NEVADA BUREAU OF MINES AND GEOLOGY 1995

NBMG OPEN-FILE REPORT 95-3

STRATIGRAPHIC SECTIONS OF THE MISSISSIPPIAN CHAINMAN FORMATION, UTAH-NEVADA

Walter Sadlick
542 North Waiola Avenue
LaGrange Park IL 60525

This information is being released in rough draft form; it will be retyped and redrafted later. It has not been edited or checked for completeness or accuracy, and should be considered preliminary. For related information, see *Stratigraphic Subdivision of the Chainman Formation* by Walter Sadlick in Nevada Petroleum Society Fieldtrip Guidebook, July 20-23, 1995, p. 3-43.

STRATIGRAPHIC SECTIONS OF THE MISSISSIPPIAN CHAINMAN FORMATION, UTAH-NEVADA

Walter Sadlick
542 N. Waiola Avenue
LaGrange Park, Il. 60525

ABSTRACT

Eleven measured stratigraphic sections are described in detail of the middle and upper Mississippian Chainman Formation. The sections are adjacent to the Utah-Nevada state line in a belt about 100 miles wide and extend about 200 miles from north to south; from the Wendover-Wells area southward to north of Pioche, Nevada. Most of the sections are located in western Millard County, Utah.

Fossils (chiefly brachiopods, gastropods and cephalopods) useful for correlations are listed as well as their geologic ages. Paleontological zones normally reported in intercontinental studies are given in each section. These are Visean (P1,P2), Namurian (E1,E2), and Meramecian and Chesterian. Generally each section has all four zones. Mamet foraminiferal zones 15 through 19 (in the Jensen Member) together with goniatite zones are presented in a fence diagram. Fossils in the Pequop Mountains of northeastern Nevada suggest a disconformity where the Donner Member ("Diamond Peak") overlies strata containing lower Camp Canyon fossils of P1 age. Lack of erosional features at the base of the Donner Member suggest that the area was one of sediment by-passing.

The six members [Needle Siltstone, Skunk Spring Limestone, Camp Canyon (shale and limestone), Donner (chiefly conglomeratic), Willow Gap Limestone (with clastics), and Jensen Member (several lithologies)] are differentiated in each section. However, some sections are incomplete. The uppermost three members are relatively thin blanket type deposits which are recognized at Hamilton, Nevada and the Pancake Range to the northwest. A section of the type Scotty Wash Quartzite is described. The quartzites are a sandy facies of the Jensen Member. The name Chainman Formation has nomenclatural priority over the Peers Spring Formation.

July 26, 1995.

INTRODUCTORY OVERVIEW

The numbered stratigraphic sections are presented in approximately geographic order, from south to north in Utah (sections numbered 13-61,1,2,5,4,3,15-61, and 7); then west to the Pequop Mountains (Sec. 11-61), south to Pancake Range summit in White Pine County (Sec. 2-62) and continuing south to the Pioche area for the type Scotty Wash Quartzite (Sec. 9-54).

Section 1 contains the type Needle, the basal member of the Chainman. The type Jensen, at the top of the Chainman, is in Sec. 2. Section 5 at Skunk Springs is readily accessible with excellent exposures and contains the type sections of the three "middle" members of the Chainman: Skunk Spring Limestone (a thin isochronic marker bed), Camp Canyon (shale with minor limestone) and the Willow Gap Limestone through which Willow Springs flows. Section 7 is north of Wendover, Utah and its continuation (Sec. 15-16) is to the northeast in the Silver Island Mountains. This is the type section of the Donner Member (chiefly conglomeratic) and the Wendover Phase of the Antler Orogeny. The basal Chainman truncates the Joana, Pilot, and upper Guillmette Formations. This area also contains the northernmost known limits of the Needle and Willow Gap Members.

Sec. 11-61 in the Pequop Montains contains the three uppermost Chainman Members (Donner, Willow Gap and Jensen) with a disconformity below the Donner. A similar concordant contact is present between members F and E of the type Diamond Peak Formation. In the lower half of the Pequop section is an abnormally thick clastic interval that is similar to member B of the type Diamond Peak Formation. The brachiopod *Quadratia* is present in both sections.

The widespread and relatively uniformly thick Donner, Willow Gap and Jensen Members are sharply contrasted to the to the underlying strata which are chiefly thick clastics with a very few key beds in Nevada. This suggests that the Antler orogenic belt was actively eroded prior to the deposition of the Donner Member.

The nature of the rivers that transported sediments into the Nevah Basin during Donner time were very broad, shallow, swift flowing with relatively low gradients and with broad flood plains -- similar to the lower Mississippi River. Evidence that supports this view are the subround to rounded pebbles found in the Donner Member a few hundred miles from the Antler source region; lack of scoured, eroded contacts in the basal beds of the Donner and upper

Diamond Peak. The contact of the basal beds of the Donner with the underlying meiorogenic facies were traced for about two miles in the Pequop Mountains and there was no evidence for an unconformity -- just as reported for the type Diamond Peak at the base of member F.

The presence of local coal beds and plant debris are the result of a tropical climate near an equatorial region -- perhaps similar to the swamp regions of Florida. The hydrogen sulphide and ammonia producd by bacterial action reacted with iron (from mafic rocks in the source area) to form pyrite found in the clastics and now imparts the yellowish and reddish brown tints in the rocks. For these reasons the Donner was suggested to have formed in coalescing deltaic plains. The rare amounts of muds and clays in northern Nevada is contrasted to the clayey shales of the Pioche area. The finest particles with low density and organic particles were transported by ocean currents in the trade wind belt flowing to the now present southern Nevada. The Late Mississippian strata of southernmost Nevada belong to a very different tectonic environment than that of the Chainman Formation.

Sedimentary Terminology

The terminology used for rocks in this report is defined here. The confusion of bedding (thin- or medium-bedded, etc.) is avoided by using descriptive measurements such as, "in 3- to 6-inch thick beds." At times it was difficult to determine exact thickness of beds; however, it was obvious that a particular unit "weathers into 1/4-inch thick plates." Siltstone and sandstone refer to grade terms; orthoquartzites refer to sandstones that are predominately composed of quartz grains cemented with silica. Claystone refers to a rock composed of grains less than silt-size in diameter. Mudstone is used where the precise aspect of a rock is in doubt, but generally includes mixtures of clay and silt. Shale is used for a mudstone or claystone with fissile bedding.

The amount of induration is not considered in these definitions since it has a wide range of variation. Such terms as hard, dense, resistant to weathering, and ledge-forming actually connote a well-indurated rock. Slope-forming implies a soft, poorly indurated rock.

The term limestone is avoided where possible. When used, it refers to a rock containing more than 50 per cent calcium carbonate. The carbonate rock classification employed is based on grain size ~~after Kay (1951, p. 5-6)~~ so that the classification is descriptive and genetic implications are avoided.

It was beyond the scope of this work to examine all lithologies with a petrographic microscope. However, the grain size of each lithologic type

was checked against a standard in the field and lithologies were examined at least every five feet stratigraphically. The same grain size standard was used for both detrital and carbonate rocks. Accordingly, the terms calcilutite, calcisiltite, and calcarenite refer to sedimentary rocks containing more than 50 per cent calcium carbonate and granular particles (commonly fine-shell fragments) whose size could be determined.

TABLE 1. LOCATION OF MEASURED STRATIGRAPHIC SECTIONS

Section	Location
1.	Northern Needle Range, Sec. 26, T. 25 S., R. 19 W., Millard County, Utah.
2.	Northern Burbank Hills, Sec. 35, T. 22 S., R. 18 W., Millard County, Utah.
3.	Granite Mountain, Confusion Range, Sec. 18, T. 14 S., R. 16 W., Joab County, Utah.
4.	Bishop Springs Anticline, Confusion Range, Sec. 36, T. 15 S., R. 18 W., Millard County, Utah.
5.	Skunk Springs, Confusion Range, Sec. 26, T. 16 S., R. 16 W., Millard County, Utah.
7.	A-1 Canyon, Silver Island Mountains, Sec. 33, T. 34 N., R. 70 E., Elko County, Nevada.
9-54.	Fairview Range, Secs. 34, 35, T. 4 N., R. 65 E., Lincoln County, Nevada.
11-61.	Pequop Mountains, Sec. 3, T. 34 N., R. 65 E., Elko County, Nevada.
13-61.	Southern Burbank Hills, Sec. 32, T. 23 S., R. 18 W., Millard County, Utah.
15-61.	Silver Island, Silver Island Mountains, Secs. 28, 32, T. 3 N., R. 17 W., Tooele County, Utah.
2-62.	Pancake Range, Sec. 30, T. 18 N., R. 56 E., White Pine County, Nevada.

TABLE 2. LOCATION OF OBSERVED SECTIONS

A. Black Pine Range, Sec. 32, T. 15 S., R. 29 E., Cassia County, Idaho. Dynamically metamorphosed to phyllite.

B. Vipont Mine, Vipont Mountain, Sec. 6, T. 14 N., R. 17 W., Box Elder County, Utah. Metamorphosed to phyllite.

C. Grouse Creek Range, SW 1/4 of T. 11 N., R. 16 W., Box Elder County, Utah. Dynamically metamorphosed to phyllite.

D. Crater Island, Silver Island Mountains, Sec. 2, T. 4 N., R. 17 W., Box Elder County, Utah.

E. Wood Hills, Sec. 25, T. 37 N., R. 63 E., Elko County, Nevada. Lower part of Section complexly faulted.

F. Schoonover Canyon, Independence Mountains, Sec. 19, T. 42 N., R. 53 E., Elko County, Nevada; data from Fagan, 1962.

G. Waterpipe Canyon, Independence Mountains, T. 39 N., R. 53 E., Elko County, Nevada; data from Kerr, 1962.

H. Carlin Canyon, T. 33 N., R. 53 E., Elko County, Nevada; data from Dott, 1955.

I. Diamond Mountains, T. 20 N., R. 55 E., White Pine County, Nevada; data from Dott, 1955, and Brew, 1961.

J. Antelope Mountains, Sec. 36, T. 18 N., R. 58 E., White Pine County, Nevada.

K. White Pine Mining District, Sec. 31, T. 17 N., R. 58 E., White Pine County, Nevada.

L. Chainman Mine, Egan Range, Sec. 18, T. 16 N., R. 63 E., White Pine County, Nevada. Additional data from Spencer, 1917.

M. Conners Pass, Schell Creek Range, Sec. 34, T. 14 N., R. 65 E., White Pine County, Nevada.

N. Silver Creek, Snake Range, approximately Sec. 16, R. 69 E., White Pine County, Nevada. Complexly faulted.

O. Conger Mountain, Confusion Range, Sec. 2, T. 19 S., R. 17 W., Millard County, Utah.

P. Johns Wash, Snake Range, Sec. 36, T. 11 N., R. 68 E., White Pine County, Nevada. Complexly faulted.

Q. Dutch John Mountain, Secs. 15-16, T. 6 N., R. 65 E., Lincoln County, Nevada.

R. Trough Springs, approximately S 1/2 Sec. 13, T. 6 N., R. 62 E., Lincoln County, Nevada.

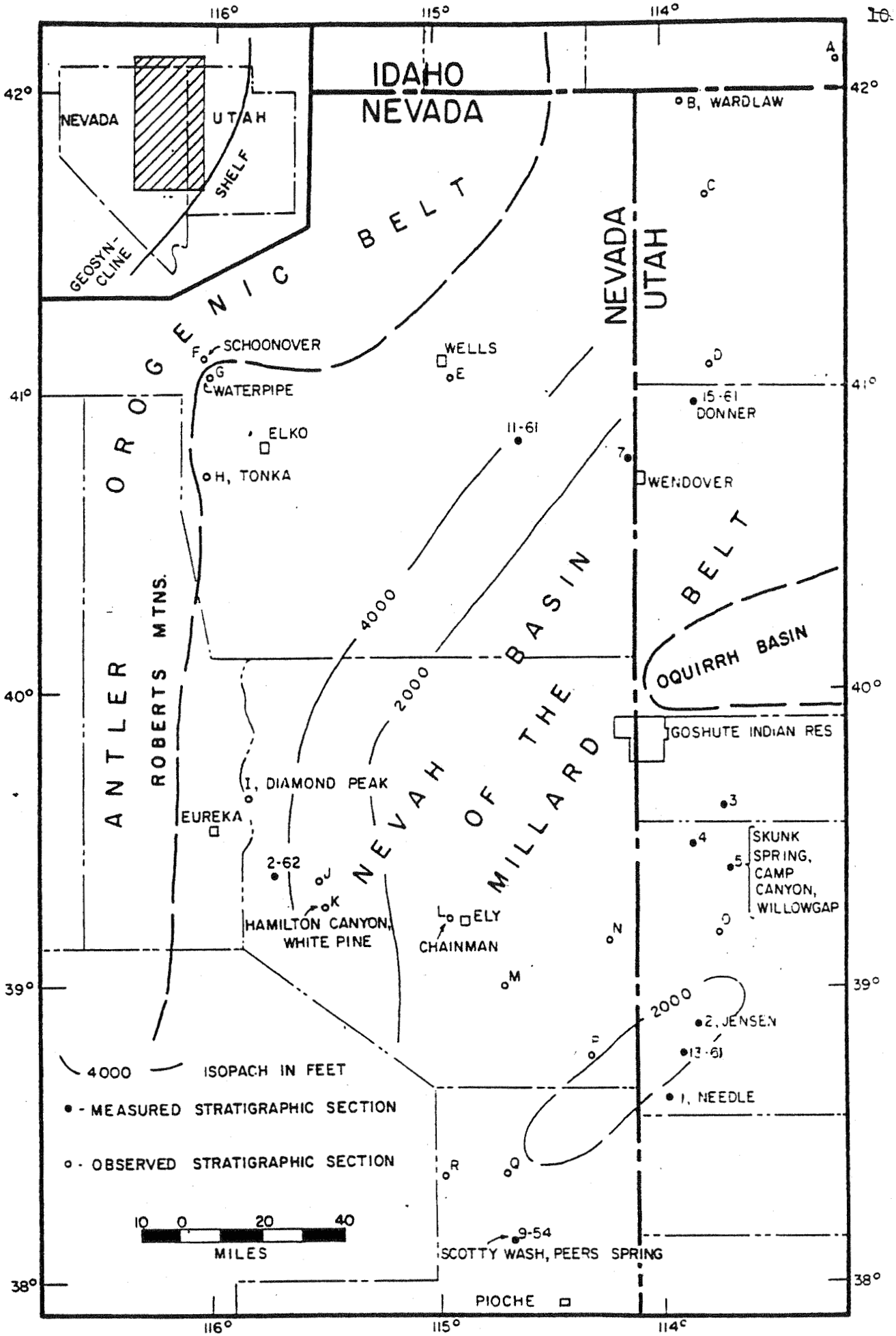


Figure 1. Index map of eastern Nevada and western Utah showing investigated sections, type sections of rock-stratigraphic units, and generalized paleogeologic map of Late Mississippian time.

