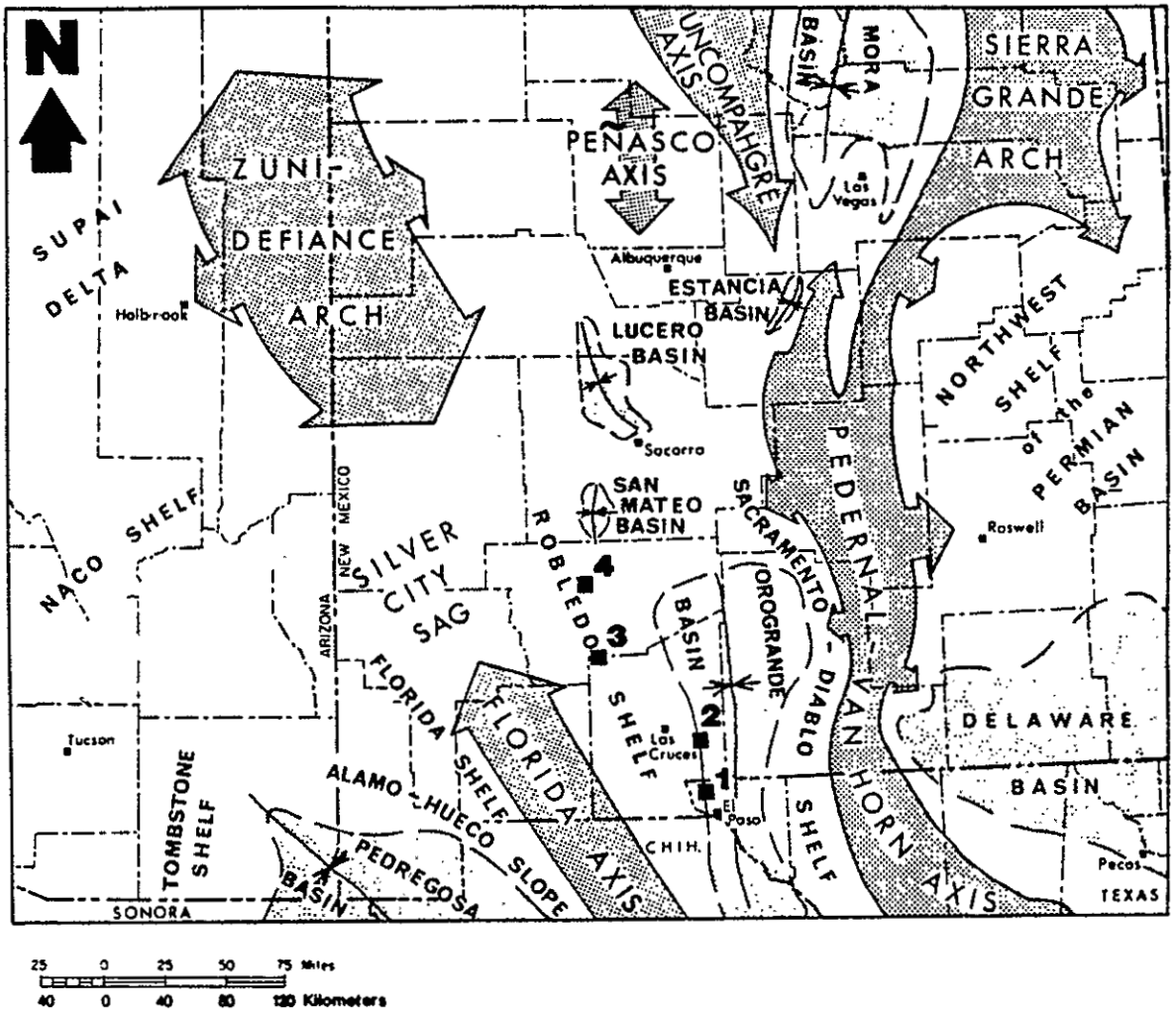
LOWER AND MIDDLE PENNSYLVANIAN MEASURED SECTIONS, TYPE DERRYAN REGION, SOUTHERN NEW MEXICO AND WESTERNMOST TEXAS



WILLIAM W. CLOPINE

1991

NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES
OPEN FILE REPORT
373 Revised

LOWER AND MIDDLE PENNSYLVANIAN MEASURED SECTIONS TYPE DERRYAN REGION, SOUTHERN NEW MEXICO AND WESTERNMOST TEXAS

WILLIAM W. CLOPINE
1991

NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES
OPEN FILE REPORT
373 Revised

Open File Report 373 comprises sections measured for a doctoral dissertation entitled "Middle Pennsylvanian Fusulinid Biostratigraphy of the Type Derryan Area in southern New Mexico and Westernmost Texas" by William W. Clopine, University of Oklahoma (1990). These sections provide the stratigraphic framework for his analysis of the Morrowan-Atokan fusulinid succession in that area, which has been accepted for publication by the New Mexico Bureau of Mines and Mineral Resources.

Sections 1-3 were visited on the field trip "Lower and Middle Pennsylvanian Stratigraphic Relations, Type Derryan Region, Southern New mexico and Westernmost Texas" held in conjunction with the Rocky Mountain-South Central Sections, Geological Society of America, meeting, April 24-26, 1991. Stop descriptions and other data are available in the guidebook for that field trip published by the New Mexico Bureau of Mines and Mineral Resources.

Vinton Canyon

El Paso County, Texas

Measured section 1 is located in Vinton Canyon on the west side of the northern Franklin Mountains (U.S.G.S. Canutillo Quadrangle [Texas-New Mexico]; 31°58'00" North; 106°30'30" West). Nelson (1940, p. 166-167) defined the La Tuna, Berino, and Bishop Cap Members of the Magdalena Formation using Vinton Canyon section. Lane (1974, p. 273) includes conodont data from Vinton Canyon and provides stratigraphic relationships for Mississippian and lowest Pennsylvanian strata in southeastern New Mexico and west Texas. Additional analyses of Vinton Canyon Lower and Middle Pennsylvanian carbonate microfacies are available in University of Texas at El Paso Masters Theses (Mims, 1971; Osleger, 1981).

Vinton Canyon is located in El Paso County, approximately 37 km (23 miles) south of Las Cruces, New Mexico and 24 km (15 miles) north of El Paso, Texas. To reach the measured section take Interstate 10 to the Westway-Vinton exit (exit 2). Mileage readings are from the overpass at this exit.

Turn east at the I-10 overpass onto Westway Boulevard and proceed toward the Franklin Mountains. At .6 km (.4 miles) the road becomes dirt. This dirt road crosses a cattle guard at 2.4 km (1.5 miles). Take the right fork in the road at the abandoned quarry (5.3 km (3.3 miles)) and continue east toward the mountains. Bear left at the fork in the road at 6.3 km (3.9 miles). Park in the cleared area at 6.8 km (4.2 miles) and continue on foot down the left fork in the road to the canyon floor. Proceed up the canyon .16 km (.1 mile) to the base of the steep, overhanging cliff on the south side of the canyon. The section begins at the base of this cliff.

Units 1-1 through 1-24 were measured on the south side of the canyon. Units 1-25 through 1-175 were measured on the north side of the canyon.

The beds strike north 14° west and dip 45° southwest. Measurements were made with a Jacob's staff and Abney hand level. Thicknesses have been rounded to the nearest .05 m (or .1 ft). The total thickness of this measured section is approximately 256 m (740 ft.).

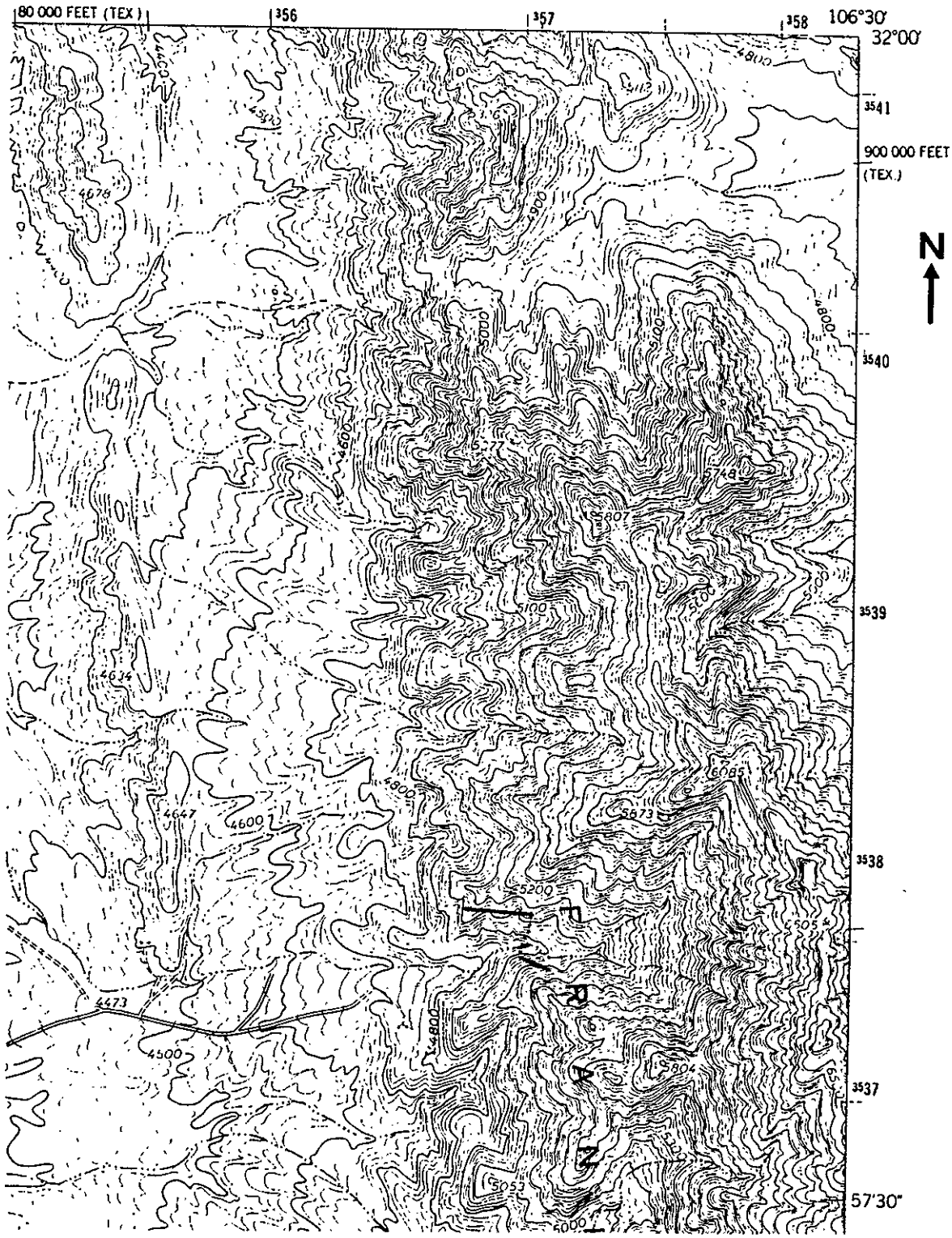


Figure 1. Vinton Canyon locality map (from U.S.G.S. Canutillo Quadrangle, Texas-New Mexico).

UNIT	LITHOLOGY	THICKNESS
1-175	Wackestone, dark grey, weathers light grey. Grains include crinoid columnals, bryozoans, fusulinids (Wedekindellina and Beedeina), algal debris, and brachiopod fragments. Many grains silicified. Medium wavy bedded. Forms lower third of prominant cliff face. Locally well exposed, mostly covered or slumped laterally. Basal contact gradational.	1.05 m (3.5')
TS 1-175	Top: Fine calcarenite-fine calcirudite; sparse, foraminifera, brachiopod, crinoid, spicule Biomicrite:Wackestone.	
TS 1-175	.45 m (1.5') BT: Fine calcarenite-fine calcirudite; sparse, ostracod, spicule, brachiopod, crinoid Biomicrite:Wackestone.	
1-174	Mudstone, dark grey, weathers light grey or tan to orange. Grains include algal debris, crinoid columnals, whole chonetid and productid brachiopods and rare fusulinids. Medium to thick bedded. Mostly covered. Forms rubbly talus slope with some blocks in place. Basal contact covered.	2.35 m (7.8')
TS 1-174	1.5 m (5') AB: Coarse calcilutite-fine calcarenite; quartz-bearing, fossiliferous Micrite:Mudstone.	
TS 1-174	Base: Very fine-fine calcarenite; burrowed, fossiliferous Microsparite:Mudstone.	
1-173	Covered.	2.9 m (9.5')
1-172	Wackestone and Chert, dark grey, weathers grey or tan to orange. Chert is black, weathers brown. Grains include whole productid brachiopods, solitary rugose corals, crinoid columnals, bryozoans and fusulinids. Fusulinids common at base, rare at top. Chert forms irregular lenticular nodules to 15 cm thick, most abundant in central third of unit. Medium to thick bedded. Forms laterally broken, low cliff face or partly covered rubbly slope. Basal contact covered.	.9 m (2.9')
TS 1-172	Base: Medium calcarenite-fine calcirudite; quartz-bearing, organic-rich, dolomitic, sparse, foraminifera, brachiopod, crinoid Biomicrosparite:Wackestone.	
1-171	Covered.	1.6 m (5.3')

UNIT	LITHOLOGY	THICKNESS

1-170 Wackestone, dark grey, weathers tan to brown or light grey. Grains poorly sorted, include crinoid columnals, solitary rugose corals, fusulinids, and brachiopod fragments. Fusulinids most abundant in lower two-thirds of the unit. Medium to thick, gently wavy bedded. Moderately well exposed, forms low broken cliff face rubbly or steep slope. Basal contact covered. .9 m (3')

TS 1-170 Top: Coarse calcilutite-coarse calcarenite; quartz-bearing, brachiopod, crinoid, spicule Biomicrite:Wackestone.

TS 1-170 .25 m (.8') AB: Coarse calcilutite-coarse calcarenite; quartz-bearing, sparse, brachiopod, crinoid, spicule Biomicrite: Wackestone.

1-169 Covered. 2.6 m (8.5')

1-168 Wackestone, dark grey, weathers light grey or tan to orange. Grains include ramose and fenestrate bryozoans, Aulopora(?) tabulate corals, solitary rugose corals, brachiopods, crinoid columnals and algal debris. Medium to thin wavy bedded. Burrowed. Mostly covered laterally, locally well exposed. Forms low broken cliff face or rubbly slope. .85 m (2.8')

TS 1-168 .3 m (1') AB: Coarse calcilutite-coarse calcarenite; sparse, bryozoan, pellet, spicule Biomicrite:Wackestone.

1-167 Covered. 1.25 m (4.1')

- -

OFFSET 7.6 m (25') north 25° east up hill on top of unit 1-166 to measure higher units.

- -

1-166 Wackestone-Packstone, dark grey, weathers grey. Grains include fusulinids, solitary rugose corals, brachiopods, and crinoid columnals. Fusulinids are commonly silicified. Irregular nodules of black chert common in lower half of unit. Chert weathers brown, forms lenticular nodules to 15 cm thick and 2 m long. Medium to thick wavy bedded. Forms very prominant cliff face. Locally slumped. Basal contact covered. 2.45 m (8.1')

UNIT	LITHOLOGY	THICKNESS

TS 1-166 .6 m (2') BT: Coarse calcilutite-fine calcirudite; packed, foraminifera, bryozoan, ostracod, crinoid Biopelmicrite: Wackestone.

TS 1-166 1.35 m (4.5') AB: Coarse calcilutite-fine calcirudite; packed, foraminifera, bryozoan, brachiopod, crinoid, spicule Biopelmicrite:Wackestone.

TS 1-166 .45 m (1.5') AB: Fine calcarenite-fine calcirudite; quartz-bearing, sparse, bryozoan, crinoid, foraminifera, brachiopod Biomicrite:Wackestone.

1-165 Covered. 2.6 m (8.6')

1-164 Wackestone, dark grey, weathers grey or brown. Grains include fusulinids (Beedeina), whole productid brachiopods, algal debris, Aulopora(?) tabulate coral colonies in growth position, rugose corals and bryozoans. Burrowed. Common lenticular nodules of chert. Chert is black, mostly weathered brown. Medium to thick wavy bedded. Partly covered, forms rubbly broken cliff face or steep slope. Base slumped, basal contact covered. 1.35 m (4.4')

TS 1-164 Fine calcarenite-fine calcirudite; organic-rich, quartz-bearing, sparse, brachiopod, foraminifera, crinoid, coralline algae Biomicrite:Wackestone.

TS 1-164 Fine calcarenite-fine calcirudite; organic-rich, quartz-bearing, sparse, crinoid, brachiopod, foraminifera, coralline algae Biomicrite:Wackestone.

1-163 Covered. .5 m (1.6')

1-162 Wackestone-Packstone, dark grey, weathers grey. Grains moderately well sorted, medium sand size brachiopod fragments, crinoid columnals, ostracods and Aulopora(?) tabulate coral fragments, and fusulinids. Scattered limonite includions. Lower half burrowed. Single bed. Forms slumped and mostly covered low terrace. Basal contact covered. .3 m (1')

TS 1-162 Top: Very fine calcarenite-fine calcirudite; quartz-bearing, packed, foraminifera, ostracod, brachiopod, crinoid, spicule, coralline algae Biomicrite:Wackestone.

UNIT	LITHOLOGY	THICKNESS

1-161 Covered. 1.2 m (3.9')

1-160 Wackestone, dark grey, weathers grey. Grains include brachiopods, crinoid columnals, algal debris, rare fusulinids, silicified rugose corals, and Aulopora(?) tabulate coral fragments and growth colonies. Limonite inclusions common. Chert nodules common. Chert is black, weathers brown, forms irregular, discontinuous lenticular nodules to 30 cm thick along bedding planes. Medium to thick wavy bedded. Forms laterally prominant cliff face. Top mostly covered. Basal contact covered. 2.9 m (9.5')

TS 1-160 .15 m (.5') BT: Coarse calcilutite-fine calcirudite; chert-bearing, packed, foraminifera, ostracod, brachiopod, crinoid, coralline algae, spicule Biomicrite:Packstone.

TS 1-160 1.7 m (5.5') AB: Coarse calcilutite-fine calcirudite; packed, foraminifera, ostracod, crinoid, coralline algae, pellet Biomicrite:Packstone.

TS 1-160 .45 m (1.5') AB: Coarse calcilutite-fine calcirudite; poorly washed, foraminifera, brachiopod, ostracod, crinoid, coralline algae Biopelsparite:Packstone.

1-159 Covered 3.5 m (4.4')

1-158 Mudstone, dark grey, weathers light grey to tan. Grains include brachiopods (Mesolobus), bryozoans and rare fusulinids. Thick bedded, forms mostly covered ridge of slumped blocks, covered laterally. Top sharp, basal contact covered. 1 m (3.2')

TS 1-158 Top: Very fine calcarenite; sparse, spicule Biomicroparite: Wackestone.

1-157 Covered. 5.25 m (17.2')

- -

OFFSET 9 m (30') north 30° east up hill on top of unit 1-156 to measure higher units.

- -

UNIT	LITHOLOGY	THICKNESS
1-156	Mudstone, dark grey, weathers light grey. Grains include planispiral gastropods, fenestrate bryozoans, crinoid columnals, echinoderm spines, rare productid brachiopods and spicules. Upper surface locally burrowed. Thick tabular beds. Forms low, partly covered ridge with well exposed upper dip slope surface. Basal contact covered.	.8 m (2.7')
TS 1-156	Top: Medium calcarenite; fossiliferous Microsparite:Mudstone.	
1-155	Covered.	.95 m (3.1')
1-154	Wackestone, dark grey, weathers light grey or brown. Grains highly variable, include straight nautiloids, coiled cephalopods, chonetid and whole productid brachiopods, Michelinea sp. tabulate corals, spicules and algal debris. Some grains partially silicified. Thick tabular bedded. Forms partly covered, laterally continuous low ridge. Basal contact covered.	.5 m (1.7')
TS 1-154	Top: Medium calcarenite; fossiliferous, quartz-bearing, trilobite, brachiopod, crinoid Microsparite:Mudstone.	
1-153	Covered.	.8 m (2.7')
1-152	Mudstone, dark grey, weathers light grey or brown to orange. Grains limited, include small crinoid columnals and algae. Chert occurs in irregular lenticular nodules. Chert is black, weathers brown, forms approximately 10% of unit. Medium bedded. Forms mostly covered rubbly slope of slumped blocks or flagy beds. Basal contact covered.	4.6 m (15.1')
TS 1-152	3.65 m (12') AB: Coarse calcilutite; poorly washed Pelsparite:Wackestone.	
TS 1-152	1.2 m (4') AB: Medium calcarenite; burrowed Microsparite: Mudstone.	
1-151	Phylloid Algae Wackestone, dark grey, weathers light grey. Grains dominated by spar replaced phylloid algae, also include brachiopods, rugose corals, crinoid columnals, echinoid spines, coralline algae debris, and small foraminifera. Medium bedded. Forms mostly covered low rubbly terrace. Basal contact covered.	.5 m (1.6')

UNIT	LITHOLOGY	THICKNESS
TS 1-151	Fine calcarenite-fine calcirudite; sparse, pelecypod, brachiopod, crinoid, phylloid algae Biomicrite:Wackestone.	
1-150	Covered.	1.3 m (4.2')
1-149	Mudstone, grey, weathers light grey or brown to orange. Grains restricted to rare fenestrate bryozoans. Scattered limonite inclusions. Thick bedded. Forms low, partly covered, blocky ridge. Basal contact covered.	.85 m (2.8')
TS 1-149	.45 m (1.5') BT: Coarse calcilutite-very fine calcarenite; burrowed, fossiliferous, spicule, pellet Microsparite: Mudstone.	
1-148	Aulopora(?) Boundstone, dark grey, weathers grey or mottled grey and tan or orange. Silicified Aulopora(?) tabulate corals in growth position and fragmented dominate grains. Grains also include crinoid columnals and whole productid brachiopods. Basal 15 cm highly burrowed. Irregular bed of black, weathered brown, chert up to 15 cm thick, 15 cm below top of unit. Medium to thick bedded. Forms continuation of 1-147 cliff face or separate cliff set back from 1-147 front. Basal contact sharp, wavy, irregular.	.75 m (2.5')
TS 1-148	1.5 m (5') AB: Very fine calcarenite-fine calcirudite; quartz-bearing, sparse, foraminifera, ostracod, spicule, crinoid, coralline algae Biomicrite:Wackstone.	
1-147	Wackestone, dark grey, weathers grey. Grains include small crinoid columnals, phylloid algae, whole productid brachiopods, solitary rugose corals and common fusulinids in upper .6 m. Many grains silicified. Irregular chert nodules to 5 cm thick and 1 m long common in upper bed. Chert is black, weathers brown. Thin to thick wavy bedded. Form cliff face or slump blocks. Basal contact covered.	1.4 m (4.6')
TS 1-147	Top: Fine-coarse calcarenite; packed, foraminifera, ostracod, brachiopod, crinoid Biomicrite:Packstone.	
TS 1-147	.4 m (1.3') BT: Fine calcarenite-fine calcirudite; sparse, ostracod, brachiopod, crinoid Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS
TS 1-147	Base: Fine calcarenite-fine calcirudite; sparse, trilobite, foraminifera, ostracod, brachiopod, crinoid, phylloid algae Biomicrite:Wackestone.	
1-146	Covered.	6.45 m (21.1')

OFFSET 33.5 m (110') north 20° east up hill on upper dip slope surface of unit 1-145 to measure higher units.

1-145	Crinoid-Fusulinid Packstone, dark grey, weathers tan. Grains dominated by well sorted, coarse to very coarse sand size crinoid columnals and fusulinids (lowest Beedeina). Other grains include brachiopod and bryozoan fragments. Limonite inclusions and cement common. Medium tabular bedded. Forms cap on 1-144 ridge and prominant, well exposed dip slope surface. Basal contact sharp, slightly wavy.	.45 m (1.4')
TS 1-145	Top: Coarse calcilutite-fine calcirudite; packed, brachiopod, foraminifera, crinoid Biomicrite:Packstone.	
1-144	Phylloid Algae Wackestone, dark grey, weathers grey. Grains include abundant spar replaced phylloid algae, crinoid columnals, silicified rugose corals, brachiopod fragments and rare whole brachiopods and fusulinids. Highly burrowed .6 m below top. Chert nodules common in basal 1 m. Chert is black, mostly weathered brown, forms nodules to 3 cm by 10 cm. Most nodules 1 cm to 3 cm in diameter. Medium to thick, wavy beds. Forms partly covered rubbly slope or ridge. Basal contact covered.	3.1 m (10.1')
TS 1-144	.15 m (.5') BT: Fine calcarenite-fine calcirudite; packed, foraminifera, ostracod, crinoid, brachiopod Biomicrite: Packstone.	
TS 1-144	1.5 m (5') AB: Fine calcarenite-fine calcirudite; sparse, foraminifera, bryozoan, ostracod, crinoid, phylloid algae Biomicrite:Wackestone.	
1-143	Covered.	.6 m (1.9')

UNIT	LITHOLOGY	THICKNESS

1-142 Phylloid Algae Wackestone, dark grey, weathers grey. Grains include abundant spar replaced phylloid algae, brachiopods, crinoid columnals and fusulinids. Fusulinids most abundant at base of unit. Discontinuous lense of black, weathered brown chert to 12 cm thick occurs .6 m above base of unit. Medium to thick wavy beds. Forms rubbly, partially slumped, moderately well exposed ridge. Basal contact covered. 2.35 m (7.7')

TS 1-142 .45 m (1.5') BT: Fine calcarenite-fine calcirudite; sparse, foraminifera, brachiopod, crinoid, ostracod, phylloid algae Biomicrosparite:Wackestone.

TS 1-142 .9 m (3') AB: Fine calcarenite-fine calcirudite; sparse, foraminifera, ostracod, brachiopod, phylloid algae Biomicrite:Wackestone.

TS 1-142 Base: Fine calcarenite-fine calcirudite; sparse, ostracod, brachiopod, crinoid, foraminifera, phylloid algae Biomicrosparite:Wackestone.

1-141 Covered. 1.95 m (6.4')

- -

OFFSET 28 m (92') north 30° east up hill on top of unit 1-140 to measure higher units.

- -

1-140 Phylloid Algal Wackestone, dark grey, weathers light grey or caliche coated white. Grains include spar replaced phylloid algae, crinoid columnals, fusulinids, brachiopod fragments and ostracods. Medium to thick wavy beds, weathered and caliche coated in lower half. Poorly exposed, mostly covered except for base in west wall of quarry and at top. Top forms well exposed dip slope. Basal contact gradational. 5.2 m (17')

TS 1-140 .6m (2') BT: Fine calcarenite-fine calcirudite; sparse, ostracod, brachiopod, foraminifera, phylloid algae Biomicrite:Wackestone.

TS 1-140 3.35 m (11') AB: Coarse calcilutite-fine calcirudite; packed, ostracod, foraminifera, brachiopod, phylloid algae Pelmicrite:Packstone.

UNIT	LITHOLOGY	THICKNESS
TS 1-140	1.5 m (5') AB: Very fine calcarenite-fine calcirudite; sparse, foraminifera, ostracod, brachiopod, crinoid, spicule Biomicrite:Wackestone.	
TS 1-140	.45 m (1.5') AB: Fine-medium calcarenite; sparse, ostracod, crinoid, phylloid algae Biomicrite:Wackestone.	
1-139	Wackestone, dark grey, weathers grey to tan or caliche coated white. Grains include crinoid columnals, brachiopod fragments, and abundant fusulinids from 25 cm to 40 cm above the base. Lenticular nodules of black, weathered brown chert to 3 cm by 10 cm common in upper 30 cm. Limonite inclusions common. Medium to thick wavy beds. Forms highest prominant cliff on west wall of quarry. Locally very well exposed, partly covered laterally. Basal contact sharp, tabular.	1.1 m (3.6')
TS 1-139	.3 m (1') AB: Fine calcarenite-fine calcirudite; organic-rich, packed, brachiopod, ostracod, foraminifera, crinoid, spicule Biomicrite:Wackestone.	
1-138	Calcareous Shale, brown, weathers white. Fissile laminate beds. Highly weathered, covered laterally, locally moderately well exposed. Basal contact covered.	.45 m (1.4')
1-137	Interbedded Crinoid Wackestone and Calcareous Shale. Wackestone, dark grey, weathers grey to tan. Calcareous shale highly weathered, caliche coated white. Grains include crinoid columnals, brachiopods, brachiopod fragments, bryozoans and rare fusulinids. Interbedded shale layers to 20 cm thick. Shale layers contain abundant nodules of wackestone. Medium to thick bedded, some thin beds. Shale zone bedding obscured by weathering and caliche coating. Laterally covered, top mostly covered, locally moderately well exposed. Basal contact sharp.	2.95 m (9.6')
TS 1-137	.6 m (2') BT: Fine calcarenite-fine calcirudite; organic-rich, packed, foraminifera, ostracod, crinoid, spicule Biomicrite:Wackestone.	
TS 1-137	1.5 m (5') AB: Fine calcarenite-fine calcirudite; organic-rich, packed, foraminifera, brachiopod, ostracod, crinoid, spicule Biomicrite:Wackestone.	
TS 1-137	.3 m (1') AB: Fine-medium calcirudite; organic-rich, packed, brachiopod, crinoid, spicule Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS
1-136	Wackestone, dark grey, weathers grey to tan. Grains include phylloid algae, crinoid columnals, brachiopod fragments, echinoderm spines and thin zones with abundant fusulinids. Limonite inclusions common. Chert common in irregular, laterally continuous band 10 to 15 cm below the top. Chert is black, weathers brown. Medium to thick bedded. Mostly covered laterally, locally well exposed. Base sharp but irregular, hummocky.	.7 m (2.3')
TS 1-136	.15 m (.5') BT: Fine calcarenite-fine calcirudite; packed, foraminifera, brachiopod, ostracod, crinoid Biomicrite: Wackestone.	
1-135	Nodular Calcareous Shale, tan weathers caliche coated white. Nodules of grey biomicrite to 3 cm diameter and carbonate coated brachiopods common. Crinoid columnals and rare fusulinids included in biomicrite nodules. Thin to very thin or laminate bedding. Locally well exposed, covered laterally. Basal contact gradational.	.7 m (2.3')
TS 1-135	.25 m (.8') BT (Limestone nodule from calcareous shale): Fine calcarenite-fine calcirudite; sparse, brachiopod, foraminifera, crinoid Biomicrosparite:Wackestone.	
1-134	Wackestone, dark grey, weathers grey to tan. Grains include crinoid columnals, bryozoans, whole brachiopods, fragmented brachiopods and rare fusulinids. More micrite at base, grains more abundant at top. Limonite inclusions common. Medium to thick bedded or thin bedded in weathered zones. Forms prominant layer in quarry wall, covered laterally. Basal contact sharp.	.9 m (2.9')
TS 1-134	.15 m (.5') BT: Fine calcarenite-fine calcirudite; chert-bearing, packed, brachiopod, foraminifera, ostracod, crinoid Biomicrosparite:Wackestone.	
1-133	Calcareous Shale, light brown, weathers white. Micritic nodules common. Micrite is very dark grey, weathers grey. Grains within micrite include crinoid columnals and productid brachiopods. Weathered, fissile, laminate to thinly laminate beds with thin to medium bedded micrite nodules. Mostly covered, locally well exposed, laterally completely covered. Basal contact sharp.	.6 m (1.9')
TS 1-133	.3 m (1') BT (Micrite nodule from calcareous shale): Coarse calcarenite-fine calcirudite; fossiliferous, crinoid Microsparite:Mudstone.	

UNIT	LITHOLOGY	THICKNESS

1-132 Phylloid Algae Wackestone, dark grey, weathers grey. Grains dominated by spar calcite replaced phylloid algae. Grains also include solitary rugose corals, crinoid columnals, brachiopod fragments and bryozoans. Scattered limonite inclusions. Medium wavy bedded with thin bedded shaly zones to 2 cm thick. Forms cliff face or partly covered talus slope in quarry, covered laterally. Basal contact sharp. 1.65 m (5.4')

TS 1-132 .3 m (1') BT: Medium-coarse calcarenite; sparse, brachiopod, phylloid algae Biomicrosparite:Wackestone.

TS 1-132 Base: Very fine calcarenite-fine calcirudite; organic-rich, chert-bearing, dolomitic, sparse, brachiopod, crinoid, spicule Biomicrite:Wackestone.

1-131 Dolomitic Crinoid-Spicule Wackestone, dark grey, weathers light grey or tan. Grains dominated by coarse sand size crinoid columnals and calcareous spicules. Grains also include ostracods, echinoderm spines, brachiopods and rare rugose corals. Limonite common, finely crystalline dolomite rhombs common. Medium to thick wavy bedded with thin bedded shaly zones to 3 cm thick. Forms prominant cliff face on quarry wall, locally partly talus covered. Covered laterally. Basal contact sharp. 4.1 m (13.4')

TS 1-131 .45 m (1.5') BT: Very fine-coarse calcarenite; chert-bearing, dolomite-bearing, crinoid, spicule Biomicrosparite:Wackestone.

