickness Fall River Formation 110

Unconformity.

Lakota Formation:

13. Mostly covered; some gray siltstone mottled orange and yellow in top 5 ft-----	36
12. Sandstone, light orange-brown, fine-grained, a few nodules cemented by iron oxides, crossbedded; forms ledges-----	12
11. Siltstone, grayish-white; and silty and sandy light-gray claystone, mottled pink and yellow; a few stringers cemented by iron oxides near top of unit; mostly non-resistant in lower part; upper part forms ledges-----	8
10. Sandstone, grayish-white, some red and pink stain, very fine grained, friable, mostly nonresistant-----	17
9. Sandstone, light-gray to light yellowish-gray, mostly medium-grained with several lenses of coarse-grained to granule sandstone; fragments of white very fine grained sandstone in basal part; friable; crossbedded; forms cliff-----	53
8. Sandstone, light-gray to light yellowish-gray, fine to very fine grained, friable, crossbedded; forms ledges-----	6

	<u>Feet</u>
Lakota Formation--Continued	
7. Mostly covered; basal 10 ft mostly gray shale interbedded with light-gray very fine grained carbonaceous sandstone-----	22
6. Sandstone, light-gray and light yellowish-gray, very fine grained, in blocky beds as much as 1 ft thick separated by thin partings of brown and gray shaly siltstone; carbonaceous; forms ledges-----	5
5. Shale, dark-gray and brownish-gray, slightly carbonaceous-----	6
Thickness Lakota Formation	
	165

Morrison Formation:

4. Partly covered; mostly medium-gray to greenish-gray claystone, silty, noncalcareous-----	27
3. Claystone, greenish-gray with purplish-red bands, silty, calcareous; a few thin nodular beds of gray argillaceous limestone-----	38
2. Covered-----	20
Thickness Morrison Formation	
	85

Sundance Formation (part):

Redwater Shale Member (part):

1. Poorly exposed; some yellow very fine grained calcareous sandstone in weathered outcrops-----	1
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Base of the exposure on south side of highway.

Locality 23.--Parts of the Fall River and Lakota Formations north of Wyoming State Highway 111, about 1 3/4 miles west of Aladdin, NE 1/4 NE 1/4 sec. 30, T. 54 N., R. 61 W., Creek County, Wyo.

Top of the ridge.

Fall River Formation (part):

19. Covered-----	12
18. Sandstone, pink, fine-grained, friable; forms ledge-----	2

	<u>Feet</u>
Fall River Formation--Continued	
17. Covered-----	17
16. Sandstone, light yellowish-gray, weathers brown, fine to very fine grained, friable, cross-laminated; top surface cemented by iron oxides; forms massive ledge-----	19
15. Covered-----	27
14. Sandstone, light-gray, weathers yellowish-gray, very fine grained, beds mostly less than $\frac{1}{2}$ ft thick; scattered nodules and a few seams cemented by iron oxides; forms ledge-----	3
13. Mostly covered; some medium- to light-gray siltstone-----	4
12. Siltstone, dark-gray at top, brown at base, shaly, very carbonaceous at base-----	1
11. Siltstone, light-gray, weathers yellowish-gray, locally grades to very fine grained sandstone, in beds 1 to 2 ft thick at top and base, thinner bedded in middle; a few seams cemented by iron oxides; locally ripple-marked; forms ledges-----	9
10. Siltstone, laminated light- and dark-gray, shaly-----	2
9. Siltstone, light-gray to yellowish-gray, grades to very fine grained sandstone, in blocky beds mostly $\frac{1}{2}$ to 2 ft thick; some nodules and seams cemented by iron oxides; cross-laminated; forms persistent ledges-----	7
8. Partly covered; mostly dark-gray shaly carbonaceous siltstone, nonresistant-----	<u>8</u>

Partial thickness Fall River Formation 111

Unconformity.

Lakota Formation (part):

7. Claystone, olive-gray, light-gray, and purplish-gray, silty, locally numerous small ferruginous spherules in upper 10 ft-----	35
6. Sandstone, light-gray, weathers orange-brown, mostly fine- to medium-grained with stringers of medium- to very coarse grained sandstone and a few granules in the bottom 20 ft; lenticular partings of grayish-white very fine grained sandstone in top 10 ft; friable; forms cliff-----	50
crossbedded;	

Lakota Formation--Continued

Feet

- | | |
|--|----------|
| 5. Mostly covered; some dark-gray silty carbonaceous claystone in bottom 5 ft; a bed 3 ft thick of brown carbonaceous shale about 12 ft above the base; a bed 2 ft thick of brown carbonaceous shale about 20 ft above the base----- | 37 |
| 4. Sandstone, light-gray, some yellow stain, fine-grained, friable, crossbedded; forms cliff----- | 22 |
| 3. Covered----- | 6 |
| 2. Claystone, medium-gray, silty to sandy; a few thin seams of light-gray fine-grained locally carbonaceous sandstone; nonresistant----- | 24 |
| 1. Sandstone, light-gray to light yellowish-gray, fine-grained, friable----- | <u>3</u> |

Partial thickness Lakota Formation 177

Base of the exposure.

Locality 24.--Parts of the Fall River and Lakota Formations along the Middle Fork of Hay Creek, SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 22, T. 54 N., R. 61 W., Crook County, Wyo.

Top of the ridge.

Fall River Formation (part):

- | | |
|---|----|
| 14. Covered----- | 6 |
| 13. Sandstone, light-gray to pinkish-brown, fine- to medium-grained, friable, locally micaceous, crossbedded; scattered nodules cemented by iron oxides; forms massive vertical cliff. (About 1,000 ft west this bed is as much as 100 ft thick. Where the bed is thickest, its base appears to cut downward at least to the top of unit 8, below)----- | 55 |
| 12. Covered----- | 16 |
| 11. Siltstone, laminated light- and dark-gray, very thin bedded to shaly; a few seams cemented by iron oxides; non-resistant----- | 6 |
| 10. Sandstone, light-gray, weathers pink locally, very fine grained, beds as much as 1 ft thick; upper surface impregnated by iron oxides; forms persistent ledge----- | 4 |

	<u>Feet</u>
Fall River Formation--Continued	
9. Poorly exposed; mostly medium- to dark-gray shaly siltstone in nearby outcrops-----	6
8. Sandstone, light-gray, weathers brown, very fine grained, slightly carbonaceous; beds mostly less than $\frac{1}{2}$ ft thick; a few seams cemented by iron oxides; forms slabby ledges	2 $\frac{1}{2}$
7. Siltstone, light- and dark-gray, micaceous, shaly-----	13
6. Sandstone as in unit 8, above-----	4
5. Mostly covered; some dark-gray shaly slightly carbonaceous siltstone at base-----	<u>7$\frac{1}{2}$</u>

Partial thickness Fall River Formation 120

Unconformity.

Lakota Formation (part):

4. Siltstone, olive-gray to medium-gray, weathers red and white, locally sandy; abundant small ferruginous spherules; nonresistant-----	13
3. Sandstone, yellowish-gray, weathers yellowish-brown, fine- to medium-grained, crossbedded; forms rounded ledges----	33
2. Siltstone, medium-gray, weathers grayish-white; a few lenticular seams cemented with iron oxides; unit thickens locally to as much as 10 ft; nonresistant-----	4
1. Sandstone, yellowish-gray, weathers orange-brown, mostly fine- to medium-grained; a lens of granule sandstone about 15 ft above the base contains fragments of reworked white siltstone; local partings of grayish-white siltstone and very fine grained sandstone; forms cliff-----	<u>40</u>

Partial thickness Lakota Formation 90

Base of the exposure at creek level.

Locality 25.--Parts of the Fall River and Lakota Formations near Aladdin,
NW 1/4 SE 1/4 sec. 28, T. 54 N., R. 61 W., Creek County, Wyo.

[Measured by K. M. Waage and Copeland MacClintock, 1955]

Feet

Fall River Formation (part):

21. Sandstone, weathers brown to orange-brown, medium-grained, massive, cross-laminated; thickens laterally and coalesces with unit 19, below-----	4
20. Mostly covered; some silty light-gray shale in lower part----	10.6
19. Sandstone, weathers yellow-gray to orange-brown, fine- to medium-grained, massive, cross-laminated-----	11.5
18. Sandstone, weathers light gray, local yellow to orange-brown stain, fine- to medium-grained, thin-bedded, laminated; forms shelving ledge-----	13.6
17. Covered; platy laminated sandstone in float-----	30
16. Sandstone, weathers light yellow-gray to brown, fine-grained, massive, laminated to cross-laminated-----	3.7
15. Covered-----	6.0
14. Sandstone, weathers buff to brown, fine- to medium-grained, cross-laminated, fucoidal markings on bedding surfaces and some vertical borings, ripple-marked-----	4.0
13. Shale, gray to dark-gray, silty, carbonaceous-----	4.6

Partial thickness (rounded) Fall River Formation 88

Unconformity.

Lakota Formation (part):

12. Siltstone and silty claystone, light-gray to white-----	.5
11. Claystone, silty, and some clayey siltstone; white, mottled yellow and orange, massive-----	2.0
10. Covered-----	44
9. Sandstone, medium-grained; channel-fills of brown-weathering massive cross-laminated sandstone irregularly interbedded with friable crossbedded sandstone like unit 8-----	21.5

Feet

Lakota Formation--Continued

8. Sandstone, weathers gray-white, stained pink to red, medium-grained, thinly crossbedded, locally friable, locally silty; contains layers and local lenses of thick-bedded sandstone impregnated by iron oxides----- 20.4
7. Sandstone, weathers brown, medium-grained, massive, cross-laminated; some scattered sandy claystone pellets in lower part----- 15
6. Sandstone, light-gray, stained pink, fine-grained; interbedded soft shaly siltstone containing thin layers impregnated by iron oxides----- 5.3
5. Sandstone, weathers buff to brown, local pink stain, medium-grained, massive, cross-laminated, lenticular----- 5.0
4. Covered; gray-white shaly siltstone in float----- 2.5
3. Sandstone, weathers buff to brown, medium-grained, locally conglomeratic, massive, cross-laminated; thin layers containing granules and pebbles of chert and quartzite; a few lenses containing fragments of siltstone and sandstone; upper surface locally impregnated by iron oxides-- 13
2. Conglomerate; mixture of large blocks and poorly rounded pieces of sandstone, hard platy siltstone, pellets of claystone, and granules and scattered polished pebbles of chert and quartzite in matrix of fine- to coarse-grained sandstone; iron-stained molds of plant fragments- 0.5-2.5
1. Sandstone, weathers light-gray to buff with pinkish cast, medium-grained, massive, cross-laminated; basal 6.0 ft contains molds of plant stems and oval ferruginous concretions----- 33.5

Partial thickness (rounded) Lakota Formation 165

Caved mine entry.

Locality 26.--Parts of the Fall River and Lakota Formations north of Wyoming State Highway 111, about $\frac{1}{2}$ mile east of Aladdin, SE $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 28, T. 54 N., R. 61 W., Creek County, Wyo.

Top of the ridge.

Fall River Formation (part):

19. Covered----- 15

Feet

Fall River Formation--Continued

18. Sandstone, light-gray, weathers light orange-brown, fine-grained, crossbedded; scattered concretions cemented by iron oxides; forms massive rounded ledges-----	47
17. Covered-----	25
16. Sandstone, light-gray to light yellowish-gray, very fine grained to silty; forms slabby to blocky ledges-----	6
15. Siltstone, medium-gray, shaly-----	6
14. Sandstone, light-gray, very fine grained, thin-bedded; a few seams cemented by iron oxides; some faint vertical tubelike structures; ripple-marked; forms ledge-----	5
13. Siltstone, olive-gray, shaly at base, slabby at top; a few seams cemented by iron oxides-----	5
12. Shale, very dark gray, sealy-----	<u>2</u>

Partial thickness Fall River Formation 111

Unconformity.