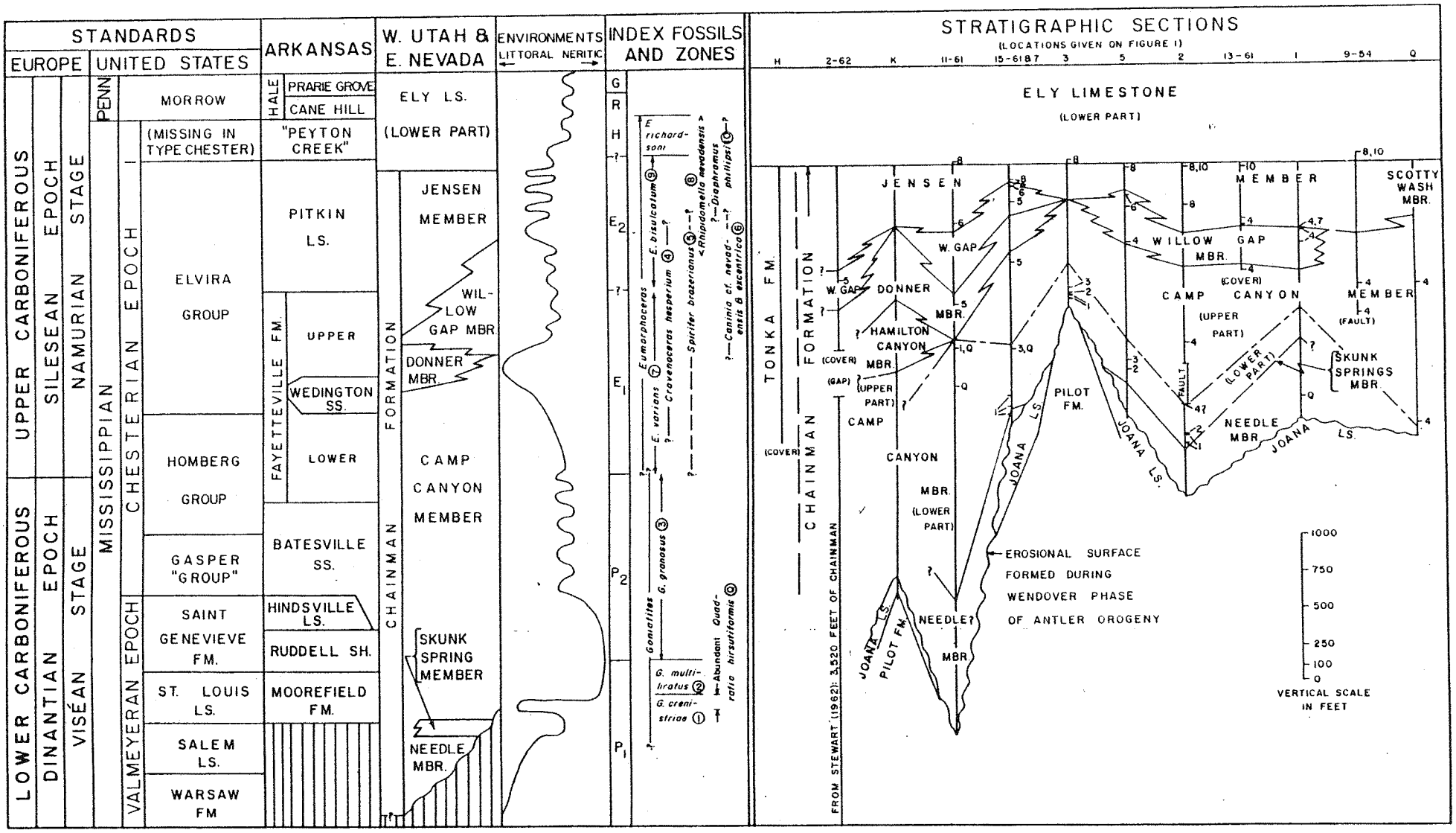

STANDARDS
EUROPE
UNITED STATES
ARKANSAS
W. UTAH & E. NEVADA
ENVIRONMENTS
LITTORAL NERITIC
INDEX FOSSILS AND ZONES
STRATIGRAPHIC SECTIONS
(LOCATIONS GIVEN ON FIGURE 1)
UPPER CARBONIFEROUS
LOWER CARBONIFEROUS
SILESEAN EPOCH
DINANTIAN EPOCH
NAMURIAN STAGE
VISÉAN STAGE
PENN
MISSISSIPPIAN
CHESTERIAN EPOCH
VALMEYERAN EPOCH
MORROW
(MISSING IN TYPE CHESTER)
ELVIRA GROUP
HOMBERG GROUP
GASPER "GROUP"
SAINT GENEVIEVE FM.
ST. LOUIS LS.
SALEM LS.
WARSAW FM
HALE
PRARIE GROVE
CANE HILL
"PEYTON CREEK"
PITKIN LS.
FAYETTEVILLE FM.
UPPER
WEDINGTON SS.
LOWER
BATESVILLE SS.
HINDSVILLE LS.
RUDDELL SH.
MOOREFIELD FM.
ELY LS.
(LOWER PART)
CHAINMAN FORMATION
JENSEN MEMBER
WILLOW GAP MBR.
DONNER MBR.
CAMP CANYON MEMBER
SKUNK SPRING MEMBER
NEEDLE MBR.
G
R
H
E2
E1
P2
P1
E richardsoni
Eumorphoceras
E. bisulcatum
E. varians
Cravenoceras hesperium
Spirifer brazerianus
Rhipidomella nevadensis
Diaphragmus
Caninia cf. nevadensis B excentrica
phillipsi
Goniatites
G. granosus
G. multiliratus
G. crenistria
Abundant
Quadratia hirsutiformis
ELY LIMESTONE
(LOWER PART)
TONKA FM.
CHAINMAN FORMATION
FROM STEWART (1962): 3,520 FEET OF CHAINMAN
(COVER)
(GAP)
JENSEN
W. GAP
DONNER
MBR.
HAMILTON CANYON MBR.
(UPPER PART)
CAMP
CANYON
MBR.
(LOWER PART)
NEEDLE?
MBR.
JOANA LS.
PILOT FM.
EROSIONAL SURFACE FORMED DURING WENDOVER PHASE OF ANTLER OROGENY
WILLOW GAP MBR.
CAMP CANYON
(UPPER PART)
(LOWER PART)
NEEDLE MBR.
MEMBER
SCOTTY WASH MBR.
SKUNK SPRINGS MBR.
(FAULT)
1000
750
500
250
100
0
VERTICAL SCALE IN FEET

Fig 2

Section No. 13-61. Southern Burbank Hills

Measured about 100 feet northeast of an unnamed southeast flowing wash, in the W½ SW¼ sec. 32, T. 32 S., R. 18 W., Millard County, Utah. Map reference: Burbank Hills Quadrangle. Approximate attitude: N 20 E, 35 SW.

Unit Number	Unit Description	Thickness in feet (of unit)	(above base)
	Ely Limestone:		
41.	Calcarenite: medium gray; fine-grained; hydroclastic; partly recrystallized; dense; in 3-foot thick beds containing 3-inch thick brown weathering chert lenses.		

Concordant contact. Resistant ledges characterize the Ely limestone whereas the Chainman Formation is a slope-forming lithostratigraphic unit.

	Chainman Formation (Jensen Member):		
40.	Covered, probably light yellowish gray siltstone.	13	418-431
39.	Calcarenite: reddish brown; crinoidal; hydroclastic; dense; forms a ledge.	2	416-418
38.	Siltstone: light yellowish gray; calcareous; slope-forming. Fossiliferous: ~~Diaphragmus~~ Carlinia phillipsi, Neochonetes, Glabrocingulum binodosum, Worthenia, 13-61-1. Age E2, late Chester.	5	411-416
37.	Covered, probably siltstone as unit 38. Middle of unimproved road at 22 feet above base.	63	348-411
36.	Sandstone: medium gray, weathers light brown; very fine-grained; no bedding evident; ledge-forming.	2	346-348
35.	Covered.	4	342-346
34.	Calcarenite: gray; recrystallized; hydroclastic. Contains fragments of crinoids and brachiopods. Very sharp contact with unit 33. Forms ledge with unit 33.	1	341-342

33.	Calcarenite and very fine-grained calcarenite: brownish gray; dense; no bedding evident. Contains well-preserved brachiopods: Inflatia, Ovatia. 13-61-3a.	1	340-341
32.	Covered, probably shale or siltstone.	41	299-340
31.	Covered by fluvial gravel. Section crosses wash.	55	244-299
30.	Siltstone: light brown, weathers dark brown; calcareous; dense; bedding manifest by tidal flat-estuarine laminae and ripple laminae.	20	224-244
29.	Covered, probably siltstone.	25	199-224
28.	Siltstone: pale purplish gray; well sorted coarse-grained silt. Lower half weathers light brown and has tidal flat-estuarine laminae and ripple laminae. Upper half weathers dark brown and no bedding is evident; transgressive.	23	176-199
27.	Covered, probably olive gray siltstone.	25	151-176
26.	Siltstone, same as unit 28. ~~Gradational with unit.~~	8	143-151
25.	Calcisiltite: medium gray, weathers medium brown and medium dark gray; silty; hydroclastic; dense. Contains fragments of spiriferids and fenestellids.	2	141-143
24.	Siltstone and clayey shale: light olive gray; poorly exposed.	25	118-141
23.	Covered, probably olive gray siltstone and clayey shale.	8	110-118
22.	Calcarenite: medium gray; fine-grained; partly recrystallized; platy weathering; basal 3 feet forms 2 equal ledges.	13	97-110
21.	Covered, prcbably light olive gray siltstone and clayey shale.	47	50-97
20.	Covered.	30	20-50

19.	Siltstone: dark olive gray. Contains siltstone nodules about 1 inch in diameter. Locally forms a desert pavement. Cravenoceras hesperium, Glabrocingulum quadrigatum, Inflatia. 13-61-7. Age E1, late Chester. Worthenia. Preshumardites	20	0-20
	Total thickness of Jensen Member:	431 feet	131.4 meters

Chainman Formation (Willow Gap Member):

18.	Calcisiltite: medium light gray. Contains interbeds of medium gray calcisiltite weathering light brown; silty; platy weathering.	18	253-271
17.	Calcarenite: gray; medium- to very coarse-grained; hydroclastic; fetid. Contains calcareous skeletal fragments.	5	248-253
16.	Covered.	24	224-248
15.	Calcisiltite: light olive gray; earthy; dense; in beds 2 feet thick. Contains pectens. Silty at base; mottled with medium gray limestone fragments; partially intraformational conglomerate.	22	202-224
14.	Calcarenite: medium dark gray; medium- to coarse-grained; fetid. Contains many crinoidal fragments. Originally a skeletal sand.	6	196-202
13.	Covered.	5	191-196
12.	Calcarenite: medium light gray; very fine- to medium-grained; laminated and cross-bedded about 8 degrees to bedding. Contains lenses of sandstone: quartzose, fine- to medium-grained; subrounded and rounded; laminated; in beds 1 inch to 1 foot thick.	12	179-191
11.	Covered.	15	164-179
10.	Calcarenite: medium dark gray; medium- to coarse-grained; fetid; contains crinoidal debris.	17	147-164

9.	Calcarenite: medium gray; fine- to medium-grained; fetid. Upper half laminated and cross bedded 8 to 20 degrees to bedding; currents were directed NNE. No bedding evident in lower half.	67	80-147
8.	Calcarenite: gray; fine- to medium-grained; fetid; forms ledges 3 to 8 feet thick. At 10 feet above base is a 3- foot thick lime sand packed with Cravenoceras cf. hesperium. 13-61-9.	43	37-80
7.	Siltstone: dark gray, weathers light brown; highly calcareous; no bedding. Contains poorly preserved chonetids, productids, and Taonurus.	2	35-37
6.	Calcarenite, same as unit 8.	12	23-35
5.	Calcarenite: medium gray; fine-grained; arenaceous; ripple marked, currents were directed towards S65E. 13-61-10.	15	8-23
4.	Sandstone: light brown and light brownish gray; silty and very fine-grained; slightly calcareous.	3	5-8
3.	Calcarenite, same as unit 5.	5	0-5
	Total thickness of Willow Gap Member:	271 feet	82.6 meters

Chainman Formation (Camp Canyon Member):

2.	Sandstone: medium gray, weathers light brown; silty and very fine-grained; highly calcareous; laminated and cross bedded 8 degrees to bedding. Cravenoceras cf. hesperium. 13-61-11. Age Ei, mid Chester	30	
1.	Remaining strata covered.		

Section No. 1. North Needle Range

Measured along east-flowing intermittent creek located in Sec. 26, T. 25 S., R. 19 W., Millard County, Utah (unsurveyed). Map reference: Gould (1959) Brigham Young University Studies in Geology, pl. 1.

Unit Member	Unit Description	Thickness in feet (of unit)	(above base)
Ely Limestone:			
73.	Calcarenite: light medium gray; very fine-grained; hydroclastic; in 3-foot thick beds. Glyptopleura and Geffinina ostracods occur eight feet above base. 1-19. Linoproductus		

Concordant contact. Light gray calcarenite ledges of the Ely begin with unit 73 and the chainman below is a slope-forming unit.

Chainman Formation (Jensen Member):

72.	Covered, probably olive gray shale.	49	402-451
71.	Interbedded shale and siltstone in equal amounts. Shale: olive gray; moderately calcareous. Siltstone: dark olive gray and dark gray; highly calcareous; in beds 1 to 1½ feet thick; step-forming.	36	366-402
70.	Covered, few exposures of olive gray shale.	54	312-366
69.	Shale: olive gray and dark gray; moderately calcareous; fissile. Stake 531 five feet above base.	42	270-312
68.	Siltstone: dark gray, weathers light brown; moderately calcareous; in one-foot thick beds.	32	238-270
67.	Siltstone: medium gray, weathers light brown; moderately calcareous; quartzose; in 3-foot thick beds.	42	196-238
66.	Shale: dark gray; highly calcareous; fissile; slope-forming.	62	134-196
65.	Siltstone: medium gray, weathers light olive gray and light brown; moderately calcareous; partially covered by weathered debris. Stake 530 at top of unit.	16	118-134

64.	Interbedded shale and siltstone. Siltstone: medium gray, weathers light brown. Shale: dark gray; moderately calcareous; poorly exposed; forms about 70 per cent of unit.	53	65-118
63.	Shale: dark gray; moderately calcareous; fissile; four feet above base is a 3-inch thick earthy calcisiltite with conodonts, Cravenoceras ~~and Eumorphoceras~~. ~~1-18.~~ Tumulites, 1-18. Age E1, late Chester	65	0-65
	Total thickness of Jensen Member:	451 feet	137.5 meters

Chainman Formation (Willow Gap Member):

62.	Calcarenite: medium olive gray, weathers medium brownish gray; argillaceous; dense; no bedding. Contains fossil hash of fenestellids, echinoderns, and brachiopods. Stake 529 and 551. 1-18a.	1	289-290
61.	Shale: olive gray and dark gray; calcareous. Four feet above base is a 1-foot thick calcisiltite; dark gray; earthy, dense; contains Cravenoceras. 1-17.	9	280-289
60.	Siltstone: medium dark gray, weathers olive gray; dense, highly calcareous; in beds 6 inches to 1 foot thick.	4	276-280
59.	Covered, probably shale.	20	256-276
58.	Calcisiltite: very dark gray, weathers olive gray; argillaceous; in beds 1 foot thick. Top of unit has ½-inch long poorly preserved pelecypods.	27	229-256
57.	Shale: dark gray; clayey; slope-forming.	38	191-229
56.	Calcisiltite: dark gray; silty; dense; very hard; conchoidal fracture. Weathers to a smooth, rounded, light brown surface. Locally contains chert nodules and outlines of pelecypods. Cravenoceras. 1-16.	1	190-191
55.	Calcisiltite: medium gray, weathers light olive gray; earthy; dense; hard; conchoidal fracture; no bedding.	3	187-190

