

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY^{1/}

Core samples from Union Oil Company's Long Ridge Corehole LR4-75
drilled in NW1/4NW1/4NE1/4 (1032.4' N and 2516.3' W of E 1/4 corner)
of sec. 20, T 5 S, R 95 W, Garfield County, Colorado

Surface elevation: 8139.5 feet
Cored interval: 648.7-1802.0 feet
Mahogany marker: 1052.9-1053.3 feet

From	To	Description
PARACHUTE CREEK MEMBER OF GREEN RIVER FORMATION		
648.7	651.7	Siltstone: Light slightly brownish gray. Faintly streaked to massive. Irregular thick parting; irregular to fairly regular fracture. Occasional fine to thin tan to brownish-gray marlstone streaks and shreds. Rare fine black carbonaceous flecks. Some broken core and rubble; contact with oil shale below missing.
651.7	652.7	Oil shale: Dark to light brownish gray in upper 0.3 foot; buff to medium and rare dark brownish gray below 652.0; dolomitic to very slightly calcareous. Faint to some distinct laminae; some fine loop structures and displacements. Irregular thick parting; slightly conchoidal and irregular fracture; slightly permeable. Fine dense silty dark gray pyritic streaks at 652.2. Regular slightly wavy contact with siltstone below.
652.7	654.9	Siltstone: Light and rare medium slightly brownish gray. Massive to faintly streaked; rare bands. Irregular thick parting; slightly irregular to irregular fracture; slightly permeable. Rare fine carbonaceous flecks in upper part. Fine oil-shale stringers and streaks at 653.7 and 653.8; a 1-inch irregular brownish gray oil-shale band interfingered with siltstone at 654.6-654.7. Sharp slightly irregular contact with oil shale below.
654.9	655.6	Oil shale: Buff to medium and rare dark brownish gray, slightly calcareous to dolomitic. Moderately distinct to faint regular to very discontinuous and displaced laminae; finely interfingered with lenticular gray-buff siltstone stringers and streaks in lower 2 inches. Slightly irregular to irregular thick parting; fairly regular fracture.
655.6	656.3	Siltstone: Medium-light gray to gray-buff. Faintly streaked and mottled; rare faint discontinuous laminae. Irregular thick parting; slightly to moderately irregular fracture; slightly permeable. Some very fine carbonaceous specks. Contact with oil shale below missing.
656.3	657.1	Oil shale: Medium brownish gray to some buff, very slightly calcareous to dolomitic. Moderately distinct regular laminae to faint discontinuous laminae and streaked bedding; abundant fine displacements and loop structures. Irregular to slightly irregular thick parting; slightly conchoidal to irregular fracture. Rare fine dense silty dark gray streaks and blebs. Diagonal fracture with brownish-black patchy bitumen coatings at 659.9. Very finely interfingered contact with siltstone below.

^{1/} By L. G. Trudell, completed February 21, 1979.

Illustration No. SBR-5015P Sheet 1 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

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From	To	Description
		thick parting; irregular and conchoidal fracture. Sparse carbonaceous flecks. Interfingered contact with oil shale below.
669.8	670.2	Oil shale: Buff to light and some medium brownish gray. Faint to moderately distinct discontinuous and displaced laminae and streaked bedding; interfingered with gray siltstone in upper 2 inches. Wavy and slightly interfingered contact with siltstone below.
670.2	670.8	Siltstone: Medium-light slightly brownish gray, dolomitic. Very faintly variegated and streaked. Irregular thick parting; slightly irregular and conchoidal fracture. Abundant very fine carbonaceous flecks. Regular contact with oil shale below.
670.8	671.1	Oil shale: Buff to light and some medium brownish gray, slightly calcareous. Faint to moderately distinct slightly discontinuous and displaced laminae. Irregular thick parting; conchoidal fracture. Grades to darker oil shale below.
671.1	672.7	Oil shale: Medium to some dark and light grayish brown, dolomitic. Faint regular to some discontinuous laminae. Irregular and rare regular thick parting; irregular to conchoidal fracture. Diagonal fracture with very fine patchy calcite crusts at 672.3.
672.7	673.3	Oil shale: Buff and tan to some medium grayish brown. Faint very fine discontinuous laminae and streaked bedding. Irregular parting and fracture; some diagonal fractures with very fine drusy crusts; uneven sample split. Some siltstone stringers.
673.3	674.2	Siltstone: Light slightly brownish gray to gray-buff. Faintly variegated and mottled. Irregular parting and fracture; uneven sample split.
674.2	674.9	Siltstone: Brownish gray, dolomitic. Faintly streaked and variegated to massive. Irregular thick parting; slightly irregular to irregular fracture. A 3/4-inch tan to grayish-brown oil-shale layer with discontinuous and displaced laminae at top; few oil-shale streaks and shreds elsewhere. Very irregular indistinct contact with oil shale below.
674.9	675.5	Oil shale: Medium to rare dark grayish brown, dolomitic. Faint streaked bedding and discontinuous laminae. Irregular thick parting; irregular to slightly conchoidal fracture. A 1/2- to 3/4-inch vermiform siltstone stringer in upper 3 inches. Interfingered and shredded contact with siltstone below.
675.5	675.9	Siltstone: Like 674.2-674.9. Regular conformable contact with oil shale below.
675.9	677.4	Oil shale: Tan and buff to medium and some dark grayish brown; dolomitic to calcareous. Faint to distinct discontinuous and displaced to regular laminae. Irregular to regular thick to some medium parting; irregular and conchoidal to regular fracture. Rare siltstone streaks in upper part; few fine vermiform siltstone stringers in lower part.

Illustration No. SBR-5015P Sheet 3 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		Sample of black satiny oil shale from 697.2 feet: X-ray--dolomite, quartz, feldspar, analcime, calcite, pyrite, Mg-siderite.
697.8	698.5	Oil shale: Medium and some dark grayish brown to some tan and rare buff, dolomitic. Faint to some fairly distinct laminae; abundant fine loop structures and displacements. Irregular thick parting; conchoidal fracture.
698.5	701.0	Oil shale: Buff and tan to medium and some dark grayish brown, dolomitic. Distinct to some faint laminae; very abundant fine loop structures and displacements. Very light buff very dolomitic mudstone in lower 0.1 foot. Irregular to regular thick to rare medium and thin parting; slightly conchoidal fracture. Sample of buff and tan oil shale from 699.6 feet: X-ray--dolomite, quartz, feldspar.
701.0	703.0	Oil shale: Tan to medium and some dark grayish brown, some buff in upper part, rare black in lower part, dolomitic. Moderately distinct to faint laminae; some fine displacements. Irregular to fairly regular thick parting; slightly to moderately conchoidal fracture. A diagonal fracture with some drusy calcite patches at 701.3; a very fine short tight calcite-filled diagonal fracture at 702.6. Very thin zones of abundant fine cavities with drusy crystals at 701.4 and 702.45.
703.0	704.2	Oil shale: Dark and rare medium grayish brown to black, common satiny to resinous luster at 703.4-704.0; dolomitic. Faint very fine regular to discontinuous laminae; nearly massive in lower 0.4 foot. Irregular to slightly irregular thick parting; slightly to moderately conchoidal and rare irregular fracture. A very fine buff-white silty lamina with abundant fine pyritic (?) patches at 703.6.
704.2	707.8	Oil shale: Medium and some dark brownish gray; dolomitic to slightly calcareous. Massive with some very faint laminae and streaks. Irregular thick parting; slightly to very conchoidal fracture. Abundant collapsed and rare open cavities with secondary mineral fillings at 705.1-705.3, 705.6, and 705.7-705.8; very fine platy boxworks with drusy calcite at 706.0. High-angle natural (??) fracture at 706.6-707.0. Irregular core pieces with some drusy calcite at bottom. Sample of oil shale as below with secondary minerals filling partly collapsed cavities and very fine fractures from 705.3 feet: X-ray--dolomite, quartz, calcite, analcime, feldspar, pyrite. Sample of medium-dark massive oil shale from 705.4 feet: X-ray--dolomite, quartz, calcite, analcime, feldspar
707.8	709.1	Missing

Illustration No. SBR-5015P Sheet 5 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
721.4	723.9	Marlstone (lean oil shale): Buff and tan to some medium and very rare dark grayish brown; moderately to slightly calcareous. Fairly distinct to faint laminae; abundant fine loop structures. Fairly regular to irregular thick parting; slightly to moderately conchoidal and irregular fracture. Few natural high-angle fractures in lower part. A thin buff to white earthy and silty layer at 723.8.
723.9	725.3	Siltstone and some oil shale: Very light gray-buff siltstone with abundant fine to thin wavy streaks and stringers of grayish-brown to tan oil shale. Irregular thick parting; slightly irregular to irregular fracture. Wavy interfingered contact with oil shale above; sharp regular contact with oil shale below. Sample of gray-buff siltstone from 724.4 feet: X-ray--quartz, analcime, feldspar, dolomite, Mg-siderite, pyrite.
725.3	726.8	Oil shale: Medium and rare dark grayish brown to some tan, some buff near top, dolomitic. Moderately distinct to faint laminae; some fine loop structures. Irregular to slightly irregular thick parting; slightly conchoidal to irregular fracture. Light slightly brownish-gray siltstone streaked with oil shale at 725.75-726.05; some carbonaceous plant fragments. Fine vermiform light gray silty streaks at 726.6-726.7.
726.8	728.2	Oil shale: Medium to some light and rare dark grayish brown and brownish gray; dolomitic to slightly calcareous. Faint to some moderately distinct laminae; some fine loop structures in upper part. Irregular to fairly regular thick parting; slightly conchoidal to some irregular fracture. Rare fine to thin buff silty streaks and stringers.
728.2	729.3	Oil shale: Tan to medium grayish brown; slightly to moderately calcareous; slightly silty in parts. Faint streaked bedding, becoming disrupted in lower part. Irregular thick parting; irregular fracture. Some very irregular buff silty stringers and streaks in lower part.
729.3	730.4	Oil shale: Tan to grayish brown; dolomitic to slightly calcareous. Faint irregular to regular streaked bedding and discontinuous laminae. Irregular thick parting; irregular to slightly conchoidal fracture. Gray-buff siltstone with some oil-shale streaks and stringers in lower 4 inches; interfingered upper contact and sharp regular lower contact.
730.4	733.0	Oil shale: Medium and rare dark grayish brown and brownish gray; dolomitic to slightly calcareous. Faint regular to discontinuous laminae and streaked bedding. Irregular to some regular thick to rare medium and thin parting; slightly to moderately conchoidal fracture. Rare fine to thin light brownish-gray silty calcareous streaks and lenses.