Lakota Formation (part):

11. Claystone, olive-gray, mottled yellow, silty, slightly micaceous, scattered tiny ferruginous spherules, non-resistant-----	9
10. Sandstone, very light gray, very fine grained, micaceous, cross-laminated, very thin bedded; forms local ledge----	8
9. Siltstone, olive-gray, fissile; sandy seams and laminae; micaceous; a few scattered carbonaceous fragments-----	80
8. Claystone, very dark gray at base becoming medium-gray at top; grades into unit above-----	16
7. Sandstone, grayish-white, stained yellow, very fine grained, very friable, nonresistant-----	2
6. Claystone, dark-gray, slightly silty, slightly carbonaceous	13
5. Covered-----	3
4. Sandstone, light-gray, fine-grained, carbonaceous; forms hard blocky ledges-----	12

	<u>Feet</u>
Lakota Formation--Continued	
3. Shale, brown, carbonaceous-----	4
2. Claystone, very dark gray-----	3
1. Sandstone, very light gray, fine-grained, friable, slightly carbonaceous; some interbedded very dark gray carbonaceous shale-----	5

Partial thickness Lakota Formation 155

Base of the exposure.

Locality 27.--Morrison and part of the Lakota Formations south of Aladdin,
NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 34, T. 54 N., R. 61 W., Creek County, Wyo.

[Measured by K. M. Waage and Copeland MacClintock, 1955]

Lakota Formation (part):

34. Sandstone, weathers yellow-gray to buff, medium-grained, mostly massive, cross-laminated; local lenses of intra- formational conglomerate 18.0 ft from top and 4.0 ft from base consisting of fragments of soft platy cross- bedded sandstone as much as 2 ft long; basal 3 ft has scattered chert and quartzite pebbles; forms cliff-----	72
33. Sandstone, medium-grained, conglomeratic, lenticular; grades into unit above; contains chert and quartzite granules and pebbles, and pellets and fragments of soft sandstone and sandy claystone in matrix of clayey sandstone; locally some interbedded friable sandstone-----	7.3
32. Siltstone, gray to purplish-gray, fissile, lenticular-----	2.0
31. Sandstone, weathers yellow-gray to yellow, medium-grained, massive, cross-laminated-----	20.0
30. Sandstone, as in unit above but irregularly bedded in beds $\frac{1}{2}$ to 2 ft thick; interbeds as much as $\frac{1}{2}$ ft thick of silty to sandy gray to brown locally coaly shale that increase in number and thickness downward-----	15.0
29. Shale, silty, dark brownish-gray, weathers gray with yellow stain on fracture surfaces, carbonaceous; basal $\frac{1}{2}$ ft is coaly shale; contains fern and oycad fossils-----	1.5
28. Sandstone, fine-grained, clayey; and sandy claystone; contains plant fragments-----	1.0
27. Sandstone, weathers yellow to yellow-gray, medium-grained, massive, friable; thin layer of shaly sandstone 1 ft above base; forms jointed broken ledge-----	4.0

Lakota Formation--Continued

Feet

26. Shale, silty, dark-gray to dark brown-gray, weathers gray to purplish-gray; contains plant fragments locally concentrated to form layers of coaly shale-----	4.0
25. Coal and shaly coal; upper 1.0 ft chiefly soft black coal, lower 1.5 ft is shaly coal-----	2.5
24. Shale, dark brownish-gray, sandy at base, many plant fragments-----	1.5
23. Shale, gray to brownish-gray, sandy; grades downward to shaly sandstone with thin shale interbeds; contains plant fragments including fossil ferns-----	1.8
22. Sandstone, medium-grained; carbonaceous and shaly in lower part-----	5.5
21. Shale, dark-gray, silty, plastic, weathers with blocky fracture-----	2.5
20. Coal-----	1.1
19. Claystone and shale, dark-gray at base grading up to dark-brown-----	3.0
18. Sandstone, gray, fine-grained, friable-----	.4
17. Shale, dark-gray, silty, blocky-----	1.1
16. Sandstone, weathers gray, fine-grained, silty, massive, friable-----	2.6
15. Shale as in unit 17, above; coaly at base-----	1.0
14. Coal-----	.2
13. Sandstone and interbedded siltstone, weathers light gray with yellow and brown stain on joint faces, fine-grained	2.8
12. Shale, silty, blocky, dark-gray-----	2.8
11. Siltstone, locally sandy, coaly-----	1.0
10. Shale, blocky, dark-gray, carbonaceous; locally a claystone	10.0
9. Shale, weathers gray, silty; bed 0.3 ft thick of clayey siltstone at base-----	1.6

Lakota Formation--Continued

8. Shale as in unit 10, above----- 1.3
7. Claystone, brown, silty to sandy, tough, carbonaceous----- 2.4
6. Sandstone, weathers yellowish gray, fine-grained, massive; some
laminae of carbonaceous gypsiferous silty shale and sandstone
in basal 0.2 ft----- 1.0

Partial thickness (rounded) Lakota Formation 173

Morrison Formation:

5. Claystone, greenish-gray; selenite crystals at base----- 2.8
4. Marlstone, dark greenish-gray; zones of scattered gray lime-
stone nodules and thin irregular beds of gray limestone.
Contains the charophytes Aclistochara bransoni Peck, A.
jonesi Peck, and Sphaerochara verticillata (Peck) identified
by R. E. Peck, and abundant ostracodes including Therio-
synoecum wyomingense (Branson) identified by I. G. Sohn
(USGS loc. 26926)----- 13.0
3. Mostly covered; green marlstone in a few scattered exposures;
limestone fragments in float; locally abundant ostracodes-- 15.0

Thickness (rounded) Morrison Formation 31

Sundance Formation (part):

Redwater Shale Member (part):

2. Sandstone, weathers yellow, very fine grained to silty, very
calcareous; locally grades to sandy limestone; contains
laminae and thin beds of gray fissile shale; grades into
unit below----- 11.0
1. Shale, gray; a few siltstone laminae----- 5.0

Partial thickness Sundance Formation 16

Gully bottom.

Locality 28.--Parts of the Fall River and Lakota Formations north of Wyoming
State Highway 111, about 1 mile east of Aladdin, NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 27, T. 54 N.,
R. 61 W., Crook County, Wyo.

Top of the ridge.

Fall River Formation (part):

19. Covered----- 15
18. Sandstone, light-gray to light yellowish-gray, very fine
grained to silty, thin-bedded; a few thin seams cemented by
dark brown iron oxides; forms slabby ledges----- 2

	<u>Feet</u>
Fall River Formation--Continued	
17. Covered-----	8
16. Sandstone, yellowish-gray, very fine grained to silty; a few seams cemented by iron oxides; ripple-marked; slightly carbonaceous; forms blocky ledge-----	2
15. Covered-----	<u>4</u>
Partial thickness Fall River Formation	31
Unconformity.	
Lakota Formation (part):	
14. Poorly exposed; appears to be mostly grayish-white very fine grained sandstone; scattered small ferruginous spherules--	3
13. Sandstone, alternating grayish-white and yellowish-gray beds, some pink stain, fine-grained, thin-bedded, cross-lam- inated; forms ledges-----	3
12. Mostly covered; scattered exposures of friable grayish-white very fine grained sandstone; locally cemented by dark-brown iron oxides-----	9
11. Sandstone, light-gray, weathers orange-brown, mostly fine- grained, scattered coarse grains and granules of chert and quartzite and fragments of white siltstone in basal 1 to 4 ft; partings of white siltstone and very fine grained sandstone in upper part; friable; crossbedded; forms cliffs and ledges-----	75
10. Sandstone, light-gray, weathers orange-brown, mostly fine- grained, stringers of medium-grained to granule sandstone and fragments of white siltstone in bottom 6 ft; cross- bedded; friable; forms a ledge. Locally a lens as much as 3 ft thick of white siltstone separates this unit from the one above-----	18
9. Sandstone, yellowish-gray to pink, fine- to medium-grained, crossbedded, friable; forms rounded ledges and cliffs-----	45
8. Covered-----	3
7. Claystone, medium- to dark-gray, carbonaceous-----	6
6. Sandstone, light-gray to light yellowish-gray, fine-grained, friable, locally carbonaceous, crossbedded; a parting of coal 6 in. thick occurs 2 ft above the base; forms blocky ledges-----	8

	<u>Feet</u>
Lakota Formation--Continued	
5. Claystone, medium- to dark-gray, carbonaceous-----	7
4. Coal (caved mine entry)-----	1.3
3. Shale, gray, carbonaceous-----	0.4
2. Covered-----	30±
1. Claystone, dark-gray, silty, carbonaceous; a few laminae of light-gray very fine grained sandstone; a thin coaly seam about middle of the unit (exposed in road cut)-----	15

Partial thickness (rounded) Lakota Formation 224±

Base of the exposure, road level.

Locality 29.--Parts of the Fall River and Lakota Formations in road cuts and
on the adjacent hillside about 1½ miles east of Aladdin, SE¼ NE¼ sec. 27,
T. 54 N., R. 61 W., Creek County, Wyo.

Top of the ridge.

Fall River Formation (part):

14. Sandstone, light yellowish-gray, fine-grained, carbonaceous; a few scattered nodules cemented by iron oxides; forms ledge-----	1
13. Covered grassy slope-----	18
12. Sandstone, light-gray, fine- to medium-grained, cross-lamin- ated; a parting of gray siltstone about the middle; upper and lower parts form persistent ledges-----	7
11. Siltstone, gray, locally weathers red, shaly-----	1

Partial thickness Fall River Formation 27

Unconformity.

Lakota Formation (part):

10. Partly covered; mostly gray claystone mottled red, pink, and purple, silty; a few thin lenses of siltstone impregnated by iron oxides; small ferruginous spherules in top 6 ft; nonresistant-----	50±
9. Sandstone, yellowish-brown, fine-grained, irregularly cemented by iron oxides; forms bench-----	2

Lakota Formation--Continued

Feet

8. Sandstone, light-gray, locally mottled pink, mostly fine-
to medium-grained, a few stringers of granule sandstone
in basal part; partings of grayish-white siltstone in
top 4 ft; crossbedded; friable; forms local ledges.
This bed and the overlying one thicken to about 40 ft
where exposed about 50 ft to the northwest----- 16
7. Claystone, dark-gray at base, banded gray, red, and yellow
in upper part, local sandy seams about middle----- 12
6. Claystone and sandstone, interbedded; claystone is dark-
gray, sandy and silty; sandstone is light gray, very
fine grained, locally carbonaceous; nonresistant----- 20
5. Sandstone, light-gray, weathers light-brown, very fine
grained; top surface cemented by iron oxides; forms ledge 6
4. Sandstone, light-gray, very fine grained, thin-bedded,
locally carbonaceous; interbedded and interlaminated
dark-gray silty claystone----- 25
3. Sandstone, light-gray, fine to very fine grained, friable;
forms ledges----- 5
2. Claystone, dark-gray, silty to sandy; a bed 3 to 4 ft thick
of brown carbonaceous shale about middle----- 12
1. Sandstone, light-gray to light yellowish-gray, weathers
orange-brown, fine-grained, friable, crossbedded;
scattered nodules cemented by iron oxides; lenticular;
forms ledges----- 32

Partial thickness Lakota Formation 180±

Base of the exposure.