54.	Shale: dark olive gray; clayey; very highly calcareous; slope-forming. In middle of unit is a 1-foot earthy calcisiltite: dark gray, weathering medium olive gray, and to a rounded surface.	25	162-187
53.	Calcisiltite: dark gray, weathers olive gray; argillaceous; no bedding. Basal 3 feet ledge-forming. Contains nautiloid fragments. 1-15.	5	157-162
52.	Shale: dark gray; highly calcareous; 50 per cent covered.	41	116-157
51.	Covered, some olive gray shale exposed.	42	74-116
50.	Shale: dark gray; highly calcareous; hard; clayey; fissile; slope-forming.	52	22-74
49.	Calcisiltite: dark gray, weathers olive gray; dense; argillaceous; blocky weathering. At 15 feet below top is a 1-foot thick calcarenite: medium gray; fine-grained; dense; fetid; upper 1 inch has many clay galls about 1 inch in diameter. <u>Glyptopleura</u> ostracodes. 1-14a.	22	0-22
	Total thickness of Willow Gap Member:	290 feet	88.4 meters

<u>Chainman Formation</u> (<u>Camp Canyon Member</u>):

48.	Shale: dark gray; highly calcareous: slope-forming.	40	474-514
47.	Calcisiltite: dark gray; dense; forms a series of steps 1 to 3 feet thick. Acid etch reveals laminae in top 3 feet. <u>Brachythyris</u> sp. 1-14.	15	459-474
46.	Covered, probably dark gray shale, partially slumped. Basal 5 feet is dark gray silty calcisiltite in 1-foot beds. At 10 to 16 feet above base is a similar calcisiltite, slumped.	59	400-459
45.	Shale; dark gray; highly calcareous. Contains poorly preserved pelecypods and nautiloids. 1-13.	18	382-400

44.	Calcisiltite: dark gray and olive gray; argillaceous; in beds $\frac{1}{4}$-inch thick; slope-forming. Contains molds of planospiraled gastropods, 3 inches in diameter. 1-12.	14	368-382
43.	Calcisiltite: light olive gray and dark gray; dense; brittle; argillaceous; in beds about 1 foot thick. Unit slumped. Contains poorly preserved mollusks which were crushed and broken before lithification.	107	261-368
42.	Calcisiltite: dark gray; dense; argillaceous; no bedding; ledge-forming. Contains lenses of light olive gray siltstone. Brachythyris sp. 1-8. Probably top of the lower part of the Camp Canyon Member.	15	246-261
41.	Shale: dark gray; highly calcareous; weathers into 3/4-inch chips; slope-forming. 1-7.	59	187-246
40.	Mudstone: light olive gray; highly calcareous.	2	185-187
39.	Shale: dark gray; highly calcareous; weathers into hard, dime-sized chips.	34	151-185
38.	Calcisiltite: dark gray, weathers medium gray; argillaceous; parts into 6-inch thick layers that are laminated.	22	129-151
37.	Mudstone: light olive gray; highly calcareous; no bedding. Stake 524.	3	126-129
36.	Covered; black earthy beds exposed at top 3 feet.	8	118-126
35.	Calcisiltite; dark gray, weathers light gray; argillaceous; slabby weathering. Contains poorly preserved pelecypods and gastropods. 1-5.	1	117-118
34.	Shale: dark gray; fissile; non-calcareous. Contains dark gray argillaceous calcisiltite lenses in lower part.	95	22-117
33.	Calcisiltite: dark olive gray, weathers olive brown; in 3-inch thick beds. ~~Sartenaeria~~. 1-4. Leiorhynchoidea	3	19-22

32.	Shale: dark gray; non-calcareous; silty hard. Taped across road.	19	0-19
	Total thickness of Camp Canyon Member:	514 feet	156.7 meters

Chainman Formation (Skunk Spring Member):

31.	Calcisiltite: medium gray; dense; brittle; no bedding. Residue of HCl acid etch has lumpy, white, secondarily replaced siliceous sponge? spicules. Upper part in beds 4 inches thick; less resistant than lower half. Stake 543.	5	0-5 1.5 meters

Chainman Formation (Needle Member): Type section

30.	Siltstone: olive gray and dark gray, weathers light olive brown; moderately calcareous; in beds $\frac{1}{4}$- to $\frac{1}{2}$-inch thick. 1-4a at top.	14	536-550
29.	Siltstone: dark gray; highly calcareous; fissile and parts into layers $\frac{1}{4}$- to $\frac{1}{2}$-inch thick.	20	516-536
28.	Siltstone: dark gray, weathers light brown; highly calcareous; quartz-grained. Lower half in beds 3 to 5 feet thick.	24	492-516
27.	Shale: dark gray; fissile; non-calcareous. 1-3.	4	488-492
26.	Calcisiltite: medium gray; dense; in one bed.	1	487-488
25.	Covered.	4	483-487
24.	Siltstone: light grayish brown and dark gray, weathers light brown; highly calcareous; in beds 1 to 2 inches thick. About 20 per cent covered.	85	398-483
23.	Sandstone: dark yellowish brown, weathers light brown; very fine- and fine-grained; well-sorted; silty; fetid; in beds 3 to 5 feet thick. Exposed in wash.	32	366-398

22.	Siltstone: light olive gray, weathers light brown; quartzose; well-sorted; moderately calcareous; parts into layers 1 to 6 inches thick. Stake 522.	20	346-366
21.	Sandstone: light olive gray, weathers light brown; slightly calcareous; very fine-grained.	20	326-346
20.	Siltstone: light olive gray, weathers light brown; moderately calcareous; in 1-inch thick beds; upper 5 feet massive.	36	290-326
19.	Siltstone: medium gray and olive gray, weathers light olive brown; slightly calcareous; quartz-grained.	19	271-290
18.	Siltstone: olive gray, weathers light brown; well-sorted; in beds $\frac{1}{4}$ to $\frac{1}{2}$ inch thick.	10	261-271
17.	Covered with light brown silty debris, probably siltstone.	39	222-261
16.	Siltstone: olive gray, weathers olive brown; moderately calcareous; very fine quartz grains in upper 1 foot; in beds about 1 foot thick.	13	209-222
15.	Covered with light brown silty debris.	12	197-209
14.	Siltstone: dark gray; non-calcareous; quartz-grained; laminated; slope-forming.	27	170-197
13.	Siltstone: dark gray; moderately calcareous; parts into 1-inch thick beds.	2	168-170
12.	Siltstone: medium dark gray, weathers light grayish brown; very slightly calcareous; fissile; abundant nematode? impressions. Quadratia hirsutiformis and ~~Sartenaeria~~. Leiorhynchoidea 1-2.	23	145-168
11.	Covered.	8	137-145
10.	Shale and about 10 per cent mudstone; light brown and dark gray; non-calcareous; abundant nematode? impressions.	20	117-137

9.	Siltstone: light olive brown and dark gray; slightly calcareous; no bedding.	3	114-117
8.	Mudstone: medium grayish brown and dark gray; non-calcareous; weathers into layers 1 inch thick. ~~Sarthenaeris~~ polypleura. Leiorhynchoidea 1-1.	10	104-114
7.	Shale: light olive gray; non-calcareous; fissile.	11	93-104
6.	Covered. Stake 537.	40	53-93
5.	Siltstone: medium gray, weathers light brown; siliceous cement; chippy weathering; well-sorted.	5	48-53
4.	Siltstone: dark gray; non-calcareous; chippy weathering.	13	35-48
3.	Sandstone: dark gray, weathers light brownish gray and pale red; quartzose; siliceous cement; silty and very fine-grained; poorly sorted; blocky and slabby weathering.	30	5-35
2.	Covered. Contact appears to be concordant.	5	0-5
	Total thickness of Needle Member:	550 feet	167.6 meters

Joana Limestone:

1. Calcilutite: medium gray; dense; conchoidal fracture; in beds 1 to 2 feet thick; ledge-forming.

Section No. 2. Northern Burbank Hills.

Measured southeasterly from crest of hill northeast of Jensen Wash in NE ¼ sec 35 and SW¼ sec 36, T. 22 S., R. 18 W., Millard County, Utah. Map reference: Burbank Hills Quadrangle, Millard County, Utah. Approximate attitude: N 40 E, 40 NW

Unit Number	Unit Description	Thickness in feet (of unit)	(above base)
	Ely Limestone:		
94.	Calcarenite: medium gray; fine- and medium-grained; in 5-foot thick beds; ledge-forming. Basal two feet is thin-bedded and silty; fossiliferous, 2-18.	8	
	Concordant contact selected on basis of ease of mapping; resistant ledges characterize the Ely Formation whereas the Chainman Formation is mainly slope-forming.		
	Chainman Formation (Jensen Member): Type Jensen		
93.	Interbedded shale and siltstone; light olive gray; highly calcareous; non-resistant. Fossiliferous, Rhipidomella nevadensis. 2-17. Late Chester.	8	462-470
92.	Shale: light olive gray; highly calcareous. Contains brachiopods and corals. 2-16.	41	421-462
91.	Interbedded siltstone and calcarenite: medium gray, weathers light olive gray; highly calcareous; dense; in 6-inch thick beds.	5	416-421
90.	Shale: dark gray, weathers olive gray; clayey; highly calcareous. Ostracodes and Rayonnoceras? at 10 ft. above base.	51	365-416
89.	Interbedded calcarenite and siltstone. Calcarenite: medium gray; very coarse-grained; hydroclastic; forms top and bottom of unit. Siltstone: medium gray, weathers light brown; highly calcareous; ledge-forming. Eumetria sp. 2-15b. Fault, section offset.	10	355-365

88.	Interbedded 70 per cent shale and 30 per cent siltstone. Shale: dark gray; moderately calcareous. Siltstone: medium gray, weathers light brown; moderately calcareous; in beds 1 inch to 6 inches thick.	17	338-355
87.	Shale: dark gray; moderately calcareous. Contains broyozoans, pelecypods, and horn corals. 2-15.	8	330-338
86.	Covered by weathered debris of underlying unit.	19	311-330
85.	Siltstone: very light gray, weathers light brown; highly calcareous; forms dip slope. Current ripple marked in directions towards S70E, S10E, and N70W. Rib-and-furrow at top one foot. Shoreline trends N20E. (streaky fluvial primary bedding)	8	303-311
84.	Sandstone: light gray; silty, medium-grained; quartzose; slightly calcareous; dense, brittle; ledge-forming. Separated from overlying unit by an undulating surface having an average relief of 2 inches, and a maximum relief of 6 inches. About 15 per cent of hand specimens have dark reddish purple blebs, medium-grained in size. Orbiculoidea. 2-14.	5	298-303
83.	Covered with debris from overlying unit, probably shale.	8	290-298
82.	Siltstone: medium gray, weathers medium grayish brown; moderately calcareous; dense, hard. Bedding manifest by ripple laminae; ledge-forming.	1	289-290
81.	Shale: olive gray; highly calcareous; clayey. Between 3 to 9 feet above base occur lenses of dark reddish purple, moderately calcareous mudstone with Rhipidomella nevadensis. 2-13.	43	246-289
80.	Siltstone: light brown in lower foot, olive gray in upper foot; highly calcareous; dense, very hard; ripple laminae on weathered surface.	2	244-246
79.	Siltstone: medium olive gray; quartzose; moderately calcareous; in beds $\frac{1}{4}$- to 2-inches thick.	9	235-244

78.	Calcarenite: light olive brown, weathers light brown; medium-grained; silty; no bedding. Archimedes and Fenestella abundant. 2-12.	1	234-235
77.	Mudstone: brownish gray; highly calcareous; laminated.	50	184-234
76.	Covered with debris from underlying unit.	19	165-184
75.	Calcarenite: medium gray, weathers medium brownish gray; arenaceous, very fine-grained; some recrystallization to form coarse-grained crystals; blocky weathering; forms dip slope.	8	157-165
74.	Siltstone: medium gray, weathers light brown and light olive gray; moderately calcareous; quartzose; weathers into ¼- to 6-inch thick slabs.	8	149-157
73.	Interbedded silty shale and siltstone: dark gray, weathers light brown; moderately calcareous. Shale predominant in lower 30 feet and siltstone increases upward; weathers into ½- to 1-foot thick beds. ~~Sartenaoria~~ Leiorhynchoidea carbonifera.	72	77-149
72.	Shale: dark gray; clayey and silty; highly calcareous; weathers into small blocky chips. Basal 6 feet contains Cravenoceras, Eumorphoceras, Glabrocingulum quadrigatum, and Neochonetes. 2-11. Age: near E_1-E_2 boundary.	77	0-77
	Total thickness of Jensen Member:	470 feet	143.3 meters

Chainman Formation (Willow Gap Member):

71.	Calcarenite: dark gray, weathers dark brownish gray; silty, medium- to coarse-grained; encrinitic. Ostracodes Geffinina and Glyptopleura. 2-10.	1	234-235
70.	Shale: dark gray, poorly exposed.	15	219-234
69.	Covered, section crosses road and small gully.	80	139-219

68.	Interbedded calcarenite and shale. Calcarenite: olive gray; speckled with light brown, medium-grained blebs. In ascending order the unit contains 5 feet of shale, 8 feet of slumped calcarenite, 11 feet of shale, and 1 foot of calcarenite.	25	114-139
67.	Calcarenite: gray; medium-grained; pebbly, contains ½- to 1-inch fragments of fossils and limestone; hydroclastic; micro-laminated; ledge-forming. Fragments of brachiopods, cephalopods, and bryozoans.	11	103-114
66.	Siltstone: light brown; highly calcareous.	3	100-103
65.	Covered with light olive gray powdery soil, probably shale or siltstone.	31	69-100
64.	Calcarenite: olive gray; medium- to very coarse-grained; in beds 2- to 6-inches thick. Lepidodendron veltheimianum (plant).	2	67-69
63.	Covered with light olive gray powdery soil, probably shale or siltstone.	45	22-67
62.	Siltstone: light brown; moderately calcareous.	2	20-22
61.	Shale: dark gray; non-calcareous; corn-flakey.	14	6-20
60.	Siltstone: light olive gray, weathers light brown; highly calcareous; in ½-inch thick beds.	2	4-6
59.	Calcarenite: medium gray, weathers dark olive gray; medium- to very coarse-grained; ledge-forming. Bryozoans. 2-9. The few calcarenites suggest approximately the southern limit of the Willow Gap Member	4	0-4
	Total thickness of Willow Gap Member:	235 feet	71.6 meters

Chainman Formation (Camp Canyon Member, upper part):

58.	Shale: dark gray; non-calcareous; corn-flakey.	76	591-667
57.	Covered.	21	570-591
56.	Calcisiltite: dark gray, weathers olive gray; dense.	10	560-570

55.	Siltstone: dark gray; highly calcareous; weathers in granules up to 8 mm in diameter.	24	536-560
54.	Calcisiltite: dark gray; dense; fractured perpendicularly to bedding plane; no bedding. Top of unit weathers to a round, smooth surface.	12	524-536
53.	Shale: dark gray; highly calcareous.	14	510-524
52.	Siltstone: dark gray; highly calcareous; parts into 2-inch thick layers.	3	507-510
51.	Interbedded shale and siltstone: dark gray; highly calcareous; slumped.	7	500-507
50.	Calcisiltite: dark gray; silty; in beds to 2 feet thick. Contains a few crinoidal fragments.	14	486-500
49.	Siltstone: dark gray; highly calcareous; weathers into granules up to 8 mm in diameter.	14	472-486
48.	Calcisiltite: dark gray; splintery weathering; dense.	3	469-472
47.	Siltstone: dark gray; highly calcareous; weathers into grains about 4 mm in diameter. Unit slumped, dips 15 degrees.	4	465-469
46.	Interbedded shale and siltstone: dark gray; highly calcareous. Siltstone: dense; weathers into slivers; in beds 2 to 4 feet thick. ~~Sartenaoria~~ Leiorhynchoidea replaced with pyrite at 20 feet below top of unit.	47	418-465
45.	Shale: dark gray; highly calcareous; corn-flakey.	70	348-418
44.	Siltstone: dark gray, weathers light olive gray, moderately calcareous; in 6-inch thick beds at top and bottom and laminated in central part. Unit probably approximates base of the Donner Member.	26	322-348
43.	Shale: dark olive gray; highly calcareous. At 5 feet below top is a one-foot bed of olive gray siltstone.	16	306-322

Siltstones characterize the upper Camp Canyon Member.