Illustration No. SBR-5015P Sheet 7 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

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From	To	Description
747.0	749.2	Oil shale: Dark brownish gray in upper part to dark and medium grayish brown in lower part; dolomitic to calcareous. Faint very fine regular to discontinuous laminae. Irregular to rare regular thick to rare medium parting; regular to conchoidal fracture. Few fine to 1/2-inch medium to light brownish-gray silty streaks and irregular lenses in upper 0.3 foot. A 2-inch buff silty and earthy tuff band at 747.4-747.6. A 1-inch brownish-gray dense very fine blebby-textured dolomite band at 747.8.
749.2	750.2	Oil shale: Medium grayish brown and brown, calcareous. Faint and rare moderately distinct discontinuous to regular laminae. Irregular to slightly irregular thick parting; slightly conchoidal to irregular fracture. Irregular natural high-angle fracture with fine patchy bitumen coatings in lower 0.4 foot.
NOTE: Core pieces were mixed up between 749.9 and about 755.0 feet. After fitting the pieces together the correctness of the sequence from 750.2 to 753.8 cannot be positively confirmed.		
750.2	751.2	Oil shale: Medium to dark brownish gray and some black, dolomitic. Moderately distinct to faint regular to disrupted streaked bedding; slightly discontinuous laminae in lower 0.2 foot. Irregular thick parting; irregular to slightly irregular and conchoidal fracture. A small rounded piece of buff mudstone with fine to small drusy cavities at 751.0 (not included in assay sample).
751.2	752.2	Oil shale: Dark brownish gray to black; dolomitic to slightly calcareous; rare satiny to resinous luster. Faintly laminated. Irregular to fairly regular thick to rare medium and thin parting; slightly to moderately conchoidal fracture. A very fine vertical calcite-filled fracture from 751.4 to 752.0. A fine to 1/4-inch gray-buff silty to very fine blebby-textured tuff stringer at 751.4.
752.2	754.2	Oil shale: Dark brownish gray in upper part to medium grayish brown in lower part, calcareous. Faint regular to discontinuous laminae. Irregular to rare regular thick parting; moderately to slightly conchoidal fracture. Diagonal fracture with very fine calcite coatings at 753.4-753.7. Sample of dark brownish-gray oil shale from 752.4 feet: X-ray--dolomite, calcite, quartz, feldspar, analcime, pyrite.
754.2	756.2	Oil shale: Medium to some light and rare dark grayish brown; slightly to moderately calcareous. Faint to some moderately distinct laminae. Irregular to slightly irregular thick parting; slightly to moderately conchoidal and irregular fracture. Diagonal fracture with very fine drusy dolomite crusts at 754.5-754.7.
756.2	758.2	Oil shale: Medium grayish brown in upper part to medium-dark in lower part; slightly calcareous to dolomitic. Faint laminae to

Illustration No. SBR-5015P Sheet 9 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
777.5	778.5	Oil shale: Medium-dark to dark grayish brown; dolomitic to calcareous. Faint streaked bedding and very fine laminae. Cut by several regular parallel high-angle fractures with very fine drusy dolomite (?) crusts; uneven sample split.
778.5	786.0	Oil shale: Dark brownish gray, calcareous. Faint very fine laminae and some very faint streaked bedding. Irregular thick parting; slightly irregular to very irregular fracture. Some high-angle to irregular fractures with very fine drusy crusts. Irregular broken core pieces and rubble in a few places.
786.0	787.0	Rubble: Oil shale as above and below. Irregular small to 2-inch chunks and few rounded core pieces. Grab sampled.
787.0	790.8	Missing
790.8	793.0	Oil shale: Dark to medium grayish brown; calcareous to dolomitic. Moderately distinct to faint very fine regular to discontinuous laminae. Regular to irregular thick parting; slightly irregular and conchoidal fracture. Vertical fracture with sparse very fine disseminated pyrite at 790.8 and 792.0; vertical fracture with very fine drusy crusts and abundant pyrite in lower 0.3 foot. Rare very fine crystalline laminae and streaks. Sample of dark grayish-brown oil shale from 791.3 feet: X-ray--dolomite, quartz, calcite, analcime, feldspar.
793.0	798.0	Oil shale: Medium to some dark grayish brown; slightly calcareous to dolomitic. Faint to moderately distinct very fine regular to discontinuous laminae. Regular to irregular thick to rare thin parting; slightly irregular fracture. Rare high- to low-angle natural fractures. A 1/2-inch light brownish-gray to gray-white silty to blebby analcime band at 795.0.
798.0	801.0	Oil shale: Dark brownish gray and grayish brown; slightly calcareous to dolomitic. Faint very fine discontinuous laminae and streaked bedding. Irregular to slightly irregular thick parting; slightly irregular to irregular fracture. Rare very fine buff silty tuff streaks.
801.0	803.2	Oil shale: Dark to medium grayish brown, dolomitic. Faint very fine discontinuous laminae and streaked bedding. Irregular to regular thick parting; slightly to moderately irregular and conchoidal fracture.
803.2	804.3	Oil shale: Medium grayish brown, dolomitic. Faint very fine discontinuous to regular laminae. Regular to irregular thick parting; slightly irregular fracture. Two closely-spaced parallel high-angle fractures with very fine drusy calcite crusts and disseminated pyrite at 803.2-803.5. A very fine gray-buff silty tuff lamina at 803.8. Sample of medium grayish-brown oil shale from 803.9 feet: X-ray--dolomite, quartz, feldspar, calcite, analcime, pyrite.

Illustration No. SBR-5015P Sheet 11 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

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From	To	Description
818.0	819.0	Oil shale: Dark and rare medium grayish brown, dolomitic. Faint very fine regular to discontinuous laminae. Regular to irregular thick to rare medium parting; slightly conchoidal and irregular fracture.
819.0	820.0	Oil shale: Dark to some medium grayish brown, dolomitic. Faint very fine regular to discontinuous laminae. Irregular to regular thick to some medium parting; slightly conchoidal fracture. Diagonal fracture with very fine calcite coatings at top; vertical fracture with fine disseminated pyrite cubes at 819.15-819.4 (some broken core).
820.0	821.0	Oil shale: Medium and rare dark grayish brown, dolomitic. Faint to fairly distinct very fine discontinuous to regular laminae; abundant fine loop structures. Regular thick and rare thin parting; slightly to moderately conchoidal and rare coarse hackly fracture. Abundant insect larvae.
821.0	822.0	Oil shale: Light to medium and rare dark brownish gray and grayish brown, dolomitic. Faint to some distinct regular to discontinuous laminae; rare fine loop structures and displacements. Some insect larvae.
822.0	823.5	Oil shale: Medium and rare dark grayish brown, dolomitic. Faint to moderately distinct laminae. Regular to irregular thick to rare medium and thin parting; slightly conchoidal to irregular fracture. High-angle fractures with very slight mineral coatings at 822.2-822.5 and 822.7-822.8. Possible insect larvae.
823.5	824.9	Oil shale: Medium to some dark grayish brown, dolomitic. Faint very fine laminae; becoming slightly crinkled near bottom. Irregular to slightly irregular thick parting; slightly conchoidal and irregular fracture.
824.9	825.9	Oil shale: Black to dark brownish gray, dolomitic. Faint wavy laminae in upper part becoming contorted at 825.3; very faint disrupted streaked bedding in lower part. Regular to irregular thick parting; slightly conchoidal to irregular fracture. Fairly abundant fine to very small light blebby mineral patches from 825.2 to 825.6.
825.9	828.0	Oil shale: Medium and some dark grayish brown, dolomitic. Faint very fine discontinuous and slightly irregular to regular laminae; disrupted bedding near top. Irregular to fairly regular thick to rare medium and thin parting; irregular to regular fracture. Some fine to small light brownish-gray to white blebby to earthy patches in upper 0.4 foot. A diagonal fracture with very fine noncalcareous mineral crusts and disseminated pyrite at 826.4. A fine white silty pyritic lamina at 827.4. Abundant fine pyrite cubes on parting surfaces at 827.5.
828.0	830.1	Oil shale: Medium and some dark grayish brownish and brownish gray, dolomitic. Moderately distinct to faint very fine regular to discontinuous laminae; faint streaked bedding in lower 0.3

