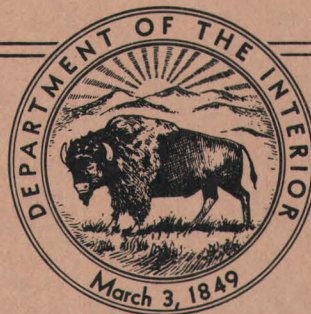

GEOLOGICAL SURVEY CIRCULAR 68



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DETAILED SECTIONS
OF PRE-PENNSYLVANIAN ROCKS
ALONG THE FRONT RANGE OF COLORADO

By

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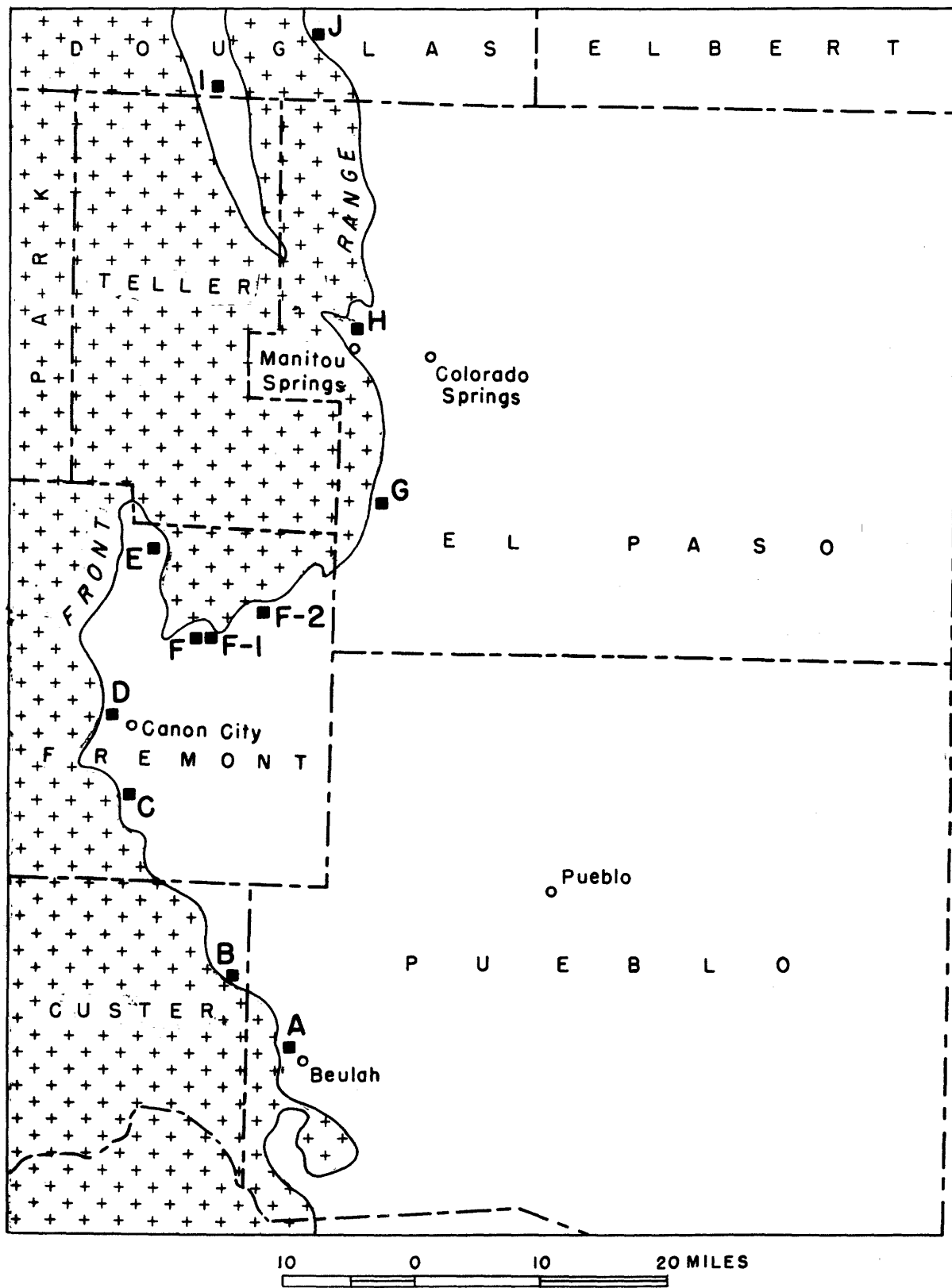
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Locations of sections of pre-Pennsylvanian rocks along the Front Range of Colorado..... facing p. 1

Table 1. Past and present classification of pre-Pennsylvanian rocks along the Front Range of Colorado, and correlation with subsurface formations in western Kansas..... 1



LOCATIONS OF SECTIONS OF PRE-PENNSYLVANIAN
ROCKS ALONG THE FRONT RANGE OF COLORADO

Detailed sections of pre-Pennsylvanian rocks along the Front Range of Colorado

by

John C. Maher

Since 1943, the U. S. Geological Survey, partly in cooperation with the State Geological Survey of Kansas, has been conducting detailed microscopic studies of the stratigraphy of the rocks penetrated in deep wells in western Kansas and eastern Colorado. The results of these studies have been released in a series of cross sections published by the State Geological Survey of Kansas (Collins, J. B., 1947; Edson, F. C., 1945, 1947; Maher, J. C., 1946, 1947, 1948) and in a Preliminary Map of the Oil and Gas Investigations Series of the U. S. Geological Survey (Maher, J. C., and Collins, J. B., 1949). The subsurface studies necessarily have been based on correlation from well to well of suites of cuttings, supplemented by electrical logs. Standard subsurface practice of petroleum geologists in the Midcontinent region is to use the terminology of rocks exposed in the Mississippi Valley sections and in Oklahoma. As a logical part of the present investigation it was decided to trace the subsurface units westward to their outcrop in the Front Range in Colorado.

Accordingly 12 sections of pre-Pennsylvanian Paleozoic rocks were measured and sampled along the Front Range at the places shown on the accompanying index map. The writer was assisted in this work by Donald C. Swanson in June, July, and August 1948. Measurements were made with a steel tape and Abney level, and sampling was done with a sledge, shovel, and mattock-pick. In the field, the samples were examined under a hand lens, tested with 6N acid, and described in a notebook before being sacked in canvas bags. In the laboratory, these samples were crushed in a small ore crusher to the size of oil-well cuttings, washed, divided into three portions, sacked in paper sample envelopes, and filed in cardboard sample boxes. This procedure resulted in three complete sets of samples for each measured section. One set was examined under a low-power binocular microscope and described, one was used for preparations of insoluble residues, and one was placed in reserve. A description of the samples and residues for each section was made on a log strip using a scale of one inch to 10 feet in order to record the detail. This description was combined with data from the field notebook to give the sections described below. Fossils of the collections made were identified by G. A. Cooper of the United States National Museum.

The correlations of the subsurface units with the rocks cropping out in the Front Range are shown graphically in Preliminary Chart 39 of the United States Geological Survey's Oil and Gas Investigations series (Maher, John C., 1950). The correlation and nomenclature of the rocks also are discussed on the chart. The space available on the chart, however, does not permit the detailed description of individual rock units needed by subsurface investigators. It is believed that the following completely detailed description of the surface sections will be valuable to those who are doing subsurface stratigraphy based on the detailed examination of well cuttings.

Table 1. Past and present classification of pre-Pennsylvanian rocks along the Front Range of Colorado, and correlation with subsurface formations in western Kansas.

Previous classification ^{1/}		Present classification		Subsurface classification in eastern Colorado and western Kansas	
MISSISSIPPIAN	Madison (or Leadville ^{2/} limestone	MIDDLE (?) MISSISSIPPIAN	Beulah limestone	MIDDLE MISSISSIPPIAN	Ste. Genevieve limestone
			Hardscrabble limestone		St. Louis limestone
			Williams Canyon limestone		Spargen limestone
		LOWER MISSISSIPPIAN		LOWER MISSISSIPPIAN	Warsaw limestone
DEVONIAN	Williams Canyon limestone	DEVONIAN		DEVONIAN	Osage group
ORDOVICIAN	Fremont limestone	ORDOVICIAN	Fremont limestone	ORDOVICIAN	Kinderhook group
	Harding sandstone		Harding sandstone		Viola limestone
	Manitou limestone		Manitou limestone (restricted)		Simpson group
CAMBRIAN		UPPER CAMBRIAN (?)	Ute Pass dolomite	UPPER CAMBRIAN	Arbuckle group ^{3/}
	Sawatch sandstone ¹	UPPER CAMBRIAN	Sawatch quartzite		Bonnetterre dolomite
					Lamotte sandstone

1/ Brainerd, A. E., Baldwin, H. L., Jr., and Keyte, I. A., Pre-Pennsylvanian Stratigraphy of Front Range in Colorado: Am. Assoc. Petroleum Geologists Bull. vol. 17, no. 4, pp. 375-396, 1933.

2/ Brainerd, A. E., and Johnson, J. H., Mississippian of Colorado: Am. Assoc. Petroleum Geologists Bull., vol. 18, no. 4, pp. 541-542, 1934.

3/ Includes some Upper Cambrian in the type area.

SECTION A. Beulah, Pueblo County, Colorado, NW $\frac{1}{4}$ and NE $\frac{1}{4}$ sec. 4, T. 23 S.,
R. 68 W., and SE $\frac{1}{4}$ sec. 32, T. 22 S., R. 68 W.

(Measured by hand level and tape along cliffs on north side of Middle Creek.)

	<u>Ft.</u>	<u>in.</u>
Carboniferous		
Pennsylvanian rocks		
Fountain formation		
Mississippian rocks		
Beulah limestone		

(Measurements in the NW $\frac{1}{4}$ sec. 4, T. 23 S., R. 68 W.)