42.	Siltstone: dark gray, weathers light olive gray; moderately calcareous; in beds 6 inches thick. ~~Sartenaeria~~. Leiorhynchoidea.	4	302-306
41.	Shale: dark gray; moderately calcareous. Midway in unit in a one-foot mudstone: light olive brown; in beds ½- to 2-inches thick.	34	268-302
40.	Siltstone: medium gray, weathers olive gray; highly calcareous. Contains about 25 per cent very fine-grained quartz. Dips vertically, cut out by fault about 200 feet to the south.	5	263-268
39.	Covered, some poorly exposed dark gray shale.	54	209-263
38.	Siltstone: light olive gray, weathers light brown; moderately calcareous; in beds 1 to 3 inches thick.	26	183-209
37.	Covered, probably shale which weathers olive gray. Midway in unit is a one-foot siltstone: dark gray, weathers light brown; highly calcareous.	29	154-183
36.	Mudstone: light brown; highly calcareous; in 3- to 5-inch thick beds. Contains mollusk fragments. Cravenoceras. 2-8.	1	153-154
35.	Covered, probably olive gray shale.	21	132-153
34.	Siltstone: light brown; highly calcareous.	1	131-132
33.	Covered, probably olive gray shale.	20	111-131
32.	Fault breccia mudstone: light olive gray; highly calcareous; highly porous. Fault strikes N 65 E, dips NW.	14	97-111
31.	Covered, probably dark gray shale. At about 63 feet above base Lunulazona sadlicki collected in Paracravenoceras (E1) zone (U.S. Geol. Survey Prof. Paper 1369).	36	61-97
30.	Fault breccia mudstone: light olive gray; moderately calcareous.	22	39-61
29.	Shale: dark gray; highly calcareous; cornflakey.	39	0-39
	Total thickness of Camp Canyon Member, upper part	667 feet	203.3 meters

Chainman Formation (Camp Canyon Member, lower part):

28.	Calcisiltite: medium gray; dense; hard; smooth fracture; ledge-forming. Paracravenoceras. 2-7a. Age P_1.	1	315-316
27.	Shale: dark gray, weathers medium gray; silty hard; moderately calcareous; platy weathering. At 22 feet above base is a two-foot thick calcisiltite like unit 28.	72	243-315
26.	Fault breccia mudstone: light olive gray, weathers light brown; highly calcareous; very vuggy.	3	240-243
25.	Shale: dark gray; highly calcareous; corn-flakey.	68	172-240
24.	Calcisiltite: dark gray, weathers olive gray; dense; forms a smooth, rounded surface.	1	171-172
23.	Shale and siltstone: dark gray; non-calcareous. About every 5 feet occurs a one foot bed of calcareous siltstone separated by shale.	52	119-171
22.	Calcisiltite: dark gray, weathers medium gray; no bedding; ledge-former. Contains conodonts; striate Goniatites. 2-7. Age P_2.	4	115-119
21.	Shale: dark gray; non-calcareous; corn-flakey.	9	106-115
20.	Calcisiltite: dark gray; weathers brownish gray; dense; brittle; no bedding; ledge-forming. Striate Goniatites. 2-6. Age P_2	2	104-106
19.	Shale: dark gray; non-calcareous; corn-flakey.	32	72-104
18.	Calcisiltite: dark gray; argillaceous; dense; even fracture. Crenistriate Goniatites. 2-5. Age P_1.	1	71-72
17.	Covered, probably dark gray shale.	3	68-71
16.	Calcisiltite: dark gray, weathers olive gray;	0.3	67-68
15.	Shale: dark gray, non-calcareous; corn-flakey.	21	46-67

14.	Calcisiltite: dark gray; weathers to a smooth brownish gray ledge; dense; even fracture. Crenistriate Goniatites, and conodonts: Cavusgnathus, Spathognathodus, and Hindeodella. 2-3. Age P1.	1	45-46
13.	Shale: dark gray; fissile; poorly exposed.	9	36-45
12.	Mudstone: light olive gray; highly calcareous; in 1-inch thick beds. Contains ~~Sartenaeria~~ Leiorhyncoidea polypleura and linguloid brachiopods. 2-2.	0.3	36
11.	Shale: dark gray; slightly calcareous; corn-flakey.	9	27-36
10.	Shale: dark gray, weathers light bluish gray; non-calcareous; corn-flakey.	7	20-27
9.	Covered, few exposures of dark gray fissile shale. Note that lower Camp Canyon has thick shales with interbedded thin limestones.	20	0-20
	Total thickness of Camp Canyon Member, lower part:	316 feet	96.3 meters
	Chainman Formation (Skunk Spring Member):		
8.	Calcisiltite: medium gray; argillaceous; dense; even fracture. No bedding in basal 3 feet; less resistant in upper 2 feet. Horn corals, (2-1) in living position with apices down.	5	0-5
	Chainman Formation (Needle Member):		
7.	Interbedded shale and siltstone: dark gray, weathers olive gray; slightly calcareous; parts into ½-inch thick plates; slope-forming.	16	299-315
6.	Siltstone: dark gray, weathers light brown; slightly calcareous; parts into ½-inch thick plates; slope-forming.	23	276-299
5.	Siltstone: dark gray; fissile; non-calcareous; slope-forming.	12	264-276
4.	Siltstone: dark gray, weathers light brown; slightly to non-calcareous; parts into ½-inch thick plates; slope-forming.	137	127-264

3. Shale: olive gray; silty; poorly exposed; slope-forming.	56	71-127
2. Covered. Slope-forming unit covered with debris from Joana Limestone.	71	0-71
Total thickness of Needle Member:	315 feet	96 meters

Joana Limestone:

1. Calcisiltite: medium gray, weathers light and medium gray; parts into about one foot thick beds. Contains dark gray chert nodules with maximum length of 6 inches.

Section No. 5. Skunk Springs, Confusion Range

Section measured east of and in the gap (Willow Gap) formed by Willow Springs Creek, in SE$\frac{1}{4}$ sec. 28, T. 17 S., R. 16 W., and about 0.2 mi. north of Skunk Springs. Topographic map reference: Cowboy Pass, Millard County, Utah. Attitude: about N 15 E, 40 NW.

Unit Number	Unit Description	Thickness in feet (of unit)	(above base)
	Ely Limestone:		
60.	Calcarenite: light gray; medium-grained; lower 4 feet in 6-inch and 1-foot thick beds, upper 10 feet no bedding. Can be traced laterally on serial photos.		
59.	Siltstone and calcisiltite in equal amounts. Siltstone: pale purplish gray; moderately calcareous; silt content decreases upward. Calcisiltite: light olive-gray.	41	2-43
58.	Calcarenite: light olive-gray; fine- to medium-grained; contains brown silicified fossil fragments; ledge-forming.	2	0-2
	Concordant contact. The Jensen Member forms slopes below the ledge-forming Ely limestone.		
	Chainman Formation (Jensen Member):		
57.	Covered, probably siltstone; slope-forming.	8	175-183
56.	Siltstone and silty calcarenite, interbedded. Siltstone: light olive-gray, weathers light yellowish brown; slightly to moderately calcareous; dense. Silty calcarenite is medium light gray, weathers medium gray. Both in irregular beds about 1-foot thick. *Rhipidomella nevadensis*. 5-15.	31	144-175
55.	Calcisiltite: medium gray; dense; contains about 20 per cent siltstone; no bedding; ledge-forming.	1	143-144
54.	Siltstone: dark gray, weathers light yellowish brown; moderately calcareous; no bedding.	1	142-143

omit underlining

53.	Poorly exposed light brown silty beds and alluvium.	59	83-142
52.	Siltstone: light gray, weathers light yellowish brown; quartzose; highly calcareous; sorting excellent; in 1- and 1½-foot beds; blocky weathering; ledge-forming.	25	58-83
51.	Weathered light brown silty beds; slope-forming.	29	29-58
50.	Covered by alluvium. At 1 foot above base is a 4-inch thick silty calcarenite, light brown; contains gray, ostracod-like pellets, medium- to very coarse-grained.	29	0-29
	Total thickness of Jensen Member:	182 feet	55.8 meters

Chainman Formation (Willow Gap Member): Type section.

49.	Calcisiltite: light gray, weathers medium light gray; dense; ledge-forming. Top 2 feet is a calcarenite: pale yellowish gray; medium-grained. Productids, horn corals (Caninia), and gastropods observed in rock.	18	344-362
48.	Calcisiltite: medium gray; dense; in 1- to 2-foot beds separated by shale parting.	12	332-344
47.	Calcarenite: medium gray; fine-grained; ledge-forming. 5-14.	4	328-332
46.	Calcisiltite: medium light gray; partly saccharoidal; ledge-forming. Caninia corals 2½- to 3-inches in diameter. 5-13.	6	322-328
45.	Calcisiltite and calcarenite: medium gray; dense. Calcarenite is very fine-grained with about 20 per cent quartz grains; in 1½- to 5-foot thick beds; poorly exposed.	31	291-322
44.	Calcarenite: medium gray, weathers medium brownish gray; sandy; in 1- to 1½-foot thick beds.	5	286-291

43.	Calcarenite: medium gray; very fine-grained dense; in 1- to 2-foot beds; forms ledges south side of wash. 5-12.	34	252-286
42.	Calcarenite: medium light gray, weathers medium olive gray; very fine- and fine-grained; saccharoidal; in 2- to 4-foot thick beds; ledge-forming. 5-11.	15	237-252
41.	Siltstone: dark gray, weathers brownish gray and medium light gray; very highly calcareous; dense; in 1-foot thick beds.	36	201-237
40.	Calcarenite: medium olive gray and medium gray, weathers light olive-gray and medium gray; fine- and medium-grained; dense; very hard; weathers to 2- to 4-foot ledges. 5-10.	25	176-201
39.	Calcisiltite: medium gray; 1- to 2-foot thick beds; slope-forming; poorly exposed. 5-9.	60	116-176
38.	Calcarenite: medium gray; fine- to medium-grained; dense; in 1- to 2-foot beds. Forms prominent ridge. Eumorphoceras, cravenoceratids; uniserial forams. 5-8.	10	106-116
37.	Calcarenite: medium gray; very fine- to coarse-grained; in ½- to 1-foot beds; poorly exposed. 5-7.	21	85-106
36.	Calcarenite: medium gray; very fine-grained; dense; in 1- to 2-foot beds; ledge-former. Acid residue has many sponge spicules and Ammvortella? forams.	7	78-85
35.	Covered, slope-forming.	40	38-78
34.	Calcarenite: medium gray; fine-grained. Forms a persistent ridge laterally. Oval ~~Neo~~Spirifer. 5-5.	24	14-38
33.	Calcarenite: medium gray; very fine-grained, in 1- to 2- foot thick beds; hesperium in upper 6 feet. 5-4. Age Ei. ← Cravenoceras	14	0-14
	Total thickness of Willow Gap Member:	3~~5~~62 feet	110.3 meters

Chainman Formation (Camp Canyon Member, upper part): Type section

32.	Siltstone: light olive gray, weathers medium olive gray; dense; highly calcareous. Bedding manifest by laminae and 4-inch thick ledges. Gradational into overlying unit.	48	620-668
31.	Covered slope, probably shale.	21	599-620
30.	Siltstone and argillaceous calcisiltite: dark gray and medium olive gray, weathers light yellowish gray and medium gray; moderately to highly calcareous; in 6-inch thick beds with shale partings.	80	519-599
29.	Siltstone: medium gray and medium olive gray, weathers light yellowish gray; highly calcareous; in 3- to 6-inch beds; weathers into ½-inch thick plates. Contains about 30 per cent shale as interbeds.	42	477-519
28.	Siltstone: dark gray, weathers light yellowish and medium gray; moderately calcareous; in 6-inch thick beds.	21	456-477
27.	Calcisiltite: medium and dark gray, weathers light brownish gray; dense, argillaceous; in beds 6-inches thick.	45	411-456
26.	Siltstone: dark olive gray, weathers light brownish gray; highly calcareous; in beds ¼- to 2-inches thick.	65	346-411
25.	Covered.	28	318-346
24.	Siltstone: dark gray, weathers light olive gray; highly calcareous; weathers into plates ½- to 2-inches thick.	40	278-318
23.	Covered with alluvium.	67	211-278
22.	Mudstone and siltstone: dark gray; highly calcareous. Forms ledges and slopes. Ledges are 1 to 3 feet thick and weather into ½-inch thick plates. Slopes are about 10 feet thick; fissile.	69	142-211
21.	Covered by alluvium.	18	124-142

20.	Siltstone: gray; dense; highly calcareous; slope-forming.	6	118-124
19.	Shale and mudstone: dark gray; highly calcareous; fissile and in 1/8-inch thick platy beds. Traverse crosses road.	95	23-118
18.	Siltstone: light brownish gray and medium gray, weathers light yellowish brown and light olive gray; highly calcareous; slope-forming.	3	20-23
17.	Alluvium, in wash. Note increase of clastics, particularly siltstones, in the upper member	20	0-20

Total thickness of Camp Canyon Member, upper part: 668 feet 203.6 meters

Chainman Formation (Camp Canyon Member, lower part): Type section

16.	Calcisiltite: medium olive gray and dark gray; weathers light brown; in ½- to 2-foot thick beds; ledge-forming. Offset by 2 small faults. Contact chosen at highest limestone.	24	27~~0~~2-29~~4~~6
15.	Shale: light olive gray; highly calcareous; slope-forming.	40	23~~0~~2-27~~0~~2
14.	Calcarenite: medium gray, weathers medium olive-gray; fine-grained; poorly exposed as 6-inch thick ledges with less resistant beds in between.	9	22~~1~~3-23~~0~~2
13.	Shale: dark gray; moderately calcareous; poorly exposed. At 8 feet below top is a light olive-gray siltstone; 1 foot thick; highly calcareous.	31	192-22~~1~~3
12.	Calcarenite: medium gray; fine- and medium-grained; in 1-foot beds. Can be traced for at least one mile along strike. Thickens to south~~wardly~~.	6	186-192
11.	Shale: light olive gray, weathers light yellowish brown; moderately calcareous; thoroughly weathered. Neoglyphioceras subcirculare, Goniatites granosus, etc. collected ~~13 to 30~~ 156 to 173 feet ~~below top~~ above base, ~~see~~ (Jour. Paleontology, March 1952). 5-3. Age P_2	57 127	129-186

10.	Alluvium. Top of concretionary shale member of Poole and Sandberg (1921, p. 77) at 111 ft above base.	34	95-129
9.	Calcisiltite: dark gray; dense; poorly exposed.	1	94-95
8.	Shale: dark gray; non-calcareous; fissile.	3	91-94
7.	Calcisiltite: dark gray; dense; no bedding; may be a lense. Goniatites multiliratus (5-2), in concretions. Age R	1	90-91
6.	Shale: dark gray; non-calcareous; fissile.	32	58-90
5.	Alluvium.	58	0-58
	Total thickness of Camp Canyon Member, lower part:	296 feet	90.2 meters

Chainman Formation (Skunk Spring Member): Type section

4.	Calcisiltite: medium gray; dense; in beds 2 to 4 feet thick; smooth fracture; offset by small faults. 5-1.	15	0-15 4.5 meters

Chainman Formation (Needle Member):

3.	Siltstone: dark olive-gray and dark gray, weathers light brown; very slightly calcareous; lower half in ¼-inch thick beds; upper half in 3-inch thick beds. Goniatites americanus 15 feet below top perm. Gordon. Age Pl.	163	53-216
2.	Slope covered with Joana limestone debris.	53	0-53
	Total thickness of Needle Member:	216 feet	65.8 meters

Paraconformable contact. The Joana thickens to the south along strike. Pre-Chainman erosion took place during the Wendover phase of the Antler orogeny.