TS 1-131 2.15 m (7') AB: Very fine-coarse calcarenite; organic-rich, cherty, dolomitic, packed, brachiopod, crinoid, spicule Biomicrite:Packstone.

TS 1-131 .6 m (2') AB: Very fine-coarse calcarenite; cherty, dolomitic, packed, crinoid, spicule Biomicrite:Wackestone.

1-130 Calcareous Shale, grey, weathers brown. Contains common mudstone-wackestone nodules. Nodules dark grey, weather grey, include crinoid columnals, brachiopods and algal debris. Unit most calcareous in lower .6 m. Very thin bedded to laminate over most of unit, lower .5 m thin to medium bedded. Forms partly covered talus slope, covered laterally. Basal contact slightly gradational. 2.4 m (7.8')

TS 1-130 .6 m (2') BT (Calcareous nodule from shale): Medium calcarenite-fine calcirudite; silt-bearing, fossiliferous, crinoid Microsparite:Mudstone.

UNIT	LITHOLOGY	THICKNESS
TS 1-130	.6 m (2') AB (Calcareous nodule from shale): Fine calcarenite-fine calcirudite; silt-bearing, sparse, brachiopod, trilobite, crinoid Biomicrosparite:Wackestone.	
1-129	Wackestone, dark grey, weathers grey to tan. Grains moderately well sorted, include crinoid columnals, brachiopod fragments, solitary rugose corals and algal debris. Scattered limonite inclusions. Medium to thick bedded. Forms prominant layer in quarry, covered laterally. Basal contact gradational.	.45 m (1.4')
TS 1-129	.15 m (.5') AB: Very fine-fine calcarenite; sparse, spicule, crinoid, brachiopod, ostracod Biomicrosparite:Wackestone.	
1-128	Calcareous Shale, brown, weathers brown to white. Most calcareous at base. Very thin bedded, highly weathered. Forms dip slope or weathered cut in quarry wall. Covered laterally. Basal contact gradational.	1.85 m (6')
1-127	Crinoid Packstone, grey, weathers olive grey, locally caliche coated white. Grains dominated by very coarse sand to granule size crinoid columnals. Grains also include bryozoans and brachiopod fragments. Scattered limonite inclusions. Single bed. Forms upper half of prominant ridge in quarry, covered laterally. Basal contact sharp.	.4 m (1.3')
TS 1-127	Top: Fine calcarenite-medium calcirudite; silt-bearing, packed, rounded, bryozoan, foraminifera, brachiopod, crinoid Biomicrite:Packstone.	
1-126	Wackestone, very dark grey, weathers olive grey. Grains include whole brachiopods, crinoid columnals, solitary rugose corals and rare tabulate corals. Scattered limonite inclusions. Locally caliche coated. Single bed. Forms lower half of prominant ridge in quarry. Covered laterally. Basal contact sharp.	.35 m (1.1')
TS 1-126	Base: Very fine calcarenite-fine calcirudite; chert-bearing, packed, brachiopod, crinoid Biomicrite:Packstone.	
1-125	Calcareous Shale and Marlstone, weathers brown or caliche coated white. Micrite lenses to 15 cm thick. Lower portion more shaly. Unit includes fusulinids but highly leached and limonite replaced. Thin to very thin bedded. Mostly covered in quarry, totally covered laterally. Basal contact covered.	3.8 m (12.4')

UNIT	LITHOLOGY	THICKNESS
1-124	Packstone, dark grey, weathers olive grey or caliche coated white. Grains well sorted, fine sand size, include brachiopod and crinoid fragments and quartz silt. Limonite inclusions common. Medium bedded. Forms prominant dip slope on east wall of quarry. Covered laterally. Basal contact covered.	.65 m (2.1')
TS 1-124	.3 m (1') BT: Very fine-medium calcarenite; burrowed, silt-bearing, sorted, rounded, bryozoan, foraminifera, ostracod, brachiopod, crinoid Biomicrite:Packstone.	
1-123	Wackestone, grey, weathers grey. Grains include spicules, brachiopod fragments, crinoid columnals, encrusting foraminifera and common fusulinids from 30 cm above the base to 45 cm below the top. Scattered small chert nodules and limonite inclusions. Medium to thick bedded. Forms low blocky ridge, laterally partly covered, locally forms well exposed dip slope on surface .45 m below the top. Basal contact covered.	1.2 m (4')
TS 1-123	.45 m (1.5') BT: Very fine-coarse calcarenite; organic-rich, packed, brachiopod, foraminifera, crinoid, spicule Biomicrite: Wackestone.	
1-122	Covered.	.95 m (3.1')

OFFSET down hill south 10° west on top of unit 1-121 to quarry cut on north side of canyon to measure higher units.

1-121	Mudstone, grey, weathers grey. Common whole productid brachiopods only identified grain. Thick to very thick bedded. Forms locally well exposed, laterally broken, rubbly or partly covered, prominant ridge. Basal contact covered.	1 m (3.3')
TS 1-121	.45 m BT: Very fine calcarenite-fine calcirudite; packed, foraminifera, brachiopod, coralline algae, spicule Biomicrite: Wackestone.	
1-120	Covered.	.6 m (1.9')

UNIT	LITHOLOGY	THICKNESS

1-119 Wackestone, dark grey, weathers grey or mottled grey. Top 15 cm tan or orange. Grains include common fusulinids from .6 m above base to top (and lowest Fusulinella, encrusting foraminifera, crinoid columnals and brachiopod fragments. One to three cm diameter subround chert nodules common at top. Lower beds burrowed. Medium wavy bedded. Forms partly to mostly covered cliff face, base slumped mostly covered. Lower beds form undercut in cliff face. Weathers to flaggy slabs. Basal contact covered. 2.45 m (8.1')

TS 1-119 Top: Fine-coarse calcarenite; chert-bearing, sparse, crinoid, foraminifera, brachiopod, spicule Biomicrite:Wackestone.

TS 1-119 1.8 m (6') AB: Very fine-coarse calcarenite; packed, crinoid, brachiopod, foraminifera Biomicrite:Wackestone.

TS 1-119 .6 m (2') AB: Very fine-coarse calcarenite; sparse, crinoid, brachiopod, foraminifera, spicule Biomicrite:Wackestone.

1-118 Crinoid-Foraminifera Wackestone-Packstone, dark grey, weathers grey. Grains include abundant crinoid columnals and common fusulinids (advanced Profusulinella). Bulk of rock is wackestone but locally crinoid columnals form packstone lenses. Other grains include brachiopod fragments and ostracods. Chert common as broken nodular layer .45 to .6 m below top. Chert is black, weathers brown. Isolated lenticular chert nodules common above and below main lense. Thick to medium bedded. Top locally weathered to thin bedded. Forms locally slumped or covered terrace, laterally moderately well exposed, locally well exposed. Basal contact covered. 1.9 m (6.3')

TS 1-118 .15 m (.5') BT: Fine-coarse calcarenite; packed, ostracod, foraminifera, crinoid, brachiopod Biomicrite:Wackestone.

TS 1-118 .6 m (2') AB: Fine-coarse calcarenite; chert-bearing, organic-rich, sorted, rounded, ostracod, brachiopod, crinoid, foraminifera Biomicrosparite:Packstone.

1-117 Wackestone, dark grey, weathers grey to tan or brown. Grains include crinoid columnals, fusulinids, encrusting foraminifera and calcareous algae. Limonite common in rippled zones as small inclusions. Medium wavy bedded. Very poorly exposed. Forms mostly covered rubbly slope with rare in place beds. Top covered, base covered, basal contact not exposed. 2.95 m (9.7')

UNIT	LITHOLOGY	THICKNESS
TS 1-117	Approximately 1.8 m (6') AB: Very fine-medium calcarenite; burrowed, sparse, crinoid, ostracod, spicule Biomicrite: Wackestone.	

OFFSET 136 m (445') down hill south 30° west on top of unit 1-116 to measure higher units.

1-116	Cherty Wackestone, dark grey, weathers grey. Chert is black, weathers brown. Grains include common fusulinids from 1.2 m above base, other foraminifera, crinoid columnals, algal debris and brachiopod fragments. Chert forms lenticular and irregular lenses to .6 m thick and 3 m long. Chert concentrated in horizontal lenses but also extends vertically. Medium to thick, slightly wavy bedded. Forms low, partly covered rubbly cliff face, terrace or rubbly slope. Basal contact covered.	2.65 m (8.7')
TS 1-116	Top: Coarse calcilutite-coarse calcarenite; cherty, organic-rich, ostracod, crinoid, foraminifera, spicule Biomicrite: Packstone.	
TS 1-116	1.5 m (5') AB: Very fine-coarse calcarenite; sparse, ostracod, crinoid, foraminifera, spicule, pellet Biomicrosparite: Wackestone.	
TS 1-116	.45 m (1.5') AB: Fine-coarse calcarenite; sparse, ostracod, foraminifera, spicule Biomicrosparite:Wackestone.	
1-115	Covered.	.8 m (2.7')
1-114	Foraminifera Wackestone, dark grey, weathers olive grey to tan. Grains dominated by abundant fusulinids (Profusulinella). Grains also include crinoid columnals, brachiopod fragments and algal debris. Scattered nodules of black chert, weathered brown. Nodules subround, 5 cm by 10 cm in diameter. Medium to thick bedded. Mostly covered laterally, locally well exposed. Forms rubbly terrace of slumped blocks. Top sharp where exposed. Basal contact covered.	.8 m (2.6')
TS 1-114	.3 m (1') BT: Coarse calcilutite-fine calcirudite; organic-rich, packed, ostracod, crinoid, foraminifera, spicule Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS
TS 1-114	Base: Coarse calcilutite-fine calcirudite; cherty, organic-rich, packed, ostracod, foraminifera, brachiopod, spicule Biomicrite:Wackestone.	
1-113	Covered	1.35 m (4.4')

OFFSET 6 m (20') down hill south 30° west on top of unit 1-112 to measure thickness of 1-112 and higher units.

1-112	Wackestone, dark grey, weathers dark brown to tan. Grains include crinoid columnals, algal debris and brachiopod fragments. Burrows common. Burrowed zone has slightly more micrite than rest of rock. Limonite common. Medium tabular bedded. Forms mostly covered, locally moderately well exposed low broken ridge. Basal contact covered.	.45 m (1.4')
TS 1-112	Top: Coarse calcilutite-coarse calcarenite; burrowed, organic-rich, sparse, foraminifera, ostracod, brachiopod, crinoid, spicule Biomicrite:Wackestone.	
1-111	Cherty Crinoid Wackestone, dark grey, weathers grey to tan. Chert black, weathers brown. Grains dominated by very coarse sand size crinoid columnals. Grains also include brachiopods, crinoid columnals and echinoid spines. Locally burrowed. Limonite inclusions common. Chert forms lenticular nodules to 15 cm thick and over 1 m long. Chert is approximately 10% of rock unit. Medium to thick bedded. Mostly covered, locally moderately well exposed. Forms rubbly slope, many blocks slumped. Basal contact covered.	2.5 m (8.2')
TS 1-111	.6 m (2') BT: Coarse calcilutite-coarse calcarenite; cherty, organic-rich, packed, brachiopod, ostracod, spicule Biomicrite:Wackestone.	
TS 1-111	.6 m (2') AB: Fine-coarse calcarenite; dolomitic, sparse, brachiopod, crinoid Biomicrite:Wackestone.	
1-110	Covered.	.75 m (2.4')

UNIT	LITHOLOGY	THICKNESS

OFFSET 11 m (35') north 25° east up hill on top of unit 1-109 to measure higher units.

1-109 Crinoid Wackestone, grey, weathers grey. Grains dominated by coarse to very coarse sand size crinoid columnals. Grains also include brachiopod fragments, rare whole brachiopods and rare solitary rugose corals. Scattered limonite and hematite. Medium to thick bedded. Forms laterally prominant and well exposed cliff face, locally broken and partly covered. Basal contact gradational. .35 m (1.1')

TS 1-109 Center: Very fine calcarenite-fine calcirudite; packed, brachiopod, ostracod, foraminifera, spicule, crinoid Biomicrite:Wackestone.

1-108 Burrowed Wackestone, dark grey, weathers mottled grey. Grains include crinoid columnals and brachiopod fragments. Burrows abundant. Hematite inclusions common. Laterally elongate chert lenses common. Chert is black, weathers brown, in lenses to 15 cm thick and over 10 m long. Medium to thin bedded, locally weathered and nodular. Forms continuation of 1-107 rubbly slope or base of 1-109 low cliff. Basal contact sharp, irregular. .45 m (1.5')

TS 1-108 Top: Very fine calcarenite-fine calcirudite; organic-rich, burrowed, packed, foraminifera, ostracod, spicule, brachiopod, crinoid Biomicrite:Wackestone.

1-107 Cherty Mudstone, dark grey, weathers grey or tan. Chert black, weathers brown. Grains restricted to crinoid columnals, brachiopods, rare solitary rugose corals and rare planispiral gastropods. Chert forms irregular lenticular nodules. Carbonate inclusions in chert lenses common. Scattered limonite inclusions. Medium to thin bedded, locally very thin bedded or weathered and fissile. Forms partly covered rubbly slope. Basal contact sharp. 1.6 m (5.2')

TS 1-107 .3 m (1') BT: Coarse calcilutite; organic-rich, fossiliferous, spicule, pellet Microsparite:Mudstone.

TS 1-107 .45 m (1.5') AB: Coarse calcilutite-medium calcarenite; sparse, foraminifera, spicule, crinoid, pellet Biomicrite: Wackestone.

UNIT	LITHOLOGY	THICKNESS
1-106	Wackestone, grey, weathers grey. Grains include coarse sand size crinoid columnals, small foraminifera, and brachiopod fragments. Chert forms beds 15 cm below top and at base. Both chert beds range from 0 to 15 cm thick. Irregular chert nodules common between main chert beds. Chert is black, weathers brown. Thick bedded. Forms upper half of laterally prominant cliff face. Basal contact sharp.	.75 m (2.5')
TS 1-106	Top: Very fine calcarenite-fine calcirudite; sparse, rounded, foraminifera, brachiopod, spicule, crinoid Biomicrosparite: Wackestone.	
1-105	Crinoid Packstone, dark grey, weathers grey. Grains dominated by crinoid columnals. Grains also include encrusting foraminifera and brachiopod fragments. Finely crystalline dolomite rhombs common. Chert beds and lenticular chert nodules common. Chert beds laterally continuous, to 15 cm thick. Chert is black, weathers brown. Medium to thin tabular beds. Forms lower half of laterally prominant cliff face. Locally covered. Basal contact covered.	1.3 m (4.2')
TS 1-105	.6 m (2') BT: Medium calcarenite-fine calcirudite; dolomitic, organic-rich, poorly washed, sorted, rounded, foraminifera, brachiopod, crinoid Biosparite:Packstone.	
1-104	Covered.	.4 m (1.3')
1-103	Wackestone, dark grey weathers grey. Grains include ostracod valves, algal debris, crinoid columnals and Chaetetes colonies to 5 cm by 10 cm. Burrowed, burrows cross 1-103/1-102 contact. Mostly covered, forms locally well exposed cap on 1-101 and 1-102 blocks. Basal contact gradational.	.1 m (.4')
TS 1-103	Coarse calcirudite-medium calcarenite; sparse, foraminifera, crinoid, ostracod, spicule, pellet Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS
1-102	Oolitic Skeletal Grainstone, dark grey, weathers dark grey. Grains coated skeletal fragments including crinoid columnals, brachiopod fragments, ostracod valves and foraminifera. Many grains coated sufficiently to be ooids. Burrowed. Cement spar calcite. Spar also replaces many skeletal grains. Single bed. Forms mostly covered interval or rubbly weathered surface at top of 1-101. Locally well exposed. Basal contact gradational due to burrowing.	.2 m (.7')
TS 1-102	Medium-coarse calcarenite; sorted, rounded, foraminifera, intraclast, ostracod, bryozoan, brachiopod, crinoid Oosparite:Grainstone.	
1-101	Wackestone, grey, weathers mottled grey. Grains restricted to crinoid columnals and common whole productid brachiopods. Highly burrowed. Burrows filled with coated skeletal grains from unit 1-102. Thin wavy bedded. Forms low bluff or mostly covered terrace with common rubble blocks. Basal contact covered.	.35 m (1.1')
TS 1-101	Base: Very fine-medium calcarenite; burrowed, quartz-bearing, packed, foraminifera, brachiopod, crinoid, spicule Biomicrite: Wackestone.	
1-100	Covered.	.15 m (.5')
1-99	Wackestone, dark grey, weathers grey with abundant brown Chaetetes colonies. Grains include brachiopod fragments, crinoid columnals, colonial rugose corals, and small foraminifera. Chaetetes colonies range to over 30 cm in diameter and are approximately 50% silicified. Many Chaetetes and colonial rugose corals in growth position. Scattered limonite inclusions. Thick bedded. Forms prominant cliff or terrace of rubbly blocks, locally slumped. Basal contact covered.	1.05 m (3.4')
TS 1-99	Top: Coarse calcilutite-medium calcarenite; sparse, foraminifera, ostracod, spicule, crinoid, pellet Biomicrite:Wackestone.	
1-98	Covered.	1.85 m (6.1')

UNIT	LITHOLOGY	THICKNESS
1-97	Wackestone, grey weathers grey. Grains include whole productid brachiopods, crinoid columnals, encrusting foraminifera and uncommon fusulinids. Locally burrowed. Brachiopods commonly silicified. Common chert nodules, weathered brown, 3 to 5 cm in diameter. Thick bedded or massive. Forms top of laterally prominant cliff face. Basal contact sharp.	.75 m (2.5')
TS 1-97	.3 m (1') BT: Fine-medium calcarenite; sparse, ostracod, foraminifera, crinoid, spicule Biomicrite:Wackestone.	
1-96	Cherty Wackestone, grey, weathers light grey. Chert is black, weathers brown. Grains include brachiopods, crinoid columnals, echinoderm spines, encrusting foraminifera, bryozoans and fusulinids. Grains concentrated in lenticular wavy zones. Chert nodules subround, to 5 cm thick and 20 cm long. Thin wavy or rippled beds. Forms weathered zone or undercut of center of 1-95 to 1-97 cliff face. Basal contact sharp, wavy.	.45 m (1.4')
TS 1-96	.15 m (.5') AB: Fine calcarenite-fine calcirudite; sparse, brachiopod, foraminifera, crinoid, spicule Biomicrite: Wackestone.	
1-95	Wackestone, grey, weathers grey. grains include abundant pellets, crinoid columnals, and brachiopod fragments. Chert common in 2-3 cm subround nodules and 15 cm by 1 m lenticular nodules. Chert is black, weathers brown. Medium to thick bedded or massive. Forms lower third of prominant cliff face. Basal contact sharp, tabular.	.45 m (1.4')
TS 1-95	.3 m (1') AB: Coarse calcilutite-coarse calcarenite; packed, ostracod, foraminifera, spicule, brachiopod, crinoid, pellet, Biomicrite:Wackestone.	
1-94	Crinoid Wackestone and Chert, dark grey, weathers grey. Chert is black, weathers brown. Grains include common crinoid columnals and rare brachiopod fragments. Chert forms lenticular beds to 15 cm thick and over 5 m long. Medium to thin wavy beds. Forms mostly covered, locally well exposed, rubbly steep slope at base of prominant cliff. Basal contact covered.	.9 m (2.9')
TS 1-94	Top: Fine-coarse calcarenite; sparse, ostracod, foraminifera, brachiopod, crinoid Biomicrosparite:Wackestone.	
1-93	Covered.	1.85 m (6')

UNIT	LITHOLOGY	THICKNESS
1-92	Wackestone, grey, weathers mottled grey. Grains include encrusting foraminifera, calcareous algae, crinoid columnals and spicules. Common poorly defined burrows. Lenticular and subround chert nodules common. Chert black, weathers brown, subround nodules to 5 cm diameter, lenticular nodules to 10 cm thick and 40 cm long. Medium to thick wavy bedded. Top broken, locally slumped. Forms top of laterally prominant and well exposed cliff face. Basal contact gradational.	.6 m (1.9')
TS 1-92	Top: Coarse calcilutite-medium calcarenite; sparse, ostracod, foraminifera, spicule, pellet Biomicrosparite:Wackestone.	
1-91	Burrowed Wackestone, dark grey weathers mottled grey. Grains include crinoid columnals, planispiral gastropod internal molds to 4 cm diameter, common silicified solitary rugose corals and silicified brachiopods. Common chert nodules, black, weathered brown, to 3 cm by 10 cm diameter. Thin to medium bedded. Form portion of prominant cliff face. Basal contact sharp, wavy and irregular.	.2 m (.7')
TS 1-91	.15 m (.5') BT: Very fine calcarenite-fine calcirudite; burrowed, sparse, ostracod, brachiopod, foraminifera, spicule Biomicrosparite:Wackestone.	
1-90	Cherty Burrowed Wackestone, dark grey, weathers mottled grey and light grey. Chert is black, weathers brown. Grains include crinoid columnals, brachiopod fragments, and rare foraminifera. Chert forms 20% of rock. Chert most abundant in lenticular nodules at top of unit. Limonite inclusions common. Thin nodular, wavy bedded. Forms undercut at center of prominant cliff face. Basal contact sharp. Base irregular, cuts into 1-89 up to 10 cm.	.35 m (1.2') (or thicker where cuts into Unit 1-89)
TS 1-90	.1 m (.3') BT: Coarse calcilutite-coarse calcarenite; sparse, foraminifera, spicule, pellet Biomicrite:Wackestone.	
1-89	Wackestone, grey, weathers light grey. Grains include crinoid columnals and spicules. Common irregular to subround nodules of black chert. Chert weathers brown. Medium to thick wavy beds. Forms lower half of laterally prominant cliff face. Basal contact covered.	1.4 m (4.6')
TS 1-89	.75 m (2.5') AB: Very fine-medium calcarenite; packed, foraminifera, spicule Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS
1-88	Covered.	.6 m (2')
1-87	Wackestone, dark grey, weathers light grey. Grains include common fusulinids (Profusulinella), crinoid columnals and brachiopod fragments. Laterally continuous lense of black chert, weathered brown, near base of unit. Single bed. Forms low broken terrace, locally well exposed, mostly covered laterally. Basal contact covered.	.3 m (1')
TS 1-87	Top: Coarse calcilutite-medium calcarenite; packed, sorted, brachiopod, foraminifera, spicule, crinoid Biomicrite: Packstone.	
1-86	Covered.	.35 m (1.1')
1-85	Foraminifera Packstone, grey, weathers light grey. Grains dominated by variety of small foraminifera and primative fusulinids (Profusulinella, Eoschubertella). Grains also include brachiopod fragments, rare whole silicified brachiopods, and crinoid columnals. Locally highly burrowed. Burrows weather darker than rest of unit. Chert zone with lateral continuity but variable thickness .6 to 1 m above base. Additional chert nodules common above main chert zone. Chert is black or weathered brown. Very thick bedded or massive. Forms laterally prominent, well exposed high cliff face. Basal contact covered.	1.5 m (5')
TS 1-85	.45 m (1.5') BT: Very fine-coarse calcarenite; packed, brachiopod, foraminifera, spicule, crinoid Biomicrite: Packstone.	
TS 1-85	Base: Very fine-coarse calcarenite; packed, foraminifera, spicule, crinoid Biomicrite:Packstone.	
1-84	Foraminifera Wackestone, grey, weathers light grey. Grains dominated by encrusting foraminifera and primative fusulinids. Grains also include crinoid columnals, brachiopod spines and spicules. Unit highly burrowed. Burrows both vertical and horizontal, 1 to 3 cm wide, and up to 10 cm long. Thin wavy bedded, locally contorted bedding. Forms undercut at base of 1-85 prominant cliff face. Basal contact sharp.	.35 m (1.1')

UNIT	LITHOLOGY	THICKNESS
TS 1-84	Top: Coarse calcilutite-coarse calcarenite; packed, ostracod, spicule, foraminifera Biomicrite:Wackestone.	
1-83	Mudstone and Chert, grey, weathers light grey. Chert black, weathers brown. Grains include algal debris, foraminifera, and rare, whole, partially silicified productid brachiopods. Chert beds 15 to 25 cm thick and isolated subround chert nodules form approximately 10% of rock unit. Medium to thick bedded. Forms base of laterally prominant cliff. Basal contact covered.	1.15 m (3.7')
TS 1-83	.45 m (1.5') BT: Very fine-fine calcarenite; sparse, foraminifera, brachiopod, spicule Biomicrite:Wackestone.	
1-82	Covered.	1.9 m (6.2')
1-81	Phylloid Algae Wackestone, grey, weathers very light grey. Grains include spar replaced phylloid algae, rare whole brachiopods, and spicules. Unit is burrowed. Burrows irregular, weather slightly darker than rest of rock, and range to 1 cm by 5 cm. Scattered irregular silicification and limonite inclusions. Thin to thick wavy beds. Thinner beds in lower portion, more massive at top. Forms upper half of locally broken or slumped but laterally prominant cliff face. Basal contact sharp, wavy.	1.05 m (3.4')
TS 1-81	.45 m (1.5') AB: Coarse calcilutite-fine calcarenite; packed, foraminifera, spicule Pelmicrite:Wackestone.	
1-80	Cherty Wackestone, dark grey, weathers grey. Chert is black, weathers brown or white. Grains include crinoid columnals, rare brachiopod fragments and spicules. Chert forms approximately 30% of unit. Chert forms laterally continuous wavy beds or lenticular nodules from 3 to 5 cm thick. Medium wavy bedded. Forms lower half of laterally prominant, locally broken or slumped cliff face. Basal contact covered.	1.2 m (3.9')
TS 1-80	.3 m (1') BT: Very fine-coarse calcarenite; sparse, crinoid, foraminifera, brachiopod, spicule Biomicrite:Wackestone.	
1-79	Covered.	3.9 m (12.7')

UNIT	LITHOLOGY	THICKNESS
1-78	Wackestone, grey to olive grey, weathers grey. Grains include pellets, crinoid columnals, rare brachiopods and spicules. Burrowed in upper portion. Chert nodules common, irregular and highly weathered brown or white. Limonite inclusions common. Poorly defined medium to thick wavy beds. Forms laterally prominant blocky cliff face. Locally slumped. Basal contact sharp, wavy, irregular.	1.1 m (3.6')
TS 1-78	.3 m (1') AB: Coarse calcilutite-fine calcirudite; packed, foraminifera, phylloid algae, crinoid, pellet Biomicrite: Wackestone.	
1-77	Phylloid Algae Biomicrite, dark grey, weathers grey. Spar replaced phylloid algae grains form up to 10% of rock. Other grains include bryozoans and rare brachiopods. Chert occurs in thin lenticular zones to 2 cm thick and 1 m long. Chert is black, weathers brown. Medium wavy bedded. Forms mostly covered, locally moderately well exposed, rubbly slope or undercut at base of 1-78 cliff face. Basal contact covered.	1.35 m (4.4')
TS 1-77	.45 m (1.5') BT: Fine calcarenite-fine calcirudite; sparse, foraminifera, ostracod, phylloid algae Biomicrite:Wackestone.	
1-76	Limonitic Wackestone, olive grey, weathers mottled grey and orange. Grains include spicules, crinoid columnals, rare rugose corals, brachiopods and bryozoans. Limonite abundant as inclusions, grain replacement and fracture fill. Rugose corals silicified. Medium to thin bedded or forms single bed. Mostly covered laterally but prominant where exposed due to orange color of weathered surface. Basal contact sharp.	.2 m (.9')
TS 1-76	Top: Very fine calcarenite-coarse calcarenite; sparse, foraminifera, crinoid, spicule Biomicrosparite:Wackestone.	
1-75	Wackestone-Packstone, grey, weathers grey. Grains include small foraminifera, crinoid columnals, brachiopod fragments and rare fusulinids. Limonite and dolomite grain replacement and fracture fill common. Forms single bed. Mostly covered laterally, locally well exposed. Basal contact irregular, unit cuts into 1-74 up to 3 cm.	.25 m (.8')
TS 1-75	Top: Fine-coarse calcarenite; dolomitic, packed, foraminifera, brachiopod, crinoid Biomicrosparite:Packstone.	

UNIT	LITHOLOGY	THICKNESS
1-74	Dolomite, tan, weathers tan. Silt size dolomite rhombs form bulk of rock. Interbedded fossiliferous zones contain unidentified skeletal fragments. Forms two main beds separated by 3 cm thick zone with more abundant skeletal material. Mostly covered. Basal contact sharp but highly irregular. Base cuts into 1-73 up to few centimeters, locally fills in karsted overhangs in 1-73 upper surface.	.3 m (1')
TS 1-74	Base: Medium crystalline fossiliferous dolomite.	
1-73	Wackestone-Packstone, grey, weathers light grey. Grains include algal debris, small foraminifera, crinoid columnals and brachiopod fragments. Limonite and dolomite replacement common. Medium tabular beds. Forms mostly covered, locally well exposed low blocky ridge. Basal contact covered. Top locally cut by unit 1-74.	.8 m (2.6')
TS 1-73	.3 m (1') BT: Coarse calcilutite-coarse calcarenite; dolomitic, packed, foraminifera, brachiopod, crinoid Biomicrite:Wackestone.	
1-72	Covered.	2.25 m (7.3')
1-71	Wackestone, grey, weathers grey or orange. Grains include rare foraminifera, rare brachiopods, crinoid columnals, small pelecypods, calcareous algae and spicules. Locally burrowed. Limonite inclusions common. Lower third of unit has common nodules of brown chert to 1 cm by 3 cm diameter. Medium to thick bedded. Forms laterally continuous, locally slumped cliff face with rubbly upper surface. Basal contact covered.	2.05 m (6.7')
TS 1-71	.9 m (3') BT: Very fine calcarenite-coarse calcilutite; sparse, foraminifera, phylloid algae, brachiopod, crinoid, spicule Biomicrite:Wackestone.	
TS 1-71	.3 m (1') AB: Very fine-coarse calcarenite; sparse, foraminifera, brachiopod, crinoid, spicule Biomicrite: Wackestone.	
1-70	Covered.	2.4 m (7.9')

UNIT	LITHOLOGY	THICKNESS

OFFSET 4.5 m (15') south 50° west down hill on top of unit 1-69 to measure higher units.

1-69 Crinoid-Foraminifera Wackestone and Chert, dark grey, weathers grey. Chert is black, weathers brown. Grains include crinoid columnals, fusulinids (Profusulinella abundant 45 cm below the top), other foraminifera and calcareous algae. Three to four chert lenses ranging from 0 to .75 m thick. Medium to thick wavy bedded. Forms partly covered rubbly slope or cliff face. Laterally distinctive and prominant. Base shaly, weathered. Basal contact sharp, irregular. — 2.6 m (8.6')

TS 1-69 2.1 m (6.5') AB: Coarse calcilutite-fine calcirudite; packed, ostracod, foraminifera, bryozoan, brachiopod, spicule, crinoid Biomicrite:Wackestone.

TS 1-69 1.2 m (4') AB: Coarse calcilutite-fine calcirudite; packed, ostracod, foraminifera, bryozoan, brachiopod, crinoid Biomicrite:Wackestone.

TS 1-69 .6 m (2') AB: Coarse calcilutite-fine calcirudite; packed, ostracod, foraminifera, bryozoan, brachiopod, spicule, crinoid Biomicrite:Wackestone.

TS 1-69 Base: Coarse calcilutite-fine calcirudite; packed, foraminifera, ostracod, brachiopod, crinoid Biomicrosparite: Wackestone.

1-68 Wackestone, dark grey, weathers grey. Grains include fine sand size pellets, crinoid columnals, calcareous algae and brachiopod fragments. Limonite and hematite inclusions common. Medium to thick bedded or massive. Forms mostly covered terrace with locally well exposed cliff face. Basal contact sharp. — .6 m (2')

TS 1-68 Top: Coarse calcilutite-coarse calcarenite; sparse, bryozoan, ostracod, foraminifera, crinoid, brachiopod, pellet Biomicrosparite:Wackestone.