Illustration No. SBR-5015P Sheet 13 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		fine horizontal to high-angle pyrite-filled fractures at 846.1-846.7. Very rare very fine buff-white silty to earthy laminae and streaks. Very rare fine dense gray streaks.
850.0	851.0	Oil shale: Black to very dark brownish gray, common satiny and rare resinous luster, dolomitic. Very faint very fine streaked bedding and discontinuous laminae. Irregular thick parting; slightly to moderately conchoidal fracture. Sample of black satiny to resinous oil shale from 850.2 feet: X-ray--dolomite, quartz, feldspar, Mg-siderite.
851.0	851.8	Oil shale: Very dark to medium-dark brownish gray, some satiny luster, dolomitic. Very faint streaked bedding in upper part; faint distorted to regular laminae in lower part. Irregular thick parting; irregular to slightly conchoidal fracture. Some fine light to medium brownish-gray crystalline blebs in upper half. Sample of very dark oil shale with few fine crystalline blebs from 851.2 feet: X-ray--dolomite, quartz, calcite, feldspar, fluorite, pyrite, Mg-siderite.
851.8	853.8	Oil shale: Dark to medium grayish brown; dolomitic to slightly calcareous. Faint discontinuous to regular laminae. Irregular thick parting; moderately to slightly conchoidal fracture. Irregular fractured core pieces with very fine drusy coatings in upper 0.4 foot. Two very fine high-angle calcite-filled fractures with disseminated pyrite at 852.4-852.7.
853.8	858.3	Oil shale: Medium and rare dark grayish brown; slightly calcareous to dolomitic. Faint to rare moderately distinct laminae. Irregular to rare regular thick to rare medium and thin parting; irregular and conchoidal to fairly regular fracture. Rare medium to high-angle fractures with very fine drusy calcite.
858.3	858.5	Oil shale: Very dark brownish gray, slightly satiny luster. Faint very fine streaked bedding. Regular contacts with leaner oil shale above and below.
858.5	858.85	Oil shale: Medium to rare dark and light grayish brown. Faint to rare distinct laminae.
858.85	859.1	Oil shale: Like 858.3-858.5.
859.1	859.3	Oil shale: Very dark to medium grayish brown, dolomitic. Faint to moderately distinct laminae. Regular contact with very dark oil shale below.
859.3	860.4	Oil shale: Very dark brownish gray to black, common satiny to resinous luster, dolomitic. Faint very fine laminae and streaked bedding. Slightly irregular thick parting; conchoidal to regular fracture.
860.4	861.6	Oil shale: Very dark to medium grayish brown, dolomitic. Faint discontinuous to regular laminae. Irregular thick parting; slightly to moderately conchoidal fracture. Diagonal fracture with drusy calcite at 861.1-861.4.

Illustration No. SBR-5015P Sheet 15 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		slightly to moderately conchoidal and irregular fracture. Rare very small to fine dark brownish-gray dense to silty blebs, lenses, and streaks. Rare very fine buff-white earthy and silty streaks in upper part. A fine vitreous black brittle organic seam at 878.4.
879.1	881.6	Oil shale: Medium to dark and rare light brownish gray, slightly calcareous. Very faint to rare moderately distinct laminae. Irregular to rare regular thick parting; slightly to moderately irregular and conchoidal fracture. Abundant small to medium dark brownish-gray to buff silty to very fine granular tuff patches at 879.3-879.5 (some tarry impregnation); very thin slightly irregular tuff laminae at 880.85 and 880.95.
881.6	882.8	Oil shale: Dark to medium and rare light grayish brown; dolomitic to calcareous. Faint to rare distinct laminae. Irregular to regular thick parting; slightly conchoidal fracture. A 3-inch irregular mottled buff and earthy to dark brownish-gray sandy-textured and tar-impregnated tuff at top.
882.8	883.9	Oil shale: Medium to medium-dark grayish brown, very dark brownish-gray to black zone at 883.43-883.58; calcareous to dolomitic. Faint very fine laminae and streaked bedding. Irregular to slightly irregular thick parting; slightly irregular and conchoidal fracture.
883.9	884.9	Oil shale: Very dark brownish gray, some slight satiny luster, dolomitic. Faint very fine streaked bedding. Slightly irregular to irregular thick parting; slightly irregular fracture.
884.9	885.5	Oil shale: Medium grayish brown, dolomitic. Faint streaked bedding. Slightly irregular to irregular thick parting; slightly irregular and conchoidal fracture.
885.5	886.5	Oil shale: Very dark to dark brownish gray, dolomitic. Faint streaked bedding. Irregular to slightly irregular thick parting; regular to slightly irregular and conchoidal fracture. A very thin buff to tan silty tuff stringer with some very fine pyrite blebs at 886.3.
886.5	890.6	Oil shale: Dark to medium grayish brown; dolomitic to slightly calcareous. Very faint streaked bedding to faint laminae. Regular to some irregular thick parting; slightly conchoidal to irregular fracture. Rare fine gray pyritic streaks.
890.6	891.8	Marlstone: Buff, some tan in upper part, calcareous, slightly silty. Moderately distinct to faint laminae. Regular to irregular thick to medium parting; slightly conchoidal fracture. Few zones with abundant very fine black specks. Rounded core piece at bottom. Sample of buff marlstone from 891.0 feet: X-ray--dolomite, quartz, calcite, feldspar, Mg-siderite.
891.8	892.5	Missing

Illustration No. SBR-5015P Sheet 17 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		0.1-foot dark to medium brownish-gray tar-impregnated tuffs in lower half. Irregular thick parting; irregular to slightly irregular fracture.
912.1	913.0	Oil shale: Dark brownish gray; slightly to moderately calcareous. Faint very fine laminae and streaked bedding. Irregular to fairly regular thick parting; regular to conchoidal fracture. A thin tar-impregnated tuff at 912.9.
913.0	913.2	Marlstone and tuff: Very faintly bedded tan to buff marlstone with a 1-inch medium to dark grayish-brown tar-stained tuff band near top.
913.2	916.0	Oil shale: Medium-dark to very dark grayish brown; moderately to slightly calcareous. Faint very fine discontinuous laminae and streaked bedding. Fairly regular to irregular thick parting; slightly to moderately conchoidal and irregular fracture. A thin light brownish-gray to gray-buff tuff stringer at 913.35; rare fine streaks elsewhere.
916.0	917.0	Oil shale: Dark grayish brown, calcareous. Faint streaked bedding and very fine laminae. Irregular thick parting; slightly to moderately conchoidal fracture. Thin to fine grayish-brown to gray-buff tuffs in grayish-brown to tan oil shale at 916.4, 916.6, and 916.8.
917.0	918.0	Oil shale: Dark grayish brown in upper and lower parts, medium grayish brown to tan at 917.3-917.6; slightly calcareous to dolomitic. Faint very fine laminae and streaked bedding. Irregular thick parting; conchoidal to fairly regular fracture. Natural (?) diagonal fracture with very slight gray coatings at 917.2. Fine buff tuff stringers at 917.4 and 917.5.
NOTE: Core from 917.8 to 956.4 feet consisted of sawed half-core and quarter-core segments. Cores were not fitted or marked before sawing. Sample lengths and continuity are not precisely reliable.		
918.0	922.7	Oil shale: Dark brownish gray; moderately to slightly calcareous. Faint streaked bedding and some very fine laminae. Regular to irregular thick parting; slightly irregular and conchoidal fracture. Fine buff-white silty tuff streaks at 918.2 and 920.2.
922.7	924.0	Oil shale: Dark to medium grayish brown and rare tan, calcareous. Faint streaked bedding and very fine laminae. Irregular to fairly regular thick parting; slightly irregular and conchoidal fracture. One-half to 1 1/4-inch light brownish-gray silty tuff nodules and pinched layers at 923.0-923.2; few very thin to fine stringers elsewhere (tuffs all associated with lighter colored oil shale).
924.0	925.5	Oil shale: Dark to medium-dark grayish brown; moderately to slightly calcareous. Faint streaked bedding and very fine laminae. Irregular to slightly irregular thick parting; regular to conchoidal fracture. A 3/4-inch light brownish-gray slightly silty band with abundant fine buff-white earthy porous specks and streaks at 924.9-925.0.

Illustration No. SBR-5015P Sheet 19 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

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From	To	Description
952.0	953.8	Oil shale: Black to dark grayish brown; dolomitic to slightly calcareous. Faint streaked bedding and very fine laminae. Regular to irregular thick parting; slightly conchoidal fracture.
953.8	955.3	Oil shale: Medium and rare dark grayish brown to some tan and rare buff, calcareous. Faint to some moderately distinct streaked bedding. Irregular to slightly irregular thick to rare thin parting; irregular to slightly irregular fracture. Very abundant very fine white earthy to silty specks and streaks. Rare irregular high-angle fractures with very fine pyrite and bitumen patches. Sample of oil shale with very fine white specks from 955.1 feet: X-ray--quartz, dolomite, feldspar, analcime, calcite, pyrite.
955.3	956.4	Oil shale: Medium and rare light grayish brown, slightly calcareous. Faint streaked bedding; laced with abundant very fine tight to open calcite-filled fractures. Irregular parting and fracture.
NOTE:	Bottom of sawed core (see note at 918 feet). Full core below.	
956.4	969.0	Oil shale: Medium-dark to dark grayish brown; moderately to slightly calcareous. Faint streaked bedding and discontinuous to regular laminae; some massive zones in upper part. Irregular to rare regular thick parting; conchoidal to regular fracture. High-angle fracture with buff-white silty to very fine sandy-textured filling at 956.7-956.9. Some fractured broken core in lower foot.
969.0	971.2	Oil shale: As above and below. High-angle to diagonal fractures throughout. Few very small partly collapsed cavities at 970.5.
971.2	972.2	Oil shale: Dark grayish brown, calcareous. Faintly laminated. Irregular to slightly irregular thick parting; slightly conchoidal fracture.
972.3	977.8	Oil shale: Dark to some medium grayish brown, calcareous. Faint and rare moderately distinct laminae to some very faintly bedded zones. Irregular thick parting; irregular to slightly conchoidal fracture.
977.8	980.7	Oil shale: Dark grayish brown; moderately to slightly calcareous. Faint discontinuous laminae and streaked bedding. Irregular thick parting; slightly to moderately conchoidal fracture. Fine gray-buff silty tuff streaks at 978.7. Natural diagonal fracture at 979.1-979.2; shale bleached to medium brown adjacent to fracture.
980.7	981.5	Oil shale: Medium to some dark grayish brown; slightly to moderately calcareous. Faint to moderately distinct discontinuous to regular laminae. Irregular to regular thick to medium parting; conchoidal to irregular fracture. High-angle fracture with