Limestone, red-stained buff fine sandy with red-stained buff calcareous, fine-grained sandstone layers and yellow-mottled red dense chert at top-----	5	6
Limestone, yellowish-buff, very oolitic, slightly sandy-----	1	
Sandstone, yellow, very limy, very fine, grading downward into pink-tinged buff oolitic medium-crystalline limestone. Oolites are oblong in part-----	4	6
Limestone, yellowish-buff, finely oolitic-----	3	
Limestone, buff, finely crystalline to dense, containing red-mottled gray-buff dense chert-----		8
Limestone, platy, buff, shaly-----	1	
Limestone, reddish buff, fine sandy, finely oolitic-----		10
Limestone, gray buff, very oolitic, medium crystalline, grading downward into red to yellow finely oolitic finely crystalline limestone-----	5	6
Limestone, finely red-banded, yellowish buff, finely oolitic, finely crystalline-----	5	6
Limestone, red- and yellow-mottled buff, faintly oolitic, finely crystalline-----	5	6
Limestone, red to yellowish buff, oolitic, slightly sandy. Oolites range from fine to medium in size-----	5	6
Limestone, cream-colored, very oolitic. Oolites are fine to medium in size-----	5	6
Limestone, gray buff, very oolitic, finely crystalline to dense-----	5	6
Sandstone, yellow to white, calcareous, medium- to coarse-grained, might be cave-fill-----	3	6
Total thickness of Beulah limestone-----	53	0

Hardscrabble limestone

Limestone, gray, finely oolitic, finely crystalline, and gray dense limestone containing a trace of orange dense chert-----	4	6
Limestone, gray, finely oolitic, finely crystalline to dense-----	5	6
Limestone, rubbly, gray buff, dense-----	5	6
Covered interval from base of upper cliff to top of lower cliff-----	38	

(Measurements near Indian Cave in the SE $\frac{1}{4}$ sec. 32, T. 22 S., R. 68 W.)

Limestone, dark-buff to brown, finely crystalline to dense. Top of lower cliff-----	5	6
Limestone, slightly pink-tinged cream-colored, finely crystalline to dense-----	27	6
Limestone, slightly pink-tinged, fossiliferous, finely crystalline to dense, containing small brachiopods-----	5	6
Limestone, cream-colored to buff, finely crystalline to dense-----	16	6
Limestone, purple-mottled buff to dark-buff, dense-----	9	6
Limestone, pink-mottled buff, chalky, very fine sandy-----	1	6
Limestone, buff, medium crystalline, grading downward into soft pink-mottled gray finely crystalline limestone containing pebbles of reworked Williams Canyon limestone. Distinctly irregular basal surface-----	5	6
Total thickness of Hardscrabble limestone-----	125	0

Williams Canyon limestone

Limestone, yellow, coarsely crystalline-----	1	
Dolomite, hard, purple-mottled lavender, very finely granular, with conchoidal fracture-----	3	
Sandstone, red, yellow, and gray, limy, fine-grained, and purple- and maroon mottled gray finely crystalline limestone-----	1	3
Dolomite, lavender to gray, finely granular, containing one layer of pinkish-white finely granular to dense chert nodules. Upper 2 feet weathers bright yellow-----	5	6
Dolomite, lavender to purple, finely crystalline, and dolomitic limestone with thin veins of calcite-----	4	3
Covered interval. Contact with Fremont limestone not exposed-----	1	3
Total thickness of Williams Canyon limestone-----	16	3

	<u>Ft.</u>	<u>in.</u>
Ordovician rocks		
Fremont limestone		
Dolomite, pinkish buff, finely to coarsely crystalline-----	5	
Dolomite, pinkish buff to red, finely to coarsely crystalline, with thin beds of brick-red finely granular dolomite-----	5	
Dolomite, massive, pitted, pink to red, coarsely crystalline-----	5	6
Contact of Fremont limestone and Harding sandstone is not exposed but estimated to be within 3 feet of bed described above-----	3	
Total thickness of Fremont limestone-----	18	6

Harding sandstone

(Measurements in the NE $\frac{1}{4}$ sec. 4, T. 23 S., R. 68 W.)

Covered interval which, judging by incomplete exposures and float, includes hard, purple and green, limy, fine-grained sandstone at top and purple, red, and green sandy shale at bottom-----	16	6
Sandstone, medium-bedded, white, very fine grained-----	4	
Sandstone, thin-bedded, white to pink, limy, very fine grained-----	11	
Covered interval, in part purple and red shale-----	22	6
Shale, red to brown, fissile; green very fine grained sandstone, and green-spotted red to purple waxy shale-----	3	
Sandstone, green, very fine grained, and maroon, green, and purple waxy shale-----	3	6
Sandstone, thin-bedded, white, very fine grained, with two hard quartzitic layers about 6 inches thick. This unit forms a distinct ledge-----	4	6
Sandstone, pale-green, limy, very fine grained-----	2	
Sandstone, purple-mottled and green-spotted white, limy, very fine grained-----	4	6
Sandstone, pink-mottled white, limy, very fine grained, with large white quartz boulders at base-----	5	
Total thickness of Harding sandstone-----	76	6

Pre-Cambrian granite

SECTION B. South Hardscrabble Creek, Custer County, Colorado, S $\frac{1}{2}$ sec. 11,
T. 22 S., R. 69 W.

[The beds here stand nearly vertical (dip 82° SW) as a result of faulting. Several faults cut the section, one of which traverses the Williams Canyon limestone beds. The section was measured by tape where undisturbed by faults.]

Carboniferous

Pennsylvanian rocks

Fountain formation

Mississippian rocks

Beulah limestone

Upper few feet not exposed.

Limestone, massive, pinkish red, very sandy-----	5	
Chert, red to yellowish buff, pyritic, dense-----		4
Limestone, buff, dense-----	1	8
Limestone, pink- and white-mottled, finely oolitic-----	1	
Limestone, thin-bedded, pink- and white-mottled, finely oolitic, fine sandy-----	1	
Limestone, red, finely crystalline; red fine sandy limestone; and buff finely oolitic fine sandy limestone-----	5	
Limestone, medium-bedded, buff-mottled red, fine sandy, finely crystalline, containing scattered calcite crystals-----	8	6
Limestone, massive, compact, tan, slightly oolitic, finely crystalline, and white to pink finely oolitic fine sandy limestone-----	5	
Limestone, massive, compact, pink, finely oolitic, fine sandy, grading downward into white finely oolitic, finely to medium-crystalline limestone-----	3	6
Limestone, white, finely oolitic, finely to medium-crystalline, and pink finely oolitic fine sandy limestone-----	5	
Limestone, red to buff finely crystalline, with white calcite veins, red chalcedonic chert, and purple fine sandy chert-----	4	6
Total thickness of Beulah limestone-----	40	6

Hardscrabble limestone

Limestone, pink to white, coarsely oolitic, with purple- and gray-mottled fine sandy chert show- ing faint figures. Oolites are large and oblong. The top of this bed is very irregular, sug- gesting a slight unconformity-----	1	6
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	Ft.	in.
Chert, brown to purple, faintly figured, fine sandy to dense-----	1	6
Limestone, gray, finely crystalline, and red very oolitic finely to medium-crystalline limestone with irregular nodules of white to tan granular, to dense chert and red to white calcite veins-----	5	
Limestone, gray, finely crystalline, with limestone pebbles and red and white calcite veins, and buff finely crystalline limestone containing traces of cream-colored dense chert-----	3	
Limestone, lavender to gray, finely crystalline, with tan dense chert grading downward into buff fine sandy limestone with white granular chert-----	5	
Limestone, lavender, finely crystalline to dense, with some layers of white fine sandy limestone-----	6	
Limestone, brown, finely crystalline to dense-----	5	
Limestone breccia, brown, dense, grading downward into brown dense limestone underlain by badly altered buff finely crystalline limestone and yellow-stained fine sandy limestone--	5	
Limestone, buff to brown, finely crystalline to dense, containing tan crinoidal dense chert-----	4	
Dolomite, lavender- and purple-banded, buff, dense-----	1	
Limestone, red, finely crystalline-----	5	2
Limestone, cream-colored to buff, fine to coarsely crystalline, containing calcite and tan dense to granular chert-----	10	
Limestone, buff to dark buff, finely crystalline, containing limestone (?) pebbles, calcite, and white subtranslucent chert-----	5	
Limestone, pinkish white, medium crystalline, and buff to brown dense to finely crystalline limestone-----	5	
Limestone, red-mottled buff to brown, finely crystalline, and buff siliceous limestone-----	5	
Limestone, red-mottled buff, finely crystalline, cream-colored medium-crystalline limestone; and cream-colored dense chert-----	3	6
Limestone, cream-colored, finely crystalline to dense-----	10	11
Chert, cream-colored, dense-----		1
Limestone, buff, finely crystalline-----	2	
Limestone, buff, coarsely crystalline, with 1- to 2-inch layers of tan dense chert-----	2	
Limestone, buff, finely crystalline, with some pink very finely granular dolomite-----	3	6
Limestone, buff to brown, dense, containing calcite veins and 1- to 2-inch layers of tan dense chert. This bed forms top of lower massive ledge-----	5	
Limestone, buff to brown, finely crystalline-----	9	
Limestone, buff, finely crystalline, containing brachiopods; white finely to medium-crystalline limestone; and brown dense limestone-----	6	
Limestone, buff, finely crystalline, containing white calcite grading downward into pink finely granular dolomitic limestone-----	5	
Limestone, pinkish buff, finely crystalline, with white calcite veins-----	5	
Limestone, red-mottled brown, finely crystalline, with calcite veins-----	4	9
Limestone conglomerate, red-stained, with wavy basal contact-----		3
Total thickness of Hardscrabble limestone-----	124	2
Williams Canyon limestone		
Limestone, gray to brown, finely crystalline-----		6
Dolomite, platy, gray buff, finely granular to dense-----	1	3
Limestone, pink, finely to medium crystalline-----	1	3
Sandstone, red-banded white, limy, fine- to medium-grained-----	2	2
Dolomite, purple-banded lavender, finely crystalline, with included sand grains at top-----	3	
Dolomite, platy, purple to lavender, very finely granular; purple coarsely crystalline limestone; and tan finely granular dolomite-----	5	
Limestone, purple to lavender, finely to medium crystalline, dolomitic, with small bed of tan finely granular dolomite at base-----	10	
Limestone, lavender to purple, finely granular, dolomitic, buff dense limestone; and purple finely crystalline limestone with calcite-----	5	
Dolomite, red to lavender, finely granular-----	5	
Limestone, thin-bedded, purple, finely granular, dolomitic, grading downward into purple finely granular dolomite and purple fine sandy dolomite and dolomitic fine sandstone with wavy basal contact-----	5	
Total thickness of Williams Canyon limestone-----	38	2
Ordovician rocks		
Fremont limestone		
Dolomite, red, finely granular to medium crystalline, yellow-stained in part-----	8-	
Dolomite, red, finely to medium crystalline, containing small crinoids and calcite veins-----	5	
Dolomite, red, finely to medium crystalline, with calcite veins and some yellow staining-----	10	
Total thickness of Fremont limestone-----	23	0

	<u>Ft.</u>	<u>in.</u>
Harding sandstone		
Sandstone, white to yellow, very fine grained-----	5	7
Covered interval-----	10	
Sandstone, white, pink, and red, limy, very fine grained, with abundant fish scales-----	1	2
Shale, platy, red to purple, fine sandy-----	5	10
Sandstone, thin-bedded, white to pink, slightly limy, very fine grained-----	8	6
Covered interval-----	41	
Sandstone, thin-bedded, white to lavender, slightly limy, very fine grained-----	3	5
Sandstone, thin-bedded, white to lavender, nonlimy, very fine grained-----	5	
Sandstone, thin-bedded, pink-tinged, nonlimy, very fine grained-----	4	6
Sandstone, white, nonlimy, medium-grained-----		6
Total thickness of Harding sandstone-----	85	6

Pre-Cambrian granite

SECTION C. Specimen Hill, Fremont County, Colorado, SE $\frac{1}{4}$ sec. 32, T. 19 S.,
R. 70 W.