1-67 Mudstone, grey, weathers grey. Grains limited to calcareous algae, spicules and fine brachiopod fragments. Limonite inclusions common. Thick bedded or massive. Forms single, locally broken or covered cliff face. Basal contact sharp, tabular. — .65 m (2.2')

UNIT	LITHOLOGY	THICKNESS
TS 1-67	.3 m (1') AB: Very fine-coarse calcarenite; packed, foraminifera, ostracod, crinoid, spicule, brachiopod Biomicrosparite:Wackestone.	
1-66	Mudstone, dark grey, weathers grey. grains restricted to rare, small, unidentified skeletal fragments. Rare small hematite inclusions. Medium wavy bedded. Forms laterally covered but locally well exposed broken cliff face. Basal contact sharp.	.5 m (1.7')
TS 1-66	Base: Fine calcarenite; fossiliferous, crinoid, brachiopod, foraminifera Biomicrite:Mudstone.	
1-65	Crinoid-Foraminifera Wackestone, grey, weathers grey. Grains include common crinoid columnals, abundant encrusting foraminifera, scattered fusulinids (Profusulinella, Eoschubertella) and brachiopod fragments. Limonite inclusions common. Thick bedded or massive. Forms cap on cliff face. Laterally rounded back or covered but mostly well exposed. Basal contact gradational.	.9 m (2.9')
TS 1-65	.15 m (.5') AB: Coarse calcilutite-medium calcirudite; packed, intraclast, foraminifera, brachiopod, bryozoan, crinoid, spicule Biomicrite:Wackestone.	
1-64	Crinoid-Foraminifera Packstone, grey, weathers grey, upper half mottled by burrowing. Grains include scattered fusulinids, crinoid columnals, abundant encrusting foraminifera, spicules and calcareous algae. Upper half burrowed. Burrows do not extend into unit 1-65. Very thick bedded or massive. Forms central portion of prominant cliff face. Basal contact gradational.	1.05 m (3.4')
TS 1-64	Center: Fine-coarse calcarenite; sparse, brachiopod, spicule, foraminifera Biomicrite:Packstone.	
1-63	Crinoid-Foraminifera Wackestone, dark grey, weathers grey, locally mottled by burrowing. Grains include crinoid columnals, encrusting foraminifera, rare fusulinids, brachiopod fragments, rare whole brachiopods and gastropods. Limonite inclusions common. Chert common .6 m above base in lenticular zone 6 cm to 30 cm thick. Chert is black, weathers brown. Very thick bedded. Forms prominant cliff face. Basal contact sharp, irregular, wavy.	1.95 m (6.4')

UNIT	LITHOLOGY	THICKNESS
TS 1-63	Top: Fine-medium calcarenite; sparse, ostracod, foraminifera Biomicrite:Wackestone.	
TS 1-63	.6 m (2') AB: Fine-coarse calcarenite; sparse, brachiopod, foraminifera, crinoid Biomicrite:Wackestone.	
TS 1-63	Base: Medium-coarse calcarenite; organic-rich, cherty, brachiopod, crinoid Biomicrite:Wackestone.	
1-62	Packstone, grey, weathers light grey. Grains include crinoid columnals, brachiopods, brachiopod fragments, bryozoans, foraminifera (lowest Profusulinella) and calcareous algae. Chert nodules to 1 cm diameter common at center of unit. Medium to thick wavy beds. Forms partly covered, locally well exposed cliff face or terrace. Basal contact sharp.	.55 m (1.8')
TS 1-62	.15 m (.5') AB: Very fine calcarenite-fine calcirudite; packed, brachiopod, foraminifera, crinoid Biomicrosparite: Packstone.	
1-61	Crinoid-Intraclast Grainstone, grey, weathers mottled grey and light grey. Grains include productid and other brachiopods, micritic intraclasts (subround to sub-angular, to 1 cm by 3 cm diameter), crinoid columnals and solitary rugose corals. Calcite spar cement. Thick bedded or single massive bed. Forms laterally broken and partly covered terrace. Basal contact covered.	.75 m (2.5')
TS 1-61	.15 m (.5') BT: Medium calcarenite-medium calcirudite; sorted, rounded, intraclast, brachiopod, bryozoan, crinoid Biosparite: Grainstone.	
1-60	Covered. Basal 3 cm of covered interval partly exposed as cap on unit 1-59. Sample for thin section description taken from this thin cap which may not be representative of entire stratigraphic thickness.	.65 m (2.2')
TS 1-60	Base: Coarse calcilutite-fine calcarenite; burrowed, sparse, crinoid, ostracod, bryozoan, spicule Biomicrite:Wackestone.	
1-59	Crinoid Grainstone, grey, weathers grey with light grey to tan zones to 2 cm thick. Grains rounded and sorted include crinoid columnals, brachiopod fragments, bryozoan fragments, intraclasts, and small rugose and tabulate corals. Burrowing common in upper 15 cm. Rare chert nodules to 3 cm diameter. Thick to very thick bedded or massive, grains appear trough cross bedded. Forms laterally prominant, locally broken distinctive cliff	1.35 m (4.5')

UNIT	LITHOLOGY	THICKNESS

face. Basal contact sharp, mostly covered.

TS 1-59 .3 m (1') BT: Medium calcarenite-fine calcirudite; sorted, intraclast, foraminifera, bryozoan, brachiopod, crinoid Biosparite:Grainstone.

1-58 Crinoid Wackestone-Packstone, grey, weathers mottled grey. Grains include crinoid columnals, brachiopod fragments and foraminifera (Lowest Eoschubertella). Grains most concentrated in packstone layers and less abundant in interbedded wackestone layers. Layers are rippled and up to 3 cm thick, most 1 to 2 cm thick. Rock approximately 50% wackestone and 50% interbedded packstone. Lenticular to subround chert nodules common. Chert black, weathers brown, ranges to nodules 4 cm thick by 10 cm long. Medium bedded. Forms top half of prominant cliff face. Basal contact wavy, irregular, gradational. 1 m (3.2')

TS 1-58 .3 m (1') AB: Coarse calcilutite-fine calcirudite; packed, trilobite, foraminifera, pellet, crinoid Biomicrosparite: Packstone.

1-57 Crinoid Packstone-Wackestone, grey weathers mottled grey and light grey. Packstone approximately 80% of rock. Grains include crinoid columnals, silicified brachiopods, bryozoans and small foraminifera. Wackestone forms thin rippled interavals (approximately 1 cm thick) between grain supported zones. Rare nodules of black chert, weathered brown, to 3 cm diameter. Medium bedded. Forms lower half of prominant cliff face. Basal contact gradational, somewhat irregular. .65 m (2.1')

TS 1-57 Base: Coarse calcilutite-fine calcirudite; burrowed, poorly washed, trilobite, foraminifera, bryozoan, brachiopod, gastropod, crinoid Biosparite:Packstone.

1-56 Cherty Crinoid Wackestone, dark grey, weathers light grey. Chert black, weathers brown. Grains include crinoid columnals, small foraminifera, and algal debris. Unit becomes more clay rich at top. Rare limonite inclusions. Chert forms irregular to subround nodules to 5 cm thick and 1 m long. Chert most abundant in upper half of unit. Medium to thick bedded. Forms laterally distinctive partly covered cliff face or steep rubbly slope. Basal contact sharp. 1.4 m (4.6')

TS 1-56 .3 m (1') BT: Very fine calcarenite-fine calcirudite; cherty, packed, ostracod, crinoid, spicule Biomicrite:Wackestone.

UNIT	LITHOLOGY	THICKNESS
TS 1-56	.15 m (.5') AB: Fine-coarse calcarenite; packed, foraminifera, ostracod, crinoid Biomicrite:Wackestone.	
1-55	Crinoid-foraminifera Packstone, dark grey, weathers grey. Grains dominated by crinoid columnals and millerellid foraminifera. Other grains include brachiopod spines, calcareous algae and rare whole rugose corals. Prominant chert bed 0 to 3 cm above base. Chert bed is 3 to 15 cm thick, black, weathered brown. Additional lenticular chert nodules common in unit laterally. Medium to very thick slightly wavy beds. Forms locally prominant, laterally broken or partly covered, cliff face. Basal contact sharp.	2.65 m (8.7')
TS 1-55	.6 m (2') BT: Fine calcarenite-fine calcirudite; quartz-bearing, packed, ostracod, brachiopod, foraminifera, spicule, crinoid Biomicrosparite:Packstone.	
TS 1-55	.45 m (1.5') AB: Fine calcarenite-fine calcirudite; quartz-bearing, packed, ostracod, barachiopod, foraminifera, spicule, crinoid Biomicrosparite:Packstone.	

OFFSET 29 m (95') south 50° west down hill on chert bed near base of unit 1-55 to measure 1-55 and higher units.

1-54	Wackestone, grey, weathers light grey. Grains include algal fragments, rare foraminifera and rare whole productid brachiopods. Thick bedded. Scattered limonite and hematite inclusions. Forms bluff face and broken, rubbly dip slope. Locally well exposed, laterally partly covered. Basal contact gradational.	.65 m (2.1')
TS 1-54	Fine-medium calcarenite; gypsum-bearing, sorted, crinoid, foraminifera, spicule Biosparite:Packstone.	
1-53	Wackestone, grey, weathers grey. Grains include whole and fragmented crinoid columnals, encrusting foraminifera, other small foraminifera, brachiopod fragments, Chaetetes colonies to 30 cm diameter, Aulopora(?) tabulate corals and colonial rugose corals. Localized nature of coral Chaetetes colonies suggest organisms perserved in growth associations. Scattered limonite inclusions. Medium wavy beds. Poorly exposed laterally, locally well exposed. Basal contact sharp, irregular, cuts into unit 1-52 up to 10 cm.	.25 to .45 m (.8 to 1.4')

UNIT	LITHOLOGY	THICKNESS

TS 1-53 Base: Very fine calcarenite-fine calcirudite; packed, brachiopod, ostracod, foraminifera, crinoid, spicule Biomicrosparite:Wackestone.

1-52 Wackestone, grey, weathers light grey. Grains include small crinoid columnals, calcareous algae, brachiopod fragments and rare small foraminifera. Locally burrowed. Subround to round chert nodules common. Most chert nodules approximately 10 cm in diameter, range up to 30 cm by 1 m. Medium to thick wavy beds. Forms upper half of cliff face and rubbly, steep dip slope surface. Basal contact sharp, irregular. 1.45 m (4.8')

TS 1-52 .3 m (1') BT: Very fine calcarenite-fine calcirudite; packed, foraminifera, brachiopod, crinoid, spicule Biomicrite: Wackestone.

TS 1-52 .15 m (.5') AB: Very fine calcarenite-fine calcirudite; packed, spicule, ostracod, foraminifera, brachiopod, crinoid Biomicrite:Wackestone.

1-51 Foraminifera Wackestone-Packstone, grey, weathers light grey. Grains dominantly small foraminifera, also include crinoid columnals, brachiopod spines and spicules. Foraminifera less common at base. Hematite and limonite inclusions common. Chert is black, weathers brown. Subround nodules range to 10 cm by 15 cm in diameter, lenticular nodules to 3 cm thick. Medium to thick wavy bedded. Forms lower half of cliff face. Basal contact covered. .9 m (3')

TS 1-51 Top: Very fine-coarse calcarenite; packed, brachiopod, ostracod, spicule, foraminifera, crinoid Biomicrosparite: Wackestone.

TS 1-51 .55 m (1.8') AB: Very fine-coarse calcarenite; quartz-bearing, packed, crinoid, foraminifera Biomicrosparite: Wackestone.

TS 1-51 .15 m (.5') AB: Coarse calcilutite-coarse calcarenite; packed, ostracod, crinoid, foraminifera, spicule, pellet Biomicrosparite:Wackestone.

1-50 Covered. 1.45 m (4.7')

UNIT	LITHOLOGY	THICKNESS
1-49	Cherty Packstone, grey, weathers grey. Chert is black, weathers dark brown to reddish brown. Grains include small foraminifera, calcareous algae, fenestrate bryozoans and brachiopod fragments. Unit is burrowed. Burrows have higher micrite and limonite content than rest of rock. Chert nodules are irregular to subround, form approximately 30% of rock. Forms single bed with well exposed dip slope surface. Basal contact sharp, wavy.	.2 m (.6')

TS 1-49 Near top: Very fine-medium calcarenite; organic-rich, packed, brachiopod, ostracod, spicule, foraminifera, coralline algae Biomicrite:Packstone.

- -

OFFSET 20 m (65') north 50° east up hill on top of unit 1-48 to measure higher units

- -

UNIT	LITHOLOGY	THICKNESS
1-48	Foraminifera Wackestone, dark grey, weathers grey. Grains include abundant millerellid foraminifera, other foraminifera, crinoid columnals and calcareous spicules. Silicified <u>Chaetetes</u> colonies and chert nodules common. Chert bed 3 cm to 5 cm thick at base. Chert is black, weathers brown. Medium to thick bedded. Forms bluff face with well exposed dip slope. Basal contact sharp, slightly wavy.	.9 m (2.9')

TS 1-48 .15 m (.5') BT: Very fine-coarse calcarenite; organic-rich, packed, ostracod, crinoid, foraminifera, coralline algae Biomicrite:Packstone.

TS 1-48 .1 m (.3') AB: Very fine-medium calcarenite; packed, ostracod, foraminifera, spicule Biomicrite:Wackestone.

- -

OFFSET 7.5 m (25') north 10° east on top of unit 1-47 to measure higher units.

- -

UNIT	LITHOLOGY	THICKNESS
1-47	Cherty Packstone, dark grey, weathers grey. Chert is black, weathers brown. Grains restricted to abundant coralline algae fragments and rare millerellid foraminifera. Chert forms nodules and lenses. Nodules up to 30 cm in diameter and lenses less than 1 cm thick but over 1 m long. Poorly defined thick wavy beds. Forms irregular, rubbly, highly fractured dip slope surface. Basal contact covered.	1 m (3.3')

UNIT	LITHOLOGY	THICKNESS
TS 1-47	.15 m (.5') BT: Very fine calcarenite-fine calcirudite; chert-bearing, poorly washed, foraminifera, crinoid, coralline algae Biosparite:Packstone.	
TS 1-47	.3 m (1') AB: Very fine calcarenite-fine calcirudite; poorly washed, chert-bearing, packed, foraminifera, crinoid, coralline algal Biosparite:Packstone.	
1-46	Covered.	.75 m (2.4')
1-45	Wackestone-Packstone, grey, weathers light grey. Grains sorted, medium sand size crinoid columnals, unidentified skeletal fragments, bryozoans, and rare whole productid brachiopods. Rare chert. Subround chert nodules to 3 cm in diameter. Scattered hematite and limonite inclusions. Thick bedded. Forms poorly exposed rubbly outcrop or covered intervals. Basal contact covered.	.5 m (1.6')
TS 1-45	.3 m (1') BT: Coarse calcilutite-fine calcirudite; packed, brachiopod, bryozoan, crinoid, foraminifera, pellet Biomicrosparite:Wackestone.	
1-44	Crinoid-Foraminifera Wackestone, dark grey, weathers grey. Grains dominated by crinoid columnals and abundant small foraminifera. Grains also include rugose corals, bryozoans, and silicified productid brachiopods and Chaetetes colonies. Upper surface burrowed. Chert nodules and lenses common. Chert is black, weathers brown. Chert lenses 0 to 20 cm thick. Medium to thick wavy bedded. Forms cliff face and rubbly dip slope. Basal contact sharp.	2.3 m (7.6')
TS 1-44	Top: Coarse calcilutite-fine calcirudite; packed, crinoid, phylloid algae, foraminifera, pellet Biomicrosparite: Wackestone.	
TS 1-44	1.7 (5.5') AB: Very fine calcarenite-fine calcirudite; packed, brachiopod, crinoid, foraminifera, pellet Biomicrite: Wackestone.	
TS 1-44	.9 m (3') AB: Very fine-coarse calcarenite; laminate (algal?), organic-rich, packed, foraminifera, crinoid brachiopod Biomicrite:Wackestone.	
TS 1-44	.3 m (1') AB: Very finely crystalline; dolomite-bearing, calcareous, fossiliferous chert.	

UNIT	LITHOLOGY	THICKNESS
TS 1-44	Base: Very fine-coarse calcarenite; packed, brachiopod, foraminifera, crinoid Biomicrosparite:Wackestone.	
1-43	Wackestone, dark grey, weathers grey. Grains include crinoid columnals, small foraminifera and brachiopod fragments. Rare whole silicified productid brachiopods. Lenticular chert and round to subround chert nodules common. Chert nodules approximately 1 cm to 3 cm in diameter. Lenticular chert common in lower half of unit, to 5 cm thick and 1 m long. Chert is black, weathers brown. Thick to very thick bedded. Forms base of laterally prominant cliff face. Basal contact covered.	.75 m (2.4')
TS 1-43	Top: Coarse calcilutite-fine calcirudite; packed, bryozoan, brachiopod, foraminifera, crinoid Biomicrosparite:Wackestone.	
TS 1-43	Base: Coarse calcilutite-fine calcirudite; quartz-bearing, packed, brachiopod, spicule, foraminifera, crinoid Biomicrosparite:Wackestone.	
1-42	Covered.	2.1 m (6.9')
1-41	Cherty Crinoid Wackestone, dark grey, weathers grey. Chert black, weathers white to dark brown. Grains include crinoid columnals and brachiopod fragments. Chert forms 30 to 40% of unit. Chert lenses discontinuous, irregular, lenticular. Chert lenses extend vertically and laterally to 30 cm thick and over 3 m long. 30 cm about base of unit a more continuous band of chert 15 to 30 cm thick occurs. Thin to thick bedded. Thinner beds at and near base. Forms laterally prominant rubbly terrace or cliff face. Basal contact mostly covered, sharp where exposed.	2 m (6.5')
TS 1-41	.15 m (.5') BT: Very fine-coarse calcarenite; authigenic quartz-rich, packed, spicule, foraminifera, crinoid Biomicrosparite:Wackestone.	
TS 1-41	1.2 m (4') AB: Very fine-coarse calcarenite; packed, brachiopod, foraminifera, crinoid, spicule Biomicrite: Wackestone.	
TS 1-41	Base: Medium calcarenite-fine calcirudite; packed, ostracod, spicule, bryozoan, foraminifera, brachiopod, crinoid Biomicrite:Packstone.	

UNIT	LITHOLOGY	THICKNESS

OFFSET 44 m (143') up hill north 35° east on well exposed dip slope of unit 1-40 to measure higher units.

1-40 Crinoid Wackestone, dark grey, weathers grey. Grains include crinoid columnals, brachiopod fragments, rare whole productid brachiopods and small foraminifera. Chert nodules common in 1 m wide zone at center of unit. Chert is black, weathers brown. Chert nodules subround or lenticular, to 10 cm thick and 50 cm long. Hematite, limonite and pyrite grain replacement common. Medium to thick wavy bedded. Forms prominant cliff face and well exposed dip slope surface. Basal contact sharp. — 2.4 m (7.9')

TS 1-40 .15 m (.5') BT: Coarse calcilutite-coarse calcarenite; packed, brachiopod, ostracod, foraminifera, spicule, crinoid, pellet Biomicrite:Wackestone.

TS 1-40 .9 m (3') AB: Very fine calcarenite-fine calcirudite; packed, bryozoan, ostracod, spicule, foraminifera, crinoid, brachiopod, Biomicrite:Wackestone.

TS 1-40 Base: Very fine calcarenite-fine calcirudite; quartz silt-bearing, packed, brachiopod, ostracod, spicule, foraminifera, crinoid Biomicrosparite:Wackestone.

1-39 Crinoid-Foraminifera Packstone, dark grey, weathers light grey. Grains sorted, dominated by crinoid columnals and small biserial foraminifera. Grains also include brachiopod fragments and ostracods. Very thick bedded or massive. Forms covered interval or rounded, broken cap on cliff face at top of unit 1-38. Basal contact sharp, mostly covered. — .5 m (1.7')

TS 1-39 Top: Very fine-coarse calcarenite; packed, spicule, ostracod, brachiopod, foraminifera, crinoid Biomicrite:Packstone.

TS 1-39 Base: Very fine calcarenite-fine calcirudite; packed, brachiopod, foraminifera, ostracod, spicule crinoid Biomicrite:Packstone.

OFFSET 4.5 m (15') north 30° east on top of unit 1-38 to measure higher units.

UNIT	LITHOLOGY	THICKNESS
1-38	Crinoid Packstone, grey, weathers light grey. Grains dominated by crinoid columnals. Grains also include brachiopod fragments, rare whole productid brachiopods and pellets. Thick to very thick bedded. Forms top of laterally prominant, locally broken cliff face. Basal contact gradational.	1.9 m (6.2')
TS 1-38	.45 m (1.5') BT: Coarse calcilutite-fine calcirudite; packed, foraminifera, brachiopod, ostracod, spicule, crinoid, pellet Biomicrite:Packstone.	
TS 1-38	.9 m (3') AB: Coarse calcilutite-fine calcirudite; packed, foraminifera, brachiopod, ostracod, spicule, crinoid, pellet Biomicrite:Packstone.	
TS 1-38	Base: Coarse calcilutite-fine calcirudite; packed, ostracod, foraminifera, crinoid, pellet Biomicrosparite:Wackestone.	
1-37	Wackestone, grey, weathers light grey. Grains include crinoid columnals, brachiopod spines, rare whole brachiopods and small foraminifera. Thick bedded to massive. Forms central portion of cliff face. Basal contact gradational.	.6 m (2')
TS 1-37	Top: Coarse calcilutite-coarse calcarenite; packed, brachiopod, foraminifera, crinoid, pellet Biomicrosparite: Wackestone.	
TS 1-37	.2 m (.7') AB: Coarse calcilutite-coarse calcarenite; packed, brachiopod, foraminifera, crinoid, pellet Biomicrosparite: Wackestone.	
1-36	Oolitic Grainstone, grey, weathers light grey. Grains well sorted, very coarse sand size ooids. Grains also include coated skeletal fragments and intraclasts. Limonite inclusions common. Spar cement. Thick bedded or massive. Forms base of prominant ridge. Basal contact covered.	.65 m (2.1')
TS 1-36	.3 m (1') AB: Medium-coarse calcarenite; sorted, rounded, oolitic Biosparite:Grainstone.	
1-35	Covered.	1.7 m (5.6')

OFFSET 98 m (323') north 25° east up hill on top of unit 1-34 to measure higher units.

UNIT	LITHOLOGY	THICKNESS
1-34	Crinoid Wackestone and Chert, dark grey, weathers grey. Chert black, weathers brown to white. Grains include crinoid columnals, brachiopod fragments, rare whole productid brachiopods, small foraminifera and calcareous algae. Chert most common in lower half of unit. Chert nodules are round, subround, irregular or contorted. Chert most commonly forms lenticular nodules to 20 cm thick and 1 m long along bedding planes. Thick to very thick wavy bedded or massive. Forms prominant, locally covered, rubbly cliff face. Basal contact sharp, irregular, drawn at base of lowest chert lense.	3 m (9.9')
TS 1-34	Top: Coarse calcilutite-fine calcirudite; quartz-bearing, packed, bryozoan, brachiopod, foraminifera, pellet Biomicrosparite:Wackestone.	
TS 1-34	1.5 m (5') AB: Coarse calcilutite-fine calcirudite; quartz-bearing, packed, foraminifera, bryozoan, brachiopod, crinoid, spicule, pellet Biomicrite:Wackestone.	
TS 1-34	Base: Coarse calcilutite-fine calcirudite; packed, foraminifera, brachiopod, crinoid, spicule, pellet Biomicrite:Wackestone.	
1-33	Crinoid Wackestone, dark grey, weathers grey. Grains dominated by crinoid columnals. Grains also include small foraminifera and spicules. Limonite inclusions common. Stylolites common approximately parallel to bedding. Very thick bedded or massive. Forms laterally prominant rubbly cliff face, locally covered, laterally well exposed. Basal contact mostly covered, sharp where exposed.	3.45 m (11.4')
TS 1-33	Top: Coarse calcilutite-coarse calcarenite; quartz-bearing, packed, ostracod, foraminifera, spicule, bryozoan, crinoid, pellet Biomicrite:Wackestone.	
TS 1-33	1.05 m (3.5') BT: Coarse calcilutite-fine calcirudite; quartz-bearing, packed, ostracod, foraminifera, spicule, bryozoan, crinoid, pellet Biomicrosparite:Wackestone.	
TS 1-33	1.35 m (4.5') AB: Coarse calcilutite-coarse calcarenite; quartz-bearing, packed, ostracod, foraminifera, spicule, bryozoan, crinoid, pellet Biomicrite:Wackestone.	
TS 1-33	.3 m (1') AB: Coarse calcilutite-coarse calcarenite; quartz-bearing, packed, ostracod, spicule, bryozoan, crinoid, pellet Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS
1-32	Packstone, grey, weathers light grey, locally caliche coated white. Grains coarse sand size crinoid columnals, encrusting foraminifera and calcareous algae. Scattered limonite inclusions. Thick bedded. Poorly exposed. Forms rubbly, locally covered surface on terrace between unit 1-31 and unit 1-33 cliff faces. Basal contact covered.	Approx. 1.2 m (4')
TS 1-32	Top: Coarse calcilutite-medium calcarenite; packed, crinoid, foraminifera Pelmicrosparite:Packstone.	

OFFSET 7.5 m (25') north 20° east up hill on top of unit 1-31 to measure higher units.

1-31	Burrowed Wackestone, dark grey, weathers mottled grey. Grains include crinoid columnals, small foraminifera, phylloid algae, and bryozoans. Burrows abundant, locally limonite stained. Very thick bedded or massive. Forms locally prominant, laterally covered cliff face. Top highly fractured and weathered. Basal contact sharp.	1.8 m (5.9')
TS 1-31	Top: Coarse calcilutite-fine calcirudite; burrowed, packed, bryozoan, crinoid, ostracod, pellet Biomicrite:Wackestone.	
TS 1-31	1.25 m (4.5') AB: Coarse calcilutite-fine calcirudite; packed, ostracod, bryozoan, crinoid, spicule, pellet Biomicrite: Packstone.	
TS 1-31	.3 m (1') AB: Coarse calcilutite-fine calcirudite; burrowed, packed, bryozoan, crinoid, ostracod, spicule, pellet Biomicrite:Wackestone.	
1-30	Wackestone, dark grey, weathers grey. Grains include common crinoid columnals, algal fragments, brachiopod fragments and small foraminifera. Chert common in lower third of unit. Chert is black, weathers brown. Medium to thin tabular bedded. Forms mostly covered slope or low terrace. Basal contact covered.	.9 m (2.9')
TS 1-30	.15 m (.5') BT: Very fine-coarse calcarenite; organic-rich, sparse, ostracod, bryozoan, foraminifera, crinoid, brachiopod Biomicrite:Wackestone.	
TS 1-30	.45 m (1.5') AB: Very fine-coarse calcarenite; organic-rich, sparse, ostracod, bryozoan, foraminifera, crinoid, brachiopod Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS
1-29	Crinoid Packstone, dark grey, weathers grey. Grains dominated by crinoid columnals. Grains also include rare small foraminifera. Scattered limonite inclusions, mix of micrite and spar cement. Forms single bed, locally well exposed, mostly covered laterally. Basal contact sharp, irregular, drawn at top of highest chert in unit 1-28.	.15 m (.5')
TS 1-29	Very fine calcarenite; quartz-bearing, sorted, rounded, foraminifera, crinoid, pellet Biosparite:Packstone.	
1-28	Chert Biomicrite, very dark grey, weathers grey. Chert is black, weathers brown or white. Grains include crinoid columnals, encrusting and other small foraminifera and spar replaced phylloid algae. Lenticular chert nodules forms 10 to 15% of rock. Chert nodules to 15 cm thick and over 1 m long. Thick bedded or massive, most apparent bedding due to lenticular cherts. Basal contact sharp.	1.8 m (5.9')
TS 1-28	.15 m (.5') BT: Very fine-medium calcarenite; organic-rich, quartz-bearing, foraminifera, crinoid Biomicrite:Mudstone.	
TS 1-28	1.05 m (3.5') BT: Medium calcarenite; organic-rich, sparse, spicule, crinoid, phylloid algae Biomicrite:Wackestone.	
TS 1-28	.1 m (.3') AB: Very fine-coarse calcarenite; packed, brachiopod, pellet, foraminifera, crinoid, phylloid algae Biomicrosparite:Wackestone.	
1-27	Crinoid Packstone, grey, weathers light grey. Grains dominated by well sorted, coarse to very coarse sand size crinoid columnals. Other grains include brachiopod fragments and bryozoan fragments. Limonite and hematite inclusions common, subequal mix micrite and spar cements. Forms laterally broken cap on 1-26 cliff face, locally covered. Basal contact sharp, irregular, cuts into unit 1-26 up to 1 cm.	.15 m (.5')
TS 1-27	Top: Medium-coarse calcarenite; sorted, rounded, brachiopod, crinoid Biosparite:Packstone.	
1-26	Wackestone, dark grey, weathers grey. Grains include crinoid columnals, small foraminifera and calcareous algae. Small limonite inclusions common. Thick to very thick bedded. Forms laterally well exposed, locally partly covered, cliff face. Basal contact covered.	1.65 m (5.4')

UNIT	LITHOLOGY	THICKNESS
TS 1-26	1.5 m (5') AB: Very fine-medium calcarenite; sparse, foraminifera, spicule, brachiopod, ostracod, crinoid Biomicrite:Wackestone.	
TS 1-26	.6 m (2') AB: Very fine-medium calcarenite; sparse, brachiopod, crinoid Biomicrite:Wackestone.	
TS 1-26	Base: Fine calcarenite-fine calcirudite; sparse, brachiopod, crinoid Biomicrosparite:Wackestone.	
1-25	Covered (limestone visible in this interval in shear inaccessable cliff face on south side of canyon).	3.6 m (11.8')

- -

OFFSET to point north 4° east across canyon to continue measurements. Unit 1-22, 1-23 and 1-24 sequence recognizable on both sides of canyon and used as basis for offset.

- -

1-24	Phylloid Algae Wackestone, dark grey, weathers light grey. Grains dominated by spar replaced phylloid algae. Grains also include rare brachiopods and foraminifera. Limonite inclusions common. Very thick bedded or massive. Locally forms prominant cliff face, laterally partly covered. Basal contact sharp. (Unit 1-24 is highest unit numbered on south side of canyon.)	2.15 m (7')
TS 1-24	Top (north side canyon): Coarse calcilutite-coarse calcarenite; packed, crinoid, phylloid algae Pelmicrite: Wackestone.	
TS 1-24	.9 m (3') AB (north side canyon): Coarse calcilutite-coarse calcarenite; packed, phylloid algae Pelmicrite:Wackestone.	
TS 1-24	Base (north side canyon): Coarse calcilutite-coarse calcarenite; packed, bryozoan, brachiopod, phylloid algae Pelmicrite:Wackestone.	
TS 1-24	Base (south side canyon): Coarse calcilutite-coarse calcarenite; packed, bryozoan, brachiopod, phylloid algae Pelmicrite:Wackestone.	
1-23	Crinoid Packstone, dark grey, weathers light grey. Grains very coarse sand to granule size crinoid columnals and brachiopod fragments. Thick, slightly wavy bedded. Forms cliff face and small dip slope terrace. Basal contact sharp.	.9 m (3')

UNIT	LITHOLOGY	THICKNESS
TS 1-23	.15 m (.5') AB: Coarse calcarenite-fine calcirudite; sorted, rounded, intraclast, bryozoan, brachiopod, crinoid Biosparite: Packstone.	
1-22	Mudstone, dark grey, weathers grey or mottled light and dark grey. Grains include rare brachiopods, crinoid columnals and phylloid algae. Burrows common. Medium bedded or massive. Forms locally well exposed, laterally mostly covered terrace. Basal contact sharp.	.3 m (1')
TS 1-22	Top: Coarse calcilutite-coarse calcarenite; packed, brachiopod, bryozoan, phylloid algae Pelmicrite:Wackestone.	
1-21	Crinoid-Foraminifera Packstone, dark grey, weathers grey. Grains sorted, coarse sand size crinoid columnals, millerellid and encrusting foraminifera, brachiopod fragments, rare whole brachiopods and rugose corals. thick bedded. Forms cap on unit 1-20 cliff face or smaller independent cliff face. Basal contact sharp.	.5 m (1.7')
TS 1-21	Top: Fine calcarenite-fine calcirudite; foraminifera, bryozoan, intraclast, brachiopod, crinoid Biosparite: Packstone.	
1-20	Wackestone, dark grey, weathers grey. Grains include small foraminifera, algal debris, brachiopod spines, rare whole productid brachiopods, rare crinoid columnals, and rugose corals (most abundant at base). Limonite inclusions common. Very thick bedded or massive. Forms upper half of prominant cliff face. Basal contact sharp but indistinct on weathered surface.	2.95 m (9.5')
TS 1-20	.3 m (1') BT: Coarse calcilutite-fine calcirudite; packed, brachiopod, bryozoan, phylloid algae Pelmicrite:Wackestone.	
TS 1-20	1.7 m (5.5') AB: Coarse calcilutite-fine calcirudite; packed, brachiopod, foraminifera, phylloid algae Pelmicrite: Wackestone.	
TS 1-20	.45 m (1.5') AB: Coarse calcilutite-fine calcirudite; packed, foraminifera, phylloid algae Pelmicrite:Wackestone.	
1-19	Phylloid Algae Wackestone, dark grey, weathers light grey. Spar replaced phylloid algae dominant grains. Grains also include rare solitary rugose corals, and rare brachiopods. Thick wavy bedded. Forms lower half of laterally prominant cliff face. Basal contact sharp.	1.85 m (6.1')

UNIT	LITHOLOGY	THICKNESS
TS 1-19	.3 m (1') BT: Coarse calcilutite-fine calcirudite; packed, brachiopod, foraminifera, bryozoan, phylloid algae Pelmicrite:Wackestone.	
TS 1-19	.65 m (2.2') AB: Coarse calcilutite-coarse calcarenite; packed brachiopod, foraminifera, calciosphene, phylloid algae Pelmicrite:Wackestone.	
1-18	Crinoid-Foraminifera Wackestone, dark grey, weathers grey. Grains dominated by coarse sand to granule size crinoid columnals and small foraminifera. Grains also include rare productid brachiopods and solitary rugose corals to 5 cm long. Medium wavy bedded. Locally well exposed, mostly covered laterally. Forms mostly covered interval between cliff faces. Basal contact gradational.	1.15 m (3.7')
TS 1-18	.3 m (1') BT: Coarse calcilutite-coarse calcarenite; sparse, crinoid, pellet Biomicrite:Wackestone.	
TS 1-18	Base: Coarse calcilutite-coarse calcarenite; sparse, brachiopod, phylloid algae, pellet, foraminifera, crinoid Biomicrite:Wackestone.	
1-17	Phylloid Algae Wackestone, dark grey, weathers grey. Spar replaced phylloid algae dominant grains. Other grains include common brachiopods, rare rugose corals and crinoid columnals. Stylolites common, most common in lower third of unit. Some grain silicification. Very thick bedded. Forms laterally prominant cliff face. Basal contact gradational.	2.35 m (7.7')
TS 1-17	.45 m (1.5') BT: Medium calcilutite-coarse calcarenite; packed, spicule, foraminifera, phylloid algae Pelmicrite: Wackestone.	
TS 1-17	1.5 m (5') AB: Coarse calcilutite-fine calcirudite; packed, brachiopod, crinoid, foraminifera, phylloid algae Pelmicrite: Wackestone.	
TS 1-17	.15 m (.5') AB: Coarse calcilutite-fine calcirudite; packed, crinoid, brachiopod, phylloid algae Pelmicrite:Wackestone.	
1-16	Crinoid-Foraminifera Wackestone, dark grey, weathers light grey. Grains dominated by crinoid columnals and small foraminifera. Grains also include rare rugose corals, rare brachiopods and phylloid algae. Limonite inclusions common. Thick poorly defined beds. Forms base of cliff face. Basal contact covered.	1 m (3.2')

UNIT	LITHOLOGY	THICKNESS
TS 1-16	Top: Medium calcarenite; packed, crinoid, intraclast, foraminifera Biomicrosparite:Wackestone.	
TS 1-16	.15 m (.5') AB: Very fine calcarenite-fine calcirudite; poorly washed, packed, sorted, rounded, algae, brachiopod, foraminifera, bryozoan, crinoid, intraclast Biosparite: Packstone.	
1-15	Covered (limestone visible in this interval in shear inaccessable cliff face on north side of canyon.	1.15 m

- -

OFFSET 12 m (40') south 40° east on top of unit 1-14 to measure higher units.