Illustration No. SBR-5015P Sheet 21 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
998.9	1005.1	discontinuous and displaced laminae. Irregular to slightly irregular parting; conchoidal to fairly regular fracture. Oil shale: Medium and some dark grayish brown; slightly to moderately calcareous. Faint discontinuous to regular laminae. Irregular and rare fairly regular thick parting; slightly to moderately conchoidal fracture. Some natural vertical to diagonal fractures from 1001.5 to 1003.1. Fine buff silty streaks at 1001.9.
1005.1	1007.3	Oil shale: Medium grayish brown and brown; slightly calcareous to dolomitic. Moderately distinct to faint very fine regular to discontinuous laminae. Irregular to fairly regular thick parting; slightly irregular and conchoidal fracture. Sample of brown oil shale from 1005.2 feet: X-ray-- dolomite, quartz, feldspar, calcite, analcime, aragonite, pyrite.
1007.3	1008.7	Oil shale: Medium to dark grayish brown; calcareous to dolomitic. Faint discontinuous laminae and streaked bedding. Irregular thick parting; conchoidal to irregular fracture.
1008.7	1009.2	Oil shale: Dark grayish brown to black; some satiny to resinous lustre. Faint discontinuous laminae and streaked bedding. Slightly irregular thick parting; slightly conchoidal fracture. A fine dark brownish-gray bitumen-impregnated silty lens at 1008.8. Sample of very dark oil shale from 1008.9 feet: X-ray-- dolomite, quartz, feldspar, analcime, Mg-siderite, pyrite.
1009.2	1011.8	Oil shale: Dark to medium grayish brown; dolomitic to calcareous. Faint regular to discontinuous laminae. Irregular to slightly irregular thick parting; slightly to moderately conchoidal and irregular fracture.
1011.8	1013.1	Oil shale: Medium and some dark grayish brown to some brown and rare tan; slightly to moderately calcareous. Faint to rare distinct laminae. Irregular to rare regular thick to rare medium parting; conchoidal to slightly irregular fracture. Rare fine dark gray pyritic streaks.
1013.1	1014.1	Oil shale: Dark and rare medium grayish brown to brownish black, common satiny to resinous luster, dolomitic. Faint and some moderately distinct laminae in upper part; very fine blebby laminae in middle; very faint streaked bedding in lower part. Irregular to regular thick to rare thin parting; slightly conchoidal and rare slightly hackly fracture. A thin displaced gray silty biotitic lamina at 1013.3. Short high-angle fractures with blue-gray coatings at 1013.5-1013.6. A fine buff silty to very fine sandy-textured lamina at 1013.7.
1014.1	1015.2	Oil shale: Dark to medium grayish brown and brown; dolomitic to calcareous. Faint to some moderately distinct discontinuous to

Illustration No. SBR-5015P Sheet 23 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		TOP OF MAHOGANY ZONE
1027.0	1028.0	Oil shale: Tan and rare buff in upper part to medium and some dark grayish brown in lower part, dolomitic. Faint very fine regular to discontinuous laminae. Regular thick to rare thin parting; fairly regular fracture. Rare fine dark gray pyritic streaks and lenses. Vuggy parting surfaces at 1027.7.
1028.0	1030.0	Oil shale: Medium to dark grayish brown and some brown, dolomitic. Faint very fine discontinuous laminae and streaked bedding. Irregular to rare regular thick to rare medium parting; slightly conchoidal to irregular fracture. Few irregular medium- to low-angle fractures with slight chalky coatings.
1030.0	1031.0	Oil shale: Dark and some medium grayish brown, some brownish-black satiny to resinous shale in lower half, dolomitic. Faint streaked bedding to slightly irregular laminae. Slightly irregular to irregular thick to rare medium parting; slightly irregular fracture.
1031.0	1032.0	Oil shale: Dark and medium grayish brown in upper part to medium grayish brown and tan to buff in lower part; dolomitic to calcareous. Faint to distinct laminae, becoming slightly inclined in lower part; rare fine to thin loop structures in lower part. Slightly irregular thick parting; slightly conchoidal and irregular fracture.
1032.0	1033.0	Oil shale and tuff: Medium and rare dark grayish-brown and brownish-gray oil shale, some tan to buff in upper 0.2 foot, dolomitic. Distinct to faint very fine irregular, distorted, and displaced to fairly regular laminae. Irregular thick parting; moderately to slightly irregular fracture. Irregular streaked and mottled layers of reddish-grayish brown to buff tuff at 1032.25-1032.35 and 1032.45-1032.85. Some fine white to dark gray secondary mineral streaks at 1032.1-1032.2. Sample of tuff from 1032.7 feet: X-ray--quartz, dawsonite, Mg-siderite, dolomite, feldspar, kaolin.
1033.0	1034.1	Oil shale: Medium and rare dark brownish gray in upper part to brown, tan, and buff in lower part; dolomitic to slightly calcareous. Faint to distinct discontinuous to regular laminae; rare fine loop structures and displacements in lower part. Slightly irregular to irregular thick parting; slightly irregular fracture. A very thin dense light gray cherty lens near top. Very fine white chalky stringer at 1033.9. Irregular core piece in lower 0.1 foot.
1034.1	1035.6	Oil shale: Tan and buff to some dark grayish brown and rare black, dolomitic. Distinct to faint regular to slightly distorted laminae in thin to 4-inch lighter and darker zones. Regular to irregular thick to medium parting; slightly to moderately irregular fracture. A 1/2-inch buff silty and

Illustration No. SBR-5015P Sheet 25 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		Buff to slightly reddish-grayish-brown irregularly streaked and mottled tuff at 1034.55-1035.15; fine oil-shale stringer at 1034.8. (Same as 1032.0-1033.0 above whipstock.)
1035.3	1036.4	Oil shale: Medium and some dark grayish brown to some tan; dolomitic to very slightly calcareous. Faint to distinct discontinuous to regular laminae. Slightly irregular thick to some medium parting; fairly regular to some irregular fracture. Rare fine dense to silty gray-buff to gray streaks and lenses. Fine buff-white silty and earthy laminae at 1036.0 and 1036.3.
1036.4	1037.9	Oil shale: Medium to dark grayish brown and brownish gray, some tan to buff in upper part, dolomitic. Fairly distinct to faint regular to some irregular laminae. Regular to irregular thick to rare medium parting; slightly irregular fracture. A 1/2-inch light gray silty to very fine sandy-textured band at 1036.9. Abundant very thin to 1/2-inch dense to silty laminae and lenses at 1037.2-1037.5; some fine light gray to gray buff silty streaks and laminae in lower part. (Same as 1034.1-1035.6 above whipstock.)
1037.9	1038.7	Oil shale: Dark and some medium brownish gray to black, rare satiny to resinous luster in lower part, dolomitic. Moderately distinct to faint regular to discontinuous and some distorted laminae. Regular to some irregular thick to medium parting; regular to rare irregular fracture. A 1 1/2-inch wavy gray-buff silty to very fine sandy-textured tuff at 1038.2-1038.3; a 3/4-inch stringer with oil-shale inclusions at 1038.4; some fine light gray tuff laminae and stringers in lower 0.3 foot.
1038.7	1039.6	Tuff: Buff and gray buff to light brownish gray, dolomitic, silty to very fine sandy textured. Irregular bedding marked by very fine dark oil-shale streaks and stringers. Irregular thick parting; slightly irregular to irregular fracture. Sample of gray-buff tuff from 1039.4 feet: X-ray-- Na-feldspar, quartz, pyrite, dolomite.
1039.6	1040.3	Oil shale: Dark brownish gray to some black, some satiny luster, dolomitic. Faint slightly irregular to discontinuous laminae; some fine to thin loop structures. Slightly irregular to irregular thick parting; slightly irregular to irregular fracture. Some fine lacy black pyritic streaks and stringers at 1040.0 and near bottom. Fine buff silty tuff streaks at 1040.2.
1040.3	1043.0	Oil shale: Dark and some medium grayish brown; slightly calcareous to dolomitic. Faint and some moderately distinct laminae to very faint streaked bedding. Irregular to regular thick to rare thin parting; fairly regular to irregular fracture. Gray-buff silty to very fine sandy-textured tuff in upper 0.2 foot (upper contact missing; hackly interfingering contact with oil shale below). A very thin gray-buff silty tuff lamina at 1040.75. Medium-light brownish gray silty tuff in lower 0.2 foot.

Illustration No. SBR-5015P Sheet 27 of 80.