(Measured by tape on west side of Oak Creek grade road. Beds strike N. 14° W. and dip
77° E.)

Jurassic rocks

Morrison formation,

Ordovician rocks

Fremont limestone

Covered interval, estimated-----	5	
Dolomite, slightly orange-mottled buff, medium-crystalline, with traces of white opaline chert-----	5	
Dolomite, soft, buff, finely granular, resembles sandstone when weathered. Trace of orange chalcedonic chert-----	10	
Dolomite, buff, finely granular-----	5	
Dolomite, hard, buff, finely crystalline, containing small geodes of bluish-white and orange agatelite chert-----	5	
Dolomite, buff, finely crystalline, with disseminated bluish-white opaline chert-----	5	
Dolomite, tan, medium-crystalline, containing red agatelite chalcedony and white calcite-----	10	
Dolomite, buff to tan, finely to medium-crystalline, containing some calcite and a few quartz geodes-----	5	
Dolomite, pinkish tan, finely to medium-crystalline, with disseminated bluish-white opaline chert and calcite-----	5	
Dolomite, buff to tan, fine- to medium-grained, with abundant quartz geodes and calcite. Abundant gray-, red-, and tan-banded chalcedony-----	6	
Dolomite, pinkish buff, fossiliferous, medium-crystalline, containing quartz geodes, crinoids, and brachiopods. A thin bed of white fine-grained sandstone is present near the base-----	4	
Dolomite, pinkish buff, very fossiliferous, medium-crystalline, containing abundant red to pink agatelite chalcedony in geodes; <u>Receptaculites</u> and <u>Rhynchotrema argenturica</u> .-----	6	
Dolomite, yellow-stained, tan to brown, medium to coarsely crystalline, with disseminated bluish-white opaline chert and white calcite veins-----	4	
Dolomite, pinkish buff, coarsely crystalline, with thin veinlets of blue-white opaline chert-----	5	
Dolomite, pinkish-buff, coarsely crystalline, with abundant quartz geodes containing red, yellow, and white agatelite chalcedony and white mammillary chert-----	5	
Dolomite, pinkish buff, coarsely crystalline, with thin veins of gray to tan dense chert-----	4	
Dolomite, red, finely crystalline-----	1	
Dolomite, red, fossiliferous, medium to coarsely crystalline, containing cup corals (Favosites?) and abundant dense white to gray and tan subtranslucent chert-----	5	
Total thickness of Fremont limestone-----	95	0

Harding sandstone

Shale, purple and yellow-----	4	4
Sandstone, purplish pink, fine-grained-----	1	
Covered interval-----	42	7
Sandstone, hard, white, quartzitic, very fine grained-----	3	4
Covered interval. White fine-grained sandstone, 1 foot thick, in middle of interval contains abundant fish plates-----	17	
Sandstone, hard, white, limy, very fine grained-----	3	
Sandstone, bright yellow-stained white, limy, very fine grained-----	4	
Covered interval. Probably white fine-grained sandstone-----	15	

	<u>Ft.</u>	<u>in.</u>
Sandstone, hard, white, quartzitic, fine-grained-----	1	
Total thickness of Harding sandstone-----	91	3

Pre-Cambrian granite

SECTION D. Canon City, Fremont County, Colorado, sec. 13, T. 18 S.,
R. 71 W. (Priest Canyon), sec. 31, T. 18 S., R. 70 W. (Harding Quarry),
and sec. 36, T. 17 S., R. 71 W. (Gnat Canyon).

Carboniferous Pennsylvanian rocks Fountain formation

(Measured by Abney level and tape along Priest Canyon road,
sec. 13, T. 18 S., R. 71 W.)

Sandstone, massive, red, arkosic, coarse-grained, containing limestone boulders and pebbles in base-----	49	
Shale, purplish maroon, micaceous, sandy, interbedded with white micaceous angular fine- to medium-grained sandstone-----	4	6
Sandstone, purplish white, micaceous, fine-grained-----	1	6
Sandstone, purplish white, micaceous, angular, coarse-grained-----	1	
Sandstone, yellow to purple, fine-grained, and sandy shale with abundant limonite concretions from size of bird shot to bean-----	3	
Shale, hard, blocky, brick-red, iron-cemented, sandy, with a trace of reworked red chert----	5	
Covered interval-----	4	
Shale, crumbly, brick-red, sandy, with limonite concretions and reworked cream-colored granular chert concretions-----	6	
Sandstone, white, well-sorted, subround, fine- to medium-grained, containing reworked buff dense chert concretions-----	1	
Shale, crumbly, maroon, sandy, with fragments of leached dolomite and chert-----	6	
Sandstone, white, subround, fine- to medium-grained, and some pink quartzitic very fine grained sandstone-----	5	
Sandstone, red-stained, gray white, subround, fine- to medium-grained-----	3	
Shale, purple to red limy fine sandy, containing fragments of reworked cream-colored dense chert. Irregular basal surface-----	1	
Total thickness of Fountain formation-----	90	0

Mississippian rocks Williams Canyon limestone

(Measured by Abney level and tape on north wall of creek in Priest Canyon,
sec. 13, T. 18 S., R. 71 W.)

Dolomite, purple- and yellow-mottled cream-colored, very finely granular-----	2	
Limestone, purple- and yellow-mottled gray, finely to medium crystalline, dolomitic, with 10-inch bed of hard compact very finely granular dolomite in middle-----	5	
Limestone, thin- and wavy-bedded, purple- and yellow-banded gray, finely crystalline, dolomitic, and pink medium crystalline limestone-----	5	
Dolomite, yellow-mottled gray, finely granular, with 6-inch bed of yellow-buff coarsely crystalline limestone in middle-----	5	
Dolomite, thin- and wavy-bedded, purple- and yellow-mottled gray, very finely granular, and dolomitic limestone-----	5	
Dolomite, thin- and wavy-bedded, purple-mottled, gray, very finely granular, and red-yellow finely crystalline, containing scattered sand grains, and angular limestone pebbles, 1 inch in diameter, in lower 3 feet-----	4	9
Shale, hard, maroon, sandy, containing angular limestone pebbles. Irregular basal surface----		3
Total thickness of Williams Canyon limestone-----	27	0

Ordovician rocks Fremont limestone

(Measured by Abney level and tape along road and creek in Priest Canyon,
sec. 13, T. 18 S., R. 71 W.)

Dolomite, thin-bedded, purple-mottled buff, finely granular-----	4
Dolomite, purple-tinged buff, finely crystalline-----	1
Dolomite, hard, cream-colored, finely oolitic (?) or microfossiliferous (?), finely granular----	1
Dolomite, thin-bedded, cream-colored, finely granular-----	3

	Ft.	in.
Dolomite, massive, slightly purple-mottled buff, finely to very finely granular, with few brachiopods near base. Forms distinct ledge-----	19	4
Dolomite, soft, pinkish buff, shaly, very finely granular-----		5
Dolomite, hard, pink to buff, very finely granular, with few brachiopods-----	1	3
Dolomite, thin-bedded, slightly red-mottled gray white, very finely granular-----	2	3
Dolomite, platy, pink-tinged gray white, limy, very finely granular-----	3	7
Dolomite, thin-bedded, gray white, very finely granular-----	2	2
Dolomite, thin-bedded, gray buff, finely granular-----	1	
Dolomite, thick-bedded, gray buff, slightly fossiliferous, very finely granular-----	4	
Dolomite, pink to gray buff, finely to very finely granular-----	10	
Dolomite, pinkish gray, finely granular-----	1	
Dolomite, pink to white, very fine sandy, finely granular-----	2	
Dolomite, purplish buff finely crystalline-----	2	
Dolomite, purple-mottled buff, finely granular, with crinoids, brachiopods, and corals. Forms ledge-----	10	
Shale, platy, purple dolomitic, in part very fine sandy; platy, brown dolomitic shale-----	5	
Dolomite, purple to cream-colored, finely crystalline-----	5	
Dolomite, slightly purple-tinged gray buff, fossiliferous, finely granular to finely crystalline, containing small calcite vugs. <i>Receptaculites</i> (?)-----	5	
Dolomite, slightly purple-tinged gray buff, finely crystalline to finely granular, with brachiopods in lower part. Forms ledge-----	16	
Dolomite, pinkish gray, fossiliferous, finely crystalline to finely granular, with small calcite vugs. Brachiopods and gastropods-----	10	
Dolomite, dark-buff, medium-crystalline-----	5	
Dolomite, pink-tinged buff, finely to medium-crystalline-----	10	
Dolomite, pink-tinged buff gray, finely granular to finely crystalline-----	6	
Dolomite, pinkish gray, fossiliferous, slightly limy, finely granular to finely crystalline, containing some red-mottled buff dense chert. Gastropods-----	5	
Dolomite, compact, pinkish gray, finely banded, finely granular-----	5	
Dolomite, pink to gray, fossiliferous, finely granular, containing a few gastropods-----	5	
Dolomite, badly altered, pink-tinged buff, finely to medium crystalline-----	16	
Dolomite, gray buff, granular-----	1	
Dolomite, hard, slightly pink-tinged buff, finely to medium crystalline-----	5	
Dolomite, buff, very porous, medium to coarsely crystalline-----	3	
Dolomite, purple-mottled gray, medium to coarsely crystalline-----	2	
Dolomite, slightly pink-tinged cream-colored, medium to coarsely crystalline-----	5	
Dolomite, hard, slightly pink-tinged cream-colored, medium crystalline, containing tan dense chert nodules-----	6	
Dolomite, pinkish-gray, fossiliferous, granular to medium crystalline. Abundant brachiopods, sponges, and corals-----	5	
Dolomite, light-buff, fossiliferous, finely granular. Brachiopods and crinoids-----	15	
Dolomite, massive, pinkish buff, fossiliferous, finely granular. Brachiopods in lower half-----	11	
Dolomite, gray, finely granular-----	1	
Dolomite, compact, pink, finely crystalline to dense, with cone-in-cone structure-----		8
Dolomite, pink to buff, finely to medium crystalline-----	8	4
Dolomite, dark-buff, finely crystalline-----	6	
Dolomite, buff, sparsely fossiliferous, finely granular to finely crystalline, with a few brachiopods in lower part-----	5	
Dolomite, cream-colored to buff, crinoidal, finely granular to finely crystalline. Filled cave nearby in this bed-----	5	
Dolomite, pinkish gray, fossiliferous, very finely granular, and pinkish-gray, finely to coarsely crystalline dolomite. Brachiopods-----	5	
Dolomite, buff, fossiliferous, finely to medium crystalline. Abundant crinoids, brachiopods, gastropods, and <i>Receptaculites</i> (?)-----	5	
Dolomite, purple-mottled buff, granular to medium crystalline-----	5	
Dolomite, pinkish buff, fossiliferous, finely to medium crystalline. Abundant crinoids and brachiopods-----	6	
Dolomite, maroon-mottled buff, sparsely fossiliferous, granular to medium-crystalline. Crinoids. Upper 3 feet appears brecciated or pebbly-----	5	
Dolomite, pink to pinkish buff, fossiliferous, medium-crystalline, with brown resinous aragonite. Abundant crinoids, <i>Receptaculites</i> (?), and <i>Orthoceras</i> -type cephalopods-----	5	
Dolomite, badly altered, pink to red, coarsely crystalline, with red silt in interstices-----	5	
Dolomite, badly altered, pink to red, medium to coarsely crystalline-----	5	
Total thickness of Fremont limestone-----	281	0