- -

1-14	Intraclast-Crinoid Packstone, dark grey, weathers grey. Grains dominated by medium sorted, rounded intraclasts and crinoid columnals. Intraclasts dominantly micrite. Other grains rare or absent. Bedding poorly defined, massive. Forms cap on 1-13 cliff face. Basal contact sharp, irregular.	.5 m (1.6')
TS 1-14	Top: Coarse calcarenite; sorted, rounded, bryozoan, intraclast, crinoid Biosparite:Packstone.	
1-13	Phylloid Algae Wackestone, dark grey, weathers light grey. Grains include abundant spar replaced phylloid algae, crinoid columnals, rugose corals and Chaetetes colonies to 1 cm by 5 cm. Burrowed. Limonite inclusions common. Medium to very thick, slightly wavy bedded. Forms very prominant cliff face. Basal contact sharp.	3.85 m (12.7')
TS 1-13	.6 m (2') BT: Medium calcilutite-fine calcirudite; packed, foraminifera, crinoid, spicule, phylloid algae, pellet Biomicrite:Wackestone.	
TS 1-13	1.5 m (5') AB: Coarse calcilutite-coarse calcarenite; sparse, phylloid algae, spicule, pellet Biomicrite:Wackestone.	
TS 1-13	.15 m (.5') AB: Coarse calcilutite-fine calcirudite; burrowed, fossiliferous, pellet, spicule, phylloid algae, crinoid Biomicrite:Mudstone.	

UNIT	LITHOLOGY	THICKNESS
1-12	Crinoid-Phylloid Algae Wackestone, dark grey, weathers light grey, locally caliche coated white. Grains dominantly spar replaced phylloid algae and crinoid columnals. Grains also include brachiopod fragments. Medium wavy bedded. Poorly exposed. Forms brush and rubble covered terrace. Best exposed in undercut at base of unit 1-13. Basal contact covered.	2.05 m (6.8')
TS 1-12	.45 m (1.5') BT: Coarse calcilutite-fine calcirudite; packed, bryozoan, brachiopod, crinoid, phylloid algae, pellet Biomicrite:Wackestone.	
TS 1-12	.45 m (1.5') AB: Coarse calcilutite-fine calcirudite; packed, brachiopod, crinoid, pellet Biomicrite:Wackestone.	
1-11	Intraclast Packstone, dark grey, weathers mottled grey and yellow. Grains dominated by micrite intraclasts to 1 cm in diameter. Grains also include crinoid columnals, bryozoans and solitary rugose corals. Lenticular chert nodules to 3 cm thick and 30 cm long common just above base. Chert is black, weathers brown. Medium to thin wavy bedded. Base gradational.	.2 m (.6')
TS 1-11	Top: Medium calcarenite-medium calcirudite; burrowed, packed, foraminifera, bryozoan, crinoid, intraclast Biomicrite: Wackestone.	
1-10	Packstone, dark grey, weathers grey. Grains sorted, coarse sand size crinoid columnals, algal debris, brachiopod fragments, foraminifera, and intraclasts. Single bed. Forms cliff face laterally distinct due to thinner wavy beds beneath. Basal contact sharp.	.25 m (.9')
TS 1-10	Base: Medium calcarenite-fine calcirudite; coated, bryozoan, foraminifera, intraclast, crinoid Biosparite:Packstone.	
1-9	Wackestone, dark grey, weathers light grey or tan. Grains include crinoid columnals, solitary rugose corals, rare brachiopods, foraminifera and algal debris. Grains locally silicified. Medium wavy bedded, nodular near top. Highly fractured. Forms prominant cliff face with overhang locally up to 3 m. Basal contact sharp, wavy.	1.3 m (4.3')
TS 1-9	.15 m (.5') BT: Coarse calcilutite-coarse calcarenite; sparse, foraminifera, bryozoan, brachiopod, crinoid, pellet Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS
TS 1-9	.25 m (.8') AB: Coarse calcilutite-fine calcirudite; packed, bryozoan, brachiopod, pellet, spicule, crinoid Biomicrite: Wackestone.	
1-8	Wackestone, dark grey, weathers grey. Grains include rugose corals, crinoid columnals, small foraminifera, algal debris and brachiopod fragments. Subround or slightly lenticular chert nodules common. Chert is black, weathers brown. Nodules to 3 cm by 10 cm. Thick bedded, tabular and wavy beds. Forms prominant cliff face with overhand locally up to 2 m. Basal contact sharp, hummocky.	1.15 m (3.8')
TS 1-8	Top: Very fine calcarenite-fine ccalcirudite; packed, brachiopod, foraminifera, pellet, crinoid Biomicrite: Wackestone.	
TS 1-8	.3 m (1') AB: Coarse calcilutite-coarse calcarenite; packed, brachiopod, foraminifera, crinoid Pelmicrite:Wackestone.	
OFFSET 15 m (50') north 25° west down hill to measure higher units.		
1-7	Crinoid Wackestone-Packstone, dark grey, weathers light grey or tan to orange. Grains include abundant crinoid columnals, large solitary rugose corals, productid brachiopods in growth position, and algal debris. Thick bedded with rare shaly laminae. Forms prominant overhanging cliff face. Basal contact sharp, slightly wavy. Marked by 3 cm thick weathered zone with abundant crinoid debris.	.8 m (2.6')
TS 1-7	.15 m (.5') BT: Coarse calcarenite-fine calcirudite; poorly washed, intraclast, pellet, spicule, ostracod, foraminifera, bryozoan, crinoid Biosparite:Packstone.	
TS 1-7	.3 m (1') BT: Coarse calcilutite-medium calcarenite; organic-rich, packed, foraminifera, algal, spicule, pellet Biomicrite:Wackestone.	
1-6	Wackestone and Shale, dark grey, weathers light grey or tan to orange. Grains include algal debris, gastropods, crinoid columnals, whole productid brachiopods in growth position, brachiopod fragments and rugose corals. Shale is black, highly fissile, locally contorted. Wackestone thin to thick wavy bedded. Shale laminate. Individual beds often pinch out laterally. Well exposed on south canyon wall, covered laterally. Forms undercut at base of prominant cliff face.	1.6 m (5.2')

UNIT	LITHOLOGY	THICKNESS

TS 1-6 .3 m (1') BT: Very fine calcarenite-coarse calcirudite; packed, foraminifera, bryozoan, brachiopod, spicule Biomicrite:Wackestone.

TS 1-6 .9 m (3') AB: Coarse calcilutite-fine calcirudite; sparse, foraminifera, gastropod, ostracod, spicule, intraclast Pelmicrite:Wackestone.

TS 1-6 .45 m (1.5') AB: Coarse calcilutite-medium calcarenite; packed, crinoid, brachiopod, bryozoan, spicule Pelmicrite: Wackestone.

TS 1-6 Base: Coarse calcilutite-coarse calcarenite; sparse, brachiopod, pellet, phylloid algae Biomicrite:Wackestone.

Mississippian Helms Formation

1-5 Calcareous Shale, grey, weathers brown. Fissile somewhat contorted bedding. Highly weathered, covered laterally, locally moderately well exposed. Forms higher terrace in Mississippian slope before start of Pennsylvanian cliff. Base sharp but irregular. (This unit is interpreted as a weathered zone or paleosol at the Mississippian/Pennsylvanian Unconformity.) .05 to .1 m (.1 to .4')

1-4 Nodular Mudstone, dark grey, weathers white or tan. Forms single bed. Mostly covered laterally. Locally well exposed. Basal contact sharp but highly irregular. .1 m (.3')

TS 1-4 Top: Coarse calcarenite; burrowed, sparse, sorted, rounded Intramicrite:Wackestone.

1-3 Silty Mudstone, very dark grey, weathers olive grey or limonite stained orange. Common quartz silt, forms single tabular bed. Mostly covered, locally well exposed. Basal contact sharp. .25 m (.8')

TS 1-3 Top: Very finely crystalline; silt-bearing Microsparite: Mudstone.

1-2 Calcareous Shale, olive grey, weathers tan to white. Fissile, laminate bedded. Base sharp, slightly wavy. .05 m (.2')

UNIT	LITHOLOGY	THICKNESS
1-1	Silty Mudstone, very dark grey, weathers olive grey or limonite stained orange. Abundant quartz silt. Forms mostly covered, locally well exposed single bed. Basal contact sharp.	.25 m (.9')
TS 1-1	Center: Very finely crystalline; silt-bearing Microsparite: Mudstone.	

Bishop Cap

Doña Ana County, New Mexico

Measured section 2 is located on the steep north-facing slope of Pyramid Peak 1.6 km (1 mile) north of Bishop Cap (U.S.G.S. Bishop Cap Quadrangle [New Mexico-Doña Ana Co.]; sec 23, T. 24 S., R. 3 E.; 32°12'10" North, 106°36'30" West). The New Mexico Bureau of Mines and Mineral Resources Geologic Map #29 (Seager, 1973) provides a detailed geologic map of the area. Seager (1973) also provides a composite stratigraphic column, cross section and a brief geologic and mining history of the region.

Bishop Cap is located approximately 24 km (15 miles) southeast of Las Cruces, New Mexico. To reach the measured section take Interstate 10 10 km (6.4 miles) south of the I-10/Interstate 25 intersection in Las Cruces to the Mesquite exit (exit 151). Mileage readings are from the overpass at this exit.

Turn east and follow the road toward the landfill. Turn east-northeast off the bluff on the small dirt road 1.5 km (.9 miles) from I-10. Bishop Cap is clearly visible north 75° east of this intersection. Proceed to the branch in the road (1.9 km; 1.2 miles) and take the left fork. Continue northeast and cross the wash (Mossman Arroyo, 2.7 km (1.7 miles)). Proceed to 3.4 km (2.1 miles) and take the left (northeast) fork in the road. Continue to 3.5 km (2.2 miles) and take the north fork in the road. Proceed past the two sets of power lines (at 5.1 km (3.2 miles) and 6 km (3.7 miles)) and continue on the main road trending northeast. Take the right fork in the road at 7.4 km (4.6 miles). Park at 7.9 km (4.9 m) from the Mesquite off-ramp bridge. The section begins at the base of the steep slope south 27° east of this location.

The beds strike north 14° east and dip 24° to the northwest. The Bishop Cap area is highly faulted but no significant faults are crossed in the measured section. Measurements were made with a Jacobs staff and Abney hand level. Thicknesses have been rounded to the nearest .05 m (or .1 ft). The total thickness of this measured section is approximately 123 m (403 ft).

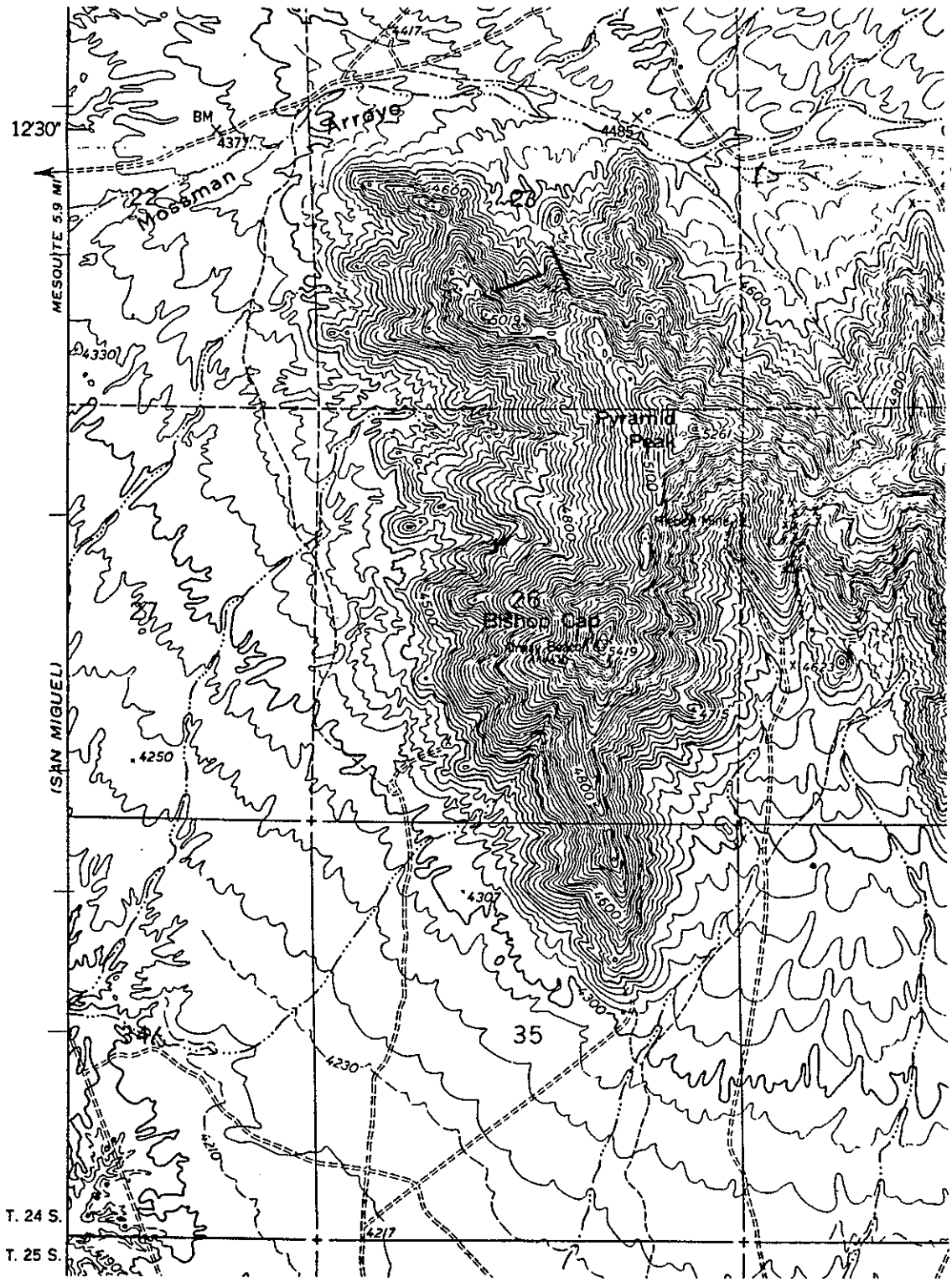


Figure 2. Bishop Cap locality map (from U.S.G.S. Bishop Cap Quadrangle, Dona Ana Co.).

UNIT	LITHOLOGY	THICKNESS

2-117 Cherty Wackestone, dark grey, weathers light grey. Grains include rare fusulinids (Wedekindellina and Beedeina scattered at base to 10 cm above base, rare over rest of unit), silicified rugose corals, fenestrate bryozoans, gastropods and coralline algae debris. Lenticular chert nodules to 4 cm thick by 20 cm long common. Chert is black, weathers brown. Medium wavy bedded. Forms locally prominant, laterally partly covered cliff face. Basal contact sharp. 1.1 m (3.6')

TS 2-117 .15 m (.5') BT: Coarse calcilutite-fine calcirudite; sparse, phylloid algae, foraminifera, spicule Biomicrite:Wackestone.

TS 2-117 Base: Fine calcarenite-fine calcirudite; packed, spicule, foraminifera, bryozoan, brachiopod, crinoid, pellet Biomicrite:Packstone.

2-116 Crinoid-Intraclast Packstone, dark grey, weathers grey. Dominant grains are well sorted, coarse to very coarse sand size crinoid columnals. Micritic intraclasts similar to 2-115 lithology also common. Other grains include ostracods, brachiopods and foraminifera. Highly weathered, poorly exposed, covered laterally, locally moderately well exposed in undercut at base of 2-117. Basal contact sharp but highly irregular. .1 m (.3')

TS 2-116 Base: Fine calcarenite-fine calcirudite; intraclast, ostracod, brachiopod, foraminifera, crinoid Biosparite:Packstone.

2-115 Wackestone, dark grey, weathers light grey. Grains include common fusulinids and phylloid algae. Bedding very poorly defined, nodular. (It is possible that the "nodules" are actually limestone cobbles and the rock would be properly classified conglomeratic calclithite but the nodules do seem to have internal continuity, and their lithologies are all exactly the same, which indicates nodular wackestone is the correct interpretation.) Very poorly exposed, completely covered laterally, locally moderately well exposed under 2-117 overhangs. Basal contact covered. .15 m (.5')

TS 2-115 .1 m (.3') BT: Fine calcarenite-fine calcirudite; fossiliferous, ostracod, phylloid algae, foraminifera Biomicrite:Mudstone.

2-114 Covered. 1.7 m (5.5')

UNIT	LITHOLOGY	THICKNESS
2-113	Crinoid Packstone, dark grey, weathers grey. Grains dominantly sorted, very coarse sand to granule size crinoid columnals. Grains also include brachiopod fragments and bryozoans. Silicification common in lenticular zones 1 to 3 cm thick and to 1 m long. Silicified zones weather brown. Medium to thick bedded or single massive bed. Forms low laterally exposed cliff face or low terrace. Basal contact gradational, but marked by color change from darker weathered 2-113 to lighter weathered 2-112.	.3 m (1')
TS 2-113	Top: Very fine calcarenite-fine calcirudite; ostracod, bryozoan, brachiopod, crinoid Biosparite:Packstone.	
2-112	Crinoid Wackestone, dark grey, weathers light grey. Grains dominantly coarse sand size crinoid columnals. Grains also include brachiopod and bryozoan fragments. Grains slightly coarser near the top. Chert nodules common, most abundant at center of unit. Medium bedded with some thin bedded to laminated zones. Mostly covered, only exposed in small stream cut. Basal contact sharp.	1.5 m (4.8')
TS 2-112	.75 m (2.5') AB: Fine-coarse calcarenite; packed ostracod, brachiopod, bryozoan, crinoid Biomicrite:Packstone.	
2-111	Crinoid Packstone, dark grey, weathers light grey with thin limonite stained zones. Grains approximately 80% very coarse sand to granule size crinoid columnals. Grains also include brachiopod fragments, bryozoans and intraclasts. Intraclasts most abundant at top. Thick bedded or single massive bed. Forms laterally continuous low cliff face and terrace. Basal contact sharp.	.35 m (1.1')
TS 2-111	Top: Fine calcarenite-fine calcirudite; packed bryozoan, brachiopod, crinoid Biomicrite:Packstone.	
2-110	Wackestone, grey, weathers slightly lighter grey. Grains include sorted, coarse sand size crinoid columnals, brachiopod fragments and fine quartz sand. Grains slightly coarser near top. Medium to thin bedded, more massive at base, thinner beds at top. Laterally covered. Moderately well exposed in small stream cut. Basal contact sharp.	.5 m (1.7')
TS 2-110	.3 m (1') BT: Very fine calcarenite-fine calcirudite; packed brachiopod, crinoid Biomicrite:Packstone.	

UNIT	LITHOLOGY	THICKNESS
2-109	Covered.	.3 m (1')
2-108	Wackestone, very dark grey, weathers grey. Grains include crinoid columnals, spicules, and brachiopod fragments. Thick bedded with two weathered zones 2-3 cm thick with very thin to laminate bedding. Laterally covered. Moderately well exposed in stream cut weathered into rounded blocks .3 m in diameter. Basal contact covered.	.8 m (2.7')
TS 2-108	.3 m (1') BT: coarse calcilutite-medium calcarenite; crinoid, spicule Pelmicrosparite:Packstone.	
2-107	Packstone, very dark grey, weathers light grey. Grains include whole productid brachiopods, rugose corals, crinoid columnals, and bryozoans. Thin to thick bedded. Thin bedded zones appear more weathered. Partly to mostly covered laterally. Moderately well exposed in stream cut. Basal contact covered.	1.55 m (5.1')
TS 2-107	.15 m (.5') BT: Coarse calcilutite-fine calcirudite; organic-rich, packed, ostracod, crinoid, brachiopod, spicule Biomicrite:Packstone.	
2-106	Silty, spicule Mudstone, dark grey, weathers light grey or tan to orange. Grains include calcareous and silicious spicules and silt sized quartz grains. Single fusulinid recovered 10 cm below the top. Scattered chert nodules to 3 cm in diameter. Limonite inclusions common. Medium wavy to irregular bedded or nodular. Mostly covered. Locally moderately well exposed in stream cut. Top broken and mostly covered. Basal contact covered.	Approx. 3.5 m (12')
TS 2-106	Top: Coarse calcilutite; sparse, spicule Biomicrite: Wackestone.	
TS 2-106	2.45 (8') AB: Coarse calcilutite; quartz-bearing, packed, spicule Biomicrite:Packstone.	
TS 2-106	.3 m (1') AB: Coarse calcilutite; packed, spicule Biomicrite: Packstone.	
2-105	Crinoid Packstone, dark grey, weathers grey to tan. Grains dominantly crinoid columnals. Grains also include brachiopod fragments and bryozoans. Medium to thin bedded with thicker beds at base and thinner beds in upper third. Mostly covered laterally. Locally well exposed in stream cut. Forms mostly covered bluff face. Basal contact sharp.	.4 m (1.4')

UNIT	LITHOLOGY	THICKNESS
TS 2-105	.3 m (.9') AB: Very fine calcarenite-fine calcirudite: packed, bryozoan, brachiopod, crinoid Biomicrite:Packstone.	
2-104	Wackestone, dark grey, weathers light grey to tan. Grains include crinoid columnals, coralline algae and brachiopod fragments. Forms single bed. Mostly covered laterally, moderately well exposed in stream cut. Basal contact covered. May be thicker than exposed thickness.	.2 m (.6')
TS 2-104	Coarse calcilutite-fine calcarenite; sparse, brachiopod, crinoid, spicule Biomicrite:Wackestone.	
2-103	Covered.	Approximately 2.9 m (9.5')
2-102	Sandy Packstone, dark grey, weathers tan. Grains well sorted, rounded, medium sand size quartz with and unidentified skeletal fragments. Forms thin cap on unit 2-101. Not well exposed. Base sharp but slightly irregular.	.05 m (.2')
TS 2-102	Very fine-coarse calcarenite; sandy, packed, crinoid, ostracod Biomicrite:Packstone.	
2-101	Mudstone, dark grey, weathers light grey or tan. Grains include crinoid columnals and brachiopods. Grains most abundant in lowest portion of unit, nearly lacking in upper portion. Very thick bedded or single massive bed. Very poorly exposed, local exposures of limited lateral extent. Basal contact gradational.	1.35 m (4.5')
TS 2-101	.9 m (3') AB: Coarse calcilutite-fine calcarenite; burrowed, fossiliferous, ostracod, pellet, spicule Biomicrite:Mudstone.	
2-100	Crinoid Packstone, dark grey, weathers light grey. Grains dominated by coarse sand to granule size crinoid columnals. Other grains include small whole brachiopods, rugose and tabulate corals, and bryozoans. Larger grains concentrated in lenses 1 to 3 cm thick. Silicification of grains common. Stylolites common subparallel to bedding. Very thick bedded or single massive bed. Locally zones of larger grains appear crossbedded. Forms very prominant cliff face. Top .3 m covered or weathered back from main cliff front. Basal contact sharp.	3.85 m (12.6')
TS 2-100	3 m (10') AB: Fine calcarenite-fine calcirudite; poorly washed, ostracod, bryozoan, crinoid Biosparite:Packstone.	

UNIT	LITHOLOGY	THICKNESS

TS 2-100 1.85 m (6') AB: Fine calcarenite-fine calcirudite; poorly washed, brachiopod, bryozoan, crinoid Biosparite:Packstone.

TS 2-100 .3 m (1') AB: Fine calcarenite-fine calcirudite; packed, brachiopod, bryozoan, crinoid Biomicrite:Packstone.

2-99 Wackestone, dark grey, weathers grey. Grains include crinoid columnals, tabulate and rugose corals, brachiopod fragments and bryozoans. Grain silicification common and small chert nodules common in lower half of unit. Thick bedded or single massive bed. Rippled zones and/or possible erosional surfaces within unit, most prominant near the top. Forms prominant cliff face or continuation of very prominant 2-100 cliff face. Basal contact sharp. .8 m (2.7')

TS 2-99 .3 m (1') BT: Coarse calcilutite-fine calcirudite; poorly washed, crinoid, bryozoan Pelsparite:Packstone.

TS 2-99 Base: Very fine calcarenite-fine calcirudite; packed, trilobite, foraminifera, brachiopod, crinoid, bryozoan Biomicrite:Packstone.

2-98 Wackestone, dark grey, weathers light grey or coated white. Grains include whole productid and other brachiopods and bryozoans. Medium to thin bedded and nodular, weathers into 2 cm to 10 cm subround nodules. Forms thin, more weathered zone within cliff face. Basal contact sharp, tabular. .2 m (.6')

TS 2-98 Base: Medium calcarenite-fine calcirudite; sparse, brachiopod, bryozoan Biomicrite:Wackestone.

2-97 Wackestone, dark grey, weathers grey. Grains include crinoid columnals, whole and fragmented brachiopods, and intraclasts. Medium bedded at top, becomes more massive near base. Basal contact covered. .35 m (2.4')

TS 2-97 Top: Fine calcarenite-fine calcirudite; poorly washed, crinoid, brachiopod, bryozoan Biosparite:Packstone.

TS 2-97 .3 m (1') BT: Fine calcarenite-fine calcirudite; packed, bryozoan, brachiopod, crinoid Biomicrite:Packstone.

2-96 Wackestone, dark grey, weathers light grey. Grains include crinoid columnals, bryozoans, and gastropods. Medium to very thin bedded. Very thin beds at base, beds become thicker higher in unit. Forms tabular, mostly covered terrace on top of 2-95 cliff face. Basal contact sharp but mostly covered. .35 m (1.1')

UNIT	LITHOLOGY	THICKNESS

TS 2-96 Top: Coarse calcilutite-medium calcarenite; packed, ostracod, spicule Biomicrite:Packstone.

2-95 Wackestone-Packstone, very dark grey, weathers grey. Grains include crinoid columnals, bryozoans, brachiopods, and tabulate and rugose corals. Hematite inclusions common, some grain silicification. Single massive bed. Forms laterally continuous cliff face. Basal contact sharp and tabular. .75 m (2.4')

TS 2-95 Top: Very fine calcarenite-fine calcirudite; organic-rich, packed, bryozoan, ostracod, brachiopod, crinoid Biomicrite: Packstone.

TS 2-95 Base: Very fine calcarenite-fine calcirudite; quartz-bearing, sparse, bryozoan, brachiopod, crinoid Biomicrite:Wackestone.

2-94 Mudstone-Wackestone, dark grey, weathers light grey. Grains include fenestrate bryozoans, rare brachiopods and very rare fusulinids. Chert nodules common. Chert is black, weathers brown. Medium bedded with thin laminate zones, becomes nodular near top. Basal contact sharp. .8 m (2.6')

TS 2-94 Top: Very fine-medium calcarenite; sparse, foraminifera, crinoid, spicule, pellet Biomicrosparite:Wackestone.

2-93 Crinoid Packstone, very dark grey, weathers light grey. Grains dominated by crinoid columnals but also include brachiopod fragments and rare whole brachiopods. Medium bedded. Very poorly exposed, covered laterally, locally exposed in small stream cut. Basal contact covered. .35 m (1.2')

TS 2-93 Top: Fine-coarse calcarenite; organic-rich, dolomitic, brachiopod, ostracod, crinoid Biomicrite:Packstone.

- -

Units 2-93 and 2-94 measured in small creek cut 11 m (37') north 28° west of main section line.

- -

2-92 Covered 2.6 m (8.5')

UNIT	LITHOLOGY	THICKNESS

2-91 Mudstone, grey, weathers light grey with distinctive orange nodules. Grains include brachiopods, rugose corals and bryozoans. Silicification of grains common. Siliceous orange nodules cover up to 20% of rock surface. Unit forms single, highly fractured bed. Forms mostly broken and covered bluff which is locally well exposed. Basal contact sharp. — .35 m (1.1')

TS 2-91 Top: Very fine-medium calcarenite; chert-bearing, packed, spicule Biomicrite:Wackestone.

- -

OFFSET 15 m (50') north 23° west on unit 2-90 to measure 2-91 and higher units.

- -

2-90 Burrowed, wackestone, dark grey, weathers light grey. Grains include crinoid columnals, brachiopod fragments, whole silicified rugose corals and rare fusulinids (includes lowest Beedeina, rare Beedeina insolita). Burrows contain more micrite and fewer grains than non-burrowed portion of rock. Burrows range to 3 cm across and 10 cm long. Medium bedded or massive, more massive in lower portion of unit. Forms laterally distinctive but broken band of large slumped blocks. Rare blocks in place. Basal contact sharp. — .75 m (2.5')

TS 2-90 Top: Fine calcarenite-fine calcirudite; quartz-bearing, packed, bryozoan, brachiopod, ostracod, crinoid Biomicrite:Packstone.

TS 2-90 .15 m (.5') AB: Fine calcarenite-fine calcirudite; quartz-bearing, burrowed, packed, foraminifera, ostracod, brachiopod, crinoid Biomicrite:Packstone.

2-89 Intraclast Packstone, light grey, weathers mottled light grey with abundant dark grey intraclasts. Grains dominated by round to subround olive grey micrite intraclasts to 1 cm by 2 cm in diameter. Other grains include crinoid columnals and whole and fragmented brachiopods. Some limonite grain coatings. Medium bedded or single massive tabular bed. Locally exposed but laterally mostly covered (best exposure 27 m (90') S27°E of main section line in small creek cut). Basal contact sharp, tabular. — .35 m (1.1')

TS 2-89 Top: Fine calcarenite-fine calcirudite; quartz-bearing, packed, intraclast, brachiopod, crinoid Biomicrite:Packstone.