Joana limestone:

1. Calcarenite: medium gray; fine- to coarse-grained; in very thick beds. Forms a mappable ridge.

Section No. 4. Bishop Springs Anticline

Measured on crest of southeast facing slope in NE ¼ SE ¼ sec. 36, T. 15 S., R. 18 W. Topographic map reference: Confusion Range 2NE, Millard County, Utah. Average attitude: N 35 W, 20 SW.

Unit Number	Unit Description	Thickness in feet (of unit)	(above base)
	Ely Limestone:		
26.	Calcarenite: medium gray; fine-grained in lower 6 feet; medium- and coarse-grained in upper 6 feet; upper part ledge-forming.	12	7-19
25.	Calcisiltite and argillaceous calcisiltite: medium gray, weathers light olive gray; forms one-foot thick ledges. Schizophoria. 4-1.	7	0-7

Concordant contact. Contact selected on basis of ease of mapping, resistant ledges characterize the Ely formation whereas the Chainman formation is mainly a slope-former.

	Chainman Formation (Jensen Member):		
24.	Covered by debris from above beds and light olive gray silty soil.	10	323-333
23.	Calcarenite: medium gray; fine- and medium-grained; dense; weathers into beds 6 inches to one-foot thick; ledge-forming.	2	321-323
22.	Shale: weathers light olive gray; forms a poorly exposed slope. Cleiothyridina and Eumetria. 4-2.	10	311-321
21.	Siltstone: dark gray, weathers light brown; slightly to moderately calcareous; no bedding.	1	310-311
20.	Covered, probably shale.	8	302-310
19.	Siltstone: medium gray; moderately to highly calcareous; dense. In poorly developed rhythms due to color, differential weathering, and thickness of bedding. A typical rhythm:	69	233-302
	B. Siltstone: light brown; in beds 3 inches to 1-foot thick; platy weathering.		
	A. Siltstone: medium gray; in 1- to 3-foot thick beds; blocky weathering.		

18.	Covered by debris from above beds.	27	206-233
17.	Interbedded siltstone and shale in rhythms as follows: B. Siltstone: dark gray; highly calcareous; in one foot beds; no bedding. A. Shale: dark gray; highly calcareous; in beds 2 to 4 feet thick; slope-forming.	33	173-206
16.	Mudstone: light brown; highly calcareous; slope-forming. Basal 6 inches emits a petroliferous odor.	3	170-173
15.	Shale: dark gray and light olive gray, weathers olive gray; highly calcareous; slope-forming.	16	154-170
14.	Calcarenite: light olive gray; silty; medium- and coarse-grained; in beds $\frac{1}{4}$-inch thick. Contains fossil hash of brachiopods, bryozoans, and crinoidal columnals.	1	153-154
13.	Soil: silty; slope-forming. Upper 2 feet is shale: dark olive gray; non-calcareous. Most of unit probably mudstone.	36	117-153
12.	Covered by debris from unit 17. Probably silty shale. 4-4.	21	96-117
11.	Calcarenite: light olive gray; silty, coarse- and very coarse-grained; no bedding. Contains fragments of brachiopods and crinoidal columnals.	0.3	96
10.	Siltstone: light grayish brown; quartzose; non-calcareous; dense, tightly cemented; no bedding; a lense.	6	90-96
9.	Calcarenite: light olive gray, weathers dark olive gray with light brown specks; very coarse-grained; in 3- to 6-inch thick beds.	1	89-90
8.	Siltstone: light grayish green; quartzose; non-calcareous; dense; no bedding.	3	86-89
7.	Siltstone: light brown; slightly calcareous; resistant to weathering. A key bed that can be traced along strike; crosses jeep trail.	4	82-86

6.	Siltstone: light grayish green; sandy; very slightly calcareous; laminated and with ripple laminae; slope-forming.	3	79-82
5.	Mudstone: light olive gray; well-weathered; highly calcareous; slope-forming. Upper 46 feet contains a zone of orthocones about $\frac{1}{4}$ inch in diameter and 1 inch in length. Glabrocingulum binodosum, Euphemites, Rayonnoceras, and Cravenoceras. 4-6.	59	20-79
4.	Siltstone: medium to dark gray, weathers light brown; highly calcareous; weathers into chips. Locally contains productid and gastropod fragments.	1	19-20
3.	Covered slope of light yellowish gray silty soil.	16	3-19
2.	Siltstone: light grayish brown, weathers light brown and light olive gray; moderately calcareous; bedding manifest by laminae; weathers into 2- to 6-inch thick layers; ledge-forming.	3	0-3
1.	Siltstone: light olive gray; weathered and slope-forming. 4-7.		
	Remaining Chainman is faulted and covered.		
	Incomplete thickness of Jensen Member:	333 feet	101.5 meters

Section No. 3. Granite Mountain

Measured on the east-facing slope of Granite Mountain beginning at the head of a wash in the Ely limestone, down a southeast trending divide between two prominent dry washes, and along the banks of a dry wash, in about the center of sec 18, T. 14 S., R. 16 W., Juab County, Utah. Map reference: Callao 4SW, Utah. Approximate attitude: N 5 E, 12 NW.

Unit Number	Unit Description	Thickness in feet (of unit)	(above base)
	Ely Limestone:		
57.	Calcarenite: light gray; coarse-grained; bedding manifest by parting every 6 inches; forms ledge about 50 feet high. 3-1.		
56.	Interbedded calcisiltite and shale; medium gray; in rhythms with 1-foot beds of calcisiltite overlain by 1- to 2-foot thick beds of shale. 3-2.	50	114-164
55.	Conglomerate: light yellowish gray. Contains fragments of siltstone and calcisiltite to 3 inches in diameter. Groundmass is calcisiltite. Weathers to a slope with concretionary pebbles.	11	103-114
54.	Calcarenite: light yellowish gray; coarse- and very coarse-grained; in two equally thick beds.	2	101-103
53.	Calcisiltite: light yellowish gray and medium gray; in slabby weathering, nodular beds 3 inches thick.	22	79-101
52.	Calcarenite: medium gray; medium-grained; ledge-forming. Cleiothyridina and Inflatia. 3-3.	4	75-79
51.	Interbedded calcisiltite and shale: light olive gray. Calcisiltite is dense and in 2-foot thick beds.	27	48-75
50.	Calcisiltite: light olive gray; dense; weathers to a fist-sized nodular surface.	8	40-48
49.	Interbedded shale and calcarenite: light olive gray. Shale is highly calcareous and predominant in upper half of unit. Calcarenite: very fine-grained; dense; in 1-foot beds; predominant in lower half of unit. ~~Above base:~~ Collection 3-4 and 92, Kozlowskia, ~~and spiriferids of~~ (Rhipidomella nevadensis Zone), Anthracospirifer occiduus.	23	17-40

48.	Calcarenite: light gray, weathers medium gray; dense; forms a massive ledge.	17	0-17

Concordant contact. Beginning with unit 48 the Ely limestone is a rhythmically bedded limestone characterized by massive, step-like beds. The Chainman is a slope-forming unit.

Chainman Formation (Jensen Member):

The following 239-foot thick interval is mainly limestone, similar to the Willow Gap Member. However, the interval is rhythmic as the Jensen Member and is interpreted to be a limestone (calcisiltite) facies of the Jensen Member.

47.	Covered slope with debris from overlying unit.	18	221-239
46.	Calcisiltite: medium gray and light olive gray, weathers medium gray; dense; forms step-like ledges as unit 45.	39	182-221
45.	Calcisiltite: dark olive gray, weathers medium gray; dense. Forms step-like ledges, each ledge about 2 feet thick.	20	162-182
44.	Calcisiltite: medium gray and dark gray, weathers medium gray; argillaceous. Deposited in rhythms as follows (descendingly):	162	0-162

C. Upper 3 inches is siltstone: dark gray, weathers light brown; slightly calcareous. Commonly weathers to a dark brown cherty appearance.

B. Middle one foot is calcisiltite: medium gray; dense.

A. Lower one foot is siltstone or argillaceous calcisiltite: medium gray; slope-forming.

Total thickness of Jensen Member: 239 feet 73.8 meters

The above strata are very anamalous in lithology and lack of fossils. These maybe the poorly fossiliferous beds referred to on P. 11 of U.S.G.S. Prof. Paper 136B and where the section was offset to that measured by Armstrong and Hose. Their section is about 308 ft. thicker than mine.

total for the Chainman

Chainman Formation (Camp Canyon Member, upper part):

43.	Interbedded calcisiltite and siltstone: dark gray, weathers light olive gray. Calcisiltite is silty and dense. Siltstone is fissile and forms about 60 per cent of unit.	13	410-423
42.	Shale: dark gray; moderately calcareous; corn-flakey; slope-forming.	20	390-410
41.	Calcisiltite: dark gray, weathers light brownish gray; ledge-forming.	7	383-390
40.	Shale: dark gray; moderately calcareous; corn-flakey; slope-forming.	25	358-383
39.	Siltstone: dark gray; highly calcareous; dense; parts into 3-foot thick beds and $\frac{1}{4}$-inch thick platy weathering layers.	34	324-358
38.	Shale: dark gray; highly calcareous; corn-flakey; slope-forming. About 50 per cent covered.	20	304-324
37.	Siltstone: dark gray, weathers light olive brown; moderately calcareous; in beds to 6 inches thick; upper 2 feet is ledge-forming.	3	301-304
36.	Shale: dark gray; highly calcareous; corn-flakey; slope-forming.	32	269-301
35.	Calcisiltite: dark gray, weathers medium gray; in beds to one foot thick; ledge-forming.	3	266-269
34.	Covered slope with siltstone debris from overlying beds. At junction of two dry washes.	15	251-266
33.	Interbedded calcisiltite and siltstone: dark gray; weathers light brownish gray; in beds 2 to 3 feet thick.	54	197-251
32.	Completely covered by blocky weathering siltstone.	12	185-197
31.	Siltstone: dark gray, weathers dark olive gray; in beds 6 inches thick.	3	182-185
30.	Covered slope of light olive gray powdery soil.	20	162-182

29.	Mudstone: dark gray; highly calcareous;	33	129-162
28.	Shale: dark gray; highly calcareous; corn-flakey; slope-forming.	4	125-129
27.	Siltstone: dark gray; highly calcareous; weathers into $\frac{1}{4}$-inch thick slabs.	1	124-125
26.	Shale: dark gray; highly calcareous; corn-flak~~e~~y; slope-forming.	8	116-124
25.	Alluvium and covered by debris from overlying units.	64	52-116
24.	Interbedded shale and siltstone: dark gray, weathers olive gray. Shale predominant in lower half. At 10 feet below top beds change attitude suggesting a fault.	18	34-52
23.	Siltstone: dark olive gray; highly calcareous; weathers into $\frac{1}{4}$-inch thick plates.	34	0-34

Total thickness of Camp Canyon Member, upper part: 423 feet 129 meters

Chainman Formation (Camp Canyon Member, lower part):

22.	Calcisiltite: dark gray; dense; in 3-foot thick beds. Contains Taonurus. Folded into a small anticline and faulted. Forms a 12-foot ~~high~~ ledge in wash.	48	274-322 312
21.	Shale: dark gray; non-calcareous; corn-flak~~e~~y; slope-forming.	51	223-274
20.	Covered, traced laterally into dark gray shale.	16	207-223
19.	Shale: dark gray, weathers olive gray; highly calcareous. Contains 1-inch thick layers of concretionary-like mudstone; light brown and medium reddish brown; slightly calcareous.	23	184-207
18.	Mudstone: light olive gray, weathers light yellow-brown; highly calcareous; exhibits cone-in-cone structure.	1	183-184
17.	Shale: dark gray, weathers light olive gray; poorly exposed.	46	137-183

16.	Shale: light olive gray; highly calcareous; exposed at head of a small gully which is a tributary to the wash in which the section was measured. Goniatites cf. granosus, Lunulazona costata (type). 3-6. Age P_2, early Chesterian.	2	135-137
15.	Shale: dark gray; moderately calcareous; weathers into splintery fragments and chips; slope-forming.	15	120-135
14.	Shale: dark gray; non-calcareous; corn-flakey; slope-forming.	18	102-120
13.	Calcisiltite: dark gray, weathers dark olive gray; weathers to one-foot beds with rounded surfaces. Striate Goniatites. 3-7. Age P_2.	3	99-102
12.	Shale: dark gray, weathers dark olive gray; upper 5 feet is highly calcareous, remainder is non-calcareous; slope-forming.	6	93-99
11.	Alluvium.	6	87-93
10.	Calcarenite: light gray, weathers medium gray; fine-grained. Contains brown calcareous silty nodules that resemble chert. Forms a ridge that can be traced several miles to the northwest. Crenistriate Goniatites. 3-8. P_1. Probably the Skunk Spring Limestone of U.S.G.S. P.P. 1368, p.8.	16	71-87
9.	Shale: dark gray; non-calcareous; corn-flakey.	1	70-71
8.	Siltstone: olive gray; moderately to highly calcareous; blocky weathering. Linguloids, ~~Sartenaeria~~. 3-9. Leiorhynchoidea	2	68-70
7.	Shale: dark gray; non-calcareous; corn-flakey.	3	65-68
6.	Calcisiltite: dark gray; argillaceous; ledge-forming. Crenistriate Goniatites, Girtyoceras. 3-10. Age P_1, late Meramecian	1	64-65
5.	Shale: dark gray; non-calcareous; corn-flakey.	7	57-64
4.	Shale: dark gray; upper half is highly calcareous, lower half is non-calcareous; corn-flakey.	14	43-57
3.	Calcisiltite: dark gray, weathers medium gray; dense; ledge-forming.	2	41-43

2. Covered by alluvium, soil and brush. Traced northward into dark gray silty shale.	41	0-41

Total thickness of Camp Canyon Member, lower part: 32 feet 98 meters

Paraconformable contact. Pencil-line contact observed having no relief. The Joana Limestone is missing. Above the selected contact the Chainman forms dark gray slopes and below, the Pilot Shale forms light greenish slopes covered with slabs $\frac{1}{4}$-inch thick.

Pilot Formation:

1. Siltstone: medium olive gray, weathers light olive gray; non-calcareous; parts into slabs about $\frac{1}{4}$-inch thick. At the base is a quartzose sandstone: medium gray, weathers dark olive brown; slightly calcareous; very fine-grained; 2 feet thick.	31	

Section No. 15-61. Silver Island Mountains (Silver Island).

Measured on a south-facing slope about one-half mile east of Campbell Canyon and one and one-half miles N45E from Silver Peak, in about SE¼ sec. 28 and NE¼ sec. 32, T. 3 N., R. 17 W., Tooele Co., Utah (unsurveyed). Map reference: Schaeffer (1960) Plate 1A. Approximate attitude: N 60 E, 50 NW.