Harding sandstone

Ft. in.

(Measured with Brunton compass and tape at first hairpin curve on entrance road to Harding Quarry about center s. line NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 31, T. 18 S., R. 70 W., and on north wall of Harding Quarry about center south line NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 31, T. 18 S., R. 70 W.)

Shale, pale-green and maroon, fossiliferous, waxy, purple, very fine sandy, and greenish-white very fine grained sandstone. Abundant fish plates-----	4	
Sandstone, massive, bright-yellow, pink, purple, and white, fossiliferous, very fine grained. Abundant fish plates on upper surface-----	13	
Sandstone, white, limy, very fine grained-----		4
Sandstone, greenish white, limy, very fine grained, and purple very fine grained sandstone containing fish plates-----	8	
Sandstone, greenish white, limy, very fine grained-----	2	
Shale, hard, fissile to blocky, purple, fossiliferous. Fish plates-----	2	6
Sandstone, white to lavender, fossiliferous, very fine grained. Fish plates-----	1	7
Sandstone, red, very fossiliferous, shaly, very fine grained. Fish plates-----		5
Sandstone, massive, white- and pink-mottled, very fine grained. Fish plates at top-----	12	6
Sandstone, red and white, fossiliferous, very fine grained. Fish plates-----	1	6
Shale, pink, very fine sandy-----	1	6
Sandstone, massive, pink to red, very fine grained-----	5	
Sandstone, thin-bedded, pink to red, very fine grained-----	3	6
Sandstone, platy, white to pink, very fine grained-----	2	
Shale, pink, purple, and green, very fossiliferous. Abundant pelecypods, brachiopods, and fish plates-----	1	10
Shale, hard, blocky, purple and green, sparsely fossiliferous, fine sandy. Brachiopods-----		8
Shale, hard blocky brown, sparsely fossiliferous, very fine sandy. Fish plates-----		10
Shale, brownish green, fossiliferous. Orange fish plates-----		5
Shale, brown, green, and purple, very fossiliferous, very finely banded. Orange fish plates--		7
Shale, blocky, green-spotted purple to brown-----		10
Shale, fissile, brown, waxy, with thin layers of purple shale-----	5	10
Shale, fissile, bright purple-----		7
Sandstone, purple- and green-mottled white, very fine grained-----	2	3
Sandstone, white, fossiliferous, fine-grained. Fish plates and other fossils near base. Forms ledge-----	4	11
Shale, purple, fossiliferous, slightly limy, very fine sandy. Fish plates-----	1	4
Sandstone, slightly pink- and green-tinged white, very fine grained-----	8	8
Shale, purple-mottled mustard-green, fossiliferous, very fine sandy. Fish plates, pelecypods, and gastropods-----	3	2
Shale, green, fossiliferous, with black inclusions and fish plates-----		10
Shale, red to purple, slightly fossiliferous, waxy-----	6	6
Shale, slightly green-mottled brown, waxy-----	2	
Shale, purple and green, fine sandy-----		6
Limestone, green-mottled purple to red, very fine sandy, and very limy, very fine grained sandstone-----		7
Sandstone, red and brown, limy and shaly, very fine grained-----		5
Shale, platy, chocolate brown, fossiliferous-----		3
Shale, purple and green, fine sandy-----		8
Limestone, red and purple, very fossiliferous, fine sandy. Abundant fish plates on upper surface-----	1	
Sandstone, pink to white, limy, very fine grained, quartzitic in part-----	3	
Sandstone, purplish white, limy, very fine grained, and purple very fine sandy shale-----	1	6
Sandstone, greenish white, very fine grained-----	1	7
Sandstone, platy, white, fossiliferous, very fine grained, with purple, sandy shale partings. Fish plates-----	2	4
Sandstone, pink-mottled white, fine-grained. Forms ledge with unit below-----	10	6
Sandstone, purple to white, limy, very fine grained, with abundant small red concretions and numerous shale partings-----	5	
Sandstone, pink-tinged white, very fine grained-----	2	
Sandstone, purple and white, shaly, very fine grained-----	1	6
Sandstone, purple- and white-banded, limy, very fine grained, with iron concretions up to 1 inch in diameter. Forms ledge-----	3	2
Sandstone, purple-mottled white, shaly, very fine grained-----		8
Sandstone, pinkish white, limy, very fine grained, containing scattered coarse sand grains and thin partings of red shale-----	3	3
Sandstone, purple-mottled white, shaly, very fine grained-----		8
Sandstone, yellow-stained pink to white, fine grained. Top of lower ledge-----	1	9

	Ft.	in.
Sandstone, pinkish white, subangular to subround, coarse-grained-----	2	2
Sandstone, white, poorly sorted, limy, subangular to subround, fine- to coarse-grained-----	1	4
Sandstone, white, subround, coarse-grained, containing at base, white quartz pebbles, 1 inch in diameter-----	1	
Total thickness of Harding sandstone-----	143	11

(Underlain by pre-Cambrian gneiss and granite in Harding quarry)

Manitou limestone

(Measured with tape in Gnat Canyon in Shaws Park,
NE $\frac{1}{4}$ sec. 36, T. 17 S, R. 71 W.)

Dolomite, dark-red, fossiliferous, medium crystalline, containing quartz geodes and Orthoceras-type cephalopods-----	1	2
Dolomite, dark-red, fossiliferous, finely crystalline, containing nodules of white granular to dense chert. Gastropods and Orthoceras-type cephalopods abundant in top 6 inches-----	3	10
Dolomite, dark-red, finely granular to finely crystalline-----	4	
Dolomite, thin- and wavy-bedded, dark-red, finely granular to finely crystalline, with seams and nodules of white to tan granular to dense chert $\frac{1}{2}$ to 1 inch thick-----	5	7
Dolomite, red, finely granular, with two seams, $\frac{1}{4}$ inch thick, of white granular chert-----	1	4
Dolomite, dark-red, finely granular-----	1	8
Dolomite, red, granular, with one seam and two nodule horizons of slightly orange-mottled white spicular (?) devitrified to dense chert-----	5	10
Dolomite, dark-red, medium crystalline, with numerous layers, 2 to 4 inches thick, of white spicular devitrified to dense chert-----	5	
Dolomite, dark-red, finely granular to finely crystalline-----	4	4
Dolomite, dark-red, granular to medium-crystalline, with white dense chert showing dolomite crystal casts. Wavy basal surface-----	3	6
Total thickness of Manitou limestone-----	36	3

Pre-Cambrian granite

SECTION F. South Tunnel, Phantom Canyon, Fremont County, Colorado,
NE $\frac{1}{4}$ sec. 32, T. 17 S., R. 69 W.

(Measured by hand level and tape above and west of south tunnel on Phantom
Canyon road.)