2-88 Covered — Approximately 5 m (16.6')

UNIT	LITHOLOGY	THICKNESS
2-87	Wackestone, dark grey, weathers light grey with tan to orange bands. Grains include crinoid columnals, small brachiopods and fusulinids. Minor grain silicification. Medium bedded, lower beds wavy, upper portion more massive. Forms low terrace. Basal contact sharp where exposed but mostly covered.	.6 m (2')
TS 2-87	Base: Coarse calcilutite-fine calcirudite; burrowed, packed, foraminifera, ostracod, pellet, crinoid Biomicrite:Wackestone.	
2-86	Fusulinid Wackestone, dark grey, weathers light grey. Grains dominated by fusulinids (Fusulinella) but also include small brachiopods, bryozoans and rugose corals. Minor grain silicification. Medium bedded. Forms laterally broken but locally prominant bluff face. Basal contact sharp.	.4 m (1.3')
TS 2-86	Top: Fine calcarenite-fine calcirudite; sparse, bryozoan, brachiopod, coralline algae, ostracod, crinoid, foraminifera Biomicrite:Wackestone.	
TS 2-86	Base: Fine calcarenite-fine calcirudite; sparse, bryozoan, brachiopod, coralline algae, ostracod, foraminifera Biomicrite:Wackestone.	
2-85	Covered.	.65 m (2.1')
2-84	Mudstone, grey, weathers light grey. Grains include whole silicified brachiopods, rare rugose corals and rare algal debris. Unit forms single bed. Forms laterally broken terrace set back 10 cm or more from laterally prominant 2-83/2-81 cliff face. Basal contact gradational.	.3 m (.9')
TS 2-84	Top: Coarse calcilutite-medium calcarenite; packed, ostracod, brachiopod, spicule Biomicrite:Wackestone.	
2-83	Wackestone, dark grey, weathers light grey. Grains include silicified rugose corals, Aulopora (?) tabulate corals, and fenestrate bryozoans. Nodules of dark brown chert and limonite inclusions common. Medium bedded. Forms cap on 2-82/2-81 laterally prominant cliff face. Basal contact sharp, irregular, wavy.	.3 m (.9')
TS 2-83	Center: Very fine calcarenite-fine calcirudite; sparse, ostracod, foraminifera, spicule, crinoid, Aulopora(?) Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS

2-82 Wackestone, dark grey, weathers light grey. Grains include silicified brachiopods, gastropods, rugose corals and scattered fusulinids. Corals most abundant near top of unit. Medium wavy bedded. Forms upper portion of laterally prominant cliff face. Basal contact sharp but indistinct, drawn at change from darker grey weathered unit 2-81 to light grey weathered surface of this unit. .75 m (2.5')

TS 2-82 Base: Fine calcarenite-fine calcirudite; sparse, foraminifera, spicule, ostracod, crinoid Biomicrite:Wackestone.

2-81 Mudstone, dark grey, weathers grey. Grains include fusulinids (lowest Fusulinella common in lower portion of unit), crinoid columnals and whole brachiopods. Laterally continuous chert band .1 to .2 m above base of unit, also scattered chert lenses to 3 cm thick and .5 m long. Chert is black, weathers brown. Medium wavy bedded. Forms lower half of laterally prominant cliff face. Basal contact sharp, mostly covered. .9 m (3')

TS 2-81 Top: Very fine-coarse calcarenite; sparse, foraminifera, ostracod, phylloid algae Biomicrite:Wackstone.

TS 2-81 .45 m (1.5') AB: Coarse calcilutite-fine calcirudite; packed, foraminifera, ostracod, crinoid, phylloid algal Pelmicrite: Packstone.

TS 2-81 Base: Very fine calcarenite-fine calcirudite; burrowed, foraminifera, ostracod, crinoid, pellet, spicule Biomicrite: Packstone.

2-80 Covered 4.5 m (14.8')

2-79 Aulopora(?) Boundstone, dark grey matrix with white corallite walls, weathers mottled light grey and tan to orange. Interlocking Auloporid tabulate corals in growth position stand in relief on weathered surface 1 to 2 mm. Other grains include large solitary rugose corals and crinoid columnals. Medium to thin bedded. Mostly covered laterally, locally well exposed as cap on 2-79/2-78 terrace. Basal contact sharp. .25 m (.8')

TS 2-79 Center: Fine calcarenite-fine calcirudite; ostracod, crinoid, Aulopora(?) Biolithite:Boundstone.

UNIT	LITHOLOGY	THICKNESS
2-78	Wackestone, dark grey, weathers light grey or yellow brown. Grains include crinoid columnals, rugose corals over 2 cm in diameter and 10 cm long, and Aulopora(?) tabulate corals. Corals commonly silicified. Medium to thin wavy bedded. Forms mostly covered low terrace. Best exposure 14 m (45') S24°E of section line in small wash. Basal contact covered.	1.5 m (5')
TS 2-78	.9 m (3') BT: Fine-coarse calcarenite; sparse, crinoid, brachiopod, algal Biomicrite:Wackestone.	
2-77	Covered.	11.5 m (37.5')
2-76	Silty Crinoid Grainstone, dark grey, weathers olive grey to brown. Grains dominated by well sorted, medium to coarse sand size crinoid columnals. Other grains include brachiopod fragments and bryozoan fragments. Scattered burrows. Thin bedded or single bed, cross bedded at base. Forms cap on 2-75 cliff face, partly covered laterally. Basal contact sharp.	.2 m (.7')
TS 2-76	Top: Very fine-coarse calcarenite; brachiopod, bryozoan, ostracod, crinoid Biosparite:Grainstone.	
2-75	Fossiliferous Siltstone, dark grey, weathers olive grey to brown. Grains include well sorted quartz silt, crinoid columnals, rare spiriferid brachiopods and rare ramose bryozoans. Calcite with minor limonite cement and grain coating and 1 to 2 cm thick silicified zones. Medium to thin bedded. Forms prominant and distinctive low terrace. Basal contact gradational.	.9 m (3')
TS 2-75	.15 m (.5') BT: Very fine-medium calcarenite; poorly washed, silty, foraminifera, ostracod Biomicrite:Packstone.	
TS 2-75	.45 (1.5') AB: Very fine-medium calcarenite; sorted, rounded, silty, skeletal fragment, ostracod Biosparite:Packstone.	
2-74	Covered.	.7 m (2.3')

UNIT	LITHOLOGY	THICKNESS

2-73 Dolomitic Brachiopod Packstone, dark grey, weathers light grey, tan or coated white. Grains unsorted, include fine quartz silt, whole brachiopods (spiriferids and others), crinoids and bryozoans. Dolomite cement dominant, also some limonite. Medium slightly wavy bedded, 1 to 2 cm thick weathered zones between more lithified intervals. Forms moderately well exposed bluff face in dry wash, covered laterally. Basal contact covered. .9 m (2.9')

TS 2-73 .15 m (.5') BT: Fine calcarenite-fine calcirudite; quartz-bearing, dolomitic, packed, ostracod, bryozoan, brachiopod, crinoid Biomicrite:Packstone.

- -

OFFSET 25 m (82') north 28° west on unit 2-75 to measure 2-73 and higher units.

- -

2-72 Covered. .3 m (1')

2-71 Crinoid Packstone, dark grey, weathers light grey. Grains dominated by granule size crinoid columnals but also include Michelinea scopulosa tabulate corals, rugose corals, echinoid spines, brachiopods, bryozoans and small Chaetetes colonies (to 3 cm diameter). Brachiopods are broken and poorly preserved but tabulate corals are well preserved. Limonite inclusions common. Medium to thick tabular beds. Forms locally moderately well exposed low broken terrace. Partly to mostly covered laterally. Basal contact sharp. .55 m (1.8')

TS 2-71 .15 m (.5') AB: Fine-coarse calcarenite; packed, ostracod, bryozoan, brachiopod, crinoid Biomicrite:Packstone.

2-70 Wackestone, dark grey, weathers grey. Grains include common whole spiriferid brachiopods on upper bedding plane surfaces, crinoid columnals, and bryozoans. Brachiopods are mostly silicified. Poorly exposed, mostly covered laterally. Shell debris lag common in basal 3 cm. Basal contact sharp but irregular, locally cuts into 2-69 up to 10 cm. Thickness measurement includes upper portion of unit which is covered except in local exposures along strike. .65 m (2.1')

TS 2-70 .15 m (.5') AB: Very fine calcarenite-fine calcirudite; chert-bearing, sparse, bryozoan, ostracod, spicule, foraminifera, brachiopod, crinoid Biomicrite:Wackestone.

UNIT	LITHOLOGY	THICKNESS

TS 2-70 Base/2-69 Top: Thin section across contact shows change from unit 2-70 Biomicrite to unit 2-69 Dolomite occurs over an interval less than 1 mm thick.

- -

OFFSET 58 m (189') north 18° west on unit 2-69 to measure 2-70 and higher units.

- -

2-69 Fossiliferous Dolomite, dark grey, weathers olive green to tan or orange. Even textured silt sized dolomite rhombs forms bulk of rock. Grains include rare crinoid columnals, brachiopod fragments, bryozoans and small rugose corals. Fossil grains most abundant in lower half of unit. Upper half of unit contains moldic porosity in zones to 5 cm diameter possibly representing leached anhydrites. Unit forms single bed. Crops out as cap on cliff face in small wash, laterally partly covered. Basal contact sharp but highly irregular. Base cuts into unit 2-68 up to 5 cm and locally fills small karsted overhangs in upper portion of 2-68. — .45 m (1.5')

TS 2-69 .3 m (1') AB: Fine-medium crystalline, quartz- and chalcedony-bearing Dolomite.

TS 2-69 Base: Finely crystalline, chert-bearing, fossiliferous Dolomite.

2-68 Crinoid Wackstone and Chert, grey, weathers light grey or tan. Chert is black, weathers brown. Grains include crinoid columnals, brachiopod fragments and bryozoans. Chert forms laterally continuous bed highly variable in thickness. Unit overall thickness relatively constant. Forms single bed in upper one-fourth of wash cut cliff face. Basal contact sharp, marked by thin chert lenses. — .25 m (.9')

TS 2-68 Base: Very fine calcarenite-fine calcirudite; chert-bearing, dolomitic, sparse, ostracod, bryozoan, foraminifera, brachiopod, crinoid Biomicrite:Wackestone.

2-67 Wackestone, dark grey, weathers grey. Grains include foraminifera, crinoid columnals, brachiopod spines, and bryozoans (<u>Prismopora</u> sp.). Chert nodules common and bryozoans commonly silicified. Forms single thick bed near center of wash cliff face. Basal contact sharp, wavy. — .35 m (1.1')

TS 2-67 .15 m (.5') BT: Coarse calcilutite-coarse calcarenite; organic rich, packed, pellet, brachiopod, crinoid, foraminifera, spicule Biomicrite:Packstone.

UNIT	LITHOLOGY	THICKNESS

2-66 Wackestone, dark grey, weathers grey or light grey. Grains include crinoid columnals and silicified brachiopods. Rare chert nodules. Chert nodules round or elongate, black or weathered brown. Medium bedded. Forms central portion of cliff face, covered laterally. Basal contact sharp. .35 m (1.2')

TS 2-66 Base: Fine calcarenite-fine calciurdite; dolomite-bearing, sparse, ostracod, spicule, crinoid, bryozoan, brachiopod Biomicrite:Wackestone.

2-65 Wackestone, dark grey, weathers grey. Grains include ramose bryozoans and brachiopod fragments. Grains commonly silicified. Chert nodules form laterally broken but persistent zone .15 m above the base. Chert is black, weathers brown. Similar chert nodules abundant at top of unit. Medium to thick bedded, thinner bedded near base, base gradational. Mostly covered laterally, locally well exposed in lower half of wash cut cliff face. Basal contact gradation. .65 m (2.1')

TS 2-65 Top: Very fine-coarse calcarenite; sparse, bryozoan, brachiopod, spicule Biomicrite:Wackestone.

2-64 Highly weathered Calcareous Shale or Wackestone. Mostly covered or caliche coated. Forms eroded undercut at base of unit 2-65. Basal contact sharp. .05 m (.2')

2-63 Mudstone and chert, dark grey weathers grey or caliche coated white. Chert is black. Grains unidentified skeletal fragments. Chert forms laterally continuous bed 3 to 12 cm thick. Mudstone thickness increases when chert thickness decreases. Forms single bed. Covered laterally, only exposure was near base of wash cut cliff face. Basal contact sharp. .15 m (.5')

TS 2-63 Base: Very fine-coarse calcarenite; cherty, sparse, brachiopod, spicule, ostracod, Biomicrite:Wackestone.

2-62 Wackestone, very dark grey or black, weathers light grey. Grains include brachiopods and bryozoans. Thin, slightly wavy bedded. Fissle and nodular where weathered. Forms base of wash cut cliff face. Covered laterally. Basal contact gradational. .45 m (1.4')

TS 2-62 Top: Fine-coarse calcarenite; organic-rich, chert-bearing, packed, ostracod, brachiopod Biomicrite:Packstone.

UNIT	LITHOLOGY	THICKNESS

2-61 Calcareous Shale, dark grey to black, weathers light grey or coated white. Fossil grains include whole spiriferid brachiopods and bryozoans. Many fossil fragments pyritized. Very thin bedded, locally highly fissile, slightly wavy bedded. Mostly covered, locally exposed in wash. Forms undercut at base of unit 2-62. Basal contact sharp but poorly exposed. .25 m (.9')

TS 2-61 Base: Fine calcarenite-fine calcirudite; clay rich, organic rich, sparse, brachiopod, ostracod Biomicrite:Wackestone.

2-60 Wackestone, very dark grey, weathers light grey. Grains include brachiopod spines and shell fragments, scattered whole brachiopods and gastropods. Thin platy bedded. Forms low terrace and dip slope on floor of wash, covered laterally. Basal contact sharp. .65 m (2.2')

TS 2-60 Top: Fine-coarse calcarenite; organic-rich, sparse, brachiopod, ostracod Biomicrite:Wackestone.

TS 2-60 .4 m (1.4') AB: Fine calcarenite-fine calcirudite; sparse, brachiopod, ostracod Biomicrite:Wackestone.

TS 2-60 Base: Very fine calcarenite-fine calcirudite; chert-bearing, dolomitic, sparse, ostracod, bryozoan, foraminifera, brachiopod, crinoid Biomicrite:Wackestone.

- -

OFFSET 19 m (63') south 17° east to small dry wash where unit 2-59 forms well exposed dip slope to measure higher units.

- -

2-59 Wackestone, dark grey, weathers gray. Grains include abundant whole silicified brachiopods and skeletal fragments. Laterally continuous but locally broken irregular chert lense at base. Chert is black, weathers brown, lense thickness from 0 to 12 cm. Thick to medium bedded. Forms low terrace, moderately well exposed but locally covered. Basal contact sharp but irregular. .5 m (1.6')

TS 2-59 .15 m (.5') BT: Very fine calcarenite-fine calcirudite; cherty, organic-rich, packed, foraminifera, ostracod, crinoid, brachiopod, spicule Biomicrite:Wackestone.

UNIT	LITHOLOGY	THICKNESS
2-58	Dolomite, light grey, weathers same except for local white caliche coating. Even textured, finely crystalline. No fossil grains observed. Ellipitical or elongate nodules of black chert common. Chert weather brown. Prominant chert nodule zone .2 m below top of unit. Medium to thick bedded or highly fractured massive bed. Forms rubbly, white stained cliff face in wash, mostly covered laterally. Basal contact gradational.	1.3 m (4.2')
TS 2-58	.45 m (1.5') AB: Fine-medium crystalline Dolomite.	
2-57	Crinoid Wackestone, dark grey, weathers grey. Grains include crinoid columnals, brachiopods and bryozoan fragments. Silt sized quartz grains common (chert grain replacement in thin section). Quartz grains most abundant near top of unit. Poorly exposed in small wash cut, covered laterally. Forms base of cliff in wash cut. Basal contact covered.	.35 m (1.2')
TS 2-57	Top: Fine calcarenite-fine calcirudite; cherty, packed, ostracod, spicule, bryozoan, brachiopod, crinoid Biomicrite:Packstone.	
OFFSET 38 m (126') south 7° east to small dry wash cut to measure units 2-57 through 2-59.		
2-56	Covered.	.45 m (1.5')
2-55	Wackestone, dark grey, weathers very light grey. Grains include small foraminifera and scattered whole brachiopods. No internal bedding. Forms low, broken, mostly covered terrace. Basal contact sharp.	.35 m (1.1')
TS 2-55	Base: Very fine-medium calcarenite; sparse, brachiopod, ostracod, foraminifera, spicule Biomicrite:Wackestone.	
2-54	Mudstone, very dark grey or black, weathers grey. Grains limited to rare unidentified skeletal fragments. Thin bedded. Beds drape folded over unit 2-53 chert nodule highs. Mostly covered, locally forms cap on 2-53 terrace. Basal contact sharp.	approx. .65 m (2.2')
TS 2-54	.15 m (.5') AB: Very fine-fine calcarenite; organic-rich, sparse, ostracod, spicule Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS
2-53	Chert and Wackestone. Chert is black with grey bands. Wackestone is grey, weathers very light grey. Fossil grains are common in the chert and wackestone. Grains include brachiopod spines and shell fragments, common gastropods, and ostracods. Bedding is highly contorted, carbonate portion is bent around nodular surface of chert bed. Chert bed is nodular, highly variable in thickness, locally chert composes entire unit. Where chert portion of unit thins wackestone portion thickens. Forms broken, laterally covered cap on cliff face. Basal contact sharp, hummocky. Locally base cuts out unit 2-52 completely. Unit thckest when 2-52 removed.	.5 to .15 m (1.7 to (.5')
TS 2-53	Center: Fine calcarenite-fine calcirudite; cherty, sparse, ostracod, spicule, gastropod, brachiopod Biomicrite: Wackestone.	
2-52	Wackestone-Packstone, very dark grey, weathers grey or light grey. Grains sorted, small foraminifera, brachiopod spines and crinoid columnals. No internal bedding features. Top is very irregular, hummocky. Unit 2-53 fill in lows. Basal contact sharp. Locally unit completely cut out by unit 2-53.	Maximum observed thickness .15 m (.5')
TS 2-52	Base: Fine-coarse calcarenite; poorly washed, ostracod, spicule, brachiopod, crinoid, foraminifera Biosparite: Packstone.	
2-51	Wackestone, dark grey, weathers light grey. Grains include brachiopod fragments, crinoid columnals and small foraminifera. Scattered, poorly preserved whole brachiopods on upper surface. No internal bedding features. Forms center bed of broken cliff face. Basal contact gradational.	.2 m (.6')
TS 2-51	Center: Very fine-medium calcarenite; packed, foraminifera, ostracod, crinoid, spicule Biomicrite:Packstone.	
2-50	Packstone, dark grey, weathers grey. Grain fragmented, include brachiopods, rugose corals and crinoid columnals. Brachiopods and corals commonly silicified. Thick bedded. Forms locally prominant but laterally broken cliff face. Basal contact slightly gradational.	.65 m (2.1')
TS 2-50	.15 m (.5') BT: Very fine-coarse calcarenite; ostracod, bryozoan, foraminifera, brachiopod, pellet, crinoid, spicule Biosparite:Packstone.	

UNIT	LITHOLOGY	THICKNESS

TS 2-50 .3 m (1') AB: Very fine-coarse calcarenite; ostracod, foraminifera, brachiopod, pellet, spicule, crinoid Biosparite: Packstone.

2-49 Crinoid Wackestone, dark grey, weathers grey. Grains include crinoid columnals and ostracods. No internal bedding. Forms base of laterally broken, locally prominant cliff face. Basal contact sharp. .15 m (.5')

TS 2-49 Center: Very fine-coarse calcarenite; packed, foraminifera, brachiopod, crinoid, spicule Biomicrite:Packstone.

2-48 Mudstone, dark grey, weathers grey. Grains limited to ostracods, small gastropods and bryozoan fragments. Forms single bed. Mostly covered but base and top locally well exposed. Forms broken terrace or cliff face where exposed. Basal contact covered. .6 m (1.9')

TS 2-48 .15 m (.5') BT: Very fine-coarse calcarenite; packed, gastropod, foraminifera, brachiopod, phylloid algae, crinoid, ostracod Biomicrite:Wackestone-Packstone.

2-47 Covered. 3.8 m (12.5')

- -

OFFSET 21 m (70') south 8° west on unit 2-46 dip slope to small wash to measure higher units.

- -

2-46 Foraminifera Wackestone, dark grey, weathers grey. Grains include common fusulinids (Profusulinella) from .5 m above base to the top, crinoid columnals, whole and fragmented brachiopods, and rugose corals. Basal .5 m more micritic than rest of unit. Prominant chert lense .75 m above base. Lense has lateral continuity but is locally discontinuous ranging in thickness from 0 to 35 cm. Chert is black, weathers brown. Additional chert nodules and silicified rugose corals common in lower half of unit. Very thick bedded. Forms top of prominant cliff face. Upper surface forms highly fractured but well exposed dip slope. Basal contact sharp, slightly irregular. 2.25 m (7.3')

TS 2-46 Top: Very fine-coarse calcarenite; packed, bryozoan, ostracod, foraminifera, spicule Biomicrite:Packstone.

UNIT	LITHOLOGY	THICKNESS

TS 2-46 1.5 m (5') AB: Very fine-coarse calcarenite; sparse, bryozoan, ostracod, foraminifera, spicule Biomicrite:Wackestone.

TS 2-46 .6 m (2') AB: Very fine-coarse calcarenite; sparse, brachiopod, crinoid, foraminifera, spicule Biomicrite: Wackestone.

2-45 Cherty Crinoid Mudstone, dark grey, weathers grey. Chert black, weathers brown. Grains restricted to crinoid columnals and rare encrusting foraminifera. Chert forms approximately 30% of unit. Chert forms 4 main bands, all are laterally continuous but highly variable in thickness. Scattered mudstone inclusions in chert lenses. Thin to medium wavy bedded. Forms base of prominant cliff. Basal contact mostly covered, sharp where exposed. 1.1 m (2.6')

TS 2-45 .15 m (.5') AB: Very fine calcarenite-fine calcirudite; sparse, foraminifera, ostracod, brachiopod, crinoid spicule Biomicrite:Wackestone.

2-44 Wackestone, dark grey, weathers grey. Grains include crinoid columnals, brachiopod spines and small foraminifera. Thick bedded. Forms mostly covered terrace with rubbly, broken cliff front. Basal contact covered. .75 m (2.4')

TS 2-44 .05 m (.1') BT: Fine-coarse calcarenite; quartz-bearing, poorly washed, foraminifera, spicule, brachiopod, crinoid Biosparite:Packstone.

2-43 Mudstone, dark grey, weathers grey. Grains restricted to small unidentified skeletal fragments. Scattered limonite and hematite inclusions. Unit forms single bed. Forms highly fractured, low, mostly covered, broken terrace and cliff front. Basal contact sharp. .4 m (1.3')

TS 2-43 .15 m (.5') AB: Medium calcarenite; fossiliferous, ostracod, foraminifera, spicule Micrite:Mudstone.

- -

OFFSET 91 m (300') north 43° west on distinctive upper surfer of unit 2-42 to measure higher units.

- -

UNIT	LITHOLOGY	THICKNESS
2-42	Burrowed Wackestone, dark grey, weathers light grey with abundant darker burrows. Grains include fusulinids, other foraminifera, crinoid columnals and rare brachiopod fragments. Burrows to 10 cm long slightly more micritic than rest of rock. Unit forms single bed. Forms cap on 2-41 cliff face and distinctive mottled dip slope surface. Basal contact slightly gradational, irregular, wavy.	.15 m (.5')
TS 2-42	Top: Very fine calcarenite-fine calcirudite; burrowed, poorly washed, bryozoan, brachiopod, crinoid, foraminifera, spicule Biosparite:Packstone.	
2-41	Wackestone, grey weathers light grey. Grains include small foraminifera, crinoid columnals, silicified brachiopods and rugose corals. Top burrowed. Single massive bed. Forms laterally prominant cliff face. Basal contact sharp, irregular.	1.6 m (5.3')
TS 2-41	1.1 m (3.6') AB: Coarse calcilutite-fine calcirudite; packed, bryozoan, foraminifera, ostracod, brachiopod, crinoid, pellet Biomicrite:Packstone.	
TS 2-41	.15 m (.5') AB: Very fine calcarenite-fine calcirudite; packed, foraminifera, brachiopod, ostracod, crinoid, spicule Biomicrite:Packstone.	
2-40	Chert, black, weathers brown. Silicified skeletal grains common. Minor carbonate inclusions scattered. Forms single irregular bed. Basal contact sharp, irregular. Thickness variable from .1 m to .2 m.	Average .15 m (.5')
TS 2-40	Base: Fossiliferous chert and organic-rich, packed Biomicrite: Packstone.	
2-39	Foraminifera Wackestone, grey, weathers light grey. Grain well sorted, include small foraminifera, fusulinds (lowest Profusulinella), brachiopod fragments and crinoid columnals. Unit forms single bed at base of 2-41/2-40 cliff face or blocky, slumped terrace. Mostly covered but locally very well exposed. Basal contact covered.	.35 m (1.2')
TS 2-39	Center: Very fine calcarenite-fine calcirudite; packed, ostracod, brachiopod, crinoid, spicule Biomicrite:Packstone.	

UNIT	LITHOLOGY	THICKNESS
2-38	Mudstone, grey, weathers grey to tan. Grains poorly preserved, include brachiopod and crinoid fragments and rare small foraminifera (lowest Eoschubertella at base). Hematite inclusions common. Highly fractured, no internal bedding. Forms laterally continuous cliff face. Basal contact sharp, irregular.	.6 m (2')
TS 2-38	Top: Fine-coarse calcarenite; quartz-bearing, packed, ostracod, brachiopod, crinoid Biomicrite:Packstone.	
TS 2-38	Base: Fine-coarse calcarenite; quartz-bearing, packed, brachiopod, crinoid Biomicrite:Packstone.	
2-37	Chert, black with grey to light grey bands, weathers dark brown. Silicified skeletal grains common. Forms single bed. Basal contact sharp, somewhat irregular. Thickenss variable, range from 15 cm to .5 m. Most thickness variation due to irregularity of upper surface.	Average .2 m (.7')
TS 2-37	Fossiliferous chert.	
2-36	Cherty Foraminifera Wackestone, dark grey, weathers grey, or tan to brown. Grains include small foraminifera and crinoid columnals. Chert is black, weathers brown, forms laterally continuous zone of variable thickness .15 to .3 m above the base. Medium to thick bedded. Forms continuation of 2-35 cliff face or separate terrace set slightly back. Basal contact sharp.	.8 m (2.6')
TS 2-36	.3 m (1') BT: Fine-coarse calcarenite; sparse, foraminifera, brachiopod, crinoid Biomicrosparite:Wackestone.	
TS 2-36	Base: Fine-coarse calcarenite; foraminifera, crinoid Biomicrosparite:Wackestone.	
2-35	Cherty Crinoid Wackestone, dark grey, weathers grey to tan. Chert is black, weathers brown. Grains dominated by crinoid columnals, also include small foraminifera and brachiopod fragments. Chert forms approximately 50% of unit. Laterally continuous zones of lenticular chert beds near base and top from 3 cm to .4 m thick. Scattered chert nodules in rest of unit. Thick bedded, forms laterally prominant cliff face. Basal contact sharp.	1.15 m (3.8')
TS 2-35	.3 m (1') BT: Fine calcarenite-fine calcirudite; organic-rich, packed, foraminifera, brachiopod, crinoid, spicule Biomicrite: Packstone.	

UNIT	LITHOLOGY	THICKNESS
TS 2-35	.25 m (.8') AB: Fine calcarenite-fine calcirudite; chert-bearing, packed, foraminifera, brachiopod, crinoid Biomicrite:Packstone.	
TS 2-35	Base: Fine-coarse calcarenite; cherty, organic-rich, packed, brachiopod, crinoid Biomicrite:Packstone.	
2-34	Covered.	1.55 m (5.1')
2-33	Crinoid Packstone, grey, weathers light grey. Grains dominated by very coarse sand size crinoid columnals, also include intraclasts and brachiopod fragments. Zones of silicified skeletal grains stand in slight relief on weathered surface. Single bed. Forms top of laterally continuous cliff face. Basal contact very sharp, tabular.	.7 m (2.3')
TS 2-33	Top: Coarse calcilutite-fine calcirudite; poorly washed, foraminifera, bryozoan, brachiopod, crinoid pellet Biosparite: Packstone.	
TS 2-33	Center: Fine calcarenite-fine calcirudite; intraclast, foraminifera, brachiopod, bryozoan, crinoid Biosparite: Grainstone.	
2-32	Cherty Crinoid Wackestone, dark grey, weathers grey. Grains dominated by crinoid columnals but also include abundant small foraminifera, brachiopod fragments and bryozoans. Chert is black, weathers brown or white, forms prominant lenticular band, laterally present but high variable in thickness. Main chert band ranges from 20 cm to .5 m thick. Scattered chert nodules outside main band and scattered wackestone inclusion within main chert band. Unit is massive, chert lenses forms only bedding. Form prominant cliff face. Basal contact sharp.	1.25 m (3.7')
TS 2-32	.15 m (.5') BT: Fine calcarenite-fine calcirudite; chert-bearing, poorly washed, brachiopod, bryozoan, spicule, crinoid Biosparite:Packstone.	
TS 2-32	.15 m (.5') AB: Fine calcarenite-fine calcirudite; poorly washed, foraminifera, brachiopod, crinoid, spicule Biosparite: Packstone.	

UNIT	LITHOLOGY	THICKNESS
2-31	Foraminifera-crinoid Wackestone, dark grey, weathers slightly lighter. Grains dominated by small foraminifera and coarse to very coarse sand size crinoid columnals. Grains also include brachiopod fragments. Lenticular nodules black chert common. Chert weathers brown or white. Nodules range to 20 cm thick and 1 m long. Thick bedded. Forms mostly covered but locally well exposed cliff face. Basal contact sharp.	1.75 m (5.8')
TS 2-31	Top: Fine-coarse calcarenite; packed, ostracod, foraminifera, crinoid, spicule Biomicrosparite:Packstone.	
TS 2-31	1.35 m (4.5') AB: Fine calcarenite-fine calcirudite; burrowed, packed, ostracod, foraminifera, crinoid, spicule Biomicrosparite:Packstone.	
2-30	Foraminifera Mudstone-Wackestone, dark grey, weathers grey. Grains dominated by small foraminifera, also crinoid columnals and brachiopod fragments. Scattered nodules of black chert, most abundant at top. Unit is mostly covered, upper portion best exposed. Forms base of 2-31 cliff face. Basal contact covered.	Approx. .45 m (1.5')
TS 2-30	.15 m (.5') BT: Fine-coarse calcarenite; quartz-bearing, packed, spicule, brachiopod, foraminifera, crinoid Biomicrite:Packstone.	
2-29	<u>Pelalaxis</u>-<u>Chaetetes</u> Boundstone, grey, weathers light grey or tan to brown. Colonial rugose corals, solitary rugose corals and <u>Chaetetes</u> colonies all in growth position, form laterally continuous bed. Matrix rock is wackestone with small foraminifera and bryozoan fragments. Locally silicified, coral and <u>Chaetetes</u> colonies mostly silicified. Forms low broken ridge or band of slumped and in place coral blocks. Top not well exposed. Basal contact covered.	.75 m (2.5')
TS 2-29	Fine calcarenite-fine calcirudite; cherty, packed, foraminifera, coral, bryozoan, spicule Biomicrite:Packstone.	
2-28	Cherty Crinoid Wackestone, dark grey, weathers grey. Chert is black, weathers brown. Grains dominated by coarse sand to granule size crinoid columnals. Grains also include silicified calcareous algae, brachiopod fragments, small foraminifera and rare solitary rugose corals. Abundant highly weathered chert nodules at top and two to three prominant chert lenses in middle of unit. Chert lenses have lateral continuity but are locally discontinuous. Unit shows no internal bedding	1.15 m (3.8')

UNIT	LITHOLOGY	THICKNESS

except for appearance of bedding given by chert lenses. Forms laterally prominant cliff face, locally covered. Basal contact sharp.

TS 2-28 Top: Fine calcarenite-fine calcirudite; chert-bearing, poorly washed, crinoid, foraminifera, coralline algae Biosparite: Packstone.

TS 2-28 .3 m (.5') AB: Very fine calcarenite-fine calcirudite; cherty, packed, foraminifera, bryozoan, brachiopod, ostracod, crinoid, spicule Biomicrite:Packstone.

2-27 Foraminifera Wackestone, dark grey, weathers grey. Small foraminifera only identified grains. Scattered limonite and hematite filling fractures. Thick bedded, mostly covered. Forms base of 2-28 prominant cliff. Basal contact not exposed. 1.35 m (4.5')

TS 2-27 Top: Coarse calcilutite-coarse calcarenite; packed, foraminifera, Biopelmicrosparite:Wackestone.