Locality 30.--Parts of the Fall River and Lakota Formations along the South
Fork of Hay Creek, 1 mile west of The Forks, SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 19, T. 54 N.,
R. 60 W., Crook County, Wyo.

Top of the ridge.

Fall River Formation (part):

13. Sandstone, light yellowish-gray, fine to very fine grained,
friable, crossbedded; forms rounded ledge----- 6
12. Covered----- 25

	<u>Feet</u>
Fall River Formation--Continued	
11. Sandstone, light yellowish-gray, very fine grained, thin-bedded, cross-laminated; forms ledges-----	6
10. Covered-----	5
9. Sandstone as in unit 11, above-----	3
8. Mostly covered; some yellowish-gray very fine grained sandstone; locally cemented by iron oxides in top 5 ft-----	22
7. Sandstone, yellowish-gray, weathers pink locally, very fine grained to silty, micaceous, thin-bedded; scattered nodules cemented by iron oxides; forms ledges-----	14
6. Sandstone, laminated pink and gray, very fine grained, very thin bedded, fucoidal markings on some bedding surfaces; forms local slabby ledges-----	6
5. Mostly covered; some laminated light- and dark-gray siltstone and sandstone-----	<u>8</u>
Partial thickness Fall River Formation	
	95

Unconformity.

Lakota Formation (part):

4. Mostly covered; some light-gray claystone, weathers yellow and pink, many small ferruginous spherules in upper part--	11
3. Sandstone, reddish-brown, medium- to coarse-grained at base becoming medium- to fine-grained at top, some reworked fragments of white siltstone, crossbedded, lenticular; forms rounded ledge-----	10
2. Sandstone, very light gray, irregularly stained pink and red, very fine grained to silty; irregular lenses as much as 5 ft thick of light-gray to light yellowish-gray fine- to medium-grained sandstone; several lenses and concretions cemented by iron oxides-----	26
1. Sandstone, light-gray to light greenish-gray, mostly very fine grained, clayey, poorly sorted, nonresistant-----	<u>10</u>

Partial thickness Lakota Formation 57

Base of the exposure.

Locality 31.--AEC cored drill hole NHR-41, about 3/4 mile northwest of the Forks, NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 19, T. 54 N., R. 60 W., Crook County, Wyo.

[Drilled March, 1955; logged by AEC personnel]

Feet

Ground surface.

Fall River Formation (part):

30. No cores taken-----	8
29. Sandstone, light-gray to yellowish-brown, limonite stain, fine to very fine grained, thin-bedded to massive, some carbonaceous flakes-----	9 $\frac{1}{2}$
28. Siltstone, gray to yellowish-brown, thin-bedded; interbedded very fine grained sandstone-----	10 $\frac{1}{2}$
27. Siltstone, medium- to dark-gray; some interbedded mudstone and very fine grained sandstone-----	10
26. Sandstone, gray to brown, very fine grained, thin- to medium-bedded, locally cross-laminated-----	28
25. Mudstone, medium- to dark-gray-----	7
24. Siltstone, gray, thin-bedded, scattered carbonaceous fragments; some interbedded very fine grained sandstone; pyrite crystals about middle of unit-----	12
23. Sandstone, yellowish-gray, very fine grained to silty, thin-bedded, locally cross-laminated-----	15
22. Shale, gray to dark-gray, silty-----	5
21. Siltstone, black, carbonaceous-----	1 $\frac{1}{2}$

Partial thickness Fall River Formation 106 $\frac{1}{2}$

Unconformity.

Lakota Formation:

20. Siltstone, pink to pinkish-gray-----	2 $\frac{1}{2}$
19. Sandstone, pinkish-gray to white, clayey, massive-----	5
18. Mudstone, light-brown in upper part, pink in bottom 4 ft-----	12
17. No core recovered-----	9 $\frac{1}{2}$

	<u>Feet</u>
Lakota Formation--Continued	
16. Sandstone, gray, fine- to medium-grained, poorly sorted, massive-----	7½
15. No core recovered-----	2½
14. Mudstone, light- to dark-gray and greenish-gray, spotted by specks of hematite and limonite-----	10½
13. Sandstone, gray to yellowish-gray, very fine grained to silty, thick-bedded-----	4
12. Claystone, gray and greenish-gray-----	9½
11. Sandstone, light-gray, very fine grained to silty-----	2
10. Siltstone, medium-gray, sandy, massive-----	3
9. Sandstone, light-gray, mostly fine to very fine grained, locally medium-grained near base, massive; mudstone split about 0.5 ft thick near top-----	30
8. Claystone, light-gray-----	3½
7. Siltstone, gray, clayey, hard-----	3½
6. Sandstone, light-gray, mostly fine to very fine grained, locally medium-grained, mostly massive, locally cross-bedded; possible parting 1 ft thick of light-gray claystone about 6½ ft below the top-----	62½
5. Mudstone, light-gray-----	1
4. Sandstone, light-gray, mostly medium to very fine grained; coarse-grained layer about 6 ft above base; massive to crossbedded; poorly sorted in basal part-----	29½
3. Claystone, mostly light- to dark-gray; black lignitic streak in upper part; bed 1 ft thick of yellow-brown very fine grained sandstone 4 ft below top-----	12½
2. Siltstone, gray, sandy; some interbedded mudstone-----	6½

Thickness Lakota Formation 217

Morrison Formation (part):

- | | |
|---|----|
| 1. Claystone, green and grayish-green, massive, some pyrite---- | 6½ |
|---|----|

Bottom of hole, total depth 330 ft.

Locality 32.--Parts of the Fall River and Lakota Formations on about the crest of the LaFlamme anticline about 3/4 mile northeast of The Forks, NW 1/4 sec. 21, T. 54 N., R. 60 W., Crook County, Wyo.

Feet

Top of the hill.

Fall River Formation (part):

22. Covered grassy slope-----	26
21. Sandstone, yellowish-gray to reddish-brown, fine to very fine grained, thin-bedded at base becoming thicker bedded at top, ripple-marked at top; forms prominent ledge-----	18
20. Partly covered; mostly yellowish-gray very fine grained sandstone; interbedded dark-gray silty shale and siltstone; nonresistant-----	6 1/2
19. Sandstone, light olive-gray, very fine grained to silty, very thin bedded, cross-laminated, nonresistant-----	8 1/2
18. Shale, dark-gray, silty; some interlaminated medium-gray siltstone-----	3
17. Partly covered; mostly interbedded light olive-gray very fine grained sandstone and siltstone; nonresistant-----	6
16. Sandstone, light yellowish-gray, very fine grained, micaceous, ripple-marked; upper part impregnated by iron oxides; forms persistent slabby ledges-----	5
15. Covered-----	9
14. Siltstone, yellowish-gray, ripple-marked; thin seams cemented by iron oxides; forms persistent blocky ledge-----	3
13. Mostly covered; some laminated olive-gray and dark-gray siltstone in top 6 ft-----	<u>15</u>

Partial thickness Fall River Formation 100

Unconformity.

Lakota Formation (part):

12. Partly covered; light-gray sandy claystone mottled purplish-gray, red, and yellow in upper half-----	24
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Lakota Formation--Continued

Feet

11. Sandstone, olive-gray, purplish-gray, and yellow, very fine grained, clayey; some interbedded siltstone; lenses 1 to 3 ft thick of fine-grained sandstone about 10 ft above base and 6 ft below top; scattered tiny ferruginous spherules in upper part; nonresistant----- 31
10. Siltstone, very light gray to very light greenish gray, a few seams of grayish-white very fine grained sandstone, nonresistant----- 12
9. Sandstone, light-gray, mottled and stained yellow and brown, fine to very fine grained; scattered nodules cemented by iron oxides; friable; forms prominent bench----- 6
8. Mostly covered; some claystone mottled yellow, green, and orange-red in upper part----- 11
7. Sandstone, grayish-white, mostly fine-grained, a few stringers of medium- to coarse-grained sandstone, poorly sorted, friable; forms ledge----- 3
6. Claystone, yellow, sandy to very sandy----- 3
5. Sandstone, grayish-white, fine-grained, friable, crossbedded; a parting 1 to 3 ft thick of yellow clayey siltstone about 10 ft below top; forms ledges----- 22
4. Covered----- 6
3. Sandstone as in unit 5, above----- 13
2. Mostly covered; some dark olive-gray to reddish-brown clay-stone----- 18
1. Sandstone, light-gray, mottled light shales of yellow and pink, fine-grained, crossbedded, friable; forms ledges--- 29

Partial thickness Lakota Formation 178

Base of the exposure.

Locality 33.--Parts of the Fall River and Lakota Formations on the east flank of the LaPlamme anticline, SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 7, T. 8 N., R. 1 E., Butte County, S. Dak.

Top of the hill.

Fall River Formation (part):

15. Sandstone, light orange-brown, very fine grained, thin-bedded, micaceous; a few nodules cemented by iron oxides; some casts of wood; forms blocky ledge----- $\frac{1}{2}$

	<u>Feet</u>
Fall River Formation--Continued	
14. Covered grassy slope-----	9
13. Sandstone, light-brown, very fine grained, thin-bedded; forms platy ledges-----	5½
12. Covered-----	1
11. Sandstone, light-brown, very fine grained to silty, thin- bedded, slightly carbonaceous; forms ledges-----	6
10. Covered-----	5
9. Sandstone, light yellowish-gray, very fine grained, micaceous, very thin bedded; forms minor ledges-----	1½
8. Partly covered; medium- to dark-gray siltstone in lower part and interlaminated siltstone and very fine grained sandstone near middle; locally carbonaceous-----	17
7. Siltstone, light-gray, weathers light-brown; top part cemented by iron oxides; cross-laminated; forms blocky ledge-----	2½
6. Siltstone, dark-gray at base, medium-gray at top, shaly, slightly carbonaceous, nonresistant-----	2
Partial thickness Fall River Formation	57

Unconformity.