Carboniferous

Pennsylvanian rocks

Fountain formation

Sandstone, red, arkosic, coarse-grained

Ordovician rocks

Fremont limestone

Dolomite, pinkish-red to yellow, granular, weathers like sandstone-----	3	10
Dolomite, yellow to pink, very finely banded, granular, grading downward into brown to red dense dolomite containing nodules of red and tan dense chert-----	3	9
Dolomite, yellow, finely pink-banded, granular. Weathers like sandstone-----	1	6
Dolomite, yellow-mottled red, fossiliferous, granular, containing a little yellow dense chert--	4	
Dolomite, yellow, pink, and red, medium- to coarsely crystalline-----	5	
Dolomite, pink to red, fossiliferous, medium- to coarsely crystalline; weathers rough. Crinoids, colonial corals, and Orthoceras-type cephalopods. Wavy basal contact-----	5	
Total thickness of Fremont limestone-----	23	1

Harding sandstone

Sandstone, yellow, red, and pink, finely banded and cross-bedded, limy, very fine grained----	3	1
Sandstone, yellow to pink, fossiliferous, fine-grained. Abundant fish plates-----	5	6
Sandstone, purple-mottled yellow, very fine grained-----	1	6
Sandstone, white, very fine grained-----	4	
Sandstone, white, slightly limy, very fine grained-----	1	
Sandstone, blocky, pink and white, slightly limy, very fine grained, with intercalated pink fine sandy shale-----	3	4
Covered interval-----	16	
Sandstone, white, very fine grained-----	1	6
Sandstone, massive, pinkish-white, very limy, fine-grained. Forms ledge-----	9	
Covered interval-----	15	6
Shale, dull-red to brown, waxy, in part green-spotted-----	16	6
Sandstone, medium-bedded, pink and white, slightly limy, fine-grained. Forms ledge-----	4	3
Sandstone, platy, purple, pink, and white, slightly limy, fine-grained, with intercalated purple fine sandy shale-----	10	6

	<u>Ft.</u>	<u>in.</u>
Sandstone, platy, pink, purple, and white, fine-grained-----	9	
Shale, thin-bedded, pink to red, sandy, and shaly sandstone containing irregular masses (fucoids?)-----	5	2
Sandstone, hard, white to red, limy, fine- to coarse-grained-----		4
Total thickness of Harding sandstone-----	106	2
Manitou limestone		
Dolomite, medium-bedded, compact, dark-red, finely granular, with 3-inch layer of bone- white finely mottled dense chert at top-----	1	8
Dolomite, dark-red, finely granular, containing white to pink dense chert nodules, 3 to 6 inches in diameter-----	2	6
Dolomite, dark-red, fossiliferous, finely granular. <u>Orthoceras</u> -type cephalopods-----	2	4
Dolomite, dark-red, finely granular, containing 1- to 2- inch layers of white to pink, finely granular chert-----	2	
Dolomite, yellow-mottled purplish-red, slightly limy, finely granular-----	4	6
Dolomite, purple and brown, finely banded, fine sandy-----		4
Dolomite, red, very cherty, finely granular; 75 percent of bed appears to be white to cream-colored dense chert-----	2	8
Dolomite, red, limy, finely granular, with little white dense chert-----	1	3
Dolomite, thick-bedded, dark-red, granular to medium-crystalline-----	3	9
Dolomite, dark-red, very cherty, medium-crystalline. White to pink granular chert, and white microfossiliferous (?) or finely figured dense chert in layers and nodules, 1 to 2 inches thick-----	5	2
Dolomite, hard, red, medium-crystalline, with white slightly mottled dense chert layers, 1 to 3 inches thick, in lower part-----	5	8
Dolomite, hard, red to yellow, finely granular to medium crystalline, with white dense to granular chert, and white mammillary chert in layers 1 to 3 inches thick and about 6 inches apart. Wavy basal contact-----	6	1
Total thickness of Manitou limestone-----	37	11

Pre-Cambrian granite and schist

SECTION F-1. Quarry, Phantom Canyon, Fremont County, Colorado, NW $\frac{1}{4}$ sec. 33, T. 17 S., R. 69 W.

(Measured by hand level and tape on east side of Eight Mile Creek,
3.4 miles north of State Highway 120 on Phantom Canyon Road.)

Carboniferous

Pennsylvanian rocks

Fountain formation

Sandstone, red, arkosic, containing quartz pebbles 1 to 2 inches in diameter.

Ordovician rocks

Harding sandstone

Sandstone, yellow-, red-, and purple-stained, very fine grained-----	5	6
Sandstone, pink- and yellow-mottled white, slightly limy, very fine grained-----	8	
Sandstone, pink to white, very fine grained, containing abundant fish scales. Forms base of upper ledge-----	5	6
Sandstone, white, limy, very fine grained-----	1	6
Sandstone, pink, very fine grained-----	4	
Sandstone, white, platy, very fine grained, with thin red layers-----	2	10
Sandstone, white, very fine grained. Forms top of massive sandstone bed-----	4	
Sandstone, pink and white, very fine grained, grading into purple very fine grained sandstone containing abundant fish scales. Forms base of massive sandstone bed-----	5	
Sandstone, pink to purple, shaly, very fine grained, with fish scales-----	2	
Covered interval. Maroon and brown shale partly exposed in places-----	27	
Sandstone, white, platy, limy, very fine grained-----	6	8
Sandstone, massive, white to pink, slightly limy, very fine grained, with scattered "ironstone" concretions-----	10	4
Sandstone, thin-bedded, white, very fine grained, interbedded with thin layers of purple shale-----	3	3
Shale, purple, with a few thin layers of white very fine grained sandstone-----	1	2
Sandstone, white, slightly limy, very fine grained-----		5
Sandstone, pink, shaly, very fine grained, and sandy shale grading into maroon shale-----	2	
Sandstone, hard, pink- and white-banded, very fine grained-----		6
Shale, purple-----	1	1
Sandstone, white, subangular to subround, coarse-grained-----		3
Total thickness of Harding sandstone-----	91	0

	<u>Ft.</u>	<u>in.</u>
Manitou limestone		
Covered interval. Contact not exposed-----	2	
Dolomite, thick-bedded, red, slightly cherty, finely granular. White milky dense to finely granular chert-----	5	4
Dolomite, thin-bedded to platy, red, slightly cherty, finely granular-----	4	
Dolomite, thick-bedded, red, finely granular-----	3	11
Dolomite, red, finely granular to medium crystalline, with 1- to 2-inch layers of tan-mottled gray dense chert, red- and white-mottled dense chert, and white subtranslucent figured, dense chert-----	4	10
Dolomite, red, compact, finely granular to medium crystalline, with scattered small nodules of bone-white faintly spicular (?) subtranslucent dense chert-----	4	10
Dolomite, red, granular to medium crystalline, with 1- to 2-inch layers of white devitrified chert, red- and gray-mottled dense chert, and white subtranslucent chert with faintly visible spicules (?)-----	8	2
Dolomite, red, compact, medium- to coarsely crystalline, with a small amount of white granular to dense chert and white mammillary chert-----	4	6
Total thickness of Manitou limestone-----	37	7

Pre-Cambrian schist

SECTION F-2. Cemetery Park, Fremont County, Colorado,
S $\frac{1}{2}$ sec. 19, T. 17 S., R. 68 W.

(Measured by tape up northeast cliff of canyon,
about 1 mile northwest of Beaver Creek road.)

Carboniferous

Pennsylvanian rocks

Fountain formation

Sandstone, red, arkosic.

Ordovician rocks

Fremont limestone

Dolomite, tan, medium-crystalline-----	3	
Dolomite, pink-mottled tan, slightly porous, medium crystalline-----	10	
Dolomite, yellowish tan, finely granular, silty to very fine sandy-----	5	
Dolomite, pink-mottled yellowish tan, finely granular, very fine sandy; resembles fine-grained sandstone on the outcrop-----	10	
Dolomite, pink, finely crystalline, and tan finely granular fine sandy dolomite-----	2	9
Dolomite, red and yellow, granular, and pink medium-crystalline dolomite. Abundant small crinoids-----	4	
Dolomite, pinkish-red, granular to medium crystalline-----	9	
Dolomite, pinkish-red, granular to coarsely crystalline-----	5	
Total thickness of Fremont limestone-----	48	9

Underlain by Harding sandstone and Manitou limestone which could not be accurately measured and sampled.

SECTION E. Oil Creek, Fremont County, Colorado, Tps. 16, 17 S., R. 70 W.

Carboniferous

Pennsylvanian rocks

Fountain formations

Sandstone, red brown, platy, shaly, medium-grained, resting on very irregular surface of Williams Canyon limestone.

Mississippian rocks

Williams Canyon limestone

(Measured by hand level in dry tributary on east side of Oil Creek opposite Kansas
University field camp, SE $\frac{1}{4}$ sec. 4. T. 17 S., R. 70 W.)

Dolomite, yellow-stained red and white, finely crystalline, slightly sandy in part-----		6
Dolomite, orange-mottled white, very finely granular to finely crystalline-----	4	
Limestone, red, yellow, and white, finely crystalline, dolomitic, and white slightly sandy medium crystalline dolomite-----	5	6
Dolomite, white to purple-banded white, finely crystalline to fine sandy-----	5	6
Dolomite, slightly yellow- and purple-tinged white, very finely granular, in thin wavy beds-----	10	8
Shale, soft, yellow and red, very fine sandy, with irregular basal surface-----		4.
Total thickness of Williams Canyon limestone-----	28	6

Ordovician rocks
Fremont limestone

Ft. in.

(Measured by hand level and tape on Trail Gulch road in N $\frac{1}{2}$ sec. 28, T. 16 S,
R. 70 W.

Dolomite, red-mottled cream-colored, medium-crystalline, with numerous cavities filled with red silt. Forms top of cliff-----	5	
Dolomite, red-mottled cream-colored, finely granular to finely crystalline-----	5	
Dolomite, slightly pink-mottled yellowish buff, granular-----	5	
Dolomite, yellowish buff, granular, with some pink very fine grained dolomite in lower part---	11	6
Dolomite, hard, yellow, finely granular to finely crystalline-----	5	
Dolomite, hard, yellow, finely granular, and limy dolomite-----	4	
Dolomite, bright-yellow, finely granular-----	6	
Dolomite, gray buff finely granular, and red medium-crystalline dolomite-----	4	6
Dolomite, pinkish buff to red, fossiliferous, coarsely crystalline. Small crinoids near top.		
Pronounced irregularity at base-----	5	6
Total thickness of Fremont limestone-----	51	6

Harding sandstone

(Measured along Shelf road in SW $\frac{1}{4}$ sec. 27, T. 16 S., R. 70 W.)