2-26 Wackestone, dark grey, weathers grey. Grains include coarse sand size crinoid columnals, rugose corals, brachiopods and small foraminifera. Rugose corals and brachiopods silicified. Chert nodules, dark brown, highly weathered, common in upper 10 cm. Unit forms single bed. Forms laterally exposed cliff face. Basal contact sharp, slightly irregular. .75 m (2.4')

TS 2-26 Top: Coarse calcilutite-fine calcirudite; packed, foraminifera, ostracod, spicule, crinoid Biopelmicrite: Packstone.

TS 2-26 Center: Coarse calcilutite-fine calcirudite; packed, foraminifera, brachiopod, ostracod, crinoid Biopelmicrite: Packstone.

2-25 Packstone, dark grey, weathers grey. Grains include coarse sand size crinoid columnals, brachiopod fragments, whole brachiopods, and fine to very fine quartz sand. Limonite and hematite grain coatings common. Forms single bed, laterally partly covered. Basal contact sharp, wavy. .3 m (1')

TS 2-25 Top: Very fine-coarse calcarenite; quartz-bearing, packed, foraminifera, ostracod, brachiopod, pellet, crinoid Biomicrite:Packstone.

UNIT	LITHOLOGY	THICKNESS
2-24	Crinoid Wackestone, dark grey, weathers grey. Grains dominated by coarse sand size crinoid columnals, also rare silicified brachiopods. Grins most abundant at base, become less abundant at top. Unit forms single bed. Most blocks slumped. Basal contact sharp, wavy and irregular.	.7 m (2.3')
TS 2-24	Top: Very fine-coarse calcarenite; packed, foraminifera, brachiopod, ostracod, crinoid, spicule Biomicrite:Packstone.	
TS 2-24	.1 m (.3') AB: Very fine calcarenite-fine calcirudite; packed, foraminifera, brachiopod, bryozoan, crinoid, spicule Biomicrite:Packstone.	
2-23	Chert, black, weathers brown. Forms single irregular bed. Base more tabular than top. Thickness variable due to irregular contacts. Thickness ranges from 10 cm to 25 cm Covered laterally, locally well exposed. Basal contact sharp.	Average .15 m (.5')
TS 2-23	Fossiliferous chert.	
2-22	Wackestone, dark grey, weathers light grey to orange. Grains moderately well sorted, include crinoid columnals, brachiopod fragments and rare solitary rugose corals. Scattered limonite and quartz inclusions. Forms single bed. Laterally covered, locally well exposed. Basal contact sharp, slightly irregular.	.1 m (.4')
TS 2-22	Base: Fine calcarenite-fine calcirudite; quartz-rich, packed, brachiopod, bryozoan, crinoid Biomicrite:Packstone.	
2-21	Quartzarenite, reddish grey, weathers brown. Grains moderately well sorted, well rounded, fine to medium sand size quartz. Calcite cement with some hematite and limonite, locally moderately well exposed. Exposed portion forms single bed. Laterally covered. Slump blocks common on underlying covered interval. Basal contact covered. (Southeast of the measured section this unit has grains to granule and small pebble size and apparent wood fragmet impressions to 5 cm wide by 10 cm long. Unit also has thickness of at least 1.2 m.)	.25 m (.8')
TS 2-21	Top: Poorly sorted, fine to medium grained, angular, calcite cemented, Quartzarenite.	

UNIT	LITHOLOGY	THICKNESS

OFFSET 17.5 m (57') south 22° east of main section line to measure units 2-21, 2-22, and 2-23.

2-20	Covered	3.4 m (11.3')
2-19	Wackestone and Chert, very dark grey or black, weathers light grey. Chert is black, weathers brown. Grains include crinoid columnals, and rare small brachiopods. Chert lenses have lateral continuity, range in thickness from 0 to 10 cm. Medium bedded. Forms laterally broken, highest cliff face before wide covered interval. Basal contact sharp, irregular.	.35 m (1.2')
TS 2-19	Top: Very fine-coarse calcarenite; sparse, ostracod, brachiopod, spicule Biomicrite:Wackestone.	
TS 2-19	Base: Very fine calcarenite-fine calcirudite; sparse, ostracod, crinoid, spicule Biomicrite:Wackestone.	
2-18	Chert, black, weathers brown. Scattered silicified skeletal grains. Forms single wavy bed with slight thickness variation. Basal contact sharp.	.2 m (.6')
TS 2-18	Top: Fossiliferous Chert.	
2-17	Crinoid Packstone, grey, weathers light grey. Grains dominantly well sorted, crinoid columnals, also include small whole brachiopods, rugose corals and bryozoans. Unit forms single bed. Forms lowest unit of terraced cliff. Basal contact sharp where exposed.	.35 m (1.1')
TS 2-17	Center: Very fine calcarenite-fine calcirudite; packed, bryozoan, ostracod, crinoid Biomicrite:Packstone.	
2-16	Wackestone, grey, weathers light grey. Grains include small foraminifera, ostracods, brachiopods and rugose corals. Rugose corals and brachiopods commonly silicified. Nodules of black, weathered brown, chert scattered. Chert most abundant near center of unit. Very thick bedded or single massive bed. Forms prominant cliff face. Basal contact sharp where exposed.	1.45 m (4.8')

UNIT	LITHOLOGY	THICKNESS

TS 2-16 1.2 m (4') AB: Fine-coarse calcarenite; sparse, brachiopod, crinoid, bryozoan, spicule Biomicrosparite:Wackestone.

TS 2-16 .6 m (2') AB: Coarse calcilutite-coarse calcarenite; packed, foraminifera, pellet, ostracod, bryozoan, brachiopod, crinoid, spicule Biomicrite:Packstone.

- -

OFFSET to point north 78° west, 13.5 m (44') above the base of the canyon to measure unit 2-16 and higher units.

- -

2-15 Wackestone-Packstone, grey, weathers light grey. Grains include crinoid columnals, algal debris, small foraminifera, and brachiopods. Authigenic quartz crystals common. Brachiopods commonly silicified. Two prominant chert beds found in upper half of unit, 1.7 m and 2.0 m above the base. Chert is black, weathers brown. Lower chert bed ranges from 0 to 10 cm thick. Upper chert bed more continuous, ranges from .2 m to .35 m thick. Scattered chert nodules outside main chert beds. Very thick bedded or massive with little or no bedding. Forms prominant cliff face with well exposed upper dip slope surface. Basal contact covered. — 2.9 m (9.5')

TS 2-15 Top: Coarse calcilutite-medium calcarenite; quartz-bearing, packed, brachiopod, foraminifera, ostracod, crinoid, spicule Biomicrite:Packstone.

TS 2-15 1.5 m (5') AB: Fine-coarse calcarenite; quartz-bearing, poorly washed, intraclast, pellet, brachiopod, ostracod, foraminifera, crinoid Biosparite:Packstone.

2-14 Wackestone-Packstone, grey, weathers light grey. Grains include well sorted coarse sand size crinoid columnals, silicified brachiopods and bryozoans. Chert nodules common. Chert is black, weathers brown, forms lenticular beds and nodules to .3 m thick and 2 m long. Medium to very thick wavy bedded with thin interbedded shale zones to 3 cm thick. Forms prominant cliff northeast of section, becomes mostly covered to southwest. Basal contact sharp, wavy, marked by 1 cm or less thick pink packstone. — 4.55 m (15')

TS 2-14 .15 m (.5') BT: Very fine-medium calcarenite; packed, bryozoan, ostracod, crinoid, spicule Biomicrite:Packstone.

UNIT	LITHOLOGY	THICKNESS

TS 2-14 3.65 m (12') AB: Very fine-coarse calcarenite; packed, brachiopod, ostracod, spicule Biomicrite:Packstone.

TS 2-14 1.5 m (5') AB: Coarse calcilutite-medium calcarenite; packed, ostracod, spicule, crinoid Pelmicrite:Packstone.

TS 2-14 Base: Very fine-medium calcarenite; quartz-bearing, packed, ostracod, crinoid spicule Biomicrite:Packstone.

2-13 Cherty Wackestone, dark grey, weathers light grey. Grains dominantly very fine unidentified skeletal fragments. Grains also include tabulate and rugose corals. Chert is black, weathers brown, forms approximately 40% of rock. Lenticular chert nodules to .4 m thick give appearance of bedding but wackestone is massive and shows little internal bedding. Forms laterally prominant cliff face on base of cliff face. Basal contact sharp, wavy, locally rippled. — 1.3 m (4.3')

TS 2-13 .45 m (1.5') BT: Fine-medium calcarenite; cherty, crinoid Biosparite:Packstone.

- -

OFFSET 13 m (43') north 47° east on unit 13 to get accurate measurement of units 2-12, 2-13 and 2-14.

- -

2-12 Cherty Packstone and Calcareous Shale, light grey. Grains include brachiopods, crinoid columnals, pelecypods and fenestrate bryozoans. Chert is black or very dark grey. Chert and packstone thin to medium bedded. Shale zones very thin bedded or laminate. Bedding wavy, rippled. Shales form in more rippled zones. Unit poorly exposed, covered laterally. Locally moderately well exposed in undercut at base of unit 13. Basal contact covered. — .85 m (2.8')

TS 2-12 .15 m (.5') BT: Very fine-coarse calcarenite; chert-bearing, packed, crinoid, spicule Biomicrite:Packstone.

2-11 Covered. — .6 m (1.9')

2-10 Mudstone, grey, weathers light grey. Grains restricted to small foraminifera and rare solitary rugose corals. Rare silicified nodules. Thick bedded or massive. Mostly slumped, laterally covered or slumped. Basal contact covered. — 1.3 m (4.3')

UNIT	LITHOLOGY	THICKNESS

TS 2-10 .15 m (.5') BT: Coarse calcilutite-fine calcirudite; sparse, brachiopod Pelmicrite:Wackestone.

TS 2-10 Base: Coarse calcilutite-fine calcirudite; sparse, brachiopod, foraminifera, pellet Intramicrosparite:Wackestone.

2-9 Covered. 2 m (6.5')

- -

OFFSET 13 m (43') south 37° east on top of unit 8 to measure higher units.

- -

2-8 Wackestone, grey, weathers light grey. Grains include crinoid columnals, small brachiopods and rugose corals. Corals are silicified, abundant in upper 15 cm of unit. Single highly fractured bed. Forms low terrace with rubbly upper dip slope surface. Basal contact sharp. .75 m (2.5')

TS 2-8 Top: Coarse calcilutite-coarse calcarenite; packed, foraminifera, brachiopod, bryozoan, crinoid Biopelmicrite: Packstone.

TS 2-8 Base: Coarse calcilutite-medium calcarenite; packed, brachiopod, bryozoan, crinoid Pelmicrite:Wackestone.

2-7 Crinoid Packstone, grey, weathers light grey. Grains dominated by coarse to very coarse sand size crinoid columnals. Grains also include brachiopod spines, ostracods and bryozoans. Many grains coated. Unit forms single bed with no internal bedding. Forms low terrace. Basal contact sharp. .45 m (1.4')

TS 2-7 Top: Fine calcarenite-fine calcirudite; poorly washed, foraminifera, bryozoan, brachiopod, crinoid Biosparite: Packstone.

TS 2-7 Base: Coarse calcilutite-coarse calcarenite; poorly washed, bryozoan, ostracod, brachiopod, crinoid Biopelsparite: Packstone.

2-6 Mudstone, dark grey, weathers grey. Grains restricted to rare brachiopods and crinoid columnals. Brachiopods commonly silicified. Single tabular bed forms low terrace. Basal contact sharp. .4 m (1.3')

UNIT	LITHOLOGY	THICKNESS

TS 2-6 Top: Coarse calcilutite-medium calcarenite; sparse, brachiopod, crinoid Pelmicrosparite:Wackestone.

- -

OFFSET 28 m (92') south 37° east on well exposed upper dip slope surface of unit 2-5 to measure higher units.

- -

2-5 Wackestone, dark grey, weathers grey. Grains include algal debris, encrusting foraminifera, other small foraminifera, brachiopods, pelecypods, and large solitary rugose corals. Scattered lenticular chert nodules to 3 cm thick and 10 cm long. Thick bedded or single massive bed with well exposed dip slope. Basal contact sharp. — .9 m (3')

TS 2-5 Top: Coarse calcilutite-fine calcirudite; packed, brachiopod, spicule Pelmicrosparite:Wackestone.

TS 2-5 .45 m (1.5') BT: Very fine-coarse calcarenite; packed, brachiopod, foraminifera, crinoid, spicule Biomicrite: Wackestone.

- -

OFFSET 38 m (125') south 57° east on top of unit 2-4 to measure higher units.

- -

2-4 Wackestone, dark grey, weathers grey. Grains include brachiopods, rugose corals, crinoid columnals, and small foraminifera. Chert nodules and lenses common. Prominant chert lense to 20 cm thick, 0 to 5 cm above base. Chert is black, weathers brown. Forms laterally continuous single bed with well exposed dip slope. Basal contact sharp. — .75 m (2.5')

TS 2-4 .15 m (.5') BT: Fine calcarenite-fine calcirudite; chert-bearing, sparse, foraminifera, brachiopod, crinoid Biomicrite: Wackestone.

TS 2-4 Base: Coarse calcilutite-medium calcirudite; chert-bearing, sparse, foraminifera, bryozoan, brachiopod, crinoid Biosparite:Wackestone.

UNIT	LITHOLOGY	THICKNESS
2-3	Wackestone, dark grey, weathers mottled grey and light grey. Grains include intraclasts, brachiopod fragments, whole productid brachiopods, crinoid columnals, and solitary rugose corals. Burrows common. Many larger grains silicified. Single tabular bed. Forms low terrace and wide upper dip slope surface. Basal contact sharp.	.4 m (1.3')
TS 2-3	Top: Coarse calcilutite-fine calcirudite; chert-bearing, intraclast, foraminifera, bryozoan, crinoid, Biopelmicrite: Wackestone.	
2-2	Wackestone and Chert, grey, weathers grey. Grains include whole productid brachiopods, bryozoans, crinoid columnals, and small foraminifera. Chert is black, weathers brown, forms lenses 2 to 5 cm thick and up to many tens of meters long. Most chert lenses less than 1 m long. Very thick to thick bedded. Forms cliff face and well exposed dip slope. Often the lowest Pennsylvanian unit exposed. Basal contact sharp.	4.1 m (13.5')
TS 2-2	3.05 m (10') AB: Coarse calcilutite-coarse calcarenite; organic-rich, chert-bearing, sparse, ostracod, bryozoan, brachiopod, crinoid, spicule Biopelmicrite:Wackestone.	
TS 2-2	1.5 m (5') AB: Coarse calcilutite-fine calcirudite; sparse, brachiopod, crinoid Pelmicrosparite:Wackestone.	
TS 2-2	.75 m (2.5') AB: Very fine-coarse calcarenite; sparse, foraminifera, bryozoan, brachiopod, crinoid Biopelmicrosparite:Wackestone.	
TS 2-2	Base: Coarse calcilutite-coarse calcarenite; quartz-bearing, sparse, foraminifera, bryozoan, brachiopod Biopelmicrosparite: Wackestone.	
2-1	Mudstone, grey, weathers grey. Grains include common large solitary rugose corals, colonial rugose corals, and brachiopods. Grains commonly silicified. Rare chert lenses. Very thick bedded. Forms broken, rubbly cliff face, partly covered laterally. Basal contact covered.	3.2 m (10.5')
TS 2-1	1.5 m (5') AB: Coarse calcilutite-medium calcarenite; sparse, ostracod, brachiopod Biopelmicrite:Wackestone.	
TS 2-1	Base: Fine calcirudite; quartz-bearing, fossiliferous Dismicrite:Mudstone.	

Mississippian Helms Formation

The Mississippian/Pennsylvanian contact is not well exposed at this section. Just north of the measured section Helms Formation oolitic grainstones and shale are within 1 m of the base of unit 2-1.

Type Derryan

Sierra County, New Mexico

Measured section 3 is located in the Derry Hills at the southwest margin of the Organ Mountains (U.S.G.S. Garfield Quadrangle [New Mexico]; sec. 29, T. 17 S., R. 4 W.; 32°47'50" North, 107°16'37" West). It is a detailed remeasurement of M. L. Thompson's (1942, p. 32-33) section 19. Thompson (1942, p. 26-27) proposed this as the type section for the Derry Series which he defined to include all rocks in central to extreme south-central New Mexico between the base of the Pennsylvanian System and the basal part of the Desmoinesian Series. Thompson (1948, p. 68) later refined the definition of the Derry Series to include rocks of south-central Mew Mexico of post-Morrowan and pre-Desmoinesian age but the type section was not redefined. Thompson's "formations" within the Derry Series do not fit the accepted definition of formations and have been dropped. However, the lithologies Thompson described can be easily identified.

The Derryan Type section is located in Sierra County, just north of the Dona Ana county line on the west slope of the Derry Hills approximately 1.3 km (.8 mile) east of Derry, New Mexico. To reach the measured section take Interstate 25 74 km (46 miles) north of the I-25/highway 70 intersection in Las Cruces, or 38 km (23.7 miles) south of Exit 76 in Truth or Consequences, to the steep roadcut 1.6 km (1 mile) north of Exit 151 (Garfield Exit). Units 3-1 through 3-5 were measured at the relatively fresh exposure where basal Pennsylvanian strata reach the terrace across the center of the I-25 roadcut. Units 3-6 and higher were measured up the ridge 200 m (650 ft) north 40° West of the initial measuring point.

Units 3-3 through 3-41 cover section originally described by Thompson (1942, p. 32-33). Units 3-42 through 3-60 have not been previously described. A small low-angle reverse fault is crossed in the measured section at the contact of units 3-44 and 3-43. Part or all of unit 3-44 is repeated unit 3-43.

The beds strike North 44° West and dip 10° Northeast. Measurements were made with a Jacob's staff and Abney hand level. Thicknesses have been rounded to the nearest .05 m (or .1 ft). The total thickness of this measured section is approximately 55 m (182 ft).

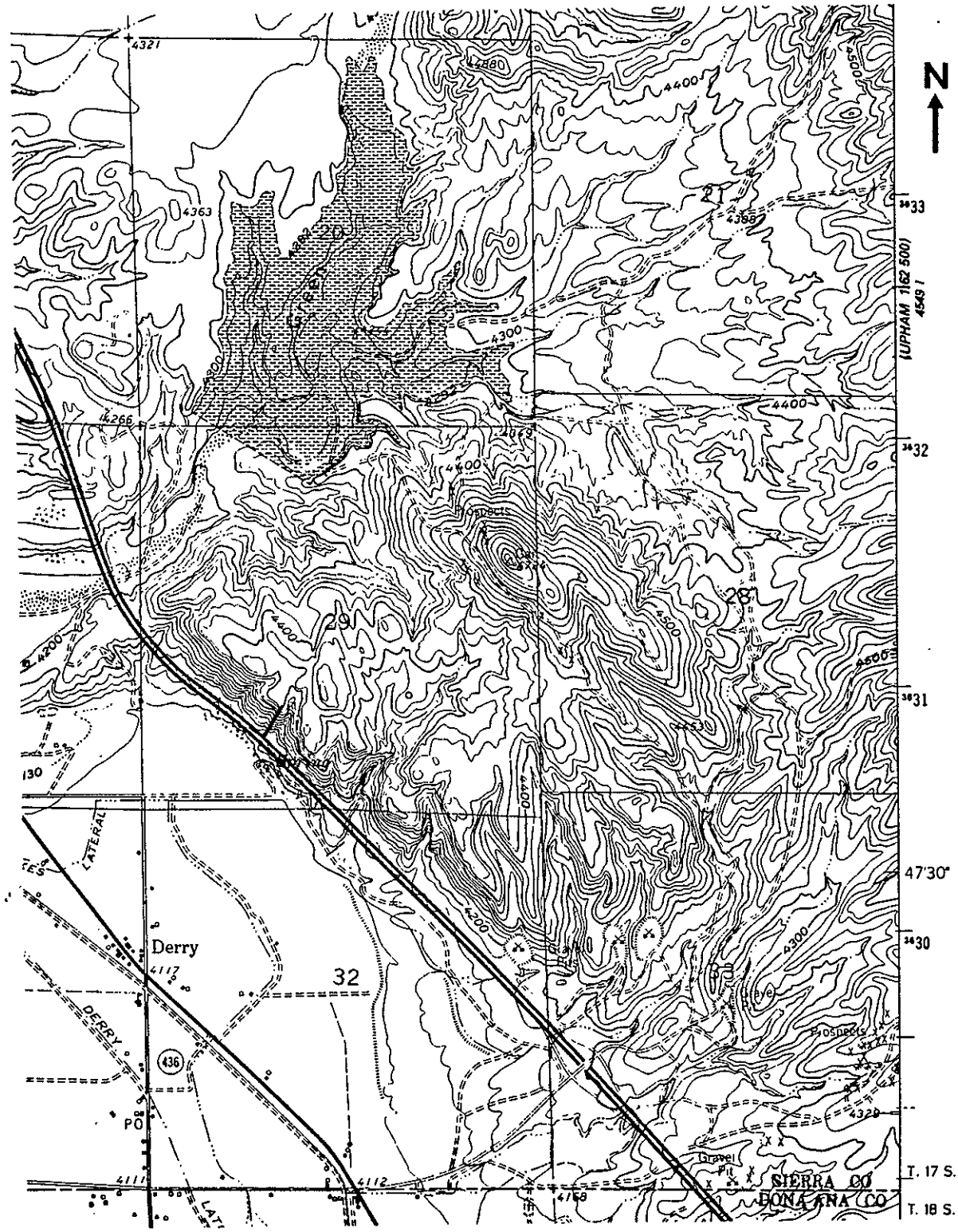


Figure 3. Type Derryan section locality map (from U.S.G.S. Garfield Quadrangle, New Mexico).

UNIT	LITHOLOGY	THICKNESS
3-60	Wackestone, grey, weathers light grey to tan or yellow. Grains include small foraminifera fusulinids (Wedekindellina, Beedeina), crinoid columnals, whole and fragmented productid brachiopods and calcareous algae. Unit is burrowed, fusulinids most abundant within burrows. Medium to thick wavey bedded. Many block slumped. Forms low terrace with rubbly slope over upper beds. Basal contact covered.	0.7 m (2.4')
TS 3-60	Base: Coarse calcilutite-coarse calcarenite; packed bryozoan, foraminifera, ostracod, brachiopod, crinoid, spicule Biomicrite:Packstone.	
3-59	Covered	1.05 m (3.5')
3-58	Packstone, grey, weathers mottled light grey and tan. Grains include crinoid columnals, ostracod valves, brachiopod shell and spine fragments, encrusting foraminifera, bryozoans and others. Medium grained, well sorted, many grains coated. Unit is burrowed. Mottled appearance due to higher micrite content in burrows than in rest of unit. Forms mostly covered low terrace, locally well exposed, many blocks slumped. Basal contact covered.	.45 m (1.4')
TS 3-58	Base: Very fine calcarenite-fine calcirudite; poorly washed, foraminifera, ostracod, crinoid, bryozoan, brachiopod, spicule Biosparite:Packstone.	
3-57	Cherty Wackestone, grey, weathers light grey. Chert beds and lenticular nodules form 40% of unit. Chert is black, weathers brown. Grains include crinoid columnals, encrusting foraminifera, scattered fusulinids and silicified solitary rugose corals to 3 cm diameter and 10 cm long. Medium to thick wavy bedded. Chert thin to thick bedded. Unit forms upper half of prominent cliff face. Top burrowed, rounded back from cliff face, and mostly covered. Basal contact sharp, set back 0.3 to 1 m from cliff front.	2.45 m (8.1')
TS 3-57	Top: Very fine calcarenite-fine calcirudite; packed, foraminifera, bryozoan, brachiopod, crinoid, spicule Biomicrite:Packstone.	
TS 3-57	1.5 m (5') A.B.: Fine calcarenite-fine calcirudite; sparse, bryozoan, brachiopod, foraminifera, crinoid Biomicrosparite: Wackestone.	

UNIT	LITHOLOGY	THICKNESS
TS 3-57	.45 m (1.5') A.B.: Very fine-coarse calcarenite; sparse, foraminifera, brachiopod, crinoid Biomicrosparite:Wackestone.	
3-56	Wackestone and chert, grey, weathers light grey. Grains include silicified solitary rugose corals, algal debris, whole and fragmented brachiopods, crinoid columnals, and fusulinids. Fusulinids are uncommon at base, more abundant in upper portion of unit. Chert forms sub-rounded nodules to 20 cm in diameter and lenticular beds to 10 cm thick and over 3 m long. Medium to thick wavy bedded. Forms lower half of laterally well exposed prominent cliff face. Basal contact covered.	1.3 m (4.2')
TS 3-56	Top: coarse calcilutite-fine calcirudite; cherty, packed, foraminifera, brachiopod, crinoid Biomicrite:Packstone.	
TS 3-56	.45 m (1.5') AB: Coarse calcilutite-coarse calcarenite; packed foraminifera, ostracod, brachiopod, crinoid, Biomicrite: Packstone.	
3-55	Covered	.8 m (2.7')
3-54	Dolomitic Wackestone, grey, weathers light grey to tan. Grains include whole and fragmented productid brachio-pods, crinoid columnals, small foraminifera and rare fusulinids. Silt sized dolomite rhombs found throughout unit but most abundant at top. Small limonite inclusions common. Medium to thick bedded. Forms low cliff face or rubbly terrace. Top mostly covered. Basal contact sharp, mostly covered.	.75 m (2.5')
TS 3-54	Top: Coarse calcilutite-coarse calcarenite; chert-bearing, dolomite-bearing, poorly wahsed, foraminifera, spicule, bryozoan, brachiopod, pellet Biosparite:Packstone.	
TS 3-54	Base: coarse calcilutite-fine calcirudite; packed, foraminifera, ostracod, brachiopod, crinoid, pellet Biomicrite:Packstone.	
3-53	Wackestone, grey, weathers slightly lighter grey. Grains include common fusulinids, algal debris, crinoid columnals, brachiopod shell and spine fragments, and silicified solitary rugose corals. Fusulinids are most abundant in lows on wavy upper bedding plane surface. Lenticular chert nodules to 3 cm by 10 cm common. Medium to thick bedded. Crops out as linear trend of mostly slumped blocks, rare blocks in place. Basal contact covered.	1.05 m (3.5')

UNIT	LITHOLOGY	THICKNESS
TS 3-53	.2 m (.8') BT: Coarse calcilutite-fine calcirudite; packed, ostracod, bryozoan, phylloid algae, pellet Biomicrite: Wackestone.	
TS 3-53	.3 m (1') AB: Coarse calcilutite-fine calcirudite; sparse, bryozoan, phylloid algae, ostracod Biomicrite:Wackestone.	
3-52	Covered	1.35 m (4.5')
3-51	Wackestone, grey, weathers grey or limonite stained tan to yellow. Grains include crinoid columnals, brachiopod spine and shell fragments, ostracods, algal debris, and rare fusulinids. Grains sorted. Limonite and hematite inclusions common. Thick bedded. Forms prominent, well-exposed cliff face and terrace, locally slumped laterally.	.7 m (2.2')
TS 3-51	Top: Very fine-coarse calcarenite: packed, crinoid brachiopod, phylloid algae, spicule, ostracod Biomicrite: Packstone.	
TS 3-51	Base: Fine calcarenite-fine calcirudite: poorly washed, ostracod, crinoid, foraminifera, brachiopod Biosparite: Packstone.	
3-50	Wackestone, grey, weathers grey or caliche coated white. Grains include phylloid algae, crinoid columnals and bryozoans. Highly nodular with individual nodules from less than 1 cm in diameter to over 10 by 30 cm. Unit initially appears to be a limestone cobble conglomerate but the wavy lenticular nature of the larger nodules does not support this interpretation. Forms locally well exposed, laterally partly to mostly covered, rubbly cliff face or undercut at base of unit 3-51. Basal contact sharp.	.35 m (1.1')
TS 3-50	Base: Fine calcarenite-fine calcirudite: sparse, foraminifera, brachiopod, crinoid Biomicrosparite:Wackestone.	
3-49	Crinoidal Wackestone, grey, weathers mottled grey, light grey and tan. Grains include crinoid columnals, brachiopod shell and spine fragments, and algal debris. Grains moderately well sorted. Unit highly burrowed, burrows irregular, to 3 cm x 10 cm, contain higher proportion micrite than nonburrowed portion of unit. Forms moderately well exposed low terrace, locally slumped. Basal contact covered.	.3 m (1.0')

UNIT	LITHOLOGY	THICKNESS

TS 3-49 Top: Very fine calcarenite-fine calcirudite: chert-bearing, packed, foraminifera, crinoid, phylloid algae, spicule, bryozoan, ostracod Biomicrite:Packstone.

- -

OFFSET 10.4 m (34') north 75° west on top of unit 3-48 to measure higher units.

- -

3-48 Fusulinid Wackstone, grey, weathers grey. Grains include common fusulinids, crinoid columnals and brachiopod fragments. Chaetetes colonies to .3 m across occur in growth position in lower portion of unit. Burrows common, some hematite inclusions. Medium wavy bedded. Forms rubbly partly covered slope, locally slumped. Basal contact sharp, wavy. .45 m (1.4')

TS 3-48 Base: Fine-coarse calcarenites: sparse, brachiopod, crinoid, foraminifera Biomicrosparite:Wackestone.

3-47 Wackestone-Packstone, grey, weathers grey. Grains include crinoid columnals, whole and fragmented productid brachiopods, bryozoans and fusulinids. Medium to thin wavy bedded, locally nodular. Locally moderately well exposed in undercut at base of 3-48, laterally forms mostly covered terrace. Basal contact covered. .2 m (.7')

TS 3-47 Base: Fine calcarenite-fine calcirudite; chert-bearing, packed, foraminifera, crinoid, brachiopod Biomicrite: Wackestone.

3-46 Wackestone, grey, weathers light grey. Grains include crinoid columnals, brachiopod fragments and rare whole brachiopods, phylloid and coralline algae, and gastropods. Unit is more micritic at base, becomes increasingly more skeletal near the top. Unit is burrowed, with burrows most abundant in lower .3 m. Bedding poorly defined, medium wavy beds or massive cliff face. Top forms mostly covered rubbly terrace. Basal contact sharp but locally indistinct due to burrows. .95 m (3.1')

TS 3-46 .6 m (2') AB: Coarse calcilutite-fine calcirudite; poorly washed, brachiopod, crinoid, foraminifera Pelsparite: Wackestone.

UNIT	LITHOLOGY	THICKNESS

OFFSET 7 m (23') west on top of unit 3-45 to measure higher units.

3-45 Phylloid Algae Wackestone, grey, weathers mottled grey and very light grey. Grains include phylloid algae, crinoid columnals, coralline algae, small foraminifera and brachiopod fragments. Unit is highly burrowed, burrows irregular, elongate to 2 cm diameter and 10 cm long. Chert common in approximately 10 cm thick discontinuous band of nodules at center of unit. Chert is black, weathers brown. Lower .6 m medium to thick wavy bedded, upper .9 m thick bedded or massive. — 1.55 m (5.1')

TS 3-45 .75 m (2.5') BT: Very fine calcarenite-fine calcirudite; sparse, foraminifera, phylloid algae, ostracod, crinoid, spicule Biomicrite:Wackestone.

3-44 Mudstone-Wackestone, dark grey, weathers grey. Grains include crinoid columnals, brachiopod fragments and rare whole silicified brachiopods, corraline algae and rare fusulinids. Chert common, forms lenticular beds to 15 cm thick. Chert is black, weathers brown. Medium wavy bedded with locally weathered thin bedded zones. Forms prominant cliff face with undercut at base. Base weathered, nodular. Basal contact sharp, at small low angle reverse fault. Part or all of unit may be repeated section. — 1.7 m (5.6')

TS 3-44 .15 m (.5') BT: Coarse calciutite-coarse calcarenite; dolomitic, poorly washed, foraminifera, ostracod, brachiopod, spicule, pellet Biosparite:Packstone.

TS 3-44 .9 m (3') AB: Coarse calcilutite-coarse calcarenite; poorly washed, foraminifera, ostracod, brachiopod, crinoid, spicule, pellet Biosparite:Packstone.