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1053.3	1056.9	Oil shale: Dark to medium grayish brown, some tan to buff mostly in upper and middle parts, dolomitic. Distinct to faint laminae; rare fine displacements and loop structures. Irregular to regular thick to some medium parting; slightly irregular and conchoidal fracture. A 1/4-inch gray silty lamina at 1053.95. A 1-inch gray mudstone band at 1054.95-1055.05 (like 1047.8) and a 1/8-inch mudstone lamina below band separated by a very thin oil-shale layer. A very thin medium to dark brownish-gray fine-grained crystalline lens at 1056.7-1056.8. Sample of tan to grayish-brown oil shale from 1054.8 feet: X-ray--dolomite, quartz, feldspar, dawsonite, Mg-siderite. Sample of fine-grained crystalline lens with small amount of oil shale from 1056.75 feet: X-ray--quartz, dawsonite, dolomite, feldspar, fluorite.
1056.9	1058.1	Oil shale: Very dark brownish gray to black, most of interval has satiny to resinous luster, dolomitic. Faint streaked bedding and very fine discontinuous laminae. Regular to slightly irregular thick to rare medium parting; slightly conchoidal fracture. Sample of satiny to resinous black oil shale from 1057.6 feet: X-ray--dolomite, quartz, analcime, feldspar, Mg-siderite, pyrite.
058.1	1059.2	Oil shale: Dark to rare medium grayish brown and rare black, dolomitic. Faint laminae and some streaked bedding. Fairly regular to irregular thick parting; regular to rare irregular fracture.
1059.2	1061.3	Oil shale: Dark to medium grayish brown, dolomitic. Faint laminae and streaked bedding. Irregular to slightly irregular thick parting; slightly irregular and conchoidal fracture.
1061.3	1063.6	Oil shale: Dark and rare medium grayish brown, some black in lower part, rare satiny luster in lower part, dolomitic. Faint streaked bedding in upper part to discontinuous and regular laminae in lower part. Irregular to slightly irregular thick parting; irregular to regular fracture. Rare fine dark brownish-gray silty streaks and lenses in upper part.
1063.6	1064.4	Oil shale: Dark to medium grayish brown and some brown, dolomitic. Faint to rare moderately distinct discontinuous to regular laminae. Irregular to regular thick parting; regular to slightly conchoidal fracture.
1064.4	1065.6	Oil shale: Dark and rare medium grayish brown to some brownish black, nearly all has satiny to resinous luster, dolomitic. Faint to rare moderately distinct discontinuous laminae and streaked bedding; rare thin loop structures. Slightly irregular thick parting; slightly to moderately irregular fracture.
1065.6	1066.8	Oil shale: Dark and rare medium brownish gray to rare black, some satiny and rare resinous luster, dolomitic. Faint to rare

Illustration No. SBR-5015P Sheet 29 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1089.4	1090.4	Oil shale: Dark grayish brown to black, some satiny luster, dolomitic. Faint streaked bedding and some laminae. Irregular to regular thick to medium parting; slightly to moderately irregular fracture.
1090.4	1091.5	Oil shale: Dark to medium-dark grayish brown, dolomitic. Faint regular to discontinuous laminae and streaked bedding. Irregular to slightly irregular thick parting; slightly conchoidal fracture. Few fine low-angle calcite-filled fractures near bottom.
1091.5	1094.1	Oil shale: Medium grayish brown, dark zone at 1092.8-1093.1, dolomitic. Faint to rare moderately distinct discontinuous to regular laminae. Regular to irregular thick to rare medium parting; slightly to moderately conchoidal and irregular fracture. Some fractured and broken core at 1092.2-1092.6. Few fine calcite-filled fractures near top. Abrupt change to very dark oil shale below.
1094.1	1096.1	Oil shale: Dark and rare medium brownish gray to rare black, dolomitic. Faint streaked bedding and discontinuous laminae. Regular to some irregular thick to rare medium parting; slightly conchoidal and irregular fracture.
1096.1	1097.1	Oil shale: As above. Some disrupted bedding. A 1-inch lenticular gray-buff to light brownish-gray silty tuff near top. Abundant fine lacy fractures filled with gritty black material in middle part.
1097.1	1099.2	Oil shale: Dark brownish gray in upper part to medium grayish brown in lower part; slightly calcareous to dolomitic. Faint discontinuous to regular laminae. Regular to slightly irregular thick parting; slightly conchoidal and irregular fracture. A fine waxy black organic streak at 1098.7. A fine gray-buff silty streak at 1098.9.
1099.2	1100.2	Oil shale: Medium grayish brown to rare tan and buff, dolomitic. Faint to some fairly distinct commonly discontinuous laminae. Regular to irregular thick to medium parting; slightly conchoidal to some irregular fracture. A very fine gray-buff blebby streak at 1099.9. Abrupt gradational change to dark oil shale below.
1100.2	1102.2	Oil shale: Dark grayish brown, dolomitic. Very faint streaked bedding. Slightly irregular to irregular thick parting; slightly conchoidal fracture. Slightly fractured and vuggy parting surface at bottom. Sample of dark grayish-brown oil shale from 1101.5 feet: X-ray--dolomite, quartz, feldspar, calcite, pyrite, Mg-siderite.
1102.2	1104.2	Oil shale: Medium grayish brown and brown, dolomitic. Faint very fine discontinuous to some regular laminae; intricately

Illustration No. SBR-5015P Sheet 31 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		streaked bedding. Irregular to rare regular thick parting; regular to conchoidal fracture.
1117.5	1118.8	Oil shale: Medium and some dark grayish brown to rare tan, slightly calcareous. Faint to some moderately distinct regular to discontinuous laminae. Irregular to fairly regular thick parting; slightly conchoidal to irregular fracture. Very fine high-angle calcite-filled fracture at 1117.8-1118.0.
1118.8	1119.9	Oil shale: Medium to some dark grayish brown; slightly calcareous to dolomitic. Faint very fine regular to discontinuous laminae. Irregular to regular thick parting; moderately to slightly conchoidal fracture. A very fine open vertical fracture with very slight calcite coatings at 1119.1-1119.5. Abrupt change to dark shale at bottom.
1119.9	1121.6	Oil shale: Very dark to some medium brownish gray; dolomitic to slightly calcareous. Faintly laminated. Regular to irregular thick parting; slightly to moderately conchoidal fracture. A 1-inch gray silty tuff lens at 1120.5; a fine light gray silty lamina at 1121.3.
1121.6	1122.0	Missing?
1122.0	1123.3	Oil shale: Medium and some dark brownish gray and grayish brown; dolomitic to slightly calcareous. Faint laminae to very faint streaked bedding. Fairly regular to irregular thick parting; slightly conchoidal fracture. Rubble in upper 0.1 foot.
1123.3	1124.3	Oil shale: Medium grayish brown to some tan and buff, calcareous. Very faint to distinct laminae. Irregular to slightly irregular thick to medium and rare thin parting; slightly conchoidal to irregular fracture; mostly discontinuous core pieces. Sample of buff to grayish-brown oil shale from 1123.8 feet: X-ray--dolomite, quartz, feldspar, calcite, pyrite.
1124.3	1125.3	Oil shale: Medium and rare dark grayish brown and brownish gray; calcareous to dolomitic. Faint very fine discontinuous to regular laminae. Irregular to regular thick to medium parting; slightly to moderately irregular fracture; few irregular core pieces with high-angle and horizontal fractures with slight chalky coatings. Sample of medium brownish-gray oil shale from 1125.1 feet: X-ray--dolomite, quartz, feldspar, calcite.
1125.3	1126.4	Oil shale: Dark to very dark brownish gray, dolomitic. Faint very fine discontinuous laminae to very faint streaked bedding. Regular to irregular thick to rare medium parting; slightly irregular fracture. A 1-inch vuggy core piece at 1125.7. Sample of very dark oil shale from 1125.8 feet: X-ray--dolomite, quartz, feldspar, Mg-siderite.
1126.4	1127.6	Oil shale: Very dark brownish gray in upper part to dark and some medium brownish gray in lower part; dolomitic to slightly calcareous. Very faintly streaked to faintly laminated; few

Illustration No. SBR-5015P Sheet 33 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1137.4	1139.8	Oil shale: Dark brownish gray and some black in upper part to dark and some medium grayish brown in lower part; slightly to moderately calcareous. Very faint very fine laminae and some streaked bedding. Irregular to some slightly irregular thick to rare medium parting; slightly conchoidal to some irregular fracture.
1139.8	1141.1	Oil shale: Medium to rare dark grayish brown and brown; calcareous to dolomitic. Faint to rare distinct laminae. Irregular to rare regular thick to some thin parting; slightly to moderately conchoidal and some irregular fracture. Rare very fine buff earthy streaks and laminae.
1141.1	1142.1	Oil shale: Medium and rare dark grayish brown in upper part to dark brownish gray and black in lower part; slightly calcareous to dolomitic. Moderately distinct to faint regular to discontinuous laminae and some streaked bedding. Irregular to regular medium to thick and rare thin parting; irregular to slightly conchoidal fracture; some irregular discontinuous core pieces in upper half--including a thin piece of brownish-gray silty tuff. Sharp wavy contact with tuff below.
1142.1	1142.8	Tuff: Medium grayish brown, silty, slightly dolomitic. Faint distorted bedding; occasional very fine black oil-shale streaks and stringers. Irregular thick parting; irregular fracture. Some fine to small buff earthy porous blebs. Irregular wavy and slightly interfingered contact with oil shale below. Sample of tuff with few fine buff earthy blebs from 1142.4 feet: X-ray--quartz, K-feldspar, Na-feldspar.
1142.8	1143.8	Oil shale: Black to dark grayish brown; some satiny luster in upper part, dolomitic. Faintly laminated; rare fine to thin loop structures. Irregular thick to rare medium parting; slightly conchoidal fracture. Some fine grayish-brown tuff streaks near top; a very thin stringer at 1143.2; a 1 1/2-inch stringer at 1143.6-1143.7.
1143.8	1144.8	Oil shale: Dark grayish brown to some black; rare satiny luster; dolomitic to slightly calcareous. Faint to rare moderately distinct laminae; slightly curved near bottom. Irregular thick parting; moderately to slightly conchoidal fracture. A thin dark grayish-brown tuff stringer at 1144.1.
1144.8	1147.4	Oil shale: Dark to some medium grayish brown; dolomitic to calcareous. Faint to rare moderately distinct laminae and streaked bedding; inclined about 35° in upper part. Diagonal fracture with very fine calcite crusts at 1145.6. Grayish-brown tuff stringer with some very fine buff earthy specks at 1146.6-1146.8, and a 1-inch stringer at 1147.0.
1147.4	1148.0	Tuff and oil shale: Irregular fractured pieces of grayish-brown silty tuff with fine oil-shale stringers and some fine buff