Sandstone, yellow-stained white, slightly limy, very fine grained-----	10	
Sandstone, purple-mottled white, fossiliferous, shaly, very fine grained. Abundant fish plates-----		8
Sandstone, yellow-stained white, slightly limy, very fine grained-----	4	
Sandstone, purple, shaly, very fine grained-----		6
Sandstone, greenish white, very fine grained-----	1	2
Shale, blocky to platy, purple, sandy, with intercalated lavender very fine grained sandstone-----	5	6
Sandstone, massive, white, fine-grained-----	7	1
Sandstone, purple, very fine grained-----		3
Sandstone, white, very fine grained-----		9
Sandstone, purple, fossiliferous, very fine grained. Abundant fish plates-----		3
Sandstone, white, very fine grained, grading downward into purplish pink very fine grained sandstone containing scattered fish plates-----	4	6
Sandstone, pink and white, very fine grained-----	10	
Sandstone, massive, gray white, very fine grained-----	4	10
Shale, white, fine, sandy-----		2
Sandstone, purple and lavender, very fossiliferous, shaly, very fine grained, grading downward into white fossiliferous very fine grained sandstone. Abundant fish plates-----	2	
Shale, platy, bright purple, very fine sandy-----	1	6
Sandstone, white, limy, fossiliferous, very fine grained. Abundant fish plates-----	2	
Shale, platy, brown, fossiliferous. Small <i>Orthoceras</i> -type cephalopods-----	2	
Shale, brown waxy-----	1	
Shale, purple to brown, waxy, containing a thin layer of very fossiliferous green waxy shale. Abundant gastropods and fish plates-----	3	
Shale, fissile, brown, waxy, green-spotted in part-----	12	6
Shale, platy, brown, waxy, grading downward into platy purple sandy shale containing scattered white subround coarse sand grains. White very fine grained sandstone layer, 3 inches thick, near middle of unit-----	5	6
Sandstone, thin-bedded, pinkish-white, very fine grained, with irregular masses (fucoids?) and very thin layers of purple-maroon fine sandy shale. Forms top of ledge-----	5	
Sandstone, gray white to pinkish white, very fine grained-----	21	
Sandstone, pinkish white, fine-grained, containing scattered white subround coarse quartz grains-----	2	
Sandstone, white, fine-grained, with scattered white coarse quartz grains-----		6
Sandstone, purple, maroon, and yellow, shaly, very fine grained-----	3	2
Shale, purple maroon, sandy-----	1	
Sandstone, yellow, subround, fine- to medium-grained-----	1	2
Shale, platy, maroon to purple, sandy, with bone-white chert fragments-----	3	2
Total thickness of Harding sandstone-----	117	2

Manitou limestone

Ft. in.

(Measured below Shelf road in NW $\frac{1}{4}$ sec. 34, T. 16 S., R. 70 W.)

Top not exposed. Estimated covered interval-----	3	
Dolomite, red, finely granular, grading downward into pink medium-crystalline dolomite containing vugs of calcite-----	7	
Dolomite, pink sandy, granular, with included large subround quartz grains-----	5	
Dolomite, red, finely granular-----	5	
Dolomite, pink, very sandy, with included large round quartz grains-----	5	
Dolomite, pinkish buff, fine sandy, finely granular; weathers like sandstone-----	4	
Dolomite, pink to cream-colored, finely granular-----	5	
Dolomite, massive, pitted, pink and red, fossiliferous, granular to medium crystalline. Small horn corals. Forms ledge-----	7	
Dolomite, pink, yellow, and white, finely granular to finely crystalline, containing scattered nodules of tan sub-translucent chert. Forms top of first ledge above creek-----	6	10
Dolomite, pinkish white, finely granular, and red medium-crystalline dolomite with trace of white devitrified chert-----	5	
Dolomite, yellow-tinged buff, medium-crystalline, containing several thin layers of white- and tan-speckled chert, white devitrified mammillary chert, and white finely figured or spicular (?) chert-----	3	
Dolomite, red, medium to coarsely crystalline, with many layers, $\frac{1}{2}$ to 1 inch thick, of gray-white to pink dense and spicular (?) chert-----	7	
Dolomite, pink to red, finely granular, medium crystalline; and coarsely crystalline dolomite with layers, $\frac{1}{2}$ to 1 inch thick, of white to tan spicular (?) dense chert-----	3	
Dolomite, red, finely granular to medium crystalline-----	2	
Total thickness of Manitou limestone-----	87	10

Pre-Cambrian gneiss or gneissic granite

SECTION G. Deadmans Canyon, El Paso County, Colorado, SE $\frac{1}{4}$ sec. 3, T. 16 S., R. 67 W.

(Measured by hand level and tape at spring about one mile northwest of State Highway 115. Dip 34° SE.)

Carboniferous

Pennsylvanian rocks

Fountain formation

Sandstone, red, arkosic, coarse-grained.

Ordovician rocks

Harding sandstone

(Measured by tape and corrected for 34° SE dip.)

Sandstone, greenish white, subround, fine-grained-----	8	5
Shale, fissile, yellow, fine sandy-----		2
Shale, fissile, green-spotted maroon to purple-----	3	9
Shale, green-spotted maroon, grading downward into red very fine sandy shale with very thin layers of white very fine grained sandstone-----	11	2
Covered interval. Judging by float, this is red-brown shale-----	5	7
Shale, red brown, with thin intercalations of pale-green shale-----	6	2
Covered interval, principally red-brown shale-----	2	10
Shale, red brown, with intercalated pale-green shale-----	12	3
Sandstone, greenish white, slightly limy, fine-grained-----	2	3
Shale, maroon, very fine sandy, and lavender very fine grained sandstone-----		11
Sandstone, greenish white, fine-grained, containing a few scattered coarse quartz grains and intercalated red shale-----	3	4
Shale, waxy brown to maroon, fine sandy-----	5	7
Sandstone, white fine-grained, with very irregular basal surface. Fills small caves and sinkholes in underlying Manitou limestone-----	5	6
Total thickness of Harding sandstone-----	87	11

	<u>Ft.</u>	<u>in.</u>
Manitou limestone		
Measured by both hand level and tape up face of cliff. Dolomite, yellow-mottled red, finely to medium-crystalline-----	6	
Dolomite, yellow-mottled, finely granular-----	4	
Dolomite, red, finely crystalline-----	5	3
Dolomite, red and yellow, finely crystalline, with one 10-inch bed of red fine sandy dolomite near base-----	10	
Dolomite, yellow to tan, finely granular to finely crystalline, grading downward into purple finely granular dolomite-----	6	
Dolomite, platy, lavender to purple, finely granular to medium-crystalline-----	4	
Dolomite, lavender, slightly sandy, finely granular-----	1	11
Dolomite, pinkish red, finely granular, with thin layers of white to yellow dense chert-----	1	8
Dolomite, pinkish red, finely granular-----	3	10
Dolomite, lavender, finely granular, grading downward into thin-bedded red finely granular dolomite-----	4	
Dolomite, purplish red to lavender, finely granular, with some calcite-----	4	2
Dolomite, yellowish red, finely granular to medium-crystalline, with trace of white milky chert at top-----	5	3
Shale, red-mottled buff-----		2
Dolomite, yellow-mottled red, medium-crystalline, containing two very thin layers of pinkish-white subtranslucent chert in lower part-----	6	3
Dolomite, yellowish brown, medium-crystalline, and red finely granular dolomite-----	5	
Dolomite, red, finely granular to medium-crystalline-----	4	5
Dolomite, red, finely granular, containing small quartz geodes and thin layers, $\frac{1}{2}$ to 1 inch thick, of buff dense chert and white faintly figured subtranslucent chert-----	3	6
Dolomite, purplish red, medium-crystalline, with five layers, 1 to 5 inches thick, of white dense chert, pink chert, showing a few spicules, and white subtranslucent chert with yellow spots-----	4	8
Dolomite, purplish red to pinkish red, finely granular-----	2	8
Dolomite, red, medium-crystalline, with thin layers, $\frac{1}{2}$ inch thick, of bone-white to cream-colored dense chert-----	2	6
Total thickness of Manitou limestone-----	85	3

Pre-Cambrian gneiss

SECTION H. Williams Canyon, El Paso County, Colorado, NW $\frac{1}{4}$ sec. 32,
T. 13 S., R. 67 W.

(Measured by hand level and tape beginning along east side of road 100 yards north of "The Narrows" and continuing on "Temple Drive" up the cliff to and above the "Cave of the Winds".)

Carboniferous

Mississippian rocks

Hardscrabble limestone

Contact with Pennsylvanian rocks not exposed. Estimated interval that could not be measured and sampled-----	15	
Dolomite, pinkish buff, finely to medium-granular-----	2	6
Limestone, brown, finely crystalline to dense, grading downward into buff finely granular dolomitic limestone-----	5	6
Limestone, white, fine, sandy, grading downward into buff, finely crystalline to dense limestone-----	5	6
Limestone, buff to tan, finely granular, dolomitic-----	3	
Limestone, cream-colored to pink, finely to medium-crystalline, with abundant calcite-----	8	
Dolomite, buff, granular, grading downward into brown finely crystalline limestone-----	5	6
Limestone, buff, medium-crystalline-----	6	
Limestone, cream-colored, finely crystalline, containing tan faintly figured dense chert and thin layers of tan granular dolomite-----	6	
Limestone, faintly red- and yellow-mottled, finely crystalline, and gray-white finely granular dolomitic limestone-----	5	6
Limestone, yellow-stained cream-colored, finely granular, dolomitic, and pink finely granular dolomite. Reddish-brown to yellowish-red subtranslucent dense chert-----	6	6
Sandstone, gray, poorly sorted, limy, subround, fine- to medium-grained; pink limy fine- to medium-grained sandstone, pink finely granular dolomite, and pinkish-buff limestone conglomerate with included clay pellets. The base of this unit appears to mark an unconformity-----	5	6

	Ft.	in.
Limestone, brown, dense; missing 5 feet east along outcrop-----		5
Limestone, yellow-stained cream-colored, finely crystalline, and dolomitic limestone-----	1	7
Dolomite, buff to tan, finely granular, containing one lens of gray- and buff-mottled dense chert-----	5	6
Dolomite, light-buff, very finely granular-----	5	6
Dolomite, pink to cream-colored, finely granular-----	4	
Dolomite, buff, slightly micaceous, finely granular, with yellow and white dense to granular chert-----	3	6
Limestone, pink-tinged buff, fine sandy-----	2	6
Limestone, pink-banded buff, micaceous, sandy and dolomitic, with irregular basal surface-----	2	6
Total thickness of Hardscrabble limestone-----	100	0

Williams Canyon limestone

Dolomite, pink- to maroon-mottled yellowish-buff, sandy; missing 10 feet east along outcrop-----	2	
Sandstone, pink to white, dolomitic, fine-grained, and yellow-stained buff finely granular dolomite-----	2	6
Dolomite, hard, purple, maroon, and yellow, slightly sandy, very finely granular-----	1	8
Shale, purple, maroon, and yellow, fine, sandy-----		4
Sandstone, gray, very limy, fine-grained-----	1	6
Limestone, maroon- and yellow-mottled buff, slightly dolomitic, finely crystalline-----	3	
Shale, yellow tan, very limy; gray-green, fine sandy shale, and yellow-white fine- to medium-grained sandstone-----	1	8
Limestone, thin-bedded, brown, finely crystalline; and red-brown, finely crystalline dolomitic limestone-----	2	6
Limestone, soft, white to buff, sandy; red dense dolomite; and tan limy shale-----	1	3
Sandstone, poorly exposed beds, gray buff, limy, fine-grained; and poorly exposed beds of brown finely crystalline limestone, and red-buff finely granular dolomite. Estimated-----	10	
Siltstone, tan, limy and in part finely sandy-----		10
Dolomite, red to brown, finely crystalline, in part fine sandy-----	2	2
Dolomite, yellow-stained, fine sandy, and gray-white very limy fine-grained sandstone, containing limestone pebbles. Irregular basal surface-----		10
Total thickness of Williams Canyon limestone-----	30	3