3-43 Mudstone, dark grey, weathers grey. Grains include rare fusulinids (lowest Beedeina), crinoid columnals, brachiopod fragments and rare whole productid brachiopods. Chert common in lenticular nodules and beds to 10 cm thick and many meters long. Chert is black, weathers brown. Lower beds dolomitic. Medium to thick wavy bedded with rare thin bedded shaly zones. Forms middle portion of prominant cliff face. Basal contact gradational. — 1.5 m (4.9')

UNIT	LITHOLOGY	THICKNESS
TS 3-43	.8 m (2.7') AB: Coarse calcilutite-coarse calcarenite; packed, foraminifera, brachiopod, ostracod, crinoid, spicule, pellet Biomicrite:Packstone.	
TS 3-43	.3 m (1') AB: Coarse calcilutite-coarse calcarenitep packed, foraminifera, ostracod, crinoid, spicule, pellet Biomicrite: Packstone.	
3-42	Fossiliferous Dolomite, dark grey, weathers grey or limonite stained orange. Grains include crinoid columnals and brachiopod fragments. Matrix silt sized dolomite rhombs. Medium to thick wavy bedded, thin bedded or laminate at base. Forms undercut or rubbly slumped zone in cliff face. Basal contact sharp, marked by 6 cm thick shaly zone.	.5 m (1.6')
TS 3-42	Top: Fine-coarse calcarenite; organic-rich, fossiliferous, finely crystalline dolomite.	
3-41	Fusulinid Wackestone, grey, weathers grey to tan. Grains include abundant fusulinids (Fusulinella devexa), crinoid columnals, bryozoans and whole brachiopods. Chert common in lenticular beds to .3 m thick and in subrounded nodules to .3 m in diameter. Chert is black, weathers brown, commonly contains abundant white silicified fusulinids. Medium wavy bedded in lower 1 m, locally nodular at base, medium to thick wavy bedded in rest of unit. Forms base of prominant cliff face. Lower 1 m mostly covered but locally well exposed. Basal contact sharp, wavy. (This unit equivalent to Thompson (1942), Section 19, Unit 21, highest type Derryan.)	3.3 m (10.8')
TS 3-41	3.2 m (10.5') AB: Very fine calcarenite-fine calcirudite; organic rich, packed, brachiopod, ostracod, foraminifera, spicule, crinoid Biomicrite:Packstone.	
TS 3-41	2.15 m (7') AB: Very fine calcarenite-fine calcirudite; organic rich, packed, foraminifera, phylloid algae, brachiopod, ostracod, crinoid, spicule Biomicrite:Packstone.	
TS 3-41	1.2 m (4') AB: Very fine calcarenite-fine calcirudite; organic rich, packed, phylloid algae, crinoid, foraminifera, spicule Biomicrite:Packstone.	

UNIT	LITHOLOGY	THICKNESS

3-40 Wackestone, grey, weathers grey with hematite stained pink to red burrowed zones. Grains include whole brachiopods, phylloid algae and abundant fusulinids. Hematite common in irregular elongate burrowed zones to 2 cm in diameter and 10 cm long. Thick bedded. Forms locally well exposed, laterally mostly covered, terrace or weathered slope, many blocks slumped. Basal contact sharp, mostly covered. .8 m (2.7')

TS 3-40 .15 m (.5') BT: Very fine calcarenite-fine calcirudite; packed, foraminifera, phylloid algae, ostracod, brachiopod, crinoid, spicule Biomicrite:Packstone.

3-39 Algal Wackestone, grey, weathers slightly lighter grey. Grains include phylloid algae, crinoid columnals, brachiopod fragments and scattered fusulinids. Chaetetes colonies in growth position to .3 m in diameter common on bedding plane surfaces. Approximately 50% of the Chaetetes colonies are silicified. Lenticular and subround chert nodules common. Lenticular nodules to 10 cm thick and 1 m long. Subround nodules to 10 cm in diameter. Chert is black, weathers brown. Medium to very thick wavy bedded. Forms laterally broken line of large slumped blocks, rare blocks in place. Basal contact sharp. 1.5 m (4.9')

TS 3-39 .3 m (1') BT: Coarse calcilutite-fine calcirudite; packed foraminifera, bryozoan, phylloid algae, crinoid, brachiopod, pellet Biomicrite:Packstone.

TS 3-39 .6 m (2') AB: Coarse calcilutite-fine calcirudite; packed foraminifera, bryozoan, brachiopod, phylloid algae, pellet Biomicrite:Packstone.

TS 3-39 Base: Coarse calcilutite-fine calcirudite; poorly washed, bryozoan, ostracod, brachiopod, foraminifera, crinoid, pellet Biosparite:Packstone.

3-38 Packstone, olive grey to yellow, weathers tan to orange. Grains include fusulinids, crinoid columnals and brachiopod fragments. Limonite abundant as grain coatings and as cement. Burrowed at top. Thick tabular bedded. Forms mostly covered slope or low slumped terrace. Locally well exposed at base of large 3-39 slump blocks. Basal contact covered. .5 m (1.7')

TS 3-38 Top: Very fine calcarenite-fine calcirudite; poorly washed, ostracod, brachiopod, foraminifera, crinoid Biosparite: Packstone.

UNIT	LITHOLOGY	THICKNESS
3-37	Covered	1.75 m (5.8')

OFFSET 23 m (75') east around hill on top of unit 3-36 to measure higher units.

-3-

36 Mudstone, grey, weathers light grey or light yellow to tan. Grains include abundant whole productid brachiopods in growth position, other brachiopods, crinoid columnals, echinoderm spines, fenestrate bryozoans. Grains concentrated on upper bedding plane surface. Limonite inclusions common. Medium to thick bedded. Forms locally slumped or broken but laterally prominant terrace and cliff face. Basal contact sharp. .7 m (2.3')

TS 3-36 .25 m (.8') AB: Coarse calcilutite-fine calcirudite; sparse, brachiopod, ostracod, crinoid, spicule Biomicrite:Wackestone.

3-35 Wackestone, grey to dark grey, weathers grey to tan. Grains include sorted crinoid columnals, whole productid brachiopods, rugose corals, algal debris, scattered fusulinids and rare planispiral gastropods. Single chert bed to 15 cm thick at top. Chert is black, weathers brown. Medium to thick wavy bedded. Forms laterally prominant cliff face. Locally slumped. Basal contact mostly covered but sharp where exposed. .8 m (2.6')

TS 3-35 .25 m (.8') AB: Fine-coarse calcarenite; packed, ostracod, brachiopod, crinoid Biomicrite:Packstone.

3-34 Mudstone-Wackestone, grey, weathers mottled grey and olive grey. Grains include crinoid columnals, brachiopod fragments, bryozoans, ostracods and rare fusulinids. Fusulinids most abundant at base. Unit is burrowed. Burrows elongate, to 2 cm by 10 cm, most abundant at top of unit. Forms massive layer with no internal bedding. Forms locally well exposed, laterally partly slumped and partly covered terrace or broken cliff face. Basal contact covered. .75 m (2.5')

TS 3-34 Top: Coarse calcilutite-fine calcirudite; sparse, algal, ostracod, spicule, brachiopod, crinoid Biomicrite:Wackestone.

TS 3-34 Base: Coarse calcilutite-fine calcirudite; sparse, foraminifera, ostracod, spicule, brachiopod, crinoid Biomicrite:Wackestone.

UNIT	LITHOLOGY	THICKNESS
3-33	Covered.	.5 m (1.7')
3-32	Crinoid Wackestone-Packstone, grey, weathers grey. Grains include crinoid columnals, brachiopod fragments, fusulinids, and rare whole brachiopods. Grains sorted. Very coarse sand to granule size. Chert nodules scattered through unit. Chert is grey, nodules to 2 by 3 cm. Medium to thick wavy bedded. Forms locally prominent, laterally partly slumped or covered blocky cliff face. Basal contact irregular and gradational over approximately 2 cm thickness.	.55 m (1.8')
TS 3-32	.15 m (.5') BT: Very fine calcarenite-fine calcirudite; poorly washed, ostracod, foraminifera, brachiopod, crinoid Biosparite:Packstone.	
TS 3-32	Base: Very fine calcarenite-fine calcirudite; poorly washed, foraminifera, ostracod, brachiopod, crinoid Biosparite: Packstone.	
3-31	Wackestone, grey, weathers grey to light tan. Grains include crinoid columnals, brachiopod fragments, ostracods, and rare fusulinids. Scattered limonite inclusions and grey chert in rare subround nodules to 3 cm diameter. Medium to thick bedded. Forms base of locally prominant, laterally slumped or covered cliff face. Lower half of unit mostly slumped or covered. Basal contact sharp where exposed.	.45 m (1.5')
TS 3-31	Top: Very fine calcarenite-fine calcirudite; packed, foraminifera, crinoid, ostracod, brachiopod Biomicrite: Packstone.	
TS 3-31	.3 m (1') AB: Very fine-coarse calcarenite; sparse, bryozoan, brachiopod, crinoid, ostracod Biomicrite:Wackestone.	
3-30	Calcareous Shale, olive green to light greenish grey or yellow. Thin bedded at top to laminate and fissile at base. Poorly exposed, mostly covered. Forms steep talus slope. Basal contact covered.	.45 m (1.5')

OFFSET 6 m (20') north 35° west on top of unit 3-29 to measure higher units.

UNIT	LITHOLOGY	THICKNESS
3-29	Wackestone, dark grey to olive grey, weathers tan to rusty brown or light grey. Grains include crinoid columnals, brachiopod fragments and ostracods. Silt sized quartz grains common. Limonitic inclusions and lenses to 1 mm by 10 mm abundant. Bedding poorly defined, massive to medium wavy bedded. Forms broken cliff face, many blocks slumpled. Basal contact gradational.	.65 m (2.1')
TS 3-29	.45 m (1.5') BT: Very fine calcarenite-fine calcirudite; chert bearing, burrowed, brachiopod, crinoid, spicule Biomicrite: Wackestone.	
3-28	Wackestone, dark grey, weathers light grey to tan. Grains include crinoid columnals, brachiopod fragments, ostracods and rare foraminifera. Limonite and hematite inclusions common. Contains nodular, thin wavy beds with thin (less than 1 cm) calcareous shale interbeds. Forms cliff face or undercut at base of unit 3-29. Basal contact sharp, marked by 1 cm thick shaley zone.	.35 m (1.2')
TS 3-28	.15 m (.5') BT: Very fine-coarse calcarenite; chert bearing, poorly washed, foraminifera, bryozoan, brachiopod, crinoid Biosparite:Packstone.	
3-27	Wackestone-Packstone, grey, weathers light grey to tan. Grains include algal debris, spicules, brachiopod fragments and scattered fusulinids. Limonite inclusions common. Thin wavy bedded. Forms rubbly terrace or cap on top of 3-26 cliff face. Laterally partly covered. Basal contact sharp.	.1 m (.4')
TS 3-27	Base: Very fine calcarenite-fine calcirudite; packed crinoid, brachiopod, foraminifera, spicule Biomicrite:Wackestone.	
3-26	Algal Wackestone-Packstone, dark grey, weathers grey to brown. Grains include algal debris, crinoid columnals and rare fusulinids. Grains well sorted, fine sand size. Prominant chert bed from .1 to .3 m thick at base. Chert is black, weathers brown. Lenticular and irregular chert nodules and hematite inclusions common. Chert nodules to .5 by 1 m in diameter. Thick, gently wavy bedded. Forms laterally prominant cliff face. Some blocks slumped. Basal contact sharp, slightly wavy.	1.15 m (3.8')
TS 3-26	Top: Very fine-coarse calcarenite; poorly washed, brachiopod, crinoid, algal Biosparite:Packstone.	

UNIT	LITHOLOGY	THICKNESS
TS 3-26	Base: Very fine-medium calcarenite; packed, brachiopod, crinoid, algal Biomicrite:Packstone.	
3-25	Foraminifera Wackestone, very dark grey or black, weathers grey, brown or caliche coated white. Grains include abundant fusulinids (lowest Fusulinella), crinoid columnals, and rare brachiopod spines. Pyrite inclusions scattered, limonite and hematite inclusions common. Nodules of black chert less than 1 cm in diameter scattered. Medium to thick bedded with thin bedded shaley zones 5 cm thick, 15 cm and 46 cm above the base. Forms base or undercut at base of laterally prominant cliff. Basal contact covered.	.65 m (2.1')
TS 3-25	Top: Coarse calcilutite-coarse calcarenite; organic rich, packed, ostracod, brachiopod, fusulinid, criniod Biomicrite:Wackestone.	
TS 3-25	Base: Coarse calcilutite-medium calcarenite; packed, ostracod, brachiopod, foraminifera, crinoid Biomicrite:Packstone.	
3-24	Covered (fissile black shale is exposed in this interval in the roadcut east of the measured section; however no rocks crop out in this interval along the line of section).	4.45 m (14.6')
3-23	Silty Mudstone-Wackestone, grey, weathers light grey, tan or brown. Grains include crinoid columnals, brachiopod fragments, ostracods, rare fusulinids (Lowest Profusulinella at base) and quartz silt. Limonite and hematite inclusions common. Silt content highest in upper two-thirds of unit, more bioclastic near the base. Medium to thin wavy bedded. Some cross bedding in upper 1 m. Forms laterally prominant rubbly cliff face. Basal contact covered.	4.05 m (13.3')
TS 3-23	3.05 m (10') AB: Fine-medium calcarenite; silty, sparse, ostracod, spicule, crinoid Biomicrite:Wackestone.	
TS 3-23	2 m (6.5') AB: Very fine calcarenite-fine calcirudite; silty, sparse, ostracod, brachiopod, bryozoan, crinoid Biomicrite: Wackestone.	
TS 3-23	1.2 m (4') AB: Very fine calcarenite-fine calcirudite; silty, packed, ostracod, brachiopod, spicule, bryozoan, crinoid Biomicrite:Packstone.	

UNIT	LITHOLOGY	THICKNESS
TS 3-23	.15 m (.5') AB: Very fine calcarenite-fine calcirudite; silty, packed, ostracod, brachiopod, spicule, bryozoan, crinoid Biomicrite:Packstone.	
3-22	Covered	1.6 m (5.2')
3-21	Wackestone, dark grey, weathers light grey or tan. Grains include crinoid columnals, brachiopod spines, whole productid and spiriferid brachiopods and bryozoans. Limonite inclusions common. Medium to thin tabular beds. Forms low, mostly covered blocky terrace or slumped block talus slope. Basal contact covered.	.4 m (1.3')
TS 3-21	.15 m (.5') BT: Very fine-coarse calcarenite; organic rich, silty, packed, foraminifera, ostracod, brachiopod, bryozoan, crinoid, spicule Biomicrite:Packstone.	
3-20	Covered (well preserved brachiopods are weathering out as surface float within this interval).	2.25 m (7.3')
3-19	Crinoid-Brachiopod Packstone, grey, weathers grey. Grains include bryozoans, brachiopod fragments, whole productid and spiriferid brachiopods, and crinoid columnals. Grains are sorted to very coarse sand size except for whole brachiopods. Medium wavy bedded. Forms mostly covered terrace, locally slumped into contact with 3-17. Basal contact sharp.	.2 m (.7')
TS 3-19	Top: Very fine calcarenite-fine calcirudite; chert bearing, poorly washed, foraminifera, ostracod, brachiopod, bryozoan, crinoid Biosparite:Packstone.	
3-18	Calcareous Shale, grey weathers grey. Mostly covered. Forms undercut at base of 3-19 terrace or rubbly slope. Basal contact covered.	.15 m (.5')
3-17	Crinoid Packstone, grey, weathers grey to tan. Grains include algal debris, brachiopod fragments and crinoid columnals. Grains are sorted, coarse sand to granule size. Limonite inclusions and limonite cement common. Medium bedded or forms single bed. Forms mostly covered, locally slumped, low terrace. Basal contact sharp, wavy.	.15 m (.5')
TS 3-17	Top: Fine calcarenite-fine calcirudite; foraminifer, brachiopod, crinoid, bryozoan Biosparite:Packstone.	

UNIT	LITHOLOGY	THICKNESS
3-16	Calcareous Shale, weathers white (no fresh exposures). Forms mostly covered rubbly slope. Basal contact sharp.	.25 m (.8')
3-15	Crinoid-Bryozoan Packstone, grey, weathers light grey or tan. Grains include bryozoans, crinoid columnals, ostracods, brachiopods and algal debris. Grains sorted, very coarse sand size. Unit is burrowed. Limonite inclusions common. Forms single bed or medium bedded. Forms mostly covered but locally well exposed terrace. Many blocks slumped. Basal contact sharp.	.2 m (.6')
TS 3-15	Top: Very fine calcarenite-fine calcirudite; packed, spicule, ostracod, brachiopod, bryozoan, crinoid Biomicrite:Packstone.	
3-14	Calcareous Shale, grey to tan, weathers grey or white. Brachiopods common as float on weathered surface. Upper beds fissile, laminate. Lower beds nodular. Forms covered slope, locally moderately well exposed. Basal contact gradational.	.75 m (2.4')
3-13	Wackestone, grey, weathers grey. Grains include crinoid columnals, whole and fragmented brachiopods, ostracods, and foraminifera. Scattered limonite inclusions and small (less than 1 cm diameter) chert nodules. Medium bedded. Forms mostly covered terrace. Basal contact sharp.	.35 m (1.1')
TS 3-13	Top: Very fine calcarenite-fine calcirudite; sparse, brachiopod, ostracod, crinoid, foraminifera Biomicrosparite:Wackestone.	
OFFSET 14 m (45') west on top of unit 3-12 to measure higher units.		
3-12	Wackestone and Chert, grey weathers grey or tan to brown. Chert is grey, weathers dark brown. Grains include ostracod valves, small foraminifera, crinoid columnals and algal debris. Chert forms irregular nodules to .3 m thick and over 2 m long. Chert is most abundant in upper portion of unit. Thick bedded or single massive bed. Forms well exposed, laterally broken or slumped, cliff face. Basal contact sharp and tabular.	1.05 m (3.5')

UNIT	LITHOLOGY	THICKNESS
TS 3-12	Top: Coarse calcilutite-fine calcirudite; sparse, bryozoan, foraminifera, ostracod, brachiopod, crinoid, spicule Biomicrite:Wackestone.	
TS 3-12	Base: Very fine calcarenite-fine calcirudite; packed, foraminifera, ostracod, brachiopod, crinoid, spicule Biomicrite:Packstone.	
3-11	Calcareous Shale, grey, weathers light grey or white. Laminate bedding. Unit is very poorly exposed. Forms undercut at base of 3-12 or covered by 3-12 slump blocks or talus. Basal contact covered.	.7 m (2.2')
3-10	Wackestone, grey, weathers light grey. Grains include crinoid columnals, brachiopod fragments, and ostracods. Unit is burrowed. Burrows weather slightly darker and are more micritic than rest of unit. Chert nodules are common. Chert is light grey, weathers dark brown to black. Nodules are irregular, to 4 cm by 10 cm in diameter. Thin to thick wavy bedded, nodular at top, thin shaley intervals common at base. Forms laterally prominant blocky cliff face or steep rubbly slope. Many blocks slumped. Basal contact gradational. (This unit equivalent to upper massive portion of Thompson (1942) unit 19-3).	1.05 m (3.4')
TS 3-10	Top: Coarse calcilutite-coarse calcarenite; burrowed, sparse, foraminifera, bryozoan, ostracod, crinoid, spicule Biomicrite: Wackestone.	
TS 3-10	.3 m (1') BT: Coarse calcilutite-fine calcirudite; sparse, ostracod, crinoid, spicule Biomicrite:Wackestone.	
3-9	Nodular Calcareous Shale, weathers white (no fresh exposures). Lenticular wackestone nodules common. Wackestone is light grey, fossil grains include crinoid columnals, spicules and algal debris. Unit is mostly covered, forms undercut at base of 3-10. Basal contact sharp.	.25 m (.9')
TS 3-9	Top (limestone nodule from calcareous shale): Coarse calcilutite-medium calcarenite; sparse, foraminifera, crinoid, spicule Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS
3-8	Packstone, light grey to tan, weathers light grey, tan or orange. Grains include crinoid columnals, ostracods, brachiopodsand foraminifera (foraminifera include Eoschubertella, and Pseudoendothyra). Unit is burrowed. Limonite inclusions and fracture filling common. Medium to thin bedded, thin nodular beds at base. Forms moderately well exposed ledge at top of, or set back from, 3-7. Locally slumped or covered. Basal contact sharp.	.25 m (.9')
TS 3-8	Top: Very fine calcarenite-fine calcirudite; burrowed, poorly washed, bryozoan, brachiopod, foraminifera, ostracod, crinoid Biosparite:Packstone.	
OFFSET 14 m (45') east to measure higher units.		
3-7	Cherty Mudstone, grey, weathers grey or tan. Locally coated white with calcite crystals or black. Chert is black, weathers brown. Grains include crinoid columnals, whole productid brachiopods, algal debris and rare foraminifera (foraminifera include Eoschubertella). Chert forms lenticular and irregular nodules. Lenticular nodules are to .2 m thick and over 2 m long. Very thick bedded or massive. Forms lowest laterally prominant and well exposed cliff face of Derry section. Basal contact sharp, wavy, locally cuts into unit 3-6 up to 6 cm.	2.6 m (8.6')
TS 3-7	Top: Coarse calcilutite-medium calcarenite; packed, foraminifera, brachiopod, ostracod, crinoid, spicule, pellet Biomicrite:Packstone.	
TS 3-7	Base: Coarse calcilutite-fine calcirudite; chert bearing, packed, foraminifera, brachiopod, ostracod, crinoid, spicule, pellet, Biomicrite:Packstone.	
3-6	Phylloid Algal Wackestone, grey, weathers light grey or brown. Grains include spar replaced phylloid algae, crinoid columnals and coralline algal debris. Thin to medium wavy bedded, nodular at base. Mostly covered but locally well exposed. Forms undercut at base of 3-7 massive cliff face. Basal contact sharp, wavy.	.25 to .35 m (.9 to 1.1')
TS 3-6	Top: Coarse calcilutite-fine calcirudite; packed, foraminifera, brachiopod, crinoid, phylloid algae, spicule, pellet Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS

OFFSET 206 m (675') north 40° west along roadcut terrace and across small faulted canyon on top of unit 3-5 to measure higher units.

3-5 Wackestone and Chert, grey, weathers grey or reddish brown. Grains include ostracod valves, crinoid columnals, gastropods, brachiopod fragments, rare foraminifera (lowest Eoschubertella?), and fine sand to coarse silt size quartz grains. Irregular nodules of dark grey, olive grey, or reddish chert common. Limonite and hematite inclusions abundant. Thick wavy bedded or single massive bed. Forms laterally prominant, locally slumped or partly covered cliff face. Basal contact sharp. — .95 m (3.1')

TS 3-5 Top: Very fine-medium calcarenite; cherty, packed, brachiopod, foraminifera, crinoid, spicule Biomicrite:Packstone.

TS 3-5 .15 m (.5') AB: Very fine-medium calcarenite; quartz-bearing, sparse, ostracod, spicule, brachiopod, foraminifer, crinoid Biomicrite:Wackestone.

3-4b Fissile Black Shale, highly fractured and cut by common horizontal gypsum beds. The upper 5 cm is highly weathered and lighter in color than rest of unit. Top 1 cm silty. Laminate to thinly laminated bedding. Locally well exposed in roadcut forming undercut at base of 3-5 cliff face. Covered laterally. Basal contact slightly wavy, irregular, and gradational over 3 cm stratigraphic thickness. (The 3-4b/3-4a contact is interpreted to be an unconformity at the Atokan/ Morrowan contact.) — .25 m (.8')

3-4a Clay, grey to tan. Grains restricted to fine quartz silt and fossil plant (?) fragments. Bedding not well defined but fracture and cleavage surfaces well developed. Cleavage planes well defined in unit 3-4a quickly die out after crossing the 3 cm thick 3-4b/3-4a gradational contact. Locally well exposed in roadcut, covered laterally. Basal contact sharp, irregular over nodular surface of 3-3b. (Unit 3-4a is interpreted as a paleosol developed at the Atokan/Morrowan Unconformity.) — .2 m (.7')

UNIT	LITHOLOGY	THICKNESS
3-3b	Wackestone, light grey, weathers light grey, tan or orange. Grains include crinoid columnals, brachiopods and rare small foraminifera. Bedding is poorly defined. Algal laminations locally clearly visible. Unit nodular and variable in thickness. Basal contact gradational, drawn at change from dominantly nodular wackestone to dominantly calcareous shale with wackestone nodules.	.15 to .3 m (.5 to 1')
TS 3-3b	Top: Very fine calcarenite; silt-bearing, spicule, algal Biomicrosparite:Wackestone. (Thin section shows faint but highly characteristic blue-green algal laminations.)	
3-3a	Shaly, nodular Wackestone, light grey, weathers light grey, tan, orange or soil covered brown. Grains include common whole brachiopods , crinoid columnals and rare small foraminifera. Fresh exposure is dominantly nodular carbonate with more clay-rich marlstone zones. Marlstone zones become shaly when weathered. Bedding poorly defined. Locally well exposed forming slight undercut at base of 3-3b, covered laterally. Basal contact sharp but irregular with up to 3 cm relief. (This is the lowest Pennsylvanian unit at the Type Derry section.)	.45 to .6 m (1.6 to (2')
TS 3-3a	.1 m (.3') AB: Very fine calcarenite; burrowed, algal Dismicrite:Mudstone.	
Devonian Percha Shale		
3-2	Silty Shale, white or tan, weathers tan. Unit is non-calcareous and nearly 100% clay and fine silt size quartz grains. The top is marked by light brown or tan clay layer 1 to 2 cm thick. (This unit is interpreted as a paleosol developed at the Pennsylvanian/Devonian Unconformity.	.05 m (.2')
3-1	Siltstone, white to reddish brown, weathers the same. Grains are very well sorted silt size quartz. Limonite and some calcite cement. Thin bedded or coated so bedding is not apparent. Forms lowest cliff face in roadcut at location of measured section. Basal contact gradational with silty shale.	.85 m (2.8')
TS 3-1	.15 m (.5') BT: Coarse silt, angular, very well sorted, calcite cemented Quartz Arenite.	

Whiskey Canyon

Sierra County, New Mexico

Measured Section 4 is located in Whiskey Canyon in the northern Mud Springs Mountains (U.S.G.S. Cuchillo Quadrangle [New Mexico-Sierra County]; sec. 1 and 2, T. 13 S., R. 5 W.; 33°12'10" North, 107°19'00" West). It includes a detailed remeasurement of the lower portion of M.L. Thompson's section 11 (1942, p. 37-38, 42-47). Remeasured strata ranges from the base of the zone of Fusulinella to the first occurrence of Wedekindellina.

Units 4-1a through 4-7 occur below the zone of Fusulinella and are stratigraphically lower than any units described by Thompson (1942). This author is in close agreement with Thompson's descriptions and thicknesses for units 4-9 through 4-44. However, it appears Thompson's section is incomplete, missing units 4-49 through 4-53 of this author.

Whiskey Canyon is located in Sierra County, on the northwest slope of the Mud Springs Mountains, approximately 6 km (10 miles) north-northwest of Truth or Consequences New Mexico. To reach the measured section take Interstate 25 7.2 km (4.5 miles) north of Truth or Consequences to State Highway 52 (I-25 exit 83). Proceed west on Highway 52 12.9 km (8 miles) to Cuchillo, New Mexico. Continue .8 km (.5 mile) west of the Cuchillo bar and general store to the intersection of Highway 52 and the graded dirt road. Mileage readings are from this intersection.

Turn onto the graded dirt road and proceed southwest. At .16 km (.1 mile) the road crosses Cuchillo Negro Creek and turns west. Continue west .64 km (.4 mile) until the road turns south at the cattle guard. Proceed south across the cattle guard and climb out of Cuchillo Negro Canyon. Continue south-southwest to the fork in the road at 2.25 km (1.4 miles). Cross the cattle guard on the left fork in the road and immediately turn east-northeast onto the small dirt road that follows the fence line. Continue through the gate at 5.3 km (3.3 miles) and turn south along the fence line. Proceed south to the green water tank and turn east onto the small dirt road at 6.9 km (4.3 miles). Take the south fork in the road at 8.7 km (5.4 miles). Turn east on the small dirt road at 9 km (5.6 miles). The road ends at Tofoya Tank at 11.25 km (7.0 miles). Park here and proceed on foot south 80° east down the wash for approximately 1.3 km (.8 mile). The section starts on the north side of the wash at the lowest exposed Pennsylvanian strata and continues east along the north side of Whiskey Canyon.

The beds strike north 15° west and dip 25° to the northeast. Measurements were made with a Jacob's staff and Abney hand level. Thicknesses have been rounded to the nearest 0.5 m (or .1 ft). The total thickness of this measured section is approximately 113 m (371 ft).

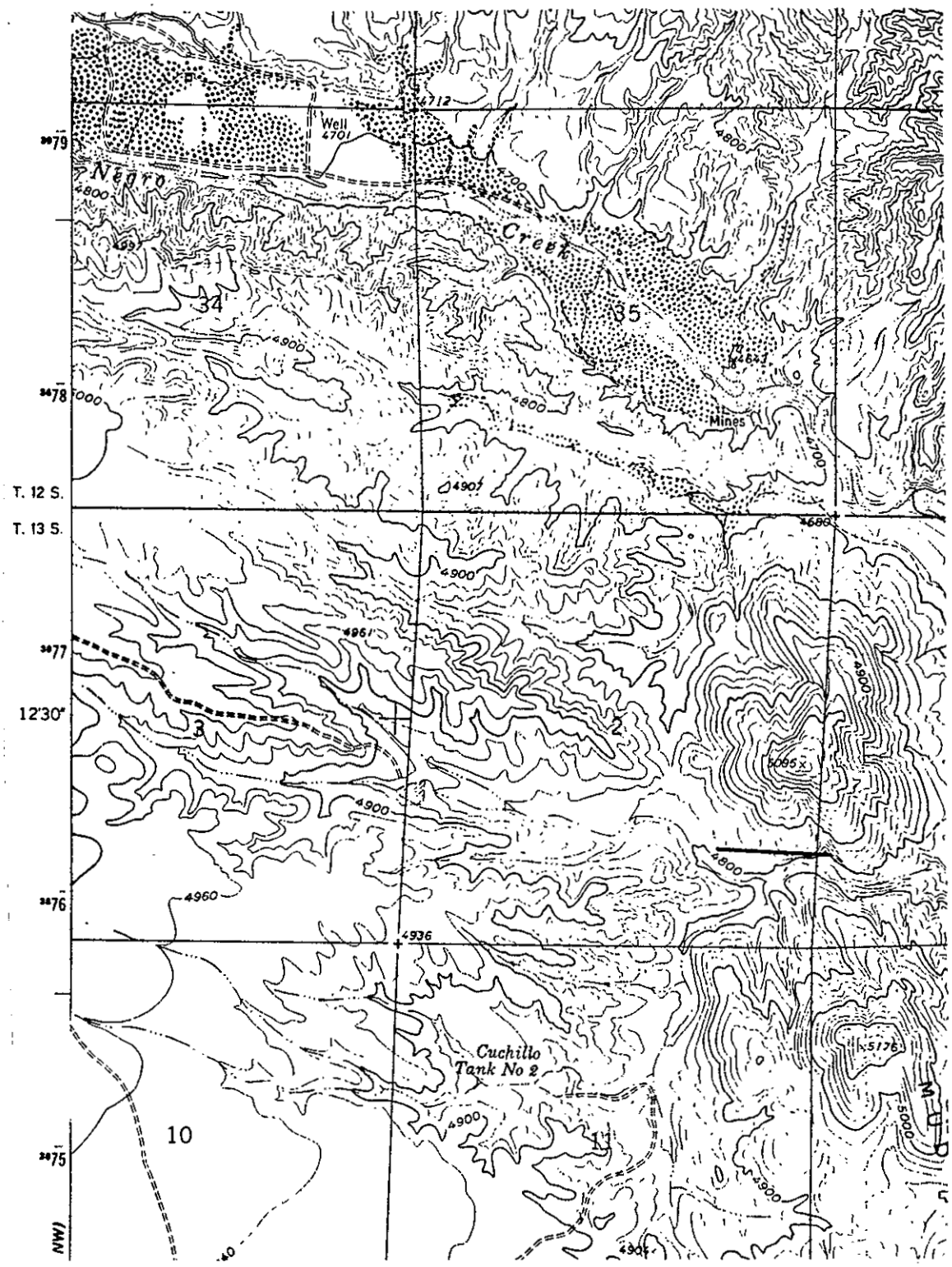


Figure 4. Whiskey Canyon locality map (from U.S.G.S. Cuchillo Quadrangle, New Mexico, Sierra County).