Illustration No. SBR-5015P Sheet 35 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		TOP OF B-GROOVE
1163.0	1167.1	Marlstone and lean oil shale: Buff and tan to rare medium and dark brownish gray; slightly to moderately calcareous. Faint to rare distinct laminae; rare zones of abundant fine loop structures. Regular to rare irregular thick to some medium parting; irregular to slightly conchoidal fracture. A 1 1/2-inch white to light gray earthy to silty tuff with rare pyritic streaks at 1163.5-1163.6. A 1/4-inch gray silty tuff lamina with brown patches at 1164.8. A 3/8-inch white silty tuff lamina at 1166.3. A 1 3/4-inch gray-buff to very light gray silty tuff with rare pyrite streaks at 1166.35-1166.5. Sample of buff and tan marlstone from 1164.1 feet: X-ray--dolomite, feldspar, analcime, pyrite. Sample of gray-buff tuff from 1166.35-1166.5 feet: X-ray--Na-feldspar, K-feldspar; some dolomite, analcime, quartz.
1167.1	1169.4	Marlstone and oil shale: Buff and tan to some medium and rare dark brownish gray and grayish brown; calcareous to dolomitic. Distinct to faint laminae. Regular to rare irregular thick to rare thin parting; slightly to moderately conchoidal fracture. A fine light gray silty tuff lamina at 1167.7. Rare fine massive pyrite laminae in lower part.
1169.4	1171.7	Marlstone: Buff and tan to rare medium and dark brownish gray, slightly calcareous. Faint to some moderately distinct laminae. Regular to some irregular thick to rare thin parting; slightly irregular and conchoidal fracture. Some very fine to rare thin gray laminae. A 1/2- x 1 1/2-inch vug with spongy pyrite at 1170.7.
1171.7	1172.4	Mudstone: Buff, slightly calcareous. Very faintly laminated and banded to massive. Irregular thick parting; slightly to moderately conchoidal fracture. Rare very fine gray pyritic streaks and specks. Sample of buff mudstone from 1172.2 feet: X-ray--dolomite, quartz, feldspar, Mg-siderite.
1172.4	1173.4	Marlstone and mudstone: Buff to rare light brownish gray, slightly calcareous. Faintly laminated. Regular to slightly irregular thick to some thin parting; regular to slightly conchoidal fracture. Few fine zones of abundant fine crystal cavities with pyrite.
1173.4	1175.2	Mudstone and marlstone: Gray buff and light gray to some light and rare medium brownish gray, slightly calcareous. Very faintly laminated. Irregular mixed up core pieces and rubble; some regular thin parting; grab sampled. Rare fine crystal cavities.
1175.2	1181.0	Missing

Illustration No. SBR-5015P Sheet 37 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		1190.6. Abundant fine wavy porous oil-shale streaks and laminae in upper inch. Sample of brownish-black slightly satiny oil shale from 1190.4 feet: X-ray--dolomite, quartz, feldspar, Mg-siderite, pyrite.
1191.1	1192.4	Oil shale: Medium to dark grayish brown, dolomitic. Faint to moderately distinct streaked bedding and discontinuous and distorted laminae in upper part to faint and some moderately distinct regular laminae in lower part. Irregular to slightly irregular thick parting; irregular and conchoidal to regular fracture. Slightly corrugated diagonal fracture with chalky coatings at 1192.1-1192.2.
1192.4	1193.7	Oil shale: Medium and rare dark grayish brown to tan and rare buff; dolomitic and rarely calcareous. Distinct to faint laminae. Regular to some irregular thick to rare thin parting; slightly irregular and conchoidal fracture. Abrupt change to streaked oil shale below.
1193.7	1195.8	Oil shale: Very dark to medium grayish brown; common satiny to resinous luster. Faint distorted streaked bedding. Irregular thick parting; irregular fracture. High- to low-angle fractures with slight chalky coatings at 1194.4 and 1195.0-1195.2.
1195.8	1196.9	Oil shale: Medium to some dark grayish brown, dolomitic. Faint streaked bedding in upper part, becoming interfingered with light brownish-gray mudstone in middle; faint very fine slightly inclined laminae at 1196.4-1196.7; very faint displaced laminae in lower 0.2 foot. Irregular to some regular thick to rare thin parting; irregular to some slightly conchoidal fracture. Some irregular fractures with slight chalky coatings.
1196.9	1199.0	Oil shale: Medium to very dark grayish brown; rare satiny to resinous luster; dolomitic to slightly calcareous. Faint to some moderately distinct laminae and rare gradational bands. Irregular to regular thick parting; slightly conchoidal fracture. Sample of medium-dark grayish-brown oil shale from 1198.5 feet: X-ray--dolomite, calcite, feldspar, quartz, pyrite, Mg-siderite.
1199.0	1199.2	Oil shale: Grayish brown to tan, very calcareous. Faint streaked bedding and very fine laminae largely obscured by abundant short tight to open fractures and rare fine cavities. Irregular parting and fracture.
1199.2	1199.3	Tuff: Buff to buff-white, chalky. Massive to faintly bedded. Irregular rounded core pieces.
1199.3	1200.3	Oil shale: Medium to some dark grayish brown and rare tan, calcareous. Faint to rare distinct laminae. Irregular to fairly regular thick parting; slightly to moderately conchoidal fracture. A large nodular buff earthy and silty tuff with some fine oil-shale stringers at 1200.05-1200.25.

Illustration No. SBR-5015P Sheet 39 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1212.0	1214.9	Oil shale: Medium and rare dark grayish brown in upper and lower parts to medium grayish brown and some tan in middle; dolomitic to calcareous. Very faint to some moderately distinct laminae. Irregular to rare regular thick parting; moderately to slightly conchoidal fracture. A 1/2-inch wavy grayish-brown fine-grained crystalline band at 1212.9. Sample of grayish-brown fine-grained crystalline band from 1212.9 feet: X-ray--quartz, fluorite, dawsonite, feldspar, analcime, dolomite.
1214.9	1217.2	Oil shale: Dark brownish gray, dolomitic. Very faint streaked bedding and discontinuous laminae. Irregular thick parting; moderately to slightly irregular fracture. Sample of dark brownish-gray oil shale from 1216.1 feet: X-ray--dolomite, quartz, feldspar, dawsonite, pyrite, Mg-siderite.
1217.2	1218.5	Oil shale: Medium and rare dark brownish gray, dolomitic. Faintly laminated; some indistinct fine to small displacements and slightly wavy bedding. Irregular thick parting; irregular fracture. Some fine crystalline streaks and stringers in upper part.
1218.5	1219.7	Oil shale: Medium and rare dark brownish gray to grayish brown and rare tan, dolomitic. Faint to rare moderately distinct laminae. Irregular to very regular thick to some thin parting; irregular to slightly conchoidal fracture. Rare fine irregular high-angle fractures with noncalcareous crystalline fillings.
1219.7	1220.8	Oil shale: Medium and some dark brownish gray and grayish brown, dolomitic. Moderately distinct to faint laminae. Irregular to regular thick to medium parting; slightly to moderately conchoidal and irregular fracture. Rare fine crystalline laminae and streaks in lower part. Sample of oil shale with fine crystalline laminae and streaks from 1220.5 feet: X-ray--dolomite, quartz, feldspar, dawsonite, Mg-siderite, pyrite.
1220.8	1223.2	Oil shale: Medium and dark brownish gray, dolomitic. Faintly laminated. Irregular to some regular thick to rare medium parting; slightly conchoidal to irregular fracture. A thin medium to dark slightly brownish-gray silty to very fine sandy-textured tuff lamina at 1221.05. Natural (?) high-angle fracture at 1222.2-1222.4.
1223.2	1224.3	Oil shale: Medium and rare dark grayish brown to tan and buff; dolomitic to slightly calcareous. Faint to some distinct laminae. Regular thick to rare thin parting; slightly conchoidal fracture. Vertical fracture with brown coatings at 1223.5-1223.7.
1224.3	1225.4	Oil shale: Medium and some dark grayish brown to rare tan; slightly calcareous to dolomitic. Faint to rare moderately distinct laminae. Irregular to fairly regular thick parting;

Illustration No. SBR-5015P Sheet 41 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		very fine discontinuous laminae in other parts. Irregular thick parting; slightly conchoidal to regular fracture.
1235.6	1237.3	Oil shale: Dark and rare medium grayish brown in upper and lower parts, medium grayish brown and brown at 1236.1-1236.5, dolomitic. Faint to some moderately distinct streaked bedding; inclined 15°-25° at 1236.4-1237.0. Irregular thick parting; moderately to slightly irregular fracture; sawed core and some rubble at 1236.0-1236.5. Rare vuggy core pieces in sawed part.
1237.3	1238.5	Oil shale: Medium to dark grayish brown, dolomitic. Faint streaked bedding and some discontinuous laminae. Irregular thick parting; slightly to moderately irregular fracture.
1238.5	1239.8	Oil shale: Medium to some dark grayish brown, dolomitic. Faint discontinuous to regular laminae and some streaked bedding. Irregular to some regular thick parting; slightly to moderately irregular fracture. A small dense gray silty lens at 1239.1
1239.8	1241.8	Oil shale: Dark brownish gray to black, dolomitic. Faint streaked bedding and discontinuous laminae. Irregular to slightly irregular thick parting; slightly conchoidal to rare irregular fracture.
1241.8	1242.8	Oil shale: Dark to medium brownish gray; dolomitic to slightly calcareous. Faint streaked bedding and discontinuous to regular laminae. Irregular to slightly irregular thick to rare medium parting; moderately to slightly irregular fracture. Rare fine to 1-inch dark brownish-gray silty streaks and lenses in upper part. Sample of dark brownish-gray silty lens from 1242.0 feet: X-ray--quartz, dolomite, feldspar, pyrite, calcite, fluorite, Mg-siderite, dawsonite.
1242.8	1244.0	Oil shale: Medium brownish gray and grayish brown; dolomitic to slightly calcareous. Very faint streaked bedding and discontinuous laminae. Irregular to regular thick to rare thin parting; slightly irregular to irregular fracture. Some high and low-angle fractures with chalky coatings. Sample of brownish-gray oil shale from 1243.0 feet: X-ray--dolomite, Na-feldspar, pyrite, quartz, K-feldspar.
1244.0	1245.2	Oil shale: Medium to light brownish gray and rare buff; dolomitic to slightly calcareous. Very faint streaked bedding to faint and rare moderately distinct regular laminae. Regular to irregular thick to some medium parting; slightly to moderately conchoidal fracture. Natural vertical fracture with chalky coatings in upper 0.4 foot; some very fine horizontal to vertical chalky streaks elsewhere. A thin hackly porous black pyritic streak with some chalky material at 1244.7. Sample of medium to light brownish-gray oil shale from 1244.4 feet: X-ray--dolomite, feldspar, quartz.