Ordovician rocks

Manitou limestone, restricted

Dolomite, massive, yellow-stained, slightly pink-tinged buff, medium-crystalline-----	7	
Dolomite, massive, pink to buff, medium to coarsely crystalline, containing light-buff chert with faintly visible figures. Very thin layer of white round- medium-grained sandstone near base. First bed above Cave of Winds parkway-----	7	
Dolomite, pitted, massive, yellow-stained pink to buff, medium- to coarsely crystalline, containing light-buff slightly figured or fossiliferous chert. First bed below Cave of Winds parkway-----	4	
Limestone, gray, medium-crystalline, dolomitic, grading downward into pink-tinged gray finely crystalline limestone-----	5	5
Dolomite, pink, fine sandy; and buff finely granular dolomite-----	2	
Limestone, purple-mottled buff, finely crystalline to dense-----	1	6
Dolomite, buff to brown, finely granular, limy-----	2	
Dolomite, hard, gray buff to buff, finely granular-----	7	10
Dolomite, pinkish buff, finely granular-----	1	11
Dolomite, platy, buff, finely granular-----		6
Limestone, buff, finely crystalline-----	2	9
Limestone, slightly yellow-stained gray buff, finely crystalline, containing gray and buff dense chert nodules-----	3	9
Limestone, massive, buff to tan, microfossiliferous, finely crystalline-----	6	9
Limestone, platy, gray, dense-----		10
Limestone, dark-buff, finely crystalline to dense-----	2	4
Limestone, brown, dense-----		7
Limestone, purplish buff, fossiliferous, glauconitic, medium-crystalline-----		6
Limestone, slightly pink-tinged buff, glauconitic, finely crystalline to dense-----	3	5
Limestone, pink-tinged buff, medium-crystalline-----	4	8
Limestone, cream-colored, finely granular, dolomitic-----	5	8
Dolomite, slightly yellow-stained buff, granular-----	3	
Limestone, thin-bedded, buff, faintly oolitic, finely crystalline-----	2	6
Limestone, cream-colored, finely to medium-crystalline, with two layers of cream-colored spicular chert nodules. Upper part is faintly oolitic-----	6	9
Dolomite, pink-mottled buff, finely granular-----	3	3

	Ft.	in.
Limestone, buff, finely crystalline-----	6	1
Dolomite, reddish buff, finely crystalline to finely granular; and buff finely crystalline limestone-----	6	
Limestone, cream-colored, finely crystalline, with included drusy quartz-----	9	2
Limestone, buff, finely to medium-crystalline; and dolomitic limestone containing white devitrified spicular chert-----	3	10
Limestone, buff, finely crystalline, and buff finely granular dolomitic limestone, with six 2-inch layers of gray spicular dense chert-----	5	
Limestone, buff, finely crystalline, grading downward into buff finely granular dolomite-----	11	5
Limestone, buff, finely crystalline-----	4	1
Limestone, pink-tinged gray to buff, finely crystalline, with a thin layer of buff very glauconitic oolitic to pisolitic microfossiliferous finely crystalline limestone about 2 feet below top-----	5	
Dolomite, yellow-stained buff, finely granular, grading downward into buff slightly oolitic finely crystalline limestone-----	4	3
Limestone, cream-colored, slightly glauconitic, faintly oolitic, finely crystalline-----	2	
Dolomite, yellow-stained cream-colored, finely granular-----		9
Dolomite, pink, finely granular-----	2	
Limestone, buff, finely crystalline, containing pyrite and white- to tan-figured chert-----	4	2
Limestone, thin-bedded, buff, finely crystalline, and dolomitic limestone-----	6	6
Limestone, buff, finely crystalline, with calcite and iron concretions-----	3	9
Limestone, thin-bedded, buff, finely crystalline, with traces of galena, calcite, and glauconite. Lower 4-inch bed is very shaly-----	2	5
Limestone, thin-bedded, cream-colored, finely crystalline to dense, with traces of galena, hematite, and glauconite-----	5	5
Limestone, thin-bedded, buff, fossiliferous, finely to medium-crystalline, and dolomitic limestone with trilobites and trace of cream-colored finely figured dense chert. <i>Kainella</i> sp.-----	5	6
Limestone, platy, dark-buff, finely crystalline to finely granular, dolomitic-----	3	6
Limestone, thin-bedded, brown, finely crystalline, and dolomitic limestone-----	3	
Limestone, brown, medium-crystalline, with paper-thin black shale partings, organic material, and limestone pebbles. Slightly wavy basal surface, possible unconformity-----		5
Dolomite, slightly yellow-stained pinkish red, glauconitic, granular; and buff finely crystalline dolomitic limestone-----	3	4
Dolomite, purplish-red, fossiliferous, coarsely crystalline, with calcite and <i>Orthoceras</i> -type cephalopods-----	1	11
Limestone, thin-bedded, finely crystalline, dolomitic-----	1	3
Total thickness of Manitou limestone, restricted-----	186	8

Cambrian rocks

Ute Pass dolomite

Dolomite, purplish red to buff, coarsely crystalline-----	1	2
Dolomite, thin-bedded, purplish red to buff, granular to coarsely crystalline, with dendrites on bedding surfaces and paper-thin green shale partings-----	4	4
Dolomite, dark-red, finely crystalline and granular-----	3	8
Dolomite, dark-red, very glauconitic, coarsely crystalline, with wavy basal surface-----	5	
Total thickness of Ute Pass dolomite-----	14	2

Cambrian rocks

Sawatch quartzite

Sandstone, platy, green gray, very glauconitic, fine-grained-----		2
Sandstone, white to red, glauconitic, subround-, medium-grained-----	1	2
Dolomite, red, very glauconitic, very sandy, coarsely crystalline, grading downward into red very glauconitic fine- to medium-grained dolomitic sandstone-----	6	6
Sandstone, red, glauconitic, fine- to medium-grained, dolomitic and red glauconitic coarse sandy dolomite-----	4	1
Sandstone, red, glauconitic, fine- to coarse-grained, dolomitic-----	5	6
Dolomite, red, glauconitic, coarsely crystalline, with included large round sand grains-----	5	4
Dolomite, dark-red, very glauconitic, coarsely crystalline, sandy-----	1	6
Dolomite, red, fine sandy-----		4
Dolomite, dark-red, very glauconitic, coarsely crystalline-----	1	2
Dolomite, red, finely crystalline, sandy, grading downward into red glauconitic slightly feldspathic subangular coarse-grained dolomitic sandstone-----	4	2
Sandstone, red to pink, glauconitic, feldspathic, subround- to subangular, medium- to coarse-grained, dolomitic-----	6	8
Sandstone, white, feldspathic, subround, coarse-grained, slightly dolomitic-----	3	7
Sandstone, pink to buff, fine- to medium-grained, with thin maroon shale partings-----		9
Sandstone, pink to white, slightly feldspathic, fine- to medium-grained, dolomitic-----	7	9

	Ft.	in.
Sandstone, green-spotted purple, subround-, medium-grained-----		8
Sandstone, white, slightly feldspathic, subround-, medium- to coarse-grained-----	1	1
Sandstone, white, subround, coarse-grained, with white quartz pebbles up to 3 inches in diameter. Wavy basal surface-----		3
Total thickness of Sawatch quartzite-----	50	8

Pre-Cambrian granite

SECTION I. Missouri Gulch, Douglas County, Colorado, E $\frac{1}{2}$ sec. 34, T. 10 S.,
R. 69 W.

(Measured by hand level up north face of quarry.)

Carboniferous

Pennsylvanian rocks

Fountain formation

Mississippian rocks

Hardscrabble limestone

Limestone, pink to gray, coarsely crystalline, capping hill. Approximate top of limestone formerly called Madison at this locality-----	2	
Dolomite, pink, medium- to coarsely crystalline-----	2	6
Dolomite, pink to gray-white, granular to coarsely crystalline-----	5	6
Dolomite, pink, finely granular; and buff finely crystalline limestone containing a small amount of brown dense chert-----	5	6
Limestone, cream-colored to buff, finely crystalline, grading downward into cream-colored, microfossiliferous, dense dolomitic limestone-----	1	6
Limestone, tan, dense, grading downward into pink-buff finely granular dolomite with thin layer of pink-white fine-grained sandstone at base. Forms base of ledge-----	5	6
Covered interval. Contact of Hardscrabble and Williams Canyon limestones in this interval-----	18	6
Total thickness of Hardscrabble limestone-----	41	0

Williams Canyon limestone

Sandstone, hard, lavender, quartzitic, subround-, fine-grained-----		6
Sandstone, lavender, limy, fine- to medium-grained-----	1	9
Limestone, cream-colored, finely crystalline-----	1	
Sandstone, pink, limy, medium-grained-----		8
Shale, platy, lavender, limy-----		1
Dolomite, thin-bedded, lavender and gray, very finely granular, fine sandy in part-----	2	8
Dolomite, thin-bedded, lavender to cream-colored, finely granular to fine sandy-----	6	6
Dolomite, lavender, fine sandy, grading downward into thin-bedded, purple-mottled buff finely granular dolomitic limestone and finely crystalline limestone-----	5	6
Dolomite, thin-bedded, purple-mottled lavender, very finely granular, and dolomitic limestone-----	5	6
Dolomite, thin-bedded, purple-banded gray buff, finely granular, grading downward into purple-banded gray-buff finely crystalline dolomitic limestone-----	5	6
Limestone, purplish gray, finely crystalline, dolomitic-----		10
Shale, platy, gray, limy-----		1
Limestone, thin-bedded, lavender, finely granular, dolomitic-----	3	
Limestone, platy, gray, finely crystalline-----		2
Sandstone, purple-mottled green, limy, conglomeratic-----		2
Shale, green, slightly limy, fine sandy-----		4
Total thickness of Williams Canyon limestone-----	34	3