UNIT	LITHOLOGY	THICKNESS
4-62	Wackestone, grey, weathers light grey. Grains include phylloid algae, scattered fusulinids (Wedekindellina and Beedeina), crinoid columnals, and rare small solitary rugose corals. Lenticular to irregular chert nodules common. Chert is black, mostly weathered brown. Limonite surface stain common. Medium to thick, slightly wavy bedded. Forms laterally prominant cliff face. Lower .9 m (3') mostly covered. Basal contact covered.	1.9 m (6.2')
TS 4-62	.45 m (1.5') BT: Coarse calcilutite-fine calcirudite; packed, ostracod, calcisphere, phylloid algae Pelmicrite:Wackestone.	
TS 4-62	.9 m (3') BT: Coarse calcilutite-fine calcirudite; phylloid algae Pelmicrite:Wackestone.	
4-61	Fusulinid Wackestone, weathers grey or brown. Grains include abundant fusulinids, algal debris, small foraminifera and rare whole brachipods. Small irregular chert nodules common at top. Chert is black, weathers brown. Silt size limonite inclusions and surface stain common. Medium to thick bedded. Forms moderately well exposed steep terraced rubbly slope or cliff face. Basal contact covered.	1.85 m (6.1')
TS 4-61	Top: Very fine calcarenite-fine calcirudite; poorly washed, brachiopod, crinoid, foraminifera Biosparite:Packstone.	
TS 4-61	1.05 m (3.5') AB: Very fine calcarenite-fine calcirudite; packed, ostracod, foraminifera, spicule, brachiopod, crinoid Biomicrite:Packstone.	
TS 4-61	.45 m (1.5'): Fine calcarenite-fine calcirudite; quartz-bearing, sparse, crinoid, foraminifera, brachiopod, ostracod Biomicrite:Wackestone.	
4-60	Covered (unit 4-61 wackestone extends to within .3 m (1') of 4-59 69 m (225') south 20° east of section line. Lowest 1' highly weathered, nodular calcareous shale and laminated fissile at same location).	1 m (3.2')
4-59	Wackestone, grey, olive grey or moderate red, weathers light grey or tan. Grains include algal debris, spicules and ostracods. Limonite inclusions common. Surface locally highly limonite stained. Grains most abundant in upper portion of unit. Medium to thick bedded or massive. Forms cap on 4-58 cliff face or low partly to mostly covered terrace. Basal contact sharp, wavy.	.75 m (2.5')

UNIT	LITHOLOGY	THICKNESS

TS 4-59 .45 m (1.5') AB: Coarse calcilutite-fine calcarenite; packed, ostracod, pellet, spicule Biomicrite:Wackestone.

4-58 Packstone, grey, weathers mottled dark brown to tan and light grey. Grains moderately well sorted, medium to fine sand size, include encrusting foraminifera, algal debris, pellets and spicules. Limonite abundant as grain replacement and surface stain. Thick bedded or massive. Forms laterally prominant cliff face. Basal contact covered. — .9 m (3')

TS 4-58 .45 m (1.5') AB: Coarse calcilutite-fine calcirudite; packed, foraminifera, pellet, spicule, crinoid, bryozoan, brachiopod, ostracod Biomicrite:Packstone.

4-57 Covered (unit 4-58 rests in direct contact with unit 4-56 in exposures on south wall of canyon 61 m (200') south of section line). — 1.5 m (5')

4-56 Silty, micaceous fossiliferous Mudstone, grey weathers olive grey or brown. Grains include crinoid fragments, abundant quartz silt and common muscovite flakes. Locally limonitic. Medium to thick tabular bedded with some cross bedding. Forms partly to mostly covered terraced slope. Basal contact mostly covered, sharp where exposed. — 1.85 m (6.1')

TS 4-56 .15 m (.5') BT: Very fine-medium calcarenite; quartz-rich, muscovite-bearing, pellet, foraminifera, crinoid, spicule, ostracod Biomicrosparite:Grainstone.

TS 4-56 .15 m (.5') AB: Very fine-medium calcarenite; quartz-rich, pellet, foraminifera, crinoid, ostracod Biomicrosparite: Grainstone.

4-55 Mostly covered. — 3.7 m (12.1')

- -

OFFSET 84 m (275') south 20° east across small wash to measure units within 4-55 covered interval.

- -

UNIT	LITHOLOGY	THICKNESS
4-55b	Wackestone, grey to olive grey, weathers tan to yellow. Grains include common fusulinids, algal flakes and spicules. Limonite and hematite common. Medium bedded with thin nodular beds in lower .3 m (1'). Forms low terrace where exposed, covered laterally. Basal contact covered.	1.1 m (3.6')
TS 4-55b	.3 m (1') BT: Fine calcarenite-fine calcirudite; silty, sparse, foraminifera, crinoid, brachiopod, spicule Biomicrite: Wackestone.	
4-55a	Calcareous Shale, grey to red, weathers tan. Fissile laminate beds. Forms slope, laterally covered. Basal contact sharp.	2.6 m (8.5')
4-54	Wackestone, mottled olive grey and red or orange, weathers light grey or mottled tan and grey. Grains include ostracods, algal debris, bryozoan fragments and brachiopod fragments. Unit burrowed. Burrows range to 1 cm diameter by 10 cm long. Matrix filling burrows is more hematite and limonite rich and has higher concentration of grains than non-burrowed portion of rock. Thick bedded. Forms low terrace. Locally well exposed, laterally partly to mostly covered. Basal contact covered.	.35 m (1.2')
TS 4-54	Top: Coarse calcilutite-medium calcarenite; quartz-bearing, foraminifera, byrozoan, brachiopod Biomicrite:Wackestone.	
4-53	Covered.	2.05 m (6.8')
4-52	Crinoid Wackestone-Packstone, grey, weathers grey to tan. Grains dominated by small, sorted crinoid columnals and columnal fragments. Grains also include brachiopod fragments, ostracods, and algal debris. Upper beds have less micrite matrix. Limonite inclusions, grain replacement, and surface stain common. Medium to thick bedded. Locally moderately well exposed, laterally partly to mostly covered. Forms series of low, terraced cliff faces or slumped to steep rubbly slope. Basal contact sharp where exposed.	1.2 m (3.9')
TS 4-52	.15 m (.5') BT: Fine calcarenite-fine calcirudite; foraminifera, brachiopod, crinoid Biosparite:Packstone.	

UNIT	LITHOLOGY	THICKNESS
	TS 4-52 Base: Fine-medium calcarenite; fossiliferous, finely crystalline calcite.	
4-51	Calcareous Shale, weathers tan to red. Locally exposed at top, covered laterally. Basal contact covered.	3.4 m (11.1')
4-50	Wackestone, olive grey to red or brown, weathers light grey, tan or light orange. Grains include common whole productid brachiopods, crinoid columnals to 1 cm in diameter, algal flakes, bryozoans and rare fusulinids. Limonite and hematite inclusions common. Thick bedded or single massive bed. Forms low, laterally partly to mostly covered cliff face. Locally slumped, slump blocks common on underlying covered interval. Basal contact sharp where exposed.	.65 m (2.2')
	TS 4-50 Top: Fine-medium calcarenite; limonitic, fossiliferous Microspar:Mudstone.	
4-49	Covered.	1.5 m (5')
4-48	Packstone, grey, weathers olive grey to tan. Grains include fenestrate and ramose bryozoans, crinoid columnals, whole and fragmented brachiopods, algal debris and ostracods. Limonite inclusions common. Scattered shaly intervals in lower .15 m (.5'). Medium to thick wavy beds, nodular at top. Locally well exposed, laterally partly to mostly covered. Forms broken or slumped cliff face on east side of small wash. Basal contact gradational.	.6 m (1.9')
	TS 4-48 .3 m (1') AB: Fine calcarenite-fine calcirudite; packed, brachiopod, crinoid bryozoan Biomicrite:Packstone.	
4-47	Nodular Calcareous Shale, grey, weathers brown to tan. Lenticular wackestone nodules scattered, most abundant at base. Laminated, fissile bedding. Locally moderately well exposed in undercut at base of unit 4-48, laterally forms covered slope. Basal contact sharp where exposed.	.75 m (2.4')

UNIT	LITHOLOGY	THICKNESS

4-46 Packstone, grey to brown, weathers mottled grey and tan to brown. Grains include crinoid columnals to over 1 cm in diameter, abundant whole brachiopods, bryozoans and algal debris. Limonite inclusions common. Medium slightly wavy bedded. Forms well exposed dip slope surface in small wash, partly to mostly covered laterally. Basal contact covered. — .75 m (2.4')

TS 4-46 .3 m (1') BT: Fine calcarenite-fine calcirudite; quartz-bearing, packed, bryozoan, crinoid, brachiopod Biomicrite: Packstone.

4-45 Covered. — 1.05 m (3.5')

4-44 Wackestone, grey, weathers mottled grey to very light grey and tan. Grains include large whole productid brachiopods, echinoderm spines, ostracods and small crinoid columnals. Unit is highly burrowed. Limonite inclusions common. Medium wavy bedded. Forms partly to mostly covered, hummocky and irregular upper dip slope surface. Basal contact irregular and gradational. — .95 m (3.1')

TS 4-44 Top: Very fine calcarenite-fine calcirudite; sparse, bryozoan, crinoid, ostracod, spicule Biomicrite:Wackestone.

TS 4-44 .3 m (1') AB: Coarse calcilutite-coarse calcarenite; packed, bryozoan, crinoid, ostracod, spicule Biomicrite:Packstone.

- -

OFFSET 30 m (100') north 15° west on contact of units 4-43 and 4-44 to measure 4-44 and higher units.

- -

4-43 Crinoid Packstone, grey, weathers grey. Grains sorted, very coarse sand size. Grains include whole and fragmented crinoid columnals, whole and fragmented brachiopods and bryozoan fragments. Locally burrowed, scattered limonite inclusions. Medium to thick bedded. Forms low, rounded, ridge of slumped platy blocks. Best exposed just north of creek bed, partly to mostly covered laterally. Basal contact covered. — 4.5 m (15')

TS 4-43 3.8 m (12.5') AB: Fine calcarenite-fine calcirudite; ostracod, bryozoan, brachiopod, crinoid Biosparite:Grainstone.

UNIT	LITHOLOGY	THICKNESS

TS 4-43 2.4 m (8') AB: Fine calcarenite-fine calcirudite; poorly washed, bryozoan, brachiopod, crinoid Biosparite:Packstone.

TS 4-43 1.2 m (4') AB: Fine calcarenite-fine calcirudite; ostracod, bryozoan, brachiopod, crinoid Biosparite:Grainstone.

4-42 Wackestone, grey, weathers grey to olive grey or tan. Grains include crinoid columnals, small whole brachiopods, brachiopod fragments, bryozoans and ostracods. Limonite and hematite inclusions and fracture filling common. Medium to thick bedded, lower beds slumped. Forms partly to mostly covered terraced slope. Basal contact covered. — 1.85 m (6')

TS 4-42 Top: Fine calcarenite-fine calcirudite; silt-bearing, packed, foraminifera, bryozoan, brachiopod, crinoid Biomicrite: Packstone.

TS 4-42 .6 m (2') AB: Fine calcarenite-fine calcirudite; sparse, phylloid algae, ostracod, crinoid, brachiopod Biomicrite: Wackestone.

4-41 Covered. — .6 m (2')

4-40 Quartz Pebble Conglomerate, reddish brown to green, weathers dark red or green. poorly sorted, coarse sand to pebble sized grains. Largest observed grain 1 cm by 5 cm diameter. Grains angular to subrounded, dominantly quartz. Silica and hematite cement. Thick wavy bedded. Forms low rounded mounds, a thin cap on weathered 4-39 surface, or a mostly covered rubbly slope. Locally truncates and/or fills lows in upper surface of unit 4-39. Basal contact very sharp. — up to .6 m (2')

TS 4-40 Top: Very fine sand-granule; very poorly sorted, angular to subrounded, hematite and limonite cemented Quartz Arenite.

- -

OFFSET 20 m (65') north 20° west on top of unit 4-39 to measure higher units.

- -

UNIT	LITHOLOGY	THICKNESS
4-39	Wackestone, grey to reddish grey, weathered grey or tan to red. Grains include crinoid columnals to over 1 cm in diameter, ostracods, brachiopods, coralline algae debris and small foraminifera. Chaetetes colonies in growth position to 20 cm in diameter common at top. Colonies often located on highs in upper bedding plane surface giving unit up to .3 m (1') thickness variation. Hematite inclusions and fracture fill common. Medium to thick bedded. Forms low cliff face and low, partly covered terraced ridge. Basal contact covered.	3.2 m (10.5')
	TS 4-39 2.4 m (8') AB: Coarse calcilutite-fine calcirudite; packed, bryozoan, phylloid algae, crinoid Pelmicrite:Wackestone.	
	TS 4-39 .9 m (3') AB: Coarse calcilutite-fine calcirudite; packed, ostracod, crinoid, spicule, calciosphere, brachiopod, coralline algae, pellet Biomicrite:Packstone.	
4-38	Covered.	.64 m (2.1')
4-37	Crinoid Grainstone, grey, weathers grey. Grains dominated by coarse sand size crinoid columnals. Grains also include brachiopod fragments and bryozoans. Scattered limonite inclusions. Medium to thick bedded. Forms mostly covered low terrace or slope. Basal contact sharp.	.6 m (1.9')
	TS 4-37 Top: Fine-coarse calcarenite; chert-bearing, sorted, bryozoan, brachiopod, crinoid Biosparite:Grainstone.	
4-36	Wackestone, weathers grey or tan. Grains include phylloid algae, crinoid columnals, and very rare fusulinids (Lowest Beedeina recovered in this study .45 m (1.5 ft) above base). Chert nodules common. Chert is black, weathered brown, and forms laterally discontinuous thin bedded lenses. Limonite inclusions common. Medium wavy bedded. Forms partly to mostly covered low broken terraces on rubbly slope. Basal contact covered.	2.35 m (7.7')
	TS 4-36 .6 m (2') BT: Coarse calcilutite-fine calcirudite; packed, phylloid algae, brachiopod, ostracod, spicule, crinoid Biomicrite:Wackestone.	
	TS 4-36 .45 m (1.5') AB: Coarse calcilutite and fine calcirudite; packed, phylloid algae, spicule, pellet Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS
4-35	Wackestone, grey, brown, or reddish brown, weathers tan to red. Grains dominated by moderately sorted coarse sand to granule size crinoid columnals. Grains also include brachiopod fragments and algal debris. Limonite and hematite common. Medium bedded. Forms poorly exposed, mostly covered slope with common slump blocks. Basal contact covered.	.25 m (.9')
TS 4-35	Top: Very fine calcarenite-fine calcirudite; packed, bryozoan, brachiopod, crinoid Biomicrite:Packstone.	
4-34	Covered.	.74 m (2.4')

OFFSET 12 m (40') south 40° east on top of unit 4-33 to measure higher units.

33	Wackestone, grey, weathers grey. Grains include abundant fusulinids (lowest Beedina?. Type specimens of Beedeina (=Fusulina) insolita (Thompson, 1948) reported from upper portion of this horizon), crinoid columnals, brachiopod fragments and algal debris. Abundant Chaetetes colonies in growth position in band .3 m to .6 m (1' to 2') thick, 1.5 m (5') above the base. Chaetetes colonies are approximately 50% silicified. Chert nodules to 1 m long and 10 cm thick common. Chert is black, weathered brown. Medium to thick bedded. Forms low, partly covered rounded ridge with locally steep terraced front and gentle, mostly covered dip slope. Basal contact covered.	4 m (13.2')
TS 4-33	.3 m (1') BT: Very fine calcarenite-fine calcirudite; sparse, ostracod, spicule, crinoid, foraminifera Biomicrite: Wackestone.	
TS 4-33	2.75 m (9') AB: Fossiliferous chert.	
TS 4-33	2.5 m (8') AB: Fine calcarenite-fine calcirudite; packed, spicule, crinoid, foraminifera, pellet Biomicrite:Wackestone.	
TS 4-33	1.05 m (3.5') AB: Very fine calcarenite-fine calcirudite; sparse, crinoid, phylloid algae Biomicrite:Wackestone.	
TS 4-33	Base: Fine calcarenite-fine calcirudite; sparse, spicule, crinoid, foraminifera Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS
4-32	Covered.	.7 m (2.3')
4-31	Quartzarenite, olive green, weathers olive green to brown. Grains poorly sorted, subangular, very coarse sand to granule size. Silica cement with minor calcite. Medium to thin bedded, cross-bedded. Forms mostly covered slope with weathered, cobble size float blocks. Locally truncates and/or fills lows in hummocky upper surface of unit 4-30. Basal contact mostly covered, sharp where exposed.	.6 m (2')
	TS 4-31 .3 m (1') AB: Medium to very coarse sand; poorly sorted, subangular, quartz overgrowth and calcite cemented Quartzarenite.	
4-30	Wackestone, grey, weathers grey to olive grey. Grains include small crinoid columnals, fusulinids, algal debris, brachiopod fragments and small whole brachiopods. Chert nodules common at top. Chert is black, weathers brown. Forms irregular or lenticular to subround nodules to 10 cm thick by 30 cm long. Medium to very thick bedded, bedding poorly defined. Forms broken ridge of slumped and in place blocks. Basal contact covered.	.95 m (3.1')
	TS 4-30 .3 m (1') BT: Very fine calcarenite-fine calcirudite; chert-bearing, packed, foraminifera, coralline algae, phylloid algae, crinoid Biomicrite:Packstone.	
	TS 4-30 .15 m (.5') AB: Fine calcarenite-fine calcirudite; chert-bearing, packed, foraminifera, ostracod, phylloid algae, crinoid Biomicrite:Wackestone.	
4-29	Covered.	1.05 m (3.5')
4-28	Biomicrite, grey, weathers grey, olive grey or tan. Grains include crinoid columnals, brachiopod, bryozoans, and algal debris. Scattered limonite and hematite inclusions. Unit is burrowed. Burrowed zones more micritic than rest of unit. Thick bedded. Forms steep terraced slope. Partly covered laterally. Locally slumped into contact with unit 4-26. Basal contact sharp.	1.75 m (5.8')
	TS 4-28 Top: Very fine calcarenite-fine calcirudite; sparse, foraminifera, ostracod, spicule, phylloid algae, brachiopod, crinoid Biomicrite:Wackestone.	

UNIT	LITHOLOGY	THICKNESS

TS 4-28 .45 m (1.5') AB: Very fine-coarse calcarenite; sparse, foraminifera, crinoid, spicule Biomicrite:Wackestone.

4-27 Calcareous Shale, highly weathered, nodular, poorly exposed. Laterally covered by slumped blocks of unit 4-28. Basal contact covered. Thickness estimated. .3 m (1')

4-26 Phylloid Algae Wackestone, grey, weathers grey to very light grey or tan. Spar replaced phylloid algae abundant through unit. Other grains include crinoid columnals, rare brachiopods and rare foraminifera. Burrows common near top. Medium to thick or very thick wavy bedded. Thinner bedded at base, more massive or nodular at top. Forms prominant cliff face on north side of wash, laterally forms terraced slope. Basal contact gradational over 2 to 3 cm or locally sharp. 2.7 m (8.9')

TS 4-26 .15 m (.5') BT: Very fine calcarenite-fine calcirudite; burrowed, sparse, ostracod, brachiopod, spicule, crinoid, phylloid algae Biomicrite:Wackestone.

TS 4-26 1.8 m (6') AB: Very fine-coarse calcarenite; sparse, foraminifera, spicule, crinoid, phylloid algae Biomicrite: Wackestone.

TS 4-26 .6 m (2') AB: Fine-medium calcarenite; sparse, crinoid, phylloid algae Biomicrite:Wackestone.

4-25 Crinoid Wackestone-Packstone, grey, weathers grey to tan. Grains dominantly moderately sorted very coarse sand to granule size crinoid columnals. Grains also include fusulinids and algal debris. Limonite inclusions common. Single bed. Locally forms lowest bed of prominant cliff, laterally partly to most covered. Basal contact sharp, wavy. .25 m (.9')

TS 4-25 Center: Fine calcarenite-fine calcirudite; packed, foraminifera, ostracod, brachiopod, crinoid Biomicrite: Packstone.

4-24 Shaly Nodular Wackestone, grey, weathers grey or white. Nodular portion of rock includes grains of crinoid columnals, fusulinids, brachiopod fragments, phylloid algae and other algal debris. Shaly portion too weathered to sample. Thin to laminated beds interbedded with nodules to 10 cm thick and 30 cm long. Nodules and laminate bedding wavy to irregular and contorted. Forms .25 m (.9')

UNIT	LITHOLOGY	THICKNESS

undercut at base of 4-25. Covered laterally. Basal contact sharp.

TS 4-24 .15 m (.5') AB: Very fine calcarenite-fine calcirudite; sparse, ostracod, foraminifera, spicule, crinoid Biomicrite: Wackestone.

4-23 Wackestone-Packstone, grey, weathers grey or tan. Grains include crinoid columnals, fusulinids, brachiopod spines and algal debris. Limonite inclusions common. Single bed. Base thin bedded where weathered. Locally forms top of cliff face. Laterally forms partly to mostly covered terrace. Basal contact sharp, wavy. .2 m (.7')

TS 4-23 Top: Fine calcarenite-fine calcirudite; packed, brachiopod, foraminifer, crinoid Biomicrite:Packstone.

4-22 Silty Mudstone, tan to reddish brown, weathers tan. Grains include quartz silt, crinoid columnals and brachiopod fragments. Limonitic. Thin bedded. Forms undercut or weathered slope at base of unit 4-23. Covered laterally. Top sharp, tabular. Basal contact sharp, irregular, shows some truncation of unit 4-21. to .05 m (.2')

TS 4-22 :Very fine-medium calcarenite; silt-bearing, sparse, brachiopod, crinoid Biomicrosparite:Wackestone.

4-21 Phylloid Algae Wackestone, grey, weathers grey to tan. Grains dominated by spar replaced phylloid algae. Grains also include crinoid columnals and rare brachiopod fragments. Single bed. Forms continuation of 4-20 terrace face or separate terrace front. Top partially truncated by unit 4-22. Partly to mostly covered laterally. Basal contact sharp. to .2 m (.6')

TS 4-21 : Medium-coarse calcarenite; sparse, crinoid, phylloid algae Biomicrite:Wackestone.

4-20 Fusulinid Wackestone, grey, weathers grey or tan. Grains include abundant fusulinids, small crinoid columnals, whole and fragmented brachiopods and algal debris. Hematite inclusions and grain replacement common. Composed of two medium beds. Forms locally well exposed low terrace or cliff face, partly covered laterally. Basal contact sharp. .3 m (1')

UNIT	LITHOLOGY	THICKNESS

TS 4-20 Base: Very fine calcarenite-fine calcirudite; packed, crinoid, foraminifera, phylloid algae, spicule Biomicrite:Packstone.

4-19 Wackestone and Chert, grey, weathers grey, tan or brown to red. Chert is dark grey to black, weathers brown. Chert forms irregular and subround to lenticular nodules to 10 by 30 cm. Grains include crinoid columnals, rare fusulinids, whole large productid brachiopods and algal debris. Limonite and hematite inclusions common. Thin to very thick slightly wavy bedded. Thin beds at base, more massive at top. Forms prominant terraced cliff face on north wall of wash. Laterally partly to mostly covered, top mostly covered. Basal contact gradational. 1.85 m (6.1')

TS 4-19 .15 m (.5') BT: Coarse calcilutite-fine calcirudite; sparse, foraminifera, spicule, pellet Biomicrosparite:Wackestone.

TS 4-19 .7 m (2.3') AB: Coarse calcilutite-coarse calcarenite; packed, chert-bearing, brachiopod, crinoid, spicule, pellet Biomicrite:Wackestone.

- -

OFFSET 11.5 m (38') south 55° east on unit 4-19/4-18 contact to north bank of the wash to measure 4-19 and higher units.

- -

4-18 Crinoid Wackestone, grey, weathers grey, red or tan to brown. Grains dominated by sorted coarse sand size crinoid columnals. Grains also include fusulinids, large whole productid brachiopods and brachiopod fragments. Limonite and hematite inclusions common. Medium to thick slightly wavy beds. Forms steep, rubbly, terraced slope. Many blocks slumped. Partly to mostly covered laterally. Basal contact gradational. 1.75 m (5.8')

TS 4-18 .45 m (1.5') BT: Very fine calcarenite-coarse calcilutite; packed, spicule, brachiopod, ostracod, crinoid Biomicrite: Packstone.

TS 4-18 Base: Very fine calcarenite-fine calcirudite; sparse, foraminifera, spicule, ostracod, brachiopod, crinoid Biomicrosparite:Wackestone.

UNIT	LITHOLOGY	THICKNESS

4-17 Phylloid Algae Wackestone, grey to red, weathers grey to brown or reddish brown. Grains dominated by spar replaced phylloid algae. Other grains include crinoid columnals, small whole brachiopods, brachiopod fragments and small foraminifera. Limonite and hematite inclusions common. Medium to thick bedded. Forms poorly exposed rubbly terraced slope. Most blocks slumped, top covered. Basal contact covered. — 1.6 m (5.3')

TS 4-17 .09 m (.3') BT: Fine-coarse calcarenite; sparse, ostracod, phylloid algae Biomicrite:Wackestone.

4-16 Covered. — 2.6 m (8.5')

4-15 Crinoid Wackestone, grey, weathers grey to tan. Grains dominated by sorted sand size crinoid columnals. Grains also include brachiopod fragments and bryozoans. Single bed. Forms poorly exposed rubbly liniation with locally moderately well exposed upper dip slope surface. Mostly covered or slumped laterally. Basal contact covered. — .1 m (.4')

TS 4-15 Top: Very fine calcarenite-fine calcirudite; sparse, bryozoan, ostracod, spicule, brachiopod, crinoid Biomicrite:Wackestone.

4-14 Covered. — .5 m (1.6')

4-13 Phylloid Algae Wackestone, grey, weathers grey. Grains dominated by spar replaced phylloid algae. Algal grains concentrated in clumps and thin lenses. Other grains include small crinoid columnals and brachiopods. Minor limonite inclusions. Medium to very thick bedded. Forms low terrace with well exposed, rubbly, upper dip slope surface. Basal contact sharp but mostly covered laterally. — .95 m (3.1')

TS 4-13 Top: Coarse calcilutite-coarse calcarenite; sparse, foraminifera, brachiopod, spicule, ostracod Biomicrite: Wackestone.

TS 4-13 Base: Coarse calcilutite-fine calcirudite; sparse, foraminifera, phylloid algae, spicule, ostracod Biomicrite: Wackestone.

UNIT	LITHOLOGY	THICKNESS
4-12	Nodular Calcareous Shale, fresh exposure does not occur, weathered surface caliche coated white. Subround mudstone nodules to 10 cm diameter common. Mudstone is grey, also coated white, and contains spar replaced phylloid algae grains. Bedding poorly preserved, locally beds thin to laminate. Best exposure at canyon wall on south side of wash. Basal contact sharp.	1.05 m (3.5')
	TS 4-12 .45 m (1.5') BT: (Nodule of carbonate from calcareous shale) Dismicrite:Mudstone.	
4-11	Packstone, grey, weathers olive grey to tan. Grains dominated by small crinoid columnals and fusulinids. Grains also include bryozoans and brachiopod fragments. Oncolites to 3 cm in diameter common in basal beds. Limonite inclusions common. Medium to thick wavy bedded. Forms low ridge of partly covered terraces. Many blocks slumped. This is the lowest unit to crop out on the south side of the wash. Basal contact covered.	2.75 m (9')
	TS 4-11 .6 m (2') BT: Fine-coarse calcarenite; quartz-bearing, sorted, brachiopod, foraminifera, crinoid Biosparite:Grainstone.	
	TS 4-11 1.35 m (4.5') AB: Fine calcarenite-fine calcirudite; quartz-bearing, poorly washed, brachiopod, foraminifera, crinoid Biosparite:Packstone.	
	TS 4-11 .3 m (1') AB: Fine calcarenite-fine calcirudite; quartz-bearing, poorly washed, bryozoan, brachiopod, foraminifera, crinoid Biosparite:Packstone.	
4-10	Covered.	5.5 m (18')
4-9	Wackestone, grey, weathers olive grey to tan. Grains include small crinoid columnals, abundant fusulinids (lowest Fusulinella), ostracods, brachiopod fragments, and algal debris. Scattered limonite and hematite inclusions. Upper .3 m (1') has common subround to irregular chert nodules. Chert is black, weathers brown. Medium to very thick bedded. Forms low cliff face and partly to mostly covered low, rubbly, rounded ridge. Locally top forms rubbly, irregular, dip slope surface. Top mostly covered laterally. Medium to very thick bedded. Basal contact covered.	1.85 m (6')

UNIT	LITHOLOGY	THICKNESS

TS 4-9 Top: Fine calcarenite-fine calcirudite; sparse, foraminifera, ostracod, brachiopod, crinoid Biomicrosparite:Wackestone.

TS 4-9 .3 m (1') AB: Fine calcarenite-fine calcirudite; sparse, foraminifera, ostracod, brachiopod, crinoid Biomicrosparite: Wackestone.

4-8 Covered. Approximately 5.6 m (18.5')

4-7 Wackestone-Packstone, grey to olive grey, weathers grey, tan to brown, or olive green. Grains dominated by crinoid columnals and brachiopod fragments. Scattered quartz silt, most abundant at top. Base marked by 2 to 3 cm thick highly weathered brachiopod coquina. Local micritic filled burrows. Irregular lenticular nodules of chert form up to 20% of unit. Chert weathers olive green to brown. Medium bedded to thin or very thin bedded and shaly at top. Forms mostly covered low rubbly terrace. Basal contact covered. .4 m (1.3')

TS 4-7 .15 m (.5') AB: Very fine calcarenite-fine calcirudite; poorly washed, spicule, brachiopod, crinoid Biosparite: Packstone.

4-6 Covered. Approximately 8.4 m (27.5')

- -

OFFSET 91 m (300') south 20° east on top of unit 4-5 to measure higher units.

- -

4-5 Wackestone, grey, weathers tan to brown. Grains include crinoid columnals, fusulinids in upper 1 meter. (Profusulinella) and brachiopods. Burrows common. Limonite inclusions and fracture fill common. Sub-round chert nodules to 10 cm diameter common in upper bed. Chert is olive green, weathers white to brown. Medium to thick tabular beds. Forms moderately well exposed series of low, partly covered terraces. Top irregular, hummocky. Basal contact covered. 1.9 m (6.3')

TS 4-5 Top: Very fine calcarenite-fine calcirudite; packed, brachiopod, crinoid, foraminifera, ostracod, spicule Biomicrite:Packstone.

UNIT	LITHOLOGY	THICKNESS

TS 4-5 .75 m (2.5') BT: Very fine calcarenite-fine calcirudite; poorly washed, brachiopod, ostracod, crinoid, spicule, foraminifera Biosparite:Packstone.

4-4 Covered. .75 m (2.5')

4-3 Quartzarenite, brown, weathers reddish brown. Grains moderately well sorted, angular to subangular, fine sand size quartz. Matrix clay with some carbonate. Minor muscovite, hematite and limonite. Single bed. Forms cap on unit 4-2. Mostly covered laterally. Basal contact sharp. .1 m (.4')

TS 4-3 :Coarse silt-very fine sand; angular to subangular, poorly sorted, immature Quartzarenite.

4-2 Silty Fossiliferous Mudstone, grey to tan, weathers grey to dark brown or tan. Grains include quartz silt, rare small crinoid columnals and rare whole spirifer brachiopods. Limonite inclusions common. Thick tabular beds. Forms series of low moderately well exposed rubbly terraces. Basal contact sharp where exposed, mostly covered laterally. 2.3 m (7.5')

TS 4-2 1.5 m (5') AB: Fine calcarenite; silty, fossiliferous Micrite:Mudstone.

TS 4-2 .45 m (.5') AB: Fine-medium calcarenite; silty, sparse, brachiopod, crinoid, bryozoan Biomicrite:Wackestone.

4-1e Crinoid Packstone, grey, weathers grey to tan. Grains include abundant crinoid columnals, brachiopod fragments, rare whole brachiopods, algal debris and small foraminifera. Limonite inclusions common. Single bed. Very poorly exposed. Forms lowest exposed unit on west side of small wash. Covered laterally. Basal contact covered. .35 m (1.1')

TS 4-1e .15 m (.5') BT: Fine calcarenite-fine calcirudite; limonitic, foraminifera, brachiopod, bryozoan, crinoid Biosparite:Grainstone.

4-1d Covered. Approximately 14 m (47')

UNIT	LITHOLOGY	THICKNESS
4-1c	Wackestone, grey, weathers grey to tan. Grains include small crinoid columnals, brachiopod fragments, foraminifera (Eoschubertella and Pseudostaffella) and ostracods. Medium bedded. Forms poorly exposed rubbly dip slope surface and rubbly terrace in a 9 m (30') long exposure on north side of main wash. Base slumped, poorly defined. Basal contact covered.	Approx. .6 m (2')
	TS 4-1c Top: Very fine-coarse calcarenite; packed, foraminifera, spicule, crinoid, ostracod, brachiopod Biomicrite:Packstone.	
	TS 4-1c Base: Fine-coarse calcarenite; sparse, crinoid, foraminifera, brachiopod Biomicrite:Wackestone.	
4-1b	Covered.	1.8 m (6')
4-1a	Chert and Fossiliferous Mudstone, grey to green. Chert green to greenish grey. Mudstone grey. Grains include rare crinoid columnals and brachiopod fragments. Single massive bed or two poorly defined beds. Mudstone restricted to uppermost 6 cm of unit and to isolated nodules set in chert scattered over rest of unit. Exposure limited, covered laterally. Forms low mostly covered terrace on north side of wash. Basal contact covered. Lowest exposed Pennsylvanian unit.	.45 m (1.5')
	TS 4-1a Top: Very fine-medium calcarenite; burrowed, sparse, brachiopod, ostracod, spicule Biomicrite:Wackestone.	

FIG. 2

Fig. 3

FIG. 4

FIG. 6