Illustration No. SBR-5015P Sheet 43 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1261.4	1263.0	Oil shale: Medium grayish brown with some thick dark brownish-gray to black zones, dolomitic. Faint and rare moderately distinct streaked bedding. Regular to irregular thick parting; slightly to moderately conchoidal and some irregular fracture.
1263.0	1264.4	Oil shale: Dark brownish gray to black; common satiny and some resinous luster. Faint streaked bedding and very fine laminae. Regular to rare irregular thick to thin parting; irregular to hackly fracture. Abundant fish scales and some fin spines and bone fragments; few very small articulated fish. A fine dark brownish-gray silty lamina at 1263.7. Sample of very dark fossiliferous oil shale from 1263.7 feet: X-ray--quartz, Na-feldspar, calcite, pyrite, dolomite, Mg-siderite.
1264.4	1265.1	Missing
1265.1	1266.1	Oil shale: Dark grayish brown, dolomitic. Very faint very fine slightly distorted discontinuous laminae and streaked bedding. Irregular thick to medium parting; slightly conchoidal to some irregular fracture. A 0.1-foot vug with irregular boxworks at top. No fossils.
1266.1	1267.1	Oil shale: Dark to medium grayish brown, dolomitic. Very faint streaked bedding and discontinuous to regular laminae. Irregular to slightly irregular thick to some medium parting; slightly to moderately conchoidal and irregular fracture.
1267.1	1268.1	Oil shale: Medium and rare dark brownish gray, dolomitic. Faint streaked bedding. Irregular thick parting; slightly conchoidal and irregular fracture. A small vug near bottom.
1268.1	1268.9	Missing
1268.9	1271.0	Oil shale: Medium brownish gray, dolomitic. Faint regular to discontinuous laminae. Irregular to rare regular thick to rare thin parting; slightly conchoidal fracture; some irregular fractured core pieces. Rare small vugs. Some fine light gray earthy laminae and streaks.
1271.0	1271.5	Rubble: Oil shale as above and below.
1271.5	1272.0	Missing?
1272.0	1274.2	Oil shale: Dark brownish gray, some medium brownish-gray earthy streaks and zones, dolomitic. Faint streaked bedding. Irregular thick to medium parting and some irregular shaly to papery parting; slightly irregular to irregular and hackly fracture; some rubble. Some fine earthy streaks (collapsed cavities). Few large to small vugs with fine hackly boxworks.
1274.2	1276.2	Missing
1276.2	1276.9	Oil shale: As above. Few small to large vugs.
1276.9	1278.8	Oil shale: Medium to rare dark brownish gray, dolomitic. Faint discontinuous laminae and streaked bedding. Irregular to fairly regular thick parting; moderately to slightly irregular fracture. A 1-inch piece of medium grayish-brown earthy porous oil shale at top.

Illustration No. SBR-5015P Sheet 45 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		fillings?) with fine dark pyritic specks at 1293.4-1293.6, 1294.2-1294.3, and 1294.8-1295.0. Sample of marlstone with white blebs and streaks from 1293.5 feet: X-ray--dolomite, pyrite, feldspar, quartz, analcime, kaolin.
1295.0	1296.2	Oil shale: Dark and some medium grayish brown to rare black, tan to buff earthy porous zone at 1295.6-1295.9, dolomitic. Faint streaked bedding; some faint to distinct discontinuous to regular laminae in earthy zone. Irregular thick parting; slightly to moderately conchoidal and irregular fracture; shaly to papery parting and slightly hackly fracture in earthy zone. Some fine white mineral blebs as above near top.
1296.2	1297.6	Oil shale: Medium to some dark grayish brown, dolomitic. Faint streaked bedding; wavy in parts. Irregular thick parting; irregular to slightly conchoidal fracture. Common small to 2-inch vugs with irregular coarse boxworks. High-angle fracture with chalky coatings at 1296.6-1296.9.
1297.6	1298.3	Oil shale: Dark brownish gray to rare black, dolomitic. Faint streaked bedding and discontinuous to regular laminae. Irregular thick parting; irregular and conchoidal fracture.
1298.3	1299.3	Oil shale: Dark to medium brownish gray, dolomitic. Faint to rare moderately distinct laminae. Regular to irregular thick to rare thin parting; irregular to regular fracture. Low-angle fracture with chalky coatings at 1298.7, and a horizontal chalky fracture at bottom.
1299.3	1300.3	Oil shale: Medium to some dark brownish gray and grayish brown, dolomitic. Faint to rare moderately distinct laminae. Irregular to regular thick to rare medium parting; irregular and conchoidal fracture. Diagonal fracture with chalky coatings at 1299.9. Rare fine pyritic streaks.
1300.3	1302.3	Oil shale: Medium and rare dark brownish gray in upper and lower parts to medium grayish brown and tan in middle, dolomitic. Faint and rare moderately distinct regular to discontinuous laminae. Irregular thick parting in upper part to regular thick to rare thin parting in lower part; conchoidal to irregular fracture. Vertical fracture with chalky coatings in upper 0.2 foot.
1302.3	1303.5	Oil shale: Medium-dark grayish brown, dolomitic. Very faint streaked bedding. Irregular thick parting; irregular and conchoidal fracture. Some very small to 3/4-inch vugs with fine and radial to coarse and irregular boxworks. Sample of medium-dark grayish-brown oil shale from 1302.9 feet: X-ray--dolomite, quartz, feldspar, Mg-siderite.
1303.5	1304.2	Oil shale: Dark brownish gray to some black, some satiny luster in upper part, dolomitic. Very faint to faint laminae and bands.

Illustration No. SBR-5015P Sheet 47 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1313.2	1314.0	Oil shale: Light to medium and rare dark brownish gray, dolomitic. Faint to some distinct laminae. Irregular to rare regular thick to medium parting; conchoidal to irregular fracture; some irregular core pieces and rubble. Two 3/4-inch chalky white nodules (vug fillings?) near top.
1314.0	1315.0	Missing
1315.0	1316.0	Oil shale: Dark and some medium brownish gray, dolomitic. Faint streaked bedding and some very fine discontinuous to regular laminae. Irregular to some regular thick to some thin parting; irregular and some hackly to slightly conchoidal fracture; some irregular discontinuous core pieces; vuggy rubble at top. Some fine earthy porous streaks. Few small to fine vugs.
1316.0	1317.7	Missing
1317.7	1318.0	Rubble: Tan to buff lumpy mud agglomerated with fine oil-shale fragments.
1318.0	1321.3	Oil shale: Dark to rare medium brownish gray and grayish brown, dolomitic. Faint streaked bedding. Irregular thick to some medium parting; irregular to conchoidal fracture.
1321.3	1322.3	Oil shale: Dark to medium brownish gray and grayish brown, dolomitic. Faint streaked bedding; faint to moderately distinct discontinuous laminae in lower 0.3 foot. Slightly irregular to irregular thick parting; irregular and conchoidal fracture.
1322.3	1323.4	Oil shale and marlstone: Medium and rare dark grayish brown to buff; dolomitic to slightly calcareous. Faint to distinct laminae; some fine loop structures and displacements. Irregular to regular thick parting; conchoidal and irregular fracture. Short high-angle fracture with varnish-like coatings at 1322.9.
1323.4	1324.6	Oil shale and marlstone: As above and below in thick darker and lighter zones.
1324.6	1326.3	Oil shale: Medium and rare dark grayish brown; dolomitic to slightly calcareous. Faint and rare moderately distinct regular to discontinuous laminae; few very faintly bedded bands. Fairly regular to some irregular thick parting; slightly to moderately irregular and conchoidal fracture.
1326.3	1327.4	Marlstone and oil shale: Buff to some medium and dark grayish brown; slightly calcareous to dolomitic. Faint to very distinct laminae; rare very fine displacements. Slightly irregular to very regular thick parting; slightly to moderately conchoidal fracture. A fine light gray to white chert (?) lamina at 1326.4.
1327.4	1328.4	Oil shale: Medium and rare dark brownish gray, some tan to buff in upper part, dolomitic. Distinct regular laminae in upper part to faint very fine discontinuous laminae in lower part. Regular to some irregular thick to rare medium parting; regular to rare irregular fracture.