Ordovician rocks

Manitou limestone

Limestone, red-mottled tan, finely crystalline-----		6
Limestone, purple-mottled gray buff, finely crystalline-----	1	6
Dolomite, red to lavender, medium-crystalline-----	3	11
Dolomite, massive, red, medium-crystalline, containing ferruginous material grading downward into red-mottled buff finely crystalline limestone-----	5	6
Dolomite, massive, pink to purplish red, very finely granular-----	5	8
Dolomite, massive, slightly yellow-mottled purplish red, medium-crystalline-----	5	6
Dolomite, massive, purplish red, very finely granular, limy, containing calcite. Yellow-stained in part-----	4	2
Dolomite, massive, purple-mottled red, very finely granular, containing some calcite-----	4	8
Dolomite, massive, purplish red, finely granular-----	4	2

	Ft.	in.
Limestone, purple-mottled gray, very fossiliferous, coarsely crystalline. Abundant trilobites and brachiopods-----		4
Limestone, rubbly, purple-mottled gray, finely crystalline-----	1	
Limestone, red, fossiliferous, finely crystalline, with abundant brachiopods on upper surface. <u>Apheoorthis</u> sp.-----	1	4
Limestone, rubbly, purplish red and buff, finely crystalline to dense, with gray-green limy shale partings-----	2	1
Limestone, red, fossiliferous, finely to medium-crystalline, dolomitic, with abundant brachiopods and trilobites on upper surface. <u>Nanorthis</u> sp., <u>Apheoorthis</u> sp.-----		11
Dolomite, rubbly, red-mottled gray, fossiliferous, finely to medium-crystalline, with gray-green fissile limy shale partings. Brachiopods abundant near middle; trilobites and brachiopods abundant at top. <u>Apheoorthis</u> sp.-----	4	6
Dolomite, red, fossiliferous, medium-crystalline, grading downward into buff coarsely crystalline limestone. Small pelecypods and gastropods abundant near top. <u>Nanorthis</u> sp., <u>Apheoorthis</u> sp., <u>Leostegium</u> sp., <u>Hystericurus</u> sp.-----	1	2
Limestone, rubbly, tan, finely crystalline, with green and purple shale partings-----	2	2
Limestone, gray buff, very fossiliferous, finely to coarsely crystalline. Abundant gastropods and trilobites. <u>Nanorthis</u> sp., <u>Apheoorthis</u> sp., <u>Finkelburgia</u> sp., snail-like <u>Sinuities</u> -----		6
Dolomite, red, medium- to coarsely crystalline-----	2	2
Limestone, rubbly, yellow-stained buff, finely to coarsely crystalline, with green sandy shale partings-----	1	1
Dolomite, red, slightly glauconitic, medium-crystalline, with included biotite mica flakes-----	2	2
Limestone, gray-buff, fossiliferous, glauconitic, coarsely crystalline, with one 8-inch bed of red glauconitic coarsely crystalline dolomite near middle. Brachiopods abundant----	4	4

(Measured by hand level along south bank of creek)

Dolomite, thin-bedded, red, glauconitic, coarsely crystalline, grading downward into gray-buff glauconitic coarsely crystalline limestone-----	5	6
Limestone, red to buff, glauconitic, coarsely crystalline, grading downward into red glauconitic conglomeratic limestone which contains gastropods, green shale fragments, and fine sand grains-----	3	6
Limestone, red, finely crystalline, dolomitic-----	2	
Dolomite, poorly exposed, thin-bedded, purplish red, slightly fossiliferous, finely granular, and pink to purplish-gray finely crystalline limestone-----	4	6
Shale, platy, brown, slightly glauconitic, micaceous-----	1	
Total thickness of Manitou limestone-----	75	10

Cambrian rocks

Ute Pass dolomite

Dolomite, alternating thick- and thin-bedded, red, very glauconitic, coarsely crystalline, containing calcite-----	4	10
Shale, platy, brown-----		6
Dolomite, thin-bedded, red, glauconitic, micaceous, fine sandy, finely granular, grading downward into red glauconitic, coarsely crystalline dolomite-----	5	6
Dolomite, thin-bedded, red, very glauconitic, medium- to coarsely crystalline, with included mica and sand grains. Contact of Ute Pass dolomite and Sawatch quartzite is not exposed but this bed which was excavated is probably within 5 feet of contact-----	5	6
Total thickness of Ute Pass dolomite-----	16	4

Cambrian rocks

Sawatch quartzite

(Measured by hand level up north side of gulch 250 yards east of quarry.)

Covered interval, estimated-----	5	
Sandstone, brown to purple, slightly limy, subround, fine- to coarse-grained-----	4	6
Sandstone, purple, slightly limy, subround, medium-grained. Sand grains show secondary enlargement in part-----	11	
Sandstone, bright yellow, poorly sorted, slightly limy, fine- to medium-grained, grading downward into purple-mottled yellow slightly limy fine-grained sandstone-----	5	6
Sandstone, red to pinkish-white, well-sorted, slightly limy, fine- to medium-grained-----	16	6
Sandstone, alternating beds of pink and white, slightly limy, subround-, fine- to medium-grained-----	5	6
Sandstone, pink, poorly sorted, slightly limy, fine- to coarse-grained-----	9	6
Sandstone, yellow, subround-, fine- to medium-grained-----	1	6
Sandstone, very friable, tan, subround-, medium-grained, grading downward into reddish-brown subround medium-grained sandstone-----	5	6

	<u>Ft.</u>	<u>in.</u>
Sandstone, ferruginous red to tan, poorly sorted, slightly feldspathic, slightly limy, fine- to coarse-grained, with some secondary quartz-----	5	6
Sandstone, ferruginous brown and red, slightly limy, subround fine- to coarse-grained-----	5	6
Total thickness of Sawatch quartzite-----	75	6

Pre-Cambrian granite

SECTION J. Gove Canyon, Douglas County, Colorado, NE $\frac{1}{4}$ sec. 2, T. 10 S.,
R. 68 W.

(Measured by hand level and tape on west side of Gove Creek.)

Carboniferous

Pennsylvanian rocks

Fountain formation

Clay, red, with limestone and chert boulders, some of which contain brachiopods of
Mississippian age.

Mississippian rocks

Williams Canyon limestone

Dolomite, pink, finely granular to finely crystalline-----	2	
Dolomite, poorly exposed, hard, pink, finely to medium-crystalline, with conchoidal fracture-----	5	6
Dolomite, poorly exposed, red, lavender, and gray buff, finely granular-----	5	6
Sandstone, red, lavender, and white, slightly limy, fine- to medium-grained-----	1	3
Dolomite, blocky, lavender, finely crystalline-----	1	8
Dolomite, lavender to buff, finely granular, sandy in part-----	4	2
Sandstone, lavender, dolomitic, fine- to medium-grained-----		4
Dolomite, lavender, fine sandy-----		4
Dolomite, lavender, finely granular to finely crystalline-----		6
Dolomite, thin-bedded, lavender and buff, slightly sandy, finely granular, and compact lavender finely granular dolomite-----	4	
Dolomite, thin-bedded, lavender, finely granular to fine sandy, with 4-inch bed of lavender dolomitic fine-grained sandstone near middle-----	4	
Dolomite, thin-bedded to rubbly, hard, lavender, finely granular, with included subround sand grains-----	4	6
Dolomite, platy, fine sandy-----		3
Dolomite, thin-bedded to rubbly, pink, finely granular, and yellow- and purple-mottled lavender finely granular dolomite-----	4	9
Siltstone, thin-bedded to rubbly, lavender dolomitic; lavender finely granular, dolomite with calcite; and red to purple finely granular dolomite-----	5	2
Shale, platy, purple, slightly dolomitic, with irregular basal surface-----		6
Total thickness of Williams Canyon limestone-----	44	5

Cambrian rocks

Ute Pass dolomite

Dolomite, medium-bedded, red, very glauconitic, sandy, interbedded with red glauconitic dolomitic fine-grained sandstone-----	5	
Dolomite, medium-bedded, red, very glauconitic, sandy to coarsely crystalline, with green layers of glauconite between beds. Calcite vugs in upper 1 foot-----	3	6
Total thickness of Ute Pass dolomite-----	8	6

Cambrian rocks

Sawatch quartzite

Sandstone, hard, brown to tan, well-sorted, glauconitic, calcareous, subround, medium- to coarse-grained-----	5	6
Sandstone, hard, brown to tan, subround, medium- to coarse-grained-----	4	2
Sandstone, friable, finely brown-banded white and tan, poorly sorted, subround, fine- to coarse-grained-----	4	10
Sandstone, friable, white to brown, subround, fine- to medium-grained-----	8	2
Sandstone, friable, brown, subround, fine- to medium-grained, grading downward into pinkish-white to tan finely brown-banded subround medium-grained sandstone-----	5	10
Sandstone, friable, white to brown, subround, fine- to medium-grained, with considerable iron staining at top-----	4	9
Sandstone, friable, white, subround, fine- to medium-grained, grading downward into white finely brown-banded subround fine- to medium-grained sandstone-----	6	
Sandstone, friable, brown, subround, fine-grained-----	4	
Sandstone, friable, white, finely red-banded, subround, fine- to medium-grained-----	4	9

	Ft.	in.
Sandstone, friable, pinkish-white, subround, slightly feldspathic, fine- to medium-grained----	7	4
Sandstone, dark reddish brown, limy, fine- to medium-grained, with ferruginous hard layers-----	3	2
Sandstone, iron-stained white, subround, fine- to coarse-grained, containing ferruginous hard nodules and layers, and scattered quartz pebbles. Cross-bedded in part-----	1	6
Sandstone, friable, white, slightly feldspathic, subround fine- to medium-grained-----	3	
Sandstone, friable, pink-, purple-, and yellow-tinged white, subround, fine- to medium-grained-----	11	6
Sandstone, very friable, white, yellow, and pink, subround-, medium- to coarse-grained----	6	11
Sandstone, friable, white, fine- to medium-grained, grading downward into hard white feldspathic subround to subangular coarse-grained sandstone, with white quartz pebbles ($\frac{1}{4}$ -inch in diameter) at base. Smooth basal contact-----	5	6
Total thickness of Sawatch quartzite-----	86	11

Pre-Cambrian granite

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