Lakota Formation (part):

5. Claystone, light-gray, mottled purple, yellow, and pink, silty; contains numerous small ferruginous spherules; weathers to tough gumbo soil; locally lenses as much as 2 ft thick of yellowish-gray very fine grained ferruginous sandstone-----	9
4. Sandstone, grayish-white, weathers light-brown, very fine grained, calcareous, cross-laminated; pinches out laterally into silty claystone; locally forms ledge-----	3
3. Siltstone, grayish-white, friable, nonresistant-----	7
2. Sandstone, grayish-white, locally stained and mottled pink and yellow, fine-grained; a few reworked fragments of grayish-white siltstone; scattered nodules cemented by iron oxides; crossbedded; forms ledge-----	15

	<u>Feet</u>
Lakota Formation--Continued	
1. Claystone, greenish-gray, soft, plastic-----	<u>3</u>
Partial thickness Lakota Formation	37
Base of the exposure.	
Locality 34.--Lakota Formation and parts of the Fall River and Morrison Formations in road cuts and on the adjacent hillside on the east flank of the LaFlamme anticline, SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 17, T. 8 N., R. 1 E., Butte <u>County, S. Dak.</u>	
Top of the hill.	
Fall River Formation (part):	
25. Mostly covered; a bed of very fine grained brown weathering sandstone $\frac{1}{2}$ ft thick makes a dip slope at the top-----	13
24. Sandstone, light yellowish-gray, very fine grained to silty, thin-bedded, crossbedded; a few fucoidal markings on the bedding surfaces; top part cemented by brown iron oxides; forms ledge-----	4
23. Partly covered; olive-gray shaly siltstone in bottom half--	10
22. Siltstone, yellowish-gray, very thin bedded; a few thin seams cemented by iron oxides; carbonaceous; forms slabby ledges-----	2
21. Siltstone, dark-gray, shaly-----	<u>2</u>
Partial thickness Fall River Formation	31
Unconformity.	
Lakota Formation:	
20. Shale, light-gray, a few thin yellow bands, slightly silty; small weathered ferruginous spherules in top 5 ft-----	24
19. Sandstone, light-gray to light yellowish-gray, very fine grained, cross-laminated, calcareous at top-----	9
18. Claystone, lower part red and olive-gray, upper part dark- gray. Within a few yards south, this bed pinches out and units 19 and 17 thicken and join to form a bed about 25 ft thick of brown-weathering fine-grained sandstone--	6 $\frac{1}{2}$
17. Sandstone, yellowish-brown, fine-grained, crossbedded, friable; forms prominent blocky ledge-----	4

Lakota Formation--Continued	Feet
16. Siltstone, grayish-white, local pink stain, blocky to concoidal fracture-----	6½
15. Sandstone, grayish-white, very fine grained, in beds ½ to 4 ft thick; interbedded green locally sandy claystone; some reworked fragments of white siltstone in upper part; forms ledges-----	14
14. Sandstone, very light gray and very light greenish gray, mostly fine-grained, scattered medium- to very coarse grains; locally clayey; nonresistant-----	9
13. Shale, dark brownish-gray, sandy; some interbedded shaly sandstone; carbonaceous; contain ostracodes identified by I. G. Sohn as " <u>Bairdiocypris</u> " spp.; <u>Cypridea</u> ? sp.; " <u>Metacypris</u> "? spp.; large smooth form, genus indet.; small smooth form, genus indet. (loc. 253-13)-----	2
12. Sandstone, light yellowish-gray, mostly fine-grained, scattered medium- to coarse grains, crossbedded; forms ledges-----	8
11. Interbedded sandstone and shale; sandstone is light gray, mostly fine grained, scattered coarser grains, friable, locally calcareous; shale is dark gray, greenish gray, and olive gray, locally calcareous; contains ostracodes--	11
10. Sandstone, very light gray, locally stained yellow, fine- to medium-grained, friable, nonresistant-----	3
9. Sandstone, very light gray, very fine grained, friable; a few seams of olive-gray siltstone and silty claystone; locally carbonaceous; nonresistant-----	7
8. Claystone, dark-gray, sandy; grades to clayey sandstone-----	3
7. Sandstone, very light gray, mostly very fine grained, a few thin streaks of fine- to medium-grained sandstone; friable; cross-laminated; locally carbonaceous; locally calcareous; forms ledges-----	19
6. Partly covered; greenish-gray slightly silty noncalcareous claystone at base and top-----	8
5. Covered-----	14

Lakota Formation--Continued

Feet

4. Sandstone, very light gray, very fine grained, very friable- 3

Thickness Lakota Formation 151

Morrison(?) Formation (part):

3. Covered----- 21
2. Poorly exposed; some greenish-gray silty calcareous clay-
stone in scattered exposures----- 12
1. Covered to bottom of hill----- 6

Partial thickness Morrison(?) Formation 39

Stream bottom.

Locality 35.--Parts of the Fall River and Lakota Formations south of South
Dakota State Highway 24, SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 23, T. 8 N., R. 1 E., Butte County,
S. Dak.

Top of the hill.

Fall River Formation (part):

18. Grass-covered slope----- 7
17. Sandstone, grayish-yellow, weathers yellowish orange, locally
stained pink, fine-grained, friable, crossbedded; len-
ticular seams at top and base cemented by iron oxides;
forms ledge----- 12
16. Partly covered; mostly grayish-yellow fine to very fine
grained cross-laminated sandstone in beds about 1 in. to
 $\frac{1}{2}$ ft thick----- 5
15. Sandstone, grayish-yellow, fine to very fine grained, in
lenticular beds as much as 1 ft thick; fucoidal markings
on the bedding surfaces; a few thin seams impregnated by
iron oxides; locally cross-laminated; forms slabby ledges 5
14. Partly covered; mostly grayish-yellow fine to very fine
grained sandstone interbedded with gray siltstone and
silty shale----- 14 $\frac{1}{2}$
13. Siltstone, medium- to dark-gray, sandy, slightly carbonaceous,
fissile----- 2

	<u>Feet</u>
Fall River Formation--Continued	
12. Sandstone, light-gray, weathers yellowish-gray, very fine grained, carbonaceous, massive in upper part becoming thin-bedded in basal $\frac{1}{2}$ ft; some thin lenses and nodules cemented by iron oxides; forms ledge locally-----	4 $\frac{1}{2}$
11. Shale, dark-gray to black, sandy in upper part, carbonaceous	2
10. Sandstone, dark-gray to black, coaly, lenticular-----	$\frac{1}{2}$
9. Sandstone, light-gray, fine to very fine grained, in beds $\frac{1}{2}$ to 2 ft thick, cross-laminated, carbonaceous in top 4 ft; scattered nodules and thin seams cemented by iron oxides; forms ledges-----	20 $\frac{1}{2}$
8. Siltstone, gray, shaly; interlaminated grayish-yellow very fine grained sandstone in beds as much as 3 in. thick, fucoidal markings on some bedding surfaces, carbonaceous in top 5 ft and in basal 3 ft; a few thin lenses cemented by dark-brown iron oxides-----	13 $\frac{1}{2}$
7. Sandstone, grayish-yellow, very fine grained, massive; scattered nodules cemented by iron oxides; forms persistent ledge-----	3
6. Sandstone, grayish-yellow, very fine grained, micaceous, thin-bedded; some interlaminated dark-gray and olive-gray shaly siltstone; fucoidal markings on some bedding surfaces-----	11 $\frac{1}{2}$
5. Siltstone, dusky-yellow, shaly, slightly carbonaceous-----	5
4. Siltstone, dark-gray, shaly, slightly carbonaceous-----	2 $\frac{1}{2}$
3. Siltstone, brownish-gray, very carbonaceous, lenticular; forms ledge-----	$\frac{1}{2}$
2. Shale, dark-gray, very carbonaceous to coaly-----	1

Partial thickness Fall River Formation 113

Unconformity.

Lakota Formation (part):

1. Claystone, medium-gray, locally mottled yellow and pink, slightly carbonaceous in top 6 in.; abundant small ferruginous spherules-----	8
---	---

Base of the exposure.

Locality 36.--Parts of the Fall River and Lakota Formations at Mona Butte,
SE 1/4 sec. 22, T. 56 N., R. 63 W., Crook County, Wyo.

[Measured by K. M. Waagé and Copeland MacClintock, 1955]

Feet

Top of butte.

Fall River Formation (part):

- | | |
|---|-----|
| 31. Sandstone, weathers brownish-orange, medium-grained, cross-bedded, friable----- | 5.3 |
| 30. Sandstone, weathers yellow-gray and orange-red, medium-grained, massive; contains seams and scattered small hollow concretions cemented by iron oxides; basal 0.1 ft impregnated by iron oxides; forms ledge----- | 51 |

Partial thickness (rounded) Fall River Formation 56

Unconformity.

Lakota Formation (part):

- | | |
|--|-----|
| 29. Siltstone, gray, clayey; weathers to white clayey soil; abundant ferruginous spherules; sandy at base----- | 4.7 |
| 28. Sandstone, light-gray to yellowish-gray, fine-grained, massive; upper 0.5 to 1.0 ft locally quartzitic; locally contains vertical tubular ferruginous concretions----- | 2.7 |
| 27. Sandstone, light-gray, fine-grained, friable, locally clayey; scattered yellow ferruginous specks----- | 3.2 |
| 26. Sandstone, light-gray to light yellowish-gray, mostly medium-grained, cross-laminated; some coarse-grained sandstone lenses in lower part; forms cliff----- | 62 |
| 25. Sandstone, light-gray, coarse-grained, locally conglomeratic, friable----- | 18 |
| 24. Sandstone as in unit 26, above----- | 3 |
| 23. Conglomerate; contains granules and small pebbles mostly of gray and black chert and gray quartzite; some fragments of claystone----- | 13 |
| 22. Mostly covered; top 1 ft is conglomeratic claystone containing fragments of black and gray chert and gray quartzite----- | 5 |
| 21. Sandstone, light-gray, fine-grained, clayey, friable; some interbedded gray sandy claystone----- | 3.5 |

	<u>Feet</u>
Lakota Formation--Continued	
20. Claystone, dark-gray, sandy; irregular laminae and thin lenses of fine-grained sandstone-----	6.5
19. Sandstone, light-gray, fine-grained; irregularly interbedded dark-gray carbonaceous friable sandy shale and claystone-----	5.5
18. Sandstone, weathers white, medium-grained, friable; alternating beds of dark-gray to black shale; beds mostly 0.4 to 1.0 ft thick-----	22
17. Claystone, dark-gray to black, plastic, somewhat shaly; leaf fragments at top, sandy at base-----	7
16. Sandstone, light-gray, mostly medium-grained, clayey, massive; lower 1 ft contains scattered coarse grains of chert-----	6.4
15. Claystone, light-gray, sandy; grades into unit below-----	4.2
14. Sandstone, medium-grained, friable; more clayey in lower part-----	9.2
13. Claystone, light-gray, weathers yellowish-gray, sandy; locally a clayey sandstone-----	6
12. Sandstone, gray, medium-grained, friable; partings of shaly coal in lower 2 ft-----	10.6
11. Sandstone, gray, brown, and black, medium- to coarse-grained; thinly interbedded with hard conglomeratic coaly sandy shale; conglomerate contains granules and small pebbles of chert, claystone, and carbonized wood-----	2.6
10. Sandstone, light-gray, medium- to coarse-grained, cross-laminated, friable; scattered chert granules locally in lower 2 ft-----	11.2
9. Claystone, black to brown, sandy and conglomeratic, coaly; granules and small pebbles of chert, sandstone, claystone, and carbonized wood-----	.7
8. Claystone, gray to brownish-gray, slightly sandy, carbonaceous specks-----	4.6
7. Sandstone, medium-grained, friable; some interbedded sandy claystone-----	4.9

	<u>Feet</u>
Lakota Formation--Continued	
6. Sandstone, light-gray, some yellow and red stain, medium- to coarse-grained, conglomeratic; granules and small pebbles of chert scattered throughout upper 9 ft; lower 2 ft clayey-----	11
5. Claystone, gray, sandy; locally clayey sandstone-----	3.7
4. Sandstone, mostly fine- to coarse-grained; conglomeratic in lower 6 ft; granules and small pebbles of chert and quartzite; mostly friable in upper part; lower 2 to 3 ft forms resistant ledge-----	8
3. Chert, gray-white to yellow-gray, irregularly bedded-----	2.2
2. Claystone, upper half gray, weathers purplish, lower half greenish-gray; locally sandy; lenses of slabby fine- grained sandstone at top-----	6
1. Sandstone, fine-grained; veinlets of gray chert-----	2

Partial thickness (rounded) Lakota Formation 249

Base of the exposure.

Locality 37.--Parts of the Fall River and Lakota Formations on the north side
of a tributary to East Creek, SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 10, T. 55 N., R. 63 W., Crook
County, Wyo.

Top of the ridge.