Unit Number	Unit Description	Thickness in feet (of unit)	(above base)
	Ely Limestone:		
42.	Calcisiltite: gray; interbedded with 20 per cent silty calcisiltite. Contains brown weathering chert beds; Ovatia, Triplophyllites with 27 septa at 14 mm diameter.		
	Concordant contact. Contact selected on basis of ease of mapping. Resistant ledges characterize the Ely Formation whereas the Chainman Formation is mainly a slope-former.		
	Chainman Formation (Jensen Member):		
41.	Conglomerate: gray, weathers light brown; dense; no bedding. Subangular pebbles of brown siliceous detritus and gray quartzite average 1 inch in diameter. 15-61-1.	25	98-123
40.	Calcisiltite and arenaceous calcisiltite: gray; very fine-grained, with subround quartz grains; in 3-inch thick beds.	14	84-98
39.	Sandstone: gray, weathers medium brown; fine-grained; highly calcareous, dense. No bedding except for some laminations.	19	65-84
38.	Siltstone: pale reddish brown, weathers brown. About 5 per cent limestone pebbles distributed irregularly in the unit. No bedding, parts into 1-foot thick layers.	14	51-65
37.	Calcisiltite: gray; nodular; silty; fragments of brachiopods.	4	47-51
36.	Quartzite: gray; no bedding.	1	46-47

35.	Siltstone: pale reddish brown, weathers medium and dark brown; composed of coarse-grained silt; dense; moderately calcareous.	6	40-46
34.	Calcisiltite: light gray; dense; hydroclastic. In beds 6 inches to 1 foot thick, separated by pale purplish gray layers about 6 inches thick. Beds exhibit discontinuity surfaces. 15-61-2.	23	17-40
33.	Calcisiltite: pale reddish brown, weathers light brown; silty. 15-61-3.	6	11-17
32.	Siltstone: pale reddish purple and light brown. Contains abundant Rhipidomella nevadensis. 15-61-4.	11	0-11
	Total thickness of Jensen Member:	123 feet	37.5 meters

Chainman Formation (Willow Gap Member):

31.	Calcarenite: gray; fine-grained; hydroclastic; crinoidal; laminated; in one bed. ~~Sartenaeria~~ Leiorhynchoidea carbonifera, Rhipidomella nevadensis.	3	211-214
30.	Calcisiltite: gray, weathers light brown; silty; slope-forming. Rhipidomella nevadensis. 15-61-5; F-8 of Schaeffer (1960). Age E2.	4	207-211
29.	Calcisiltite: medium gray; forms a resistant ledge.	4	203-207
28.	Covered, probably shale. Contains abundant abraded Caninia aff. excentrica (Meek). 15-61-6.	4	199-203
27.	Calcarenite: medium gray; very fine-grained; no bedding visible, parts into 6-foot thick units. Contains a 6-foot thick bed of banded chert 15 feet above base. F-7 of Schaeffer (1960).	57	142-199
26.	Calcisiltite: very light brown; dense; no bedding; slope-forming.	27	115-142
25.	Calcisiltite: gray; hackly surface; no bedding; ~~ridge~~ ledge-forming.	12	103-115

24.	Upper part is calcisiltite: gray, weathers light brown. Contains *Spirifer* cf. *brazerianus*. 15-61-7. Grades into a lower part containing chert nodules in 1-foot thick beds separated by 6-inch thick beds of gray siltstone.	20	83-103
23.	Calcisiltite: dark gray; dense; no bedding. Contains 10 per cent olive-gray chert nodules about 3 X 6 inches in size.	34	49-83
22.	Quartzite: medium olive gray; fine-grained; subround and round; dense. Cross-bedding, dipping not more than 20 degrees to bedding, indicates currents were toward the southeast.	8	41-49
21.	Calcisiltite: medium dark gray; dense; ~~ridge-~~ ledge-forming. Contains a 0- to 2-foot thick lense of gray quartzite same as unit 22.	5	36-41
20.	Calcisiltite: medium dark gray; arenaceous and silty. Crops out as four 3-foot thick ledges separated by partly covered slope-forming intervals. 15-61-8.	36	0-36
	Total thickness of Willow Gap Member:	214 feet	65.2 meters

Chainman Formation (Donner Member): *Type section*

19.	Siltstone: pale purplish red; oxidized and non-calcareous; blocky weathering. In Donner Canyon unit contains about 20 feet of dense brown sandstone and 60 feet of brown conglomerate. Pebbles of gray chert and about 20 per cent pale green chert; subround; ½- to 1-inch in diameter.	84	161-245
18.	Siltstone: pale purplish gray, weathers brown; highly calcareous; blocky weathering.	63	98-161
17.	Siltstone, same as unit 19.	65	33-98
16.	Sandstone and arenaceous calcisiltite: gray and brown; current-bedded; parts into one-inch thick plates. 15-61-9. In Donner Canyon this unit is a gray calcarenite with brown siltstone seams; medium-grained; laminated; contains many broken fossils, especially crinoidal debris.	25	8-33

15.	Chert-pebble conglomerate: olive-gray, weathers brown; no bedding. Chert pebbles average ½- to 1-inch in diameter; subangular to subround; chert is colored reddish brown, gray, and green. Unit mappable on photographs. Mainly a grayish brown, fine- to medium-grained sandstone in Donner Canyon.	8	0-8
	Total thickness of Donner Member:	245 feet	74.7 meters

Chainman Formation (Camp Canyon Member, upper part):

14.	Siltstone and silty calcisiltite: pale purplish gray; slope-forming.	73	586-659
13.	Calcisiltite: medium dark gray; parts into 1-foot thick layers; partly recrystallized to a calcarenite. Spirifer cf. brazerianus. 15-61-10. In Donner Canyon units 11, 12, and 13 form a mappable unit of calcarenite: medium gray; medium-grained.	34	552-586
12.	Calcisiltite: gray, weathers brownish gray; silty; no bedding.	10	542-552
11.	Siltstone: pale purplish gray; non-calcareous. Impressions of nematodes and ~~Sartenaeria~~ Leiorhynchoidea carbonifera at 32 feet above base. In Donner Canyon about the top 40 feet is a calcarenite and in the lower one-third is 15 feet of dark brown sandstone and conglomerate.	124	418-542
10.	Calcarenite: gray; very fine- and fine-grained; hydroclastic; no bedding.	3	415-418
9.	Siltstone, same as unit 11.	62	353-415
8.	Calcarenite: medium gray; very fine-grained, silty; porosity fair; no bedding. 15-61-11.	11	342-353
7.	Siltstone and silty calcisiltite: pale purplish gray and dark brown; dense, brittle. Igneous dike locally intrudes section.	28	314-342
6.	Calcarenite: olive-gray; silty; in 1-inch and 1-foot thick beds.	31	283-314

5.	Siltstone: light brown and pale purplish gray; blocky; poorly exposed. A 2-foot thick limestone ledge occurs 13 feet below the top.	117	166-283
4.	Calcisiltite: medium dark gray; dense; in 3-foot thick beds. Impurity content is very low.	10	156-166
3.	Siltstone: very light gray; non-calcareous; forms a slope covered with $\frac{1}{4}$-inch thick plates. A key silvery-colored bed traceable for several miles laterally.	71	85-156
2.	Quartzite: medium brown; dense; very fine-grained; in 1- to 3-foot thick beds. 15-61-12, 15-61-13.	85	0-85

Total thickness of Camp Canyon Member, upper part: 659 feet 200.9 meters

<u>Chainman Formation</u> (<u>Camp Canyon Member</u>, lower part):

1.	Calcisiltite: medium dark gray; in one bed. Many outlines of gastropod shells in rock. ~~Probably~~ Correlates with unit 39 of section number 7. Remaining strata, about 300 feet thick, completely covered.	3

Section No. 7. Silver Island Mountains (Leppy Range)

Measured on east-facing slope in A-1 Canyon, about 3½ miles north of U. S. route 50, in NW¼ NE¼ sec. 33, T. 34 N., R. 70 E., Elko Co., Nevada (unsurveyed). Map reference: Schaeffer (1960) Plate 1A. Approximate attitude: N 20 W, 30 SW.

Unit Number	Unit Description	Thickness in feet (of unit)	(above base)
	The upper two-thirds of the Chainman Formation is omitted because the Chainman is in fault contact with the Ely Limestone.		
	Chainman Formation (Camp Canyon Member, lower part):		
39.	Calcisiltite: dark gray, weathers medium gray; low porosity. Weathers into plates no more than 2 inches thick. Contains gastropods, ~~Lunulazona, Goniatites,~~ and Inflatia bilobata. 7-1. Neospirifer in top 5 feet. Age El. Correlates with unit 1 of Sec 15-61.	58	3 441 381-439
38.	Calcisiltite: dark olive-gray, weathers medium gray; dense. Top one foot ledge-forming, remainder in beds 3- to 6-inches thick.	4	3 379-381
37.	Siltstone: dark gray, weathers dark olive-gray with some pale purplish red tinting; dense; laminated; slope-forming. Caninia? 7-2.	17	362-379
36.	Calcisiltite: medium dark gray, weathers medium gray; dense; no bedding. Contains light yellowish brown and light olive-gray nodular blotches.	11	351-362
35.	Calcarenite: medium dark gray, weathers dark gray; very fine-grained; low porosity; no bedding. Contains dark brown chert lenses; ledge-forming.	5	346-351
34.	Shale: dark gray; silty; very highly calcareous; fissile and laminated; slope-forming.	7	339-346
33.	Sandstone: medium gray; quartzose, very fine-grained; dense; hard and brittle; moderately calcareous; no bedding. Traced northward about 1,000 feet into a chert-pebble conglomerate. Pebbles are chalcedonic and medium dark gray chert; angular; to 3 inches in diameter.	7	332-339

Paracravenoceras barnetense, Lunulazona sadlickij

Small 5

32.	Conglomerate: medium brown; moderately calcareous: subround and round pebbles to 1 inch diameter; ground mass of fine- to coarse-grained quartz grains, subround to well-round.	1	331-332
31.	Same as unit 33, but bedding manifest by laminae on weathered surface.	28	303-331
30.	Sandstone: medium gray, weathers dark olive-gray; quartzose; very fine-grained; dense; in $1\frac{1}{2}$-foot thick beds; ledge-forming.	14	289-303
29.	Sandstone and siltstone: dark gray; composition of a low-rank graywacke; very fine-grained; highly calcareous; slope-forming.	5	284-389
28.	Sandstone: medium light gray, weathers olive grayish brown; conglomeratic. Contains about 60 per cent chert and quartz and 40 per cent carbonate pebbles. Sub-angular chert pebbles to $\frac{1}{2}$-inch diameter; reddish brown and dark gray; subround quartz grains, medium- to coarse-grained. Cross-bedded towards S70W; laminated. Separated from unit below by a surface having 2 inches of relief.	13	271-284
27.	Sandstone in upper half grading to calcarenite in lower half. Sandstone: light yellowish brown; very fine-grained; quartzose; subround; highly calcareous. Calcarenite: medium gray; contains about 30 per cent fine-grained quartz; dense; slope-forming.	6	265-271
26.	Sandstone: light yellowish brown, weathers olive-gray; conglomeratic. Contains brown, dark gray and light gray subround chert pebbles with average diameter of $\frac{1}{2}$-inch. Sub- to well-round fine-grained quartz and silt compose ground mass. Cross-bedded towards S70W; ledge-forming.	9	256-265
25.	Sandstone: medium gray with limonitic staining; fine-grained orthoquartzite; dense, non-calcareous; brittle. Basal 8 feet poorly exposed.	39	217-256

24.	Sandstone: gray, weathers light yellowish brown; very fine-grained; sub- to well-round quartz grains; highly calcareous; weathers into 2-foot beds.	7	210-217
23.	Shale and siltstone: dark gray; non-calcareous; fissile and laminated; poorly exposed; slope-forming; slumped, probably faulted. Contains clastic beds as follows:	133	77-210

C. At 91 feet above base, 5 feet of sandstone: medium yellowish brown; very fine-grained; highly calcareous.

B. At 39 feet above base, 1 foot of sandstone: dark gray and yellowish brown; fine-grained; subround; quartzose; argillaceous; slightly calcareous.

A. At 10 feet above base, 3 feet of sandstone: medium brownish gray; very fine- and fine-grained; moderately conglomerate; subangular pebbles to ½ inch diameter. At top is a lense of dark gray argillaceous calcisiltite. ~~Immature crenistriate~~ Goniatites cf. crenistria. Coll. 318. Age Pl.

22.	Sandstone: light yellowish brown; very fine-grained; quartzose; moderately calcareous; limonitic powder between quartz grains; porosity good; slope-forming. Section offset for higher units.	5	72-77
21.	Sandstone: medium gray with pale purplish hue, weathers dark gray; very fine-grained; quartzose; non-calcareous; slope-forming.	2	70-72
20.	Claystone: dark gray; non-calcareous; soft, fissile corn-flakey in upper half; poorly exposed; slope-forming.	20	50-70
19.	Siltstone: medium gray, weathers dark olive-gray; quartzose; moderately calcareous; ledge-forming.	1	49-50
18.	Siltstone: dark gray; non-calcareous; hard; laminated; slope-forming.	3	46-49

17.	Sandstone: medium brown weathers medium yellowish brown in basal foot, remainder dark limonitic brown; very fine-grained; quartzose; slightly calcareous.	9	37-46
16.	Mudstone: dark gray; non-calcareous; corn-flakey; slope-forming.	3	34-37
15.	Sandstone: medium gray, weathers dark limonitic brown; very fine-grained; quartzose; moderately calcareous; has limonitic powder between quartz grains.	8	26-34
14.	Siltstone: dark gray; non-calcareous; hard; laminated; slope-forming.	14	12-26
13.	Siltstone; dark gray, weathers medium limonitic brown; highly calcareous. Corals, brachiopods (Anthracospirifer cf. arizonensis.) 7-3.	1	11-12
12.	Siltstone: dark gray; non-calcareous; hard; laminated; slope-forming.	10	1-11
11.	Calcisiltite: dark gray, weathers medium gray; dense; no bedding; poorly exposed. Skunk Springs Limestone? Normally the Needle Member underlies the Skunk Springs Ls.	1	0-1
	Total thickness of Camp Canyon Member, lower part:	441 feet	134.4 meters

Chainman Formation (Needle Member):

10.	Sandstone: dark limonitic brown; sub- to well-rounded; fine grains; non-calcareous; no bedding; ledge-forming.	2	79-81
9.	Siltstone: medium dark gray, weathers dark limonitic brown; non-calcareous; dense; chert grained; very hard; in beds about 2 feet thick; ledge-former. Six feet below top is a 5-foot thick pebbly siltstone: dark gray, weathers dark olive gray; poorly sorted with pebbles to 1½ inches in diameter; pebbles of dark gray chert, sub-rounded. Immature crenistriate Goniatites, 7-4. Age Pl.	29	50-79
8.	Siltstone: dark gray, weathers dark limonitic brown; non-calcareous; poorly exposed.	6	44-50

7.	Shale: dark gray; non-calcareous; soft; laminated; forms slope with silver colored flakes.	13	31-44
6.	Siltstone: pale purplish red; highly calcareous; weathers into $\frac{1}{4}$ inch plates; slope-forming.	1	30-31
5.	Siltstone: light brown; highly calcareous; weathers into $\frac{1}{2}$ inch plates; slope-forming.	4	26-30
4.	Siltstone: light olive gray; non-calcareous; weathers into $\frac{1}{4}$ inch thick plates; slope-forming.	6	20-26
3.	Siltstone: light olive gray, weathers light yellowish brown; slightly calcareous; weathers into $\frac{1}{4}$ inch thick plates; slope-forming.	10	10-20
2.	Siltstone: pale purplish gray, weathers medium yellowish brown; slightly calcareous; laminated; weathers into $\frac{1}{4}$ to $\frac{1}{2}$ inch plates; slope-forming.	10	0-10
	Total thickness of Needle Member:	81 feet	24.7 meters

Concordant contact. The regional relations within the Silver Island Mountains indicate that the contact is unconformable. The Chainman truncates the underlying Joana, Pilot, and Guillmette formations. The Silver Island Mountains are the type locality for the Wendover Phase of the Antler Orogeny.