Illustration No. SBR-5015P Sheet 49 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		very faint streaked bedding and discontinuous laminae elsewhere. Irregular to rare regular thick parting; slightly to moderately conchoidal fracture.
1353.9	1359.0	Marlstone and mudstone: Buff to medium brown; slightly to moderately calcareous. Distinct regular to some discontinuous laminae and some bands. Regular to irregular thick parting; fairly regular to rare irregular fracture.
1359.0	1362.0	Mudstone: Buff and rare light to medium grayish brown; moderately to slightly calcareous. Irregular to regular thick parting; slightly to moderately conchoidal and some irregular fracture. Some fine to small pyrite streaks and blebs.
1362.0	1365.1	Marlstone: Buff; slightly silty in parts; slightly calcareous to dolomitic. Very faint very fine laminae. Irregular to regular thick to rare medium parting; slightly to moderately conchoidal and some very irregular fracture. Some high-angle fracture with brown to black varnish-like coatings. Tar-impregnated breccia masses at 1362.0-1362.1, 1362.5-1362.6, and 1363.3-1363.5.
1365.1	1365.6	Marlstone grading to oil shale: Buff and tan to medium brownish gray, dolomitic. Faint to rare distinct laminae. Regular thick and rare thin parting; slightly conchoidal fracture. Thin massive pyrite streak at 1365.4.
1365.6	1367.0	Oil shale: Dark and some medium brownish gray, dolomitic. Faint regular to disrupted streaked bedding and some discontinuous laminae. Irregular thick parting; slightly to moderately irregular fracture.
1367.0	1369.0	Oil shale: Dark to medium brownish gray, dolomitic. Faint regular to some discontinuous laminae. Irregular to slightly irregular thick to rare medium parting; slightly conchoidal to rare irregular fracture.
1369.0	1370.0	Oil shale: Medium to dark brownish gray, dolomitic. Faint to moderately distinct laminae. Irregular to regular thick parting; slightly to moderately conchoidal fracture.
1370.0	1371.0	Oil shale: Dark to medium brownish gray, dolomitic. Very faint streaked bedding. Irregular thick parting; slightly to moderately conchoidal fracture.
1371.0	1373.0	Oil shale: Dark to medium grayish brown, dolomitic. Faint streaked bedding and discontinuous laminae. Irregular thick parting; conchoidal to irregular fracture. Vertical fracture with buff-white patchy dolomite crusts at 1371.7-1372.0.
1373.0	1374.2	Oil shale: Dark grayish brown to buff, dolomitic. Faint to moderately distinct very fine discontinuous to regular laminae in very distinct fine to 1-inch dark and light zones. Irregular thick parting; slightly to moderately conchoidal fracture. Rare very short tight vertical fractures with chalky coatings.

Illustration No. SBR-5015P Sheet 51 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1389.7	1390.0	Oil shale: Medium to dark grayish brown, dolomitic. Faint very fine discontinuous laminae and streaked bedding. Slightly irregular to wavy thick to thin parting; slightly irregular and rare hackly fracture.
1390.0	1390.7	Oil shale: Buff to medium grayish brown, dolomitic. Faint slightly irregular to discontinuous and displaced laminae. Irregular thick to thin parting; slightly conchoidal to irregular and hackly fracture. Some very irregular wavy glossy fracture surfaces with very fine slickensides and rare tar stains.
1390.7	1393.9	Oil shale: Dark to medium brownish gray, dolomitic. Faintly streaked in upper part to faintly laminated in lower part. Irregular thick parting; irregular to slightly conchoidal fracture.
1393.9	1395.3	Oil shale: Medium and rare dark grayish brown to some tan, dolomitic. Faint to rare moderately distinct laminae; rare thin loop structures in lower part. Slightly irregular to irregular thick parting; slightly irregular fracture. Medium brown slightly silty dolomite band at 1394.7-1394.8.
1395.3	1396.4	Oil shale breccia: Coarse angular fragments of very faintly bedded brown oil shale with resinous black organic material filling interfragmented openings. Irregular thick parting; irregular hackly fracture; good continuous core. Rare fine pyrite blebs. Rare open fractures.
1396.4	1397.8	Oil shale: Medium to dark grayish brown, dolomitic. Faint to rare moderately distinct laminae; tightly fractured and displaced in upper part. Irregular to fairly regular thick to rare medium parting; coarse hackly to slightly conchoidal fracture.
1397.8	1399.2	Oil shale: Medium and some dark grayish brown to some brown and tan, rare satiny to resinous black laminae in lower part, dolomitic. Faint to rare distinct laminae. Irregular thick parting; slightly conchoidal fracture.
1399.2	1400.5	Mudstone: Buff to light and rare medium grayish brown, very silty, calcareous. Faint and rare distinct discontinuous to regular laminae. Slightly irregular to irregular thick parting; irregular to slightly conchoidal fracture. A 0.1-foot faintly laminated regular band of medium to dark grayish-brown oil shale at bottom.
1400.5	1402.0	Mudstone: Buff and rare tan; moderately to slightly calcareous. Faint regular to discontinuous laminae. Irregular to slightly irregular thick parting; conchoidal to regular fracture. Some fine gray pyritic streaks and blebs in lower part. Few medium to high-angle fractures with speckled brownish coatings in lower part.

Illustration No. SBR-5015P Sheet 53 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1413.2	1415.0	Oil shale: Medium to rare dark slightly olive gray and some grayish brown, dolomitic. Faint regular to some discontinuous, displaced, and disrupted laminae. Irregular to regular thick to rare thin parting; moderately to slightly irregular fracture. High-angle fractures with very fine drusy pyrite and rare chalky coatings in upper 0.3 foot. Rare porous zones with fine partly collapsed cavities.
1415.0	1416.8	Oil shale: Medium to some dark brownish gray and grayish brown, rare black near bottom, dolomitic. Faint to some moderately distinct laminae. Irregular to rare regular thick to rare thin parting; slightly conchoidal to some slightly hackly fracture.
1416.8	1418.7	Oil shale: Medium brownish gray, dolomitic. Faint very fine discontinuous to regular laminae. Irregular thick parting; slightly to moderately conchoidal fracture.
1418.7	1423.8	Oil shale: Dark to medium brownish gray, dolomitic. Faint streaked bedding in upper part to faint regular laminae in lower part; distorted laminae at 1420.8. Irregular to rare regular thick to rare medium parting; irregular to slightly conchoidal fracture. Natural (?) vertical fracture at 1419.7-1420.2. A 1-inch tan-buff silty band at 1423.6.
1423.8	1424.5	Oil shale: Medium and rare dark grayish brown to tan, dolomitic. Faint to rare moderately distinct laminae. Irregular thick to medium parting; slightly conchoidal fracture.
1424.5	1427.6	Mudstone, marlstone, and oil shale: Buff to some medium and rare dark grayish brown; calcareous to dolomitic. Faint to some distinct laminae. Irregular to rare regular thick to some medium parting; slightly to moderately conchoidal fracture. Rare fine pyritic streaks and blebs. Few small vugs with fine boxworks and pyrite around 1427.2.
1427.6	1427.9	Oil shale: Dark to medium brownish gray, dolomitic. Faintly laminated. Rare fine pyritic streaks.
1427.9	1428.6	Dolostone: Medium slightly brownish gray. Massive to very faintly laminated in upper part; blebby and speckled with fine partly collapsed tar-filled cavities in lower part. Irregular thick parting; conchoidal to irregular fracture. Regular vertical fracture with brown stains and slight chalky coatings from top to 1428.4. Sample of dolostone from 1428.2 feet: X-ray--dolomite, quartz, feldspar, Mg-siderite.
1428.6	1430.4	Oil shale: Medium to dark brownish gray and rare black, dolomitic. Faint regular to discontinuous laminae and streaked bedding. Slightly irregular to irregular thick to rare medium and thin parting; slightly to moderately irregular and conchoidal fracture. Rare fine pyrite streaks and specks.
1430.4	1432.0	Oil shale: Medium to some dark brownish gray, dolomitic. Very faint discontinuous to regular laminae. Irregular thick parting; conchoidal fracture. Rare very fine pyritic streaks.

Illustration No. SBR-5015P Sheet 55 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		Sample of oil shale with minute disseminated crystals from 1446.7 feet: X-ray--analcime, dolomite, quartz, feldspar, Mg-siderite, pyrite, illite.
1447.0	1448.8	Oil shale: Dark to some medium slightly brownish and olive gray, dolomitic. Very faintly laminated. Regular to irregular thick to some thin parting; slightly irregular to irregular and some coarse hackly fracture. A fine dark gray silty lamina at 1447.4. A 1-inch medium to light grayish-brown tight silty-textured band at 1448.0-1448.1.
1448.8	1449.6	Oil shale: Medium to rare dark brownish gray, dolomitic. Faintly laminated. Irregular to regular thick parting; regular to conchoidal fracture. Bright tan silty band at 1449.4-1449.5. Sample of tan silty band from 1449.4-1449.5 feet: X-ray--Na-feldspar, analcime, Mg-siderite, dolomite, quartz.
1449.6	1450.6	Lean oil shale to marlstone: Light and some medium grayish brown to very light buff; dolomitic to slightly calcareous. Moderately distinct to faint laminae. Regular to irregular thick to rare medium parting; conchoidal fracture.
1450.6	1452.9	Marlstone: Buff and gray-buff to rare light and medium brownish gray, slightly calcareous, rarely silty. Faint to some moderately distinct laminae; rarely displaced and disrupted. Irregular to regular thick to rare medium parting; conchoidal to irregular fracture.
1452.9	1455.4	Marlstone: Buff to light and some medium brownish to slightly olive gray; slightly calcareous to dolomitic. Faint to some moderately distinct laminae; few massive bands. Irregular to regular thick to rare medium parting; conchoidal to irregular fracture. Rare fine pyrite streaks, blebs, and laminae.
1455.4	1456.2	Oil shale: Medium to some dark brownish gray and olive gray; slightly calcareous to dolomitic. Faint to rare moderately distinct laminae. Irregular to regular thick to thin parting; irregular slightly hackly fracture. Rare very fine pyrite blebs and streaks.
1456.2	1457.3	Oil shale: Medium and rare dark brownish gray, dolomitic. Very faintly laminated; massive in lower 2 inches. Irregular thick parting; irregular to conchoidal fracture.
1457.3	1458.3	Oil shale: Light brownish gray and