Fall River Formation (part):

20. Sandstone, light-gray to light yellowish-gray, fine-grained, locally cross-laminated; a few scattered concretions cemented by iron oxides; forms massive cliff-----	65
19. Siltstone, gray, weathers purplish-pink in bottom half, shaly; a few thin seams cemented by iron oxides; nonresistant----	13
18. Sandstone, light yellowish-gray, very fine grained, thin- bedded at base becoming thicker bedded at top; a few thin seams cemented by iron oxides; ripple-marked; forms ledge-	11
17. Siltstone, light yellowish-gray, very thin bedded, nonresis- tant-----	2
16. Siltstone, medium-gray, shaly; some interlaminated light-gray siltstone and very fine grained sandstone; nonresistant---	9

	<u>Feet</u>
Fall River Formation--Continued	
15. Siltstone, yellowish-gray, thin-bedded; a few thin seams cemented by iron oxides; forms ledge-----	3½
14. Siltstone, medium-gray, shaly, nonresistant-----	4
13. Sandstone, light yellowish-gray, very fine grained, in beds as much as 1½ ft thick, locally ripple-marked; scattered small concretions cemented by iron oxides; forms blocky ledges-----	11
12. Siltstone, medium-gray with light-gray laminae; several thin seams cemented by iron oxides; nonresistant-----	1
11. Covered-----	5
10. Siltstone, medium-gray with light-gray laminae, nonresistant-----	5

Partial thickness (rounded) Fall River Formation 130

Unconformity.

Lakota Formation (part):

9. Siltstone, gray, mottled yellow and red, sandy; abundant small ferruginous spherules, nonresistant-----	7
8. Sandstone, grayish-orange, fine to very fine grained, lenticular; forms ledge-----	2
7. Covered-----	6
6. Sandstone, grayish-orange, fine to very fine grained, cross-bedded; a few scattered concretions cemented by iron oxides; forms blocky ledge-----	19
5. Covered-----	10
4. Partly covered; appears to be mostly gray claystone mottled and banded green, red, and purple; sandy-----	76
3. Sandstone, gray, mottled yellow and red, very fine grained, clayey, nonresistant; grades into unit below-----	22
2. Sandstone, grayish-white, fine to very fine grained, very friable; a few thin beds of light-green clayey sandstone; nonresistant-----	43
1. Sandstone, grayish-white, fine-grained, friable, crossbedded; forms rounded ledges-----	85

Partial thickness Lakota Formation 270

Base of the exposure.

Locality 38.--Part of the Lakota Formation north of Beaverdam Creek, NE¹/₄ sec. 22,
T. 55 N., R. 63 W., Crook County, Wyo.

	<u>Feet</u>
Top of the hill.	
Lakota Formation (part):	
17. Mostly covered; appears to be mostly medium-gray claystone. Top of the unit is probably about top of the Lakota Formation-----	8
16. Siltstone and claystone, medium-gray, mottled purple and red, nonresistant-----	30
15. Sandstone, light-gray to light yellowish-gray, mostly fine to very fine grained becoming medium- to coarse-grained at top, friable, lenticular; forms ledge-----	6
14. Claystone, banded medium-gray and grayish-red, slightly silty; red ferruginous specks in the top 5 ft-----	20
13. Claystone, medium-gray, sandy becoming more sandy in basal 5 ft; a few thin seams of clayey light-gray sandstone in top 10 ft; grades into unit below-----	28
12. Sandstone, light- to medium-gray, mostly medium-grained, scattered coarse grains and a few granules locally; polished pebbles weathering out on the slope; clayey; very friable; nonresistant; grades into unit below-----	10
11. Sandstone, light yellowish-gray, mostly medium- to coarse- grained, some scattered granules and pebbles, clayey, friable; a bed 1 ft thick of dark-gray carbonaceous clay- stone $\frac{1}{2}$ ft above base; nonresistant-----	11
10. Sandstone, light-gray, mottled and streaked pale-green, yellow, and red, very fine grained, slightly clayey, very friable, nonresistant-----	24
9. Sandstone, very light gray to very light yellowish gray, some pink stain locally, fine-grained, very friable; scattered nodules cemented by iron oxides; crossbedded; forms rounded ledges-----	50
8. Shale, brown, silty, carbonaceous-----	3
7. Sandstone, light-gray, fine to very fine grained, friable, carbonaceous, nonresistant-----	2

Lakota Formation--Continued

Feet

- | | |
|--|----|
| 6. Sandstone, very light gray, fine-grained, friable, cross-bedded; pebbles and cobbles of dark-gray laminated siltstone reworked in a lenticular zone 3 ft thick at about the base----- | 32 |
| 5. Sandstone and siltstone, interbedded; sandstone is light gray, very fine to fine grained, in beds as much as 1 ft thick; siltstone is medium gray, shaly; unit is locally carbonaceous----- | 27 |
| 4. Siltstone, black, carbonaceous; a few seams of brown carbonaceous shale; nonresistant----- | 33 |
| 3. Sandstone, light-gray, locally stained yellow, fine-grained, friable----- | 1 |
| 2. Covered----- | 5 |
| 1. Siltstone, dark-brown, carbonaceous; interbedded light-gray very fine grained sandstone and brown carbonaceous shale; nonresistant----- | 10 |

Partial thickness Lakota Formation 300

Base of the exposure.

Locality 39.--Parts of the Fall River and Lakota Formations north of Wyoming State Highway 111, about 4 miles southeast of Alva, NE $\frac{1}{4}$ sec. 24, T. 54 N., R. 63 W., Crook County, Wyo.

Top of the ridge.

Fall River Formation (part):

- | | |
|---|-----|
| 15. Sandstone, yellowish-gray, weathers brown, fine-grained; some concretions cemented by iron oxides; forms hard slabby ledges----- | 39 |
| 14. Covered----- | 20 |
| 13. Sandstone, yellowish-gray, very fine grained, in beds mostly less than 1 ft thick; top surface impregnated by iron oxides; forms ledge----- | 5 |
| 12. Covered----- | 39± |
| 11. Poorly exposed; some light-gray carbonaceous siltstone----- | 5 |

Partial thickness Fall River Formation 108±

Unconformity.

Lakota Formation (part):

10. Partly covered; mostly gray silty claystone mottled red; contains numerous small ferruginous spherules-----	16±
9. Sandstone, light-gray to light yellowish-gray, fine-grained, friable, lenticular; forms ledge-----	4
8. Mostly covered; some light-gray clayey siltstone stained pink and yellow; local very small ferruginous spherules-----	12
7. Sandstone, yellowish-gray, mostly fine- to medium-grained, grades downward to granule sandstone in bottom 2 ft; friable; crossbedded; lenticular; forms ledges-----	14
6. Claystone, medium-gray to olive-gray, silty-----	25
5. Siltstone, light-gray, mottled yellow, pink, and purple, hard, breaks with a conchoidal fracture; grades into unit above--	13
4. Claystone, very light gray, mottled yellow, pink, and purple, sandy to very sandy; a few lenticular beds of clayey poorly sorted sandstone that locally make ledges; a few thin seams of gray chert; grades into unit below-----	39
3. Sandstone, light-gray to light yellowish-gray, mostly very fine to medium-grained, scattered coarser grains, a few polished pebbles weathering out on the slope, very friable	34
2. Sandstone, yellowish-gray, mostly medium- to coarse-grained, local lenses of very coarse grained to granule sandstone, friable, conspicuously crossbedded; forms upper part of massive cliff-----	28
1. Sandstone, light-gray, stained and mottled pink, fine-grained, a few reworked fragments of white siltstone about 50 ft above base; friable; crossbedded; forms lower part of massive cliff-----	85

Partial thickness Lakota Formation 270±

Base of the exposure.

Locality 40.--Parts of the Fall River and Lakota Formations along the Middle Fork of Hay Creek, NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 16, T. 54 N., R. 62 W., Crook County, Wyo.

	<u>Feet</u>
Top of the ridge.	
Fall River Formation (part):	
16. Sandstone, light yellowish-gray, fine- to medium-grained, slightly micaceous, locally crossbedded, ripple-marked near top, friable; contains a few thin lenses and concretions cemented by dark-brown iron oxides; upper 10 to 15 ft forms rounded ledges, remainder forms massive cliff--	85
15. Siltstone, medium-gray, thin-bedded; a few small nodules cemented by iron oxides-----	10
14. Siltstone, grayish-red, shaly-----	6
13. Sandstone, light yellowish-gray, very fine grained, fucoidal markings on bedding surfaces, in beds mostly less than $\frac{1}{2}$ ft thick separated by partings of light-gray siltstone; dark-brown layer 3 to 4 in. thick at top impregnated by iron oxides; forms blocky ledges-----	11
12. Shale, dark-gray, silty-----	2 $\frac{1}{2}$
11. Sandstone, yellowish-gray, very fine grained, massive, non-resistant-----	1
10. Sandstone, yellowish-gray, very fine grained, cross-laminated, in beds as much as 2 ft thick; forms blocky ledge-----	6
9. Sandstone and siltstone, interbedded; sandstone is light gray, very fine grained; siltstone is medium-gray; fucoidal markings on bedding surfaces; micaceous; nonresistant-----	3 $\frac{1}{2}$
8. Covered. (Interval to base of Fall River Formation estimated)	5
Partial thickness Fall River Formation	130
Unconformity.	
Lakota Formation (part):	
7. Covered by small landslide-----	55
6. Sandstone, yellowish-gray, very fine grained; makes hard blocky ledge-----	2

	<u>Feet</u>
Lakota Formation--Continued	
5. Covered; clay soil-----	22
4. Sandstone, yellowish-gray, fine-grained, crossbedded; forms blocky ledges-----	5
3. Sandstone, light-gray, stained red, very fine grained, clayey, nonresistant-----	5
2. Sandstone, light-gray to light pinkish-gray, mostly medium- grained, some coarse-grained to granule sandstone in lower part, fragments of white sandstone reworked in basal 2 to 3 ft, conspicuously crossbedded, friable; forms ledges and cliffs-----	20
1. Sandstone, very light gray, locally mottled pink and yellow, fine grained, friable; a few small concretions cemented by iron oxides; forms ledges and cliffs-----	54

Partial thickness Lakota Formation 163

Base of the exposure.

Locality 41.--Parts of the Fall River and Lakota Formations in road cuts along
Wyoming State Highway 111, 6 miles southeast of Alva, NW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 20, T. 54 N.
R. 62 W., Crook County, Wyo.

Top of the exposure.