Joana Limestone:

1.	Calcarenite: medium gray; silty to medium-grained; dense; no bedding in upper half; ledge-former. Only 20 feet preserved under the Wendover phase unconformity.	20	0-29

Section No. 11-61. Pequop Mountains, Nevada

Measured on the west side of the Pequop Mountains, on the crest of the south wall of a west-facing canyon, in N½ sec. 2, T. 34 N., R. 65 E., Elko County, Nevada. Map reference: Army Map Service, Elko, Nevada, NK 11-12. Average attitude of strata: N 50 E, 50 SE.

Unit Number	Unit Description	Thickness in feet (of unit)	(above base)
Ely Limestone:			
53.	Calcarenite: medium gray, weathers medium light gray; very fine- and fine-grained; crinoidal; in beds 8 feet and thicker. Contains chert nodules in upper two-thirds of unit. 11-61-2.	57	43-100
52.	Sandstone: olive gray and grayish red; very fine-grained and silty; non-calcareous; dense. Bedding manifest by ripple laminae. 11-61-2.	23	20-43
51.	Calcisiltite: medium light gray; dense; in beds 3 to 5 feet thick. Contains medium light gray chert lenses in basal 6 inches. *Rhipidomella nevadensis*. 11-61-3.	20	0-20

Concordant contact. Gray limestone ledges begin with unit 51 and the units below form slopes. Contact mappable on photographs.

Chainman Formation (Jensen Member):

50.	Interbedded siltstone and nodular siltstone: light olive gray in lower half of unit. Nodular siltstone: pale purplish gray; calcareous; nodules are from tennis to softball in diameter. Siltstone: reddish brown; non-calcareous. 11-61-4.	35	419-454
49.	Orthoquartzite: gray, reddish brown at base; slightly calcareous; medium-grained, subrounded; laminated and cross-bedded, one set of tidal current cross beds indicates current was toward N20W. Eight-inch thick pebble conglomerate at the base.	18	401-419
48.	Siltstone and two four-foot thick limestone beds; slope-forming; poorly exposed.	65	336-401

47.	Conglomerate: light olive gray. Pebbles are of reddish brown and dark gray chert; 3 to 5 mm in diameter. Matrix is very coarse-grained sandstone. 11-61-5.	2	334-336
46.	Siltstone: olive gray; parts into $\frac{1}{4}$-inch thick plates. Siltstone is 58 feet thick and is overlain by 6 feet of medium light gray pebble conglomerate followed by 6 feet of nodular siltstone.	70	264-334
45.	Orthoquartzite: medium gray; very fine-grained; slightly calcareous; dense; no bedding. 11-61-6.	15	249-264
44.	Interbedded calcisiltite and siltstone. Calcisiltite is dark gray; dense. Siltstone is reddish brown and tan; highly calcareous. 11-61-7.	55	194-249
43.	Orthoquartzite: medium light gray; very fine-grained; non-calcareous; no bedding. 11-61-8.	19	175-194
42.	Orthoquartzite: greenish gray; very fine-grained; non-calcareous; no bedding.	61	114-175
41.	Conglomerate: medium light gray; dense. Contains pebbles to 2 inches in diameter; ledge-forming.	13	101-114
40.	Interbedded 65 per cent siltstone and 35 per cent calcisiltite. Siltstone: medium gray; non-calcareous. 11-61-9. Calcisiltite: medium gray; dense; weathers platy and nodular. *Caninia* cf. *nevadensis* occurs at 25 feet above base in rock face.	77	24-101
39.	Siltstone: olive gray; non-calcareous; slope-forming.	24	0-24
	Total thickness of Jensen Member:	454 feet	138.4 meters

Chainman Formation (*Willow Gap Member*):

38.	Calcarenite: medium dark gray; very fine-grained; micritic; in beds 1 to 2 feet thick. Forms a ridge mappable on photographs. 11-61-10.	144	293-437

37.	Sandstone: gray, weathers tan; moderately calcareous; fine-grained; dense; laminated.	28	265-293
36.	Calcisiltite: medium gray; dense; in beds 1 to 2 feet thick. At 12 feet above base is a 5-foot thick orthoquartzite: gray, weathers light brown; fine-grained, subrounded and angular; dense; non-calcareous.	119	146-265
35.	Siltstone: gray and reddish brown; non-calcareous; laminated; slope-forming.	85	61-146
34.	Siltstone: olive gray and brown; non-calcareous; slope-forming. Contains abundant fenestellid bryozoans, Stroboceras sp., Wewokella sp., all preserved as molds. 11-61-11.	61	0-61
	Total thickness of Willow Gap Member:	437 feet	133.2 meters

Chainman Formation (Donner Member):

33.	Conglomerate at top grading downward to orthoquartzite: gray; fine-grained; non-calcareous; lower half laminated. Flute casts occur about 25 feet above base, slide was towards S20E. Contains a ~~Neochonetes~~ chonetid horizon (11-61-12) 10 to 18 feet above base. Forms a mappable ridge. Collection 6-3-61 probably is from this unit.	77	235-312
32.	Siltstone: olive gray; non-calcareous; laminated. Contains two dense calcarenite beds: a 1-foot bed at 52 feet above base and a 2-foot bed at 35 feet above base.	73	162-235
31.	Calcisiltite: medium dark gray, weathers medium light gray; dense; crinoidal and laminated in middle ten feet. Basal ten feet is a siltstone: medium gray, weathers grayish red; non-calcareous; dense. Contains trilobite fragments, brachiopods, and nematode impressions. 11-61-13.	55	107-162
30.	Conglomerate: light olive gray and light brown; dense; non-calcareous; pebbles average 3/8 inch in diameter, but at top maximum average is 1 to 2 inches. 11-61-14.	77	30-107

29.	Orthoquartzite: gray, weathers light brown; dense; medium-grained; no bedding.	30	0-30
	Total thickness of Donner Member:	312 feet	95 meters

Chainman Formation (meiorogenic facies)

28.	Siltstone: gray and light olive gray with brown staining; contains pale purplish red streaks; non-calcareous; platy weathering. Contains nematode impressions. Probably deposited in a mud-flat environment. Goniatites cf. crenistria w/striae and Lunulazona occur at 77 feet above base, 11-61-16. ~~Sartenaeria~~ Leiorhyncholdea and Quadratia occur at 114 feet above base, 11-61-17. Impressions of Rhodea sp. and other plants occur above Goniatites. Age: near P_1-P_2 boundary. Unit correlates with upper part of type section. There is a disconformity at the top of this unit. The upper member of the Camp Canyon is ~~missing~~ not present.	171	909-1,080
27.	Quartzite: yellowish gray; very fine- and fine-grained; non-calcareous; in beds 1 to 3 inches thick; ripple marks in upper half; lower half with beds 1 to 3 feet thick. 11-61-18.	100	809-909
26.	Siltstone: medium gray, weathers light olive gray: dense; non-calcareous; parts into ¼-inch thick plates. Asterocalamites scrobiculatus (a Viséan plant), ~~Sartenaeria~~ Leiorhyncholdea polypleura. 11-61-19. per Chester Arnold	89	720-809
25.	Quartzite: medium gray, weathers olive gray and light brown; fine-grained; non-calcareous; laminated and in beds to 4 inches thick. Fucoids common in top 20 feet.	56	664-720
24.	Siltstone: medium gray, weathers medium light gray; non-calcareous; parts into ¼-inch thick plates.	40	624-664
23.	Orthoquartzite: gray, weathers light brownish gray; fine- to medium-grained, very coarse-grained in top 5 feet, 11-61-21; bedding 3 inches thick in lower half and 2 feet thick in upper half. Load casts at base, 11-61-22.	92	532-624

22.	Siltstone: medium dark gray, weathers light brownish gray; non-calcareous; parts into ½-inch thick plates. Dike at 72 feet above base. Brachiopods (11-61-24) and Lunulazona occur near dike. Faberophyllum at 105 feet above base. 11-61-23.	189	343-532
21.	Siltstone as unit above, but with molluscan fossils. Pebble graywacke, dark gray, occurs at 72 feet above base. 11-61-25.	178	165-343
20.	Siltstone: pale yellowish brown: non-calcareous; parts into ¼-inch thick plates.	19	146-165
19.	Sandstone: leached and oxidized to a brown color; conglomeratic and silty; partially slumped. 11-61-26.	52	94-146
18.	Siltstone: dark gray; non-calcareous; in ¼-inch thick plates; poorly exposed.	94	0-94
	Total thickness of meiorogenic facies:	1,080 feet	329.2 meters

Chainman Formation (fondothem facies):

17.	Claystone and mudstone: medium and dark gray, weathers medium light gray and into chips; non-calcareous. Contains few nematode impressions.	164	564-728
16.	Claystone and mudstone as above interbedded with 50 per cent siltstone. 11-61-27.	39	525-564
15.	Siltstone: medium gray, weathers light gray; brown staining along joints; nematode impressions abundant. 11-61-28.	146	379-525
14.	Siltstone as above but weathers light brown. Goethite pseudomorphs after pyrite common in lower half. Prolecanitid cepahlopod at 75 feet above base. 11-61-29.	150	229-379
13.	Siltstone: dark gray, weathers light brown; nematode impressions common.	94	135-229

12.	Siltstone: medium gray, weathers light brown; parts into ¼-inch thick plates. Ten feet of medium gray siltstone in 1-foot beds occurs in middle of unit.	40	95-135
11.	Interbedded siltstone and sandstone: dark and medium gray. Siltstone contains nematode impressions and few goethite pseudomorphs after pyrite. Sandstone: very fine-grained; in 1-foot thick beds. Pebbly siltstone (11-61-31) occurs at 24 feet above base. Prolecanitid cephalopod found in float.	95	0-95
	Total thickness of fondothem facies:	728 feet	221.9 meters

Chainman Formation (Needle? Member):

10.	Interbedded pebble conglomerate and siltstone: medium gray, weathers medium brownish gray. Conglomerate in beds at least 5 feet thick. Pebbles of dark gray chert, of greenish Ordovician Valmy Fm. cherts, and of some lithic fragments. 11-61-32.	61	848-909
9.	Siltstone: light olive gray, weathers medium light gray; parts into ¼-inch thick plates; nematode impressions common.	67	781-848
8.	Orthoquartzite: light brownish gray and medium gray; very fine-grained and fine-grained; ripple laminae common. Few primary slump structures directed towards the southeast. Topmost beds conglomeratic, pebbles averaging 1-inch in diameter. 11-61-33.	13	768-781
7.	Interbedded siltstone and orthoquartzite: medium gray. Quartzite: fine- to medium-grained; lithic and gray and green chert fragments; non-calcareous; in beds 1-foot thick. Nematode impressions in siltstone.	50	718-768
6.	Interbedded 30 per cent sandstone and 70 per cent siltstone: dark gray. Same as unit 7.	81	637-718

5.	Same as unit 6 except siltstone weathers pale purple and contains nematode impressions. Orthoquartzite with 1/8-inch thick laminations and ripple laminae. Fossil flora at 82 feet above base. Adiantites? sp. 11-61-34.	163	474-637
4.	Siltstone: dark gray, weathers light brown. Contains 5 per cent orthoquartzite with ripple laminae. Goethite pseudomorphs after pyrite and nematode impressions common. Basal 120 feet weathers light brown and has no nematode impressions. 11-61-35.	404	70-474
3.	Siltstone: medium dark gray, weathers light olive gray. Contains about 2 per cent subgraywacke with goethite pseudomorphs after pyrite.	70	0-70
	Total thickness of Needle? Member:	909 feet	277 meters

Concordant contact, actually paraconformable. The Joana Formation is not present and no relief was detected on the Pilot Formation.

Pilot Formation:

2.	Claystone: dark gray, weathers light greenish olive gray; silty; non-calcareous; fissile. Contains a few thin dark gray limestone lenses.	201	49-250
1.	Claystone as unit 2; poorly exposed. 11-61-36.	49	0-49
	Total thickness of Pilot Formation:	250 feet	

Concordant contact. The Pilot forms a slope above the gray limestone ledges of the Guilmette Formation. The formations are in fault contact on the north wall of the canyon. Guilmette Formation is dark gray calcisiltite that weathers medium light gray.

Section No. 2-62. Pancake Range Summit

Measured north of U. S. Highway 50 in the S½ NE¼ sec. 30, T. 18 N., R. 56 E., White Pine County, Nevada. Map reference: Pancake Summit Quadrangle. Average attitude: N 5 E, 25 SE and N 28 E, 15 SE.

Unit Number	Unit Description	Thickness in feet (of unit)	(above base)
	Ely Limestone:		
	Section is incomplete at top and bottom. According to data from P. J. Fischer, Shell Oil Company, the section begins about 330 feet below the Ely limestone. Changes in attitude suggest faulting.		
	Chainman Formation (Jensen Member):		
35.	Claystone: yellowish gray; non-calcareous; slope-forming.	5½	386½-392
34.	Conglomerate in upper 13 feet grading downward to 2 feet of sandstone at base. Conglomerate: light brown; poorly sorted, medium-grained sand to 2-inch pebbles; chert pebbles colored pale yellowish green and reddish brown. Sandstone: pale reddish brown, weathers light brown; highly calcareous.	15	371½-386½
33.	Siltstone: pale brown; non-calcareous; well-sorted; laminated. Contains air-bubble structures.	2½	369-371½
32.	Claystone: brownish gray and grayish red; non-calcareous; no bedding manifest.	2½	366½-369
31.	Siltstone: grayish red; non-calcareous. Basal 6 inches is sandstone: pale brown; very fine-grained and silty; moderately calcareous.	2	364½-366½
30.	Claystone: light olive gray; non-calcareous; fissile.	2½	362-364½
29.	Shale: light yellowish gray.	13	349-362
28.	Calcarenite: light brown and pale yellowish brown; very fine-grained; dense; in beds 6 inches to 1 foot thick. Contains *Ovatia* and *Diaphragmus*. 2-62-14.	17	332-349

27.	Shale: light yellowish gray; upper part poorly exposed.	10	322-332
26.	Shale and calcarenite interbedded. Calcarenite: light brown, weathers pale yellowish brown; very fine-grained; in beds 6 inches thick.	5	317-322
25.	Covered, probably light yellowish gray shale.	6	311-317
24.	Calcisiltite: light brownish gray, weathers pale yellowish brown; dense; in one bed.	1	310-311
23.	Shale: light brownish gray.	15	295-310
22.	Calcarenite: light brownish gray, weathers pale yellowish brown; very fine-grained; micritic; in beds 6 inches to 2 feet thick.	5	290-295
21.	Covered; forms valley flat.	105	185-290
20.	Covered; forms dip slope on unit 19. Probably faulted at top of unit.	9	176-185
19.	Sandstone: pale yellowish brown, weathers pale brown; medium-grained, grains of quartz and reddish brown chert; calcareous. Contains 10 per cent chert pebbles about ½ inch in diameter; colored pale reddish brown; subrounded.	9	167-176
18.	Covered.	17	150-167
17.	Sandstone and lenses of conglomerate. Sandstone: pale brownish gray; fine- and medium-grained; non-calcareous; laminated. Conglomerate: brown, weathers reddish brown; poorly sorted. Contains gray and brown subrounded chert pebbles to 3 inches in diameter, but average size is 1 inch. According to oil company geologists this bed is traceable into northern White Pine County.	38	112-150
16.	Covered by float from unit 17.	85	27-112
15.	Covered, probably yellowish gray shale.	27	0-27