Fall River Formation (part):

23. Sandstone, yellowish-gray to light-brown, fine-grained friable, in beds mostly 1 to 3 ft thick; a few thin lenticular partings mostly less than $\frac{1}{2}$ ft thick of olive-gray shale and light-gray siltstone; upper 15 ft slabby and contains a few thin seams and layers firmly cemented by iron oxides; locally crossbedded; forms cliff-----	52
22. Siltstone, light-gray; some lenses of yellowish-gray fine to very fine grained sandstone locally cemented by iron oxides-----	4 $\frac{1}{2}$
21. Siltstone, dark-brown, firmly cemented by iron oxides; unit pinches out in about 50 yards-----	0.2
20. Siltstone, light-gray, massive; grades into unit below-----	1
19. Claystone, dark-gray to grayish-black, weathers grayish- purple, silty and sandy-----	2 $\frac{1}{2}$

	<u>Feet</u>
Fall River Formation--Continued	
18. Siltstone, purplish-gray, massive; contains a few thin seams at top cemented by iron oxides-----	1 $\frac{1}{2}$
17. Claystone as in unit 18, above-----	5
16. Sandstone, light-gray to yellowish-gray, locally mottled pink at top, fine to very fine grained, in beds mostly 1 to 6 in. thick, fucoidal markings on bedding surfaces, shaly in top 3 ft; forms slabby ledges; grades into underlying unit-----	15
15. Siltstone and sandstone, interbedded; sandstone as in unit 16, above; siltstone is light to medium gray; unit is more silty at top-----	15 $\frac{1}{2}$
14. Siltstone, dark reddish-brown, fucoidal markings on bedding surfaces, impregnated by iron oxides, lenticular-----	$\frac{1}{2}$
13. Siltstone, medium-gray, weathers very light gray, massive; becomes sandy in bottom $\frac{1}{2}$ ft-----	4
12. Claystone, medium-gray, mottled red at base, silty; a bed of very fine grained sandstone $\frac{1}{2}$ ft thick about middle of the unit-----	3
11. Sandstone, yellowish-gray, very fine grained; upper part irregularly cemented by brown-weathering iron oxides----	$\frac{1}{2}$
10. Siltstone, light- to medium-gray, shaly-----	2 $\frac{1}{2}$
9. Siltstone, light-gray, hard, blocky; contains scattered nodules as much as 1 in. long cemented by iron oxides---	<u>1</u>

Partial thickness (rounded) Fall River Formation 109

Unconformity.

Lakota Formation (part):

8. Claystone, medium-gray, mottled grayish-red and purplish-gray, silty; contains small red ferruginous spherules mostly about 1 mm in diameter-----	13
7. Covered-----	20
6. Sandstone, yellowish-gray, fine-grained, in beds mostly less than 1 ft thick separated by partings of dark-gray silty claystone and light-gray clayey to very fine grained friable sandstone-----	20

	<u>Feet</u>
Lakota Formation--Continued	
5. Covered-----	12
4. Siltstone, light- to medium-gray, faintly mottled pink, sandy; contains lenticular beds of siltstone cemented by dark reddish-brown iron oxides, and lenses of yellowish-gray fine to very fine grained sandstone-----	18
3. Claystone, olive-gray, slightly sandy and silty-----	1½
2. Sandstone, light-gray to yellowish-gray, very fine grained, crossbedded-----	2½
1. Claystone, medium-gray to olive-gray, sandy to very sandy----	7
Partial thickness Lakota Formation	94

Base of the exposures.

Locality 42.--Lakota Formation and parts of the Fall River and Morrison Formations along a tributary to North Redwater Creek, NE¼ sec. 9, T. 53 N., R. 62 W., Crook County, Wyo.

Top of the hill.

Fall River Formation (part):

29. Sandstone, yellowish-gray, fine-grained, weathers blocky to slabby; forms ledge-----	2
28. Covered; red soil in basal part-----	54
27. Sandstone, yellowish-gray, dark-gray laminae, very fine grained to silty, nonresistant-----	3
26. Sandstone, light-gray to yellowish-gray, irregularly thin-bedded; forms prominent pitted ledge-----	8½
25. Siltstone, medium-gray to grayish-red-----	1½
24. Sandstone, light-gray to grayish-orange, fine to very fine grained, in massive beds mostly 1 to 3 ft thick; a few thin seams and nodules cemented by iron oxides; forms prominent ledge-----	13
23. Sandstone, light-gray to light yellowish-gray, fine to very fine grained, in beds mostly less than 2 in. thick; vertical tublike structures in top half; several seams cemented by iron oxides-----	3½

	<u>Feet</u>
Fall River Formation--Continued	
22. Siltstone, grayish-white, sandy-----	1 2
21. Sandstone, light-gray to light yellowish-gray, fine to very fine grained, in beds mostly less than 2 in. thick, fucoidal markings on bedding surfaces; several thin seams cemented by brown-weathering iron oxides-----	5 1/2
20. Sandstone, yellowish-gray, fine to very fine grained, in beds 2 in. to 2 ft thick; vertical tubelike markings on beds in basal 2 ft; some irregular thin seams cemented by brown- weathering iron oxides; forms ledges-----	5
19. Covered-----	1
18. Shale, medium-gray, weathers grayish-red-----	2
17. Siltstone, medium-gray, some yellowish-gray and pink laminae, carbonaceous; a few nodules cemented by iron oxides-----	2 1/2
16. Sandstone, light-gray, pink laminae, very fine grained, fucoidal markings on bedding surfaces, cross-laminated; forms minor ledge-----	1

Partial thickness Fall River Formation 103

Unconformity.

Lakota Formation:

15. Claystone, medium-gray, weathers red in middle part, abundant ferruginous spherules about 1 mm in diameter in upper half of unit, locally silty-----	12
14. Sandstone, light-gray, weathers yellowish-gray, fine- grained; forms minor ledge-----	2 1/2
13. Mostly covered; some light-gray fine-grained friable sandstone in middle part-----	3 1/2
12. Sandstone as in unit 14, above-----	1
11. Poorly exposed; some light-gray fine- to medium-grained friable sandstone in lower part-----	6 1/2
10. Sandstone, light-gray to pink, mostly fine-grained, some medium- to coarse-grained stringers, crossbedded; forms rounded locally cavernous ledge-----	19

Lakota Formation--Continued

Feet

9. Claystone, medium-gray in lower part becoming reddish-brown to yellowish-brown in upper part, very sandy, scattered fine to medium rounded sand grains; weathers to hard gumbo soil-----	9
8. Sandstone, yellowish-gray, fine- to medium-grained, very clayey, poorly sorted-----	5
7. Mostly covered; some light-gray very fine grained friable sandstone at base and top-----	17½
6. Sandstone, light-gray, mottled pink, fine-grained; forms ledge-----	2
5. Sandstone, olive-gray, fine to very fine grained, clayey, scattered rounded quartz grains-----	3
4. Sandstone, light-gray, fine- to medium-grained, becomes slightly coarser in top 5 to 6 ft, crossbedded; in top 2 to 3 ft a few nodules ½ to ¾ in. in diameter cemented by iron oxides; forms cliffs-----	72
3. Sandstone, yellowish-gray to pink, medium- to coarse-grained, crossbedded, forms cliffs-----	30
2. Covered-----	15
Partial thickness Lakota Formation 198	
Morrison(?) Formation (part):	

- | | |
|---|---|
| 1. Claystone, dark-gray, noncalcareous----- | 5 |
|---|---|

Base of the exposures.

Locality 43.--Morrison and part of the Lakota Formations on the south side of a butte about ½ mile northeast of Farrall, NW¼ sec. 13, T. 53 N., R. 62 W., Crook County, Wyo.

Lakota Formation (part):

- | | |
|---|----|
| 19. Sandstone, light-gray, mostly fine-grained, a few lenses of medium to very coarse grained sandstone in lower part, friable, crossbedded; forms cliff----- | 30 |
| 18. Sandstone, light-gray, faintly mottled pink and yellow, very fine grained, friable, in beds mostly less than ½ ft thick separated by partings of very fine grained to clayey sandstone; forms minor ledges----- | 17 |

	<u>Feet</u>
Lakota Formation--Continued	
17. Covered-----	4
16. Shale, dark-gray to brown, carbonaceous, silty-----	6
15. Partly covered; appears to be mostly dark-gray to brownish-gray silty to sandy claystone; some interbedded light-gray very fine grained carbonaceous sandstone-----	47
14. Covered-----	25
13. Sandstone, light-gray, locally mottled pink and yellow, fine-grained, friable; forms local blocky ledges-----	4
12. Covered-----	17
11. Sandstone, light-gray, locally mottled yellow-orange, fine-to very fine grained, friable, carbonaceous; top few in. firmly cemented by iron oxides; forms blocky ledges-----	<u>16</u>

Partial thickness Lakota Formation 166

Morrison Formation:

10. Claystone, greenish-gray to medium-gray, noncalcareous, silty	2
9. Claystone, greenish-gray, calcareous; contains a bed of nodular-weathering light-gray limestone in upper part; abundant ostracodes-----	4
8. Sandstone, light greenish-gray, very fine grained, calcareous	1
7. Claystone, greenish-gray, calcareous, silty; beds as much as $\frac{1}{2}$ ft thick of light-gray argillaceous limestone about 5 ft above base and at top of unit-----	11
6. Sandstone, very light gray, very fine grained, calcareous, thin-bedded-----	5
5. Claystone, greenish-gray, calcareous, silty; a lenticular bed about $\frac{1}{2}$ ft thick of light-gray argillaceous limestone near middle; abundant ostracodes near top-----	8
4. Sandstone, very light gray, very fine grained, calcareous, thin-bedded, ripple-marked, slabby-----	3 $\frac{1}{2}$
3. Claystone, greenish-gray, calcareous, silty-----	2

	<u>Feet</u>
Morrison Formation--Continued	
2. Covered-----	8
	Thickness (rounded) Morrison Formation 45
Sundance Formation (part):	
Redwater Shale Member (part):	
1. Limestone, light-gray, weathers yellow, sandy and silty, thin and irregularly bedded-----	2
Locality 44.--Lakota and Morrison Formations and part of the Fall River Formation at the east end of Table Mountain, NE $\frac{1}{4}$ sec. 12, T. 53 N., R. 62 W., Crook County, Wyo.	
Top of the hill.	
Fall River Formation (part):	
30. Sandstone, yellowish-gray, weathers brown, fine- to medium-grained, crossbedded; basal $\frac{1}{2}$ ft cemented by iron oxides; forms massive cliff-----	45
29. Siltstone, grayish-white, in beds mostly less than 3 in. thick; some nodules and thin seams cemented by iron oxides-----	3 $\frac{1}{2}$
28. Siltstone, medium- to light-gray, fissile-----	3 $\frac{1}{2}$
27. Sandstone, light-gray, mottled pink, purple, and yellow, very fine grained, in beds 1 to 2 ft thick; several thin seams impregnated by iron oxides in lower part of unit; forms minor ledge-----	4 $\frac{1}{2}$
26. Sandstone, light-gray, mottled purple, very fine grained, blocky to massive, nonresistant-----	2
25. Mostly covered; some dark-gray siltstone in bottom half-----	11
24. Sandstone, light-gray to light yellowish-gray, very fine grained, very thin bedded, cross-laminated, thin seams cemented by dark-brown iron oxides; forms slabby ledges----	5
23. Sandstone, light yellowish-gray, very fine grained, thin-bedded at base, becomes massive at top; basal part contains fucoidal markings on bedding surfaces and is carbonaceous; forms persistent ledge-----	6 $\frac{1}{2}$
22. Shale, medium-gray, silty, carbonaceous, sandy in bottom $\frac{1}{2}$ ft-	2

	<u>Feet</u>
Fall River Formation--Continued	
21. Sandstone, light-gray to light yellowish-gray, thin-bedded at base and top, thicker bedded in middle, some slabby layers impregnated by dark-brown iron oxides; forms ledges-----	7
20. Siltstone, medium-gray, some laminae of light-gray and pink very fine grained sandstone-----	7
19. Sandstone, light-gray to pinkish-gray, fine, grained, in beds 1 to 2 ft thick, crossbedded; contains thin seams and nodules cemented by iron oxides; forms ledge-----	4
18. Sandstone, light-gray, fine to very fine grained, micaceous, carbonaceous; grades laterally into medium- to dark-gray carbonaceous siltstone-----	3
17. Siltstone, light olive-gray, sandy, carbonaceous-----	2½
Partial thickness (rounded) Fall River Formation 106	
Unconformity.	
Lakota Formation:	
16. Siltstone, yellowish-gray to yellowish-orange, clayey; contains numerous yellow and brown ferruginous spherules-----	4½
15. Sandstone, yellowish-gray, mottled shales of yellow, gray, and and orange, fine- to medium-grained, irregularly bedded; locally crossbedded in upper part; upper part forms cliff-----	33½
14. Sandstone, dark- to medium-gray, fine-grained, clayey, carbonaceous; grades to sandy claystone in top 2 to 3 ft; nonresistant-----	10
13. Sandstone, light-gray, mostly fine- to medium-grained, a few coarse-grained sandstone stringers, friable, crossbedded; contains a few concretions cemented by dark-brown iron oxides; forms cliff-----	43
12. Sandstone, light-gray, mottled red, pink, and yellow, fine to very fine grained; a few partings of yellowish-brown claystone-----	2
11. Covered-----	50±
10. Poorly exposed; appears to be mostly dark-gray claystone containing lenses and seams of yellowish-gray fine-grained sandstone; upper part carbonaceous-----	6
9. Covered-----	12

	<u>Feet</u>
Lakota Formation--Continued	
8. Sandstone, light-gray, mottled yellowish-orange, fine-grained, locally calcareous, carbonaceous; forms slabby ledges-----	2
7. Claystone, dark-gray; partings of dark-gray to brownish-black carbonaceous shale-----	3
6. Sandstone, light-gray, locally stained dark yellowish-orange in bottom 2 ft, fine to very fine grained, carbonaceous, friable-----	<u>4½</u>

Thickness Lakota Formation 170±

Morrison Formation:

5. Claystone, greenish-gray, noncalcareous; much selenite in float-----	6
4. Siltstone, pale olive-gray, very calcareous-----	1½
3. Claystone, greenish-gray, calcareous; a few lenticular beds of light-gray argillaceous limestone-----	18½
2. Covered-----	<u>12</u>

Thickness Morrison Formation 38

Sundance Formation (part):

Redwater Shale Member (part):

1. Sandstone, moderate-yellow, very fine grained, calcareous, friable-----	2
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Locality 45.--Lakota, Morrison, and part of the Fall River Formations about 2½ miles south of Aladdin, NE¼ NE¼ sec. 9, T. 53 N., R. 61 W., Crook County, Wyo.

Top of the ridge.

Fall River Formation (part):

33. Covered-----	6
32. Sandstone, very light gray, weathers light gray to brown, fine-grained, friable; a thin bed containing reworked fragments of sandstone and siltstone 4 ft above base; scattered small concretions cemented by iron oxides; forms cliff----	59
31.. Siltstone, medium-gray, shaly, nonresistant-----	2½

Fall River Formation--Continued

30. Sandstone, very light gray, very fine grained, thin-bedded, cross-laminated; forms ledge-----	2
29. Siltstone, medium-grained, weathers grayish-red, nonresistant-----	5
28. Sandstone, light-gray, weathers light-brown to pink, very fine grained, fucoidal markings on bedding surfaces; some seams and nodules cemented by dark-brown iron oxides; shaly parting about middle; forms ledges-----	13
27. Siltstone, medium-gray, shaly, slightly carbonaceous; a bed about $\frac{1}{2}$ ft thick of light-gray very fine grained sandstone about 1 ft below top; mostly nonresistant-----	12
26. Siltstone, medium-gray; interbedded light-gray very fine grained sandstone; a few seams cemented by iron oxides; thin-bedded; forms slabby ledges-----	2 $\frac{1}{2}$
25. Sandstone, light yellowish-gray, very fine grained, carbonaceous; scattered nodules cemented by dark-brown iron oxides; forms hard blocky ledge-----	2
24. Siltstone, medium- to dark-gray, shaly; a few seams cemented by dark-brown iron oxides; carbonaceous becoming very carbonaceous in bottom half; nonresistant-----	6
23. Siltstone, medium-gray; forms hard lenticular ledge-----	1

Partial thickness Fall River Formation 111

Unconformity.

Lakota Formation:

22. Siltstone, gray, locally stained yellow and pink, silty; contains numerous small ferruginous spherules mostly about 1 mm in diameter; nonresistant-----	11
21. Sandstone, yellowish-gray, fine-grained; a few nodules cemented by dark-brown iron oxides; forms cavernous ledge	8
20. Siltstone, gray, clayey-----	7
19. Sandstone, light-gray, very fine grained, locally cemented by iron oxides; forms ledge-----	2
18. Siltstone, olive-gray, locally weathers pale purplish-gray, clayey; contains a few sandy streaks and some small ferruginous specks; nonresistant-----	13

	<u>Feet</u>
Lakota Formation--Continued	
17. Sandstone, very light gray, faintly stained pink, fine to very fine grained, inconspicuously crossbedded; scattered nodules cemented by dark-brown iron oxides; forms ledges--	20
16. Siltstone, medium-gray, clayey, nonresistant-----	3
15. Sandstone as in unit 17, above-----	35
About $\frac{1}{4}$ mile east of the outcrops described above the interval shown by units 15 to 21, inclusive, is occupied by a bed at least 75 ft thick of grayish-white mostly fine- to medium-grained friable crossbedded sandstone containing lenses of coarse-grained to granule sandstone in top 20 to 25 ft.	
14. Covered-----	15
13. Claystone, dark-gray to black-----	5
12. Sandstone, very light gray, fine-grained, calcareous, locally cemented by iron oxides; forms minor ledge locally-----	1
11. Claystone, dark-gray to black; a seam of fine-grained light-gray sandstone near base-----	6 $\frac{1}{2}$
10. Sandstone, very light gray, locally stained yellow, very fine grained; some interbedded gray silty claystone; carbonaceous; nonresistant-----	3
9. Claystone, dark-gray to black, slightly sandy-----	36
8. Sandstone, light-gray, locally weathers yellow, very fine grained, friable, carbonaceous, slightly calcareous; forms minor ledge locally-----	1
7. Claystone, brownish-gray, sandy, locally carbonaceous-----	$\frac{1}{2}$

Thickness Lakota Formation 167

Morrison Formation:

6. Claystone, greenish-gray, noncalcareous-----	3 $\frac{1}{2}$
5. Claystone, greenish-gray and grayish-red, calcareous, sandy to very sandy in bottom half, a few thin beds of gray argillaceous limestone; contains ostracodes identified by I. G. Sohn as " <u>Metacypris</u> " spp., <u>Darwinula</u> sp., and a large smooth form genus indet. (loc. 286-5)-----	42
4. Covered-----	5

	<u>Feet</u>
Morrison Formation--Continued	
3. Claystone, greenish-gray, sandy, calcareous-----	<u>2</u>
Thickness (rounded) Morrison Formation	52
Sundance Formation (part):	
Redwater Shale Member (part):	
2. Limestone, light-gray, silty to sandy, in thin slightly contorted beds, forms ledges-----	7
1. Shale and sandstone, interlaminated; shale is dark greenish- gray, silty, noncalcareous; sandstone is very light gray, very fine grained, calcareous; nonresistant-----	<u>10</u>
Partial thickness Sundance Formation	17
Locality 46.--Part of the Lakota Formation about 4 miles southeast of Aladdin, <u>NE 1/4 sec. 1, T. 53 N., R. 61 W., Crook County, Wyo.</u>	
Top of the ridge.	
Lakota Formation (part):	
6. Partly covered; mostly very light gray fine-grained friable sandstone; a few thin lenses cemented by iron oxides; nonresistant-----	19
5. Sandstone, very light gray, locally stained yellow and orange, mostly very coarse grained to granule sandstone in basal 10 to 15 ft, remainder is medium-grained, friable, cross- bedded; a few scattered nodules cemented by dark-brown iron oxides; forms prominent cliffs-----	70
4. Claystone, dark-gray, locally weathers grayish-purple; a few lenticular seams of siltstone locally cemented by dark- brown iron oxides-----	7
3. Covered-----	5
2. Claystone, dark-gray, silty; a bed 1 ft thick of yellow fine- grained sandstone at top-----	6
1. Sandstone, yellowish-gray, weathers brown, fine- to medium- grained, friable, crossbedded; forms ledges-----	<u>25</u>
Partial thickness Lakota Formation	132
Base of the exposure.	

Locality 47.--Lakota, Morrison, and part of the Fall River Formations north of Dry Creek, SW $\frac{1}{4}$ sec. 7, T. 53 N., R. 60 W., Crook County, Wyo.

Feet

Top of the ridge.

Fall River Formation (part):

- | | |
|--|----------------------------------|
| 19. Grassy slope----- | 15 |
| 18. Sandstone, yellowish-gray, very fine grained, micaceous, fucoidal markings on bedding surfaces, in beds mostly less than 1 in. thick but including a few beds as much as $\frac{1}{2}$ ft thick, indistinctly ripple-marked; a few thin seams cemented by dark-brown iron oxides; forms slabby ledges----- | 8 |
| 17. Siltstone, light- to dark-gray, scattered carbonaceous fragments, hard and blocky in lower part, more fissile in upper part----- | <u>5$\frac{1}{2}$</u> |

Partial thickness (rounded) Fall River Formation 28

Unconformity.

Lakota Formation:

- | | |
|--|-----------------|
| 16. Siltstone, light-gray, mottled pink and yellow, clayey; a few laminae of light-gray very fine grained sandstone; numerous small ferruginous spherules mostly about 1 mm in diameter or smaller; nonresistant----- | 6 $\frac{1}{2}$ |
| 15. Sandstone, tan, fine-grained, thin-bedded; local partings of grayish-white siltstone; small ferruginous spherules in the siltstone; some thin layers impregnated by dark-brown iron oxides; lenticular; forms slabby ledges----- | 9 |
| 14. Siltstone, light-gray to grayish-white, clayey, numerous small ferruginous spherules----- | 3 |
| 13. Sandstone, tan, locally stained pink, fine- to medium-grained, in lenticular beds 1 to 10 ft thick interbedded with lenses as much as 3 ft thick of grayish-white siltstone; small fragments of siltstone locally reworked in basal parts of some of the coarser sandstone lenses; some beds inconspicuously crossbedded; forms massive cliff----- | 55 |
| 12. Poorly exposed; appears to be mostly light-gray very fine grained sandstone; forms slope----- | 12 |
| 11. Sandstone, very light gray, fine to very fine grained, friable; forms ledges and cliffs; grades into unit below----- | 44 |

Lakota Formation--Continued

Feet

10. Sandstone, light-gray, mostly medium- to coarse-grained, a few lenses of very coarse grained sandstone, friable, conspicuously crossbedded; forms cliff----- 45
9. Slumped blocks of light-gray to grayish-red fine- to medium-grained sandstone; contains fragments of gray siltstone and claystone and casts of wood fragments; locally impregnated by iron oxides; crossbedded----- 14
8. Siltstone, dark-gray; some dark-gray silty claystone; slightly carbonaceous; a few stringers of light-gray fine-grained carbonaceous sandstone----- 6

Thickness (rounded) Lakota Formation 194

Morrison Formation:

7. Covered----- 5
6. Claystone, mostly greenish-gray, dusky red in basal 1 to 2 ft, silty in lower part, noncalcareous----- 22
5. Claystone, mostly greenish-gray, dusky red in top 3 to 4 ft, silty, becomes more silty at top, calcareous; a few light-gray limestone nodules; contains charophytes identified by R. E. Peck as Aclistochara bransoni (Peck), Stellatochara obovata (Peck), Sphaerochara verticillata (Peck), and Praechara voluta (Peck), and abundant ostracodes including Theriosynoecum wyomingense (Branson) identified by I. G. Sohn (USGS loc. 26929)----- 24
4. Limestone, very light gray to light greenish-gray, silty; contains ostracodes identified by I. G. Sohn as "Metacypris" sp., Darwinula sp., large smooth form genus indet., and small smooth forms genus indet. (USGS loc. 26461)----- 2
3. Claystone, greenish-gray, calcareous; a bed $\frac{1}{2}$ ft thick of light-gray clayey limestone about 6 ft above base; locally abundant ostracodes----- 11
2. Sandstone, very light gray, very fine grained, calcareous, friable, cross-laminated; lower part forms slabby ledges-- 8

Thickness Morrison Formation 72

Sundance Formation (part):

Redwater Shale Member (part):

1. Sandstone, grayish-yellow to moderate-yellow, very fine grained, calcareous, friable; some interbedded greenish-gray shale-- 3

Locality 48.--Parts of the Fall River and Lakota Formations near U. S. Highway 85
about 4 miles south of Belle Fourche, NE¹/₄ sec. 34, T. 8 N., R. 2 E., Butte
County, S. Dak.

	<u>Feet</u>
Fall River Formation (part):	
12. Sandstone, light-gray to light yellowish-gray, fine-grained, crossbedded, friable, forms prominent rounded ledges. Top of the unit is probably within 15 ft of the top of the formation-----	20
11. Sandstone, grayish-yellow, very fine grained, thin-bedded, cross-laminated, local fucoidal markings on bedding surfaces, ripple-marked; some interlaminated yellowish- gray siltstone-----	16
10. Shale, medium- to dark-gray, silty; some interlaminated light-gray siltstone; more silty at top-----	10
9. Siltstone, dark-brown, very thin bedded, impregnated by dark- brown iron oxides; forms ledge-----	$\frac{1}{2}$
8. Shale, olive-gray, silty; some interlaminated yellowish-gray siltstone and very fine grained sandstone-----	11
7. Sandstone, light-gray to light yellowish-gray, very fine grained, thin-bedded; many partings of medium-gray silt- stone; slightly carbonaceous; locally cross-laminated; fucoidal markings on bedding surfaces-----	16
6. Sandstone, light-gray, very fine grained, massive; forms blocky ledge-----	2
5. Siltstone, laminated light- and dark-gray, fucoidal markings on bedding surfaces, carbonaceous in top 3 to 4 ft; a few thin seams of light-gray very fine grained sandstone; some thin seams of siltstone cemented by iron oxides-----	10
4. Siltstone, medium-gray, massive-----	$2\frac{1}{2}$
3. Siltstone, dark-gray, hard, carbonaceous-----	1
2. Siltstone, light-gray to light brownish-gray, carbonaceous, massive-----	<u>6$\frac{1}{2}$</u>
Partial thickness (rounded) Fall River Formation	95
Unconformity.	

Lakota Formation (part):

1. Claystone, light greenish-gray, mottled pink and brown,
silty, tough----- 10½

Base of the exposure at the bottom of abandoned clay pit.

Locality 49.--Lakota, Morrison, Unkpapa, and part of the Sundance Formations
about 2½ miles southeast of Sturgis, about center sec. 23, T. 5 N., R. 5 E.,
Meade County, S. Dak.

Top of the hill.

Lakota Formation:

19. Mostly covered; scattered exposures of gray silty claystone
mottled red and yellow; locally contains numerous small
ferruginous spherules mostly about 1 mm in diameter.
Top of the unit is probably about the top of the Lakota
Formation----- 25±
18. Covered----- 20
17. Sandstone, light-gray to yellowish-gray, mostly medium- to
coarse-grained, stringers of very coarse-grained to
granule sandstone, a few pebbles and small cobbles of
chert and quartzite at base, friable, crossbedded; forms
massive cliff----- 50±
16. Sandstone, light-gray to yellowish-gray, local pink stain,
fine- to medium-grained, friable, crossbedded; forms
local ledges----- 12
15. Partly covered; light- to medium-gray sandy siltstone in
bottom half, nonresistant----- 15
14. Sandstone, light-gray to yellowish-gray, mostly fine-grained,
scattered fragments of reworked white siltstone and very
fine grained sandstone, crossbedded; forms cliff locally- 21
13. Covered; a few fragments of light-gray limestone in the
float in basal part----- 67
12. Mostly covered; some fissile greenish-gray shale containing
ostracodes in scattered outcrops----- 5
11. Sandstone, very light gray, fine- to medium-grained, many
dark grains, calcareous; forms slabby ledge----- 1

	<u>Feet</u>
Lakota Formation-- Continued	
10. Sandstone, light-gray to yellowish-gray, fine to very fine grained, in tabular beds mostly $\frac{1}{2}$ to 6 ft thick, ripple-marked locally; forms ledges and cliffs-----	32
9. Partly covered; a few local ledges of sandstone like those in the unit above-----	10
8. Sandstone as in unit 10, above-----	12
7. Covered-----	10
6. Shale, brownish-gray, noncalcareous, weathers to slightly brittle papery fragments-----	<u>5</u>
Thickness Lakota Formation 285±	
Morrison Formation:	
5. Covered; green clay soil in lower part-----	50
Unkpapa Sandstone:	
4. Sandstone, grayish-white, very fine grained, calcareous, massive-----	60
3. Partly covered; appears to be mostly sandstone as in unit 4, above-----	<u>10</u>
Thickness Unkpapa Sandstone 70	
Sundance Formation (part):	
Redwater Shale Member (part):	
2. Covered; greenish-gray clay soil-----	29
1. Sandstone, light-gray, very fine grained, very calcareous, glauconitic; contains broken shell fragments in thin seams; forms blocky ledge-----	<u>2</u>
Partial thickness Sundance Formation 31	
Base of the exposure.	
Locality 50.--Parts of the Fall River and Lakota Formations about $\frac{3}{4}$ mile north of Morris Creek, SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 9, T. 4 N., R. 6 E., Meade County, S. Dak.	
Top of the hill.	
Fall River Formation (part):	
18. Sandstone, yellowish-gray, very fine grained, thin-bedded, ripple-marked; a few thin seams cemented by iron oxides; forms ledges-----	6

	<u>Feet</u>
Fall River Formation--Continued	
17. Siltstone, grayish-white, very thin bedded-----	8
16. Shale, medium-gray, silty; some interlaminated gray siltstone	2
15. Sandstone, very light gray, pink laminae, very fine grained to silty, thin-bedded; forms ledge-----	1½
14. Shale as in unit 16, above-----	2
13. Sandstone, very light gray, very fine grained, thin-bedded; scattered nodules and thin seams cemented by dark-brown iron oxides; forms slabby ledges-----	7
12. Sandstone, light-gray, friable, carbonaceous-----	1½
11. Siltstone, very light gray; grades locally to very fine grained sandstone; scattered nodules cemented by dark- brown iron oxides; massive; forms ledge-----	4
10. Shale, medium-gray, silty, slightly carbonaceous-----	4
9. Shale, dark-gray to black, coaly-----	2
Partial thickness Fall River Formation	38

Unconformity.

Lakota Formation (part):

8. Siltstone, mottled yellow and gray; numerous small ferruginous spherules mostly about 1 mm in diameter-----	4
7. Claystone, gray, mottled yellow, silty; scattered small ferruginous spherules-----	10
6. Mostly covered; upper part contains some gray claystone mottled purplish-gray and yellow-----	18
5. Sandstone, grayish-white, very fine grained, locally ripple- marked; some small nodules cemented by dark-brown iron oxides; forms local ledges-----	3
4. Mostly covered; some gray claystone near top and base-----	7
3. Mostly covered; scattered exposures of olive-gray clayey siltstone; weathers dark yellowish-gray-----	17
2. Claystone, dark-gray to dark greenish-gray, locally mottled red, silty to sandy-----	18

Lakota Formation--Continued

Feet

1. Siltstone, grayish-white, locally sandy, weathers to irregular blocky chips----- 6

Partial thickness Lakota Formation 83

Base of the exposure.

Locality 51.--Fall River and part of the Lakota Formations about $3\frac{1}{2}$ miles north of Blackhawk, S $\frac{1}{2}$ sec. 20, T. 3 N., R. 7 E., Meade County, S. Dak.

Skull Creek Shale (part):

26. Shale, black, very fissile----- 5

Fall River Formation:

25. Sandstone, yellowish-gray, very fine grained; impregnated with iron oxides; forms ledge----- $\frac{1}{2}$
24. Covered----- 6
23. Sandstone, light-gray, weathers brown, very fine grained, calcareous, thin-bedded; forms slabby ledge----- $1\frac{1}{2}$
22. Covered----- 25±
21. Sandstone, light-gray to light yellowish-gray, very fine grained, micaceous, ripple-marked; contains thin seams cemented by dark-brown iron oxides; forms ledge----- $1\frac{1}{2}$
20. Covered----- 7
19. Sandstone, yellowish-gray, fine to very fine grained, thin-bedded at base, thicker bedded at top, crossbedded; contains thin seams cemented by brown-weathering iron oxides; forms dip slope locally----- 5
18. Mostly covered; a bed 2 ft thick of yellowish-gray very fine grained sandstone about middle; forms ledge locally 15 $\frac{1}{2}$
17. Sandstone, light-gray, very fine grained, micaceous, cross-bedded; forms ledge----- 1
16. Partly covered; some medium-gray shale in lower half----- 5
15. Shale, dark-brown to dark-gray, carbonaceous, locally coaly 1
14. Siltstone, light-gray, micaceous, carbonaceous; forms ledge 3 $\frac{1}{2}$
13. Mostly covered; some dark-gray shaly siltstone in bottom 2 ft----- 18

Fall River Formation--Continued

12. Sandstone, light-gray, very fine grained, a few nodules cemented by dark-brown iron oxides, lenticular; forms ledge 2½
11. Partly covered; mostly dark-gray slightly carbonaceous shaly siltstone----- 17

Thickness Fall River Formation 110±

Unconformity.

Lakota Formation (part):

10. Mostly covered; in top 4 ft some gray siltstone mottled yellow; contain numerous small ferruginous spherules----- 21±
9. Claystone, dark-gray and dark greenish-gray, locally mottled red, silty. (Nearby to the north a lenticular bed about 6 ft thick of orange-brown medium-grained sandstone crops out about top of this unit.)----- 25±
8. Siltstone, gray, weathers light gray with local greenish-gray streaks, slightly carbonaceous, breaks with a conchoidal fracture into small hard chips----- 20
7. Covered; fragments of silicified wood in the float----- 30±

Section below offset about ¼ mile west.

6. Sandstone, light-gray to yellowish-gray, medium-grained, friable, crossbedded; forms cliff----- 75±
5. Sandstone, light-gray to yellowish-gray, fine- to coarse-grained; contains many fragments of white siltstone and a few fragments of silicified wood; friable; crossbedded; lenticular----- 7
4. Covered----- 12
3. Partly covered; scattered exposures of olive-gray sandy claystone; grades locally to very fine grained clayey sandstone 10
2. Sandstone, light-gray, mostly fine- to medium-grained, scattered coarser grains, very friable, clayey, nonresistant----- 16
1. Sandstone, light-gray to yellowish-gray, mostly fine-grained, a few seams of medium- to coarse-grained sandstone and fragments of green siltstone in basal 5 ft, friable, cross-bedded; forms cliff----- 55

Partial thickness Lakota Formation 271±

Base of the exposure.

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