Incomplete measured thickness of Jensen Member: 392 feet 119.5 meters
Estimated thickness of Jensen Member: 722 feet 220.1 meters

Chainman Formation (Willow Gap Member):

14.	Calcarenite: pale yellow brown; medium- to very coarse-grained; laminated and in beds to ½-inch thick; large scale bedding composed of long sweeping crossbeds dipping between 15 and 20 degrees to bedding; currents directed toward S65E. Contains about 30 per cent pale brown, subrounded chert grains; medium- to very coarse-grained. Fines winnowed out. *Caninia excentrica* (Meek) at top. 2-62-8.	36	235-271
13.	Shale: light olive gray.	19	216-235
12.	Calcisiltite: pale yellowish brown; dense; very fossiliferous. Contains *Spirifer brazerianus*, ~~Neo~~*Spirifer armstrongi*, *Flexaria*, and *Caninia* cf. *nevadensis*. 2-62-~~F~~7 F7	15	201-216
11.	Shale: pale yellowish gray.	12	189-201
10.	Interbedded shale and calcarenite. Calcarenite: brownish gray, weathers yellowish brown; medium-grained.	15	174-189
9.	Calcarenite: brownish gray, weathers yellowish brown; arenaceous. Contains about 30 per cent rounded, frosted quartz grains and greenish and gray subrounded chert grains; fine- to medium-grained.	10	164-174
8.	Calcarenite: pale yellowish brown; very fine- to coarse-grained; encrinitic, contains crinoidal fragments.	7	157-164
7.	Calcarenite: moderate yellowish brown, weathers pale reddish brown; arenaceous. Contains about 40 per cent subrounded frosted quartz and gray chert grains; fine- to medium-grained.	6	151-157
6.	Covered, probably light olive gray shale.	9	142-151
5.	Calcarenite: pale yellowish brown; fine- to medium-grained; spergenitic. Basal 10 feet arenaceous; contains about 40 per cent very fine-grained quartz and very coarse-grained light brown and gray chert grains; subrounded. Current ripple-marked towards S65E.	51	91-142

4.	Covered; slope-forming unit.	91	0-91
	Total thickness of Willow Gap Member:	271 feet	82.6 meters

Chainman Formation (Donner Member):

3.	Sandstone: light brown; medium-grained; subrounded grains of quartz and pale green chert; cross-bedded.	15	
2.	Conglomerate and 30 per cent sandstone: light and medium brown; dense; in beds 4 to 8 feet thick and about 5 per cent cross-bedded. Contains chert pebbles colored gray, pale green, to 4 inches in diameter. Sandstone: medium-grained; subrounded.	270 feet	
1.	Covered, forms valley falts.		
	~~Estimated~~ E~~e~~xposed thickness of Donner Member:	285 ~~285~~ feet	86.7 meters

Section No. 9-54. Fairview Range, Nevada

Measured in S½ sec. 34 and southwardly from fossil collection lot 5486, at the base of the Bailey Springs (= Ely) Limestone, to near the south corner of sec. 34-35, T. 4 N., R. 65 E., Lincoln County, Nevada (unsurveyed). Map reference: Geologic Map of Pioche District, USGS Prof. Paper 171, Pl. 1. Average attitude: N 75 W to N 75 E, 39 NE. New road cut, Sept., 1954.

Unit Number	Unit Description	Thickness in feet (of unit)	(above base)
	Ely Limestone:		
11.	Calcisiltite and calcarenite: light to medium gray; up to medium-grained. Fossils from basal 50 feet, collection 5486, include: Rhipidomella nevadensis, ~~Diaphragmus~~ Carlinia phillipsi, and Inflatia.		
	Concordant contact. Light gray limestone ledges characterize the Ely whereas sandstone and slope-forming shale characterize the Scotty Wash.		
	Chainman Formation (Scotty Wash Member):		
10.	Shale: reddish brown; slope-forming.	62	434-496
9.	Sandstone: medium gray, weathers dark purplish brown; very fine- and fine-grained; quartzose; non-calcareous; in 2-foot thick beds; ledge-forming. Contains hydrothermally altered reddish brown argillaceous specks.	120	314-434
8.	Shale: dark reddish brown; slope-forming.	28	286-314
7.	Sandstone: medium gray; altered to dark purplish brown; fine-grained; quartzose; slightly to moderately calcareous; in 2-foot thick beds. Contains vugs due to dissolved clay galls. Ledge-forming.	40	246-286
6.	Shale: dark reddish brown. Partly covered by blocky sandly debris from overlying units.	66	180-246
5.	Sandstone: light gray, weathers medium purplish brown; very fine- and fine-grained; quartzose; moderately calcareous; in 1-foot beds; blocky weathering; ledge-forming.	8	172-180

4.	Shale: dark reddish brown; highly weathered; slope-forming.	124	48-172
3.	Orthoquartzite: light gray, weathers pale purplish brown; very fine-grained; slightly calcareous; laminated and ripple-marked; offset by small faults.	48	0-48
	Total thickness of Scotty Wash Member:	496 feet	151.2 meters

Concordant contact. Local investigations suggest that the Chainman shales and the sandstones of the Scotty Wash intertongue.

Chainman Formation (Camp Canyon Member):

2.	Shale, very poorly exposed and covered by sandy debris from the Scotty Wash. Laterally the lower 251 feet is shale: dark gray; non-calcareous; corn-flaky; slope-forming. A reverse fault cuts the upper part of the unit which contains some dark gray shale in road cuts. Contains Cravenoceras hesperium and pelecypods in 3-incn thick beds of calcisiltite as follows: coll. 9-54-5, 192 feet above base; 9-54-4, 39 feet above base; 9-54-3, 28 feet above base; 9-54-8, 21 feet above base, also one specimen of C. merriami; 9-54-7, 18 feet above base; 9-54-2, 15 feet above base; and 9-54-1, 6 feet above base. Age E1, but very low in the section -- faults might be the reason.	544	165.8 meters
1.	Calcisiltite and siltstone: dark gray, weathers light brownish gray; highly calcareous; ledge-forming.		

and 850 feet below ELY.

Lower beds are poorly exposed. A section measured by Langenheim and Peck (1957) is given on Table 3. This section is "Q" of Table 2 and Figure 1. The Scotty Wash is 279 feet (85.9 meters) thicker at the type section (56.3%).

TABLE 3. Stratigraphic section of the Peers Spring and Scotty Wash Formations near Dutch John Mountain, Lincoln County, Nevada (after Langenheim and Peck, 1959).

Formation	Unit	Thickness (Feet)	Description
Ely	14	--	Gray limestone
	1,891 feet (576.4 meters) above base.		
Scotty Wash	13	142.5	Mostly covered; siltstone and shale interbedded with quartzite
	12	75	Pink-white quartzite; ripple-marked
	1,674 feet (510.1 meters) above base.		
Peers Spring	11	320	Quartzite scree, siltstone chips. Presumed same as unit 9 with interbedded quartzite and siltstone.
	10	140	Covered. Presumed same as unit 9.
	9	65	Black shale; fissile
	8	380	Black fissile shale with minor amounts of siltstone and limestone
	7	139.7	Interbedded limestone, shale, and calcareous siltstone
	6	210	Black shale; fissile
	5	260.4	Mostly covered; black calcareous siltstone scree
	4	57.5	Black limestone and fissile shale. *Cravenoceras hesperium*, *Rayonnoceras* sp.
	3	101.7	Buff siltstone and sandstone
	2	--	Siltstone; bench-forming
Joana	1	--	Black fossiliferous limestone

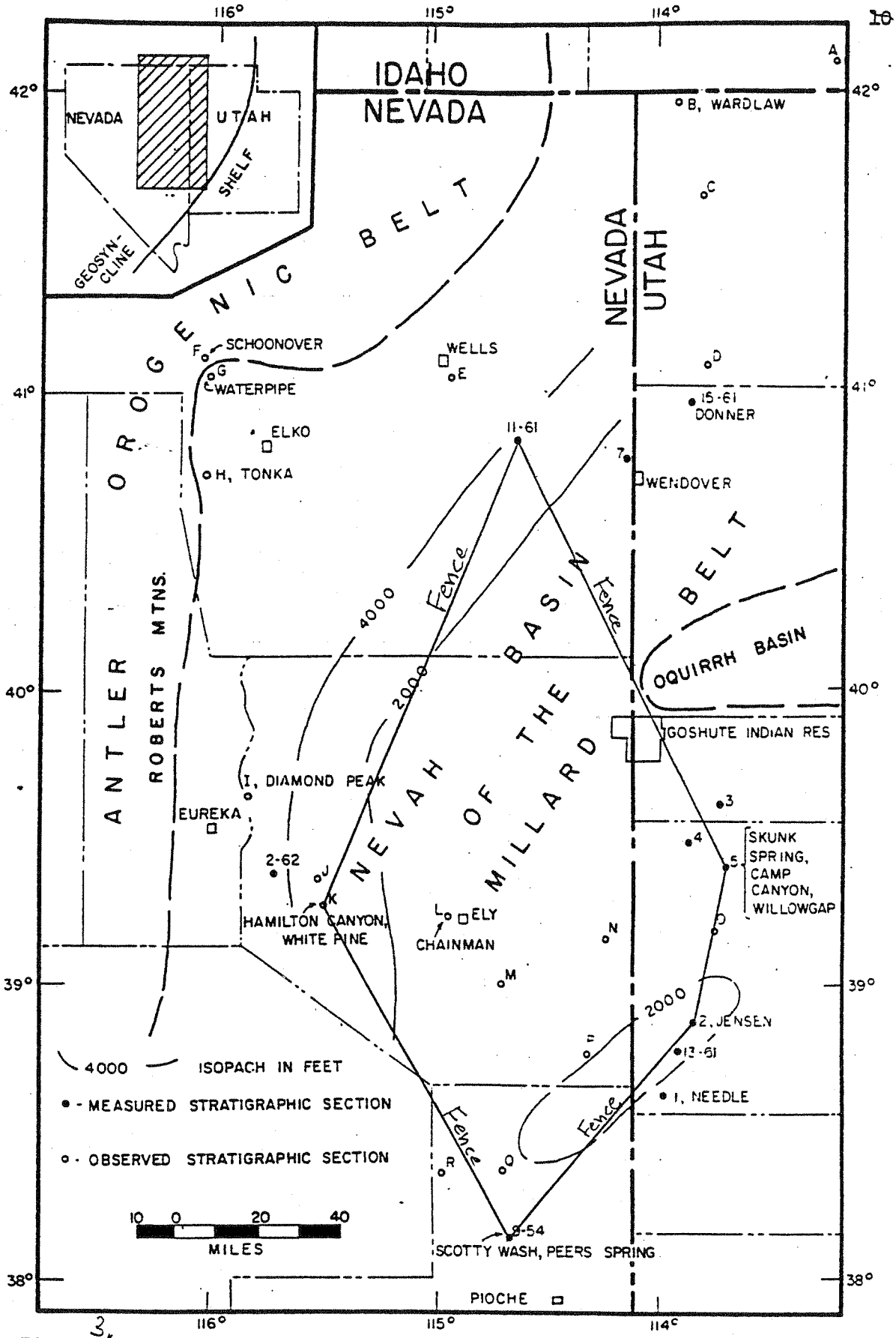
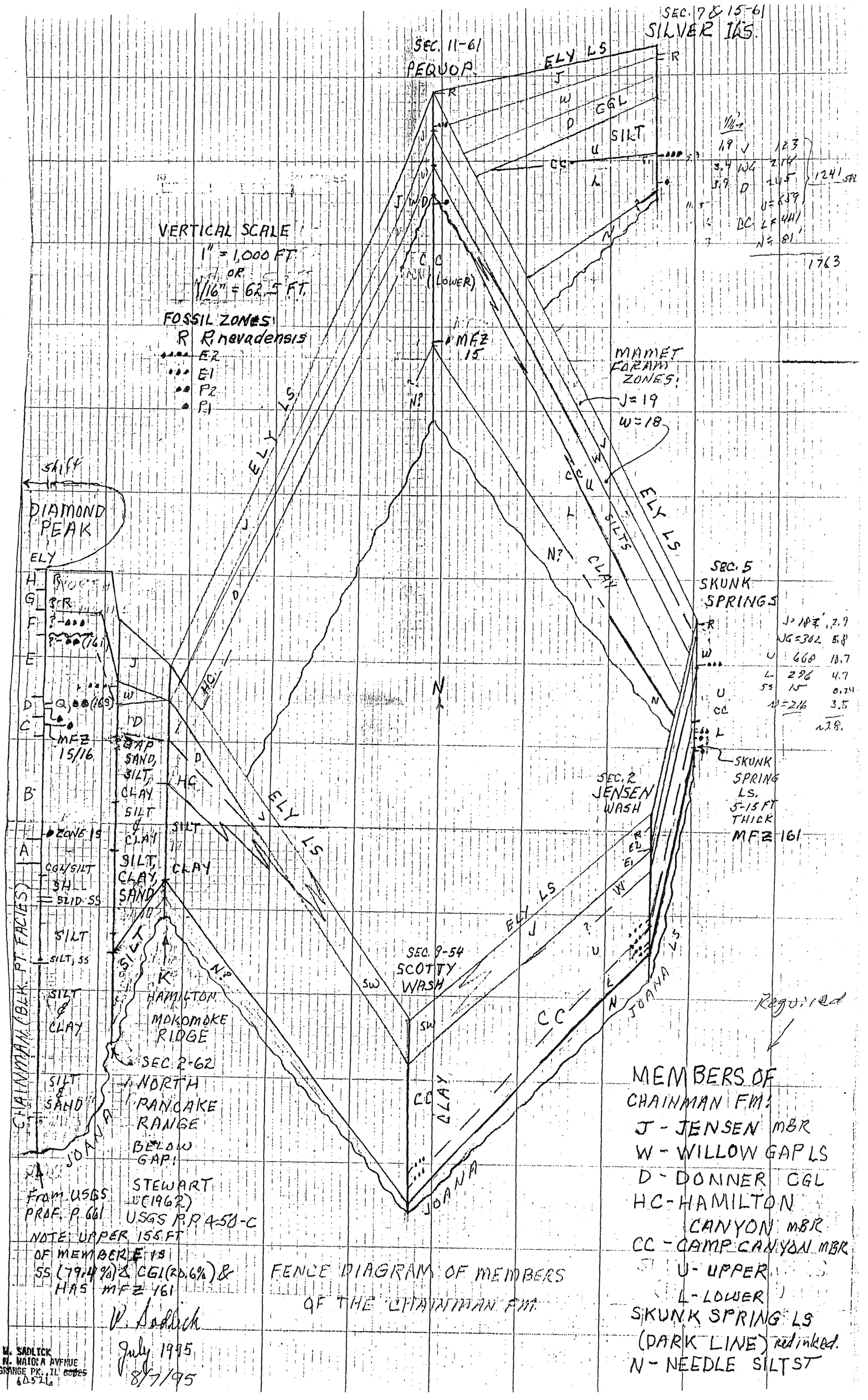


Figure 3. Index map of eastern Nevada and western Utah showing investigated sections, type sections of rock-stratigraphic units, ~~and~~ generalized paleogeologic map of Late Mississippian time, and location of fence diagram



From USGS PROF. P. 661

NOTE: UPPER 155 FT OF MEMBER E1 SS (79.4%) & CGL (20.6%) & HAS MFZ 161

FENCE DIAGRAM OF MEMBERS OF THE CHAINMAN FM.

W. Sadlick

July 1995

8/7/95

MR. W. SADLICK
542 N. MAIOLA AVENUE
LA GRANGE PK., IL 60525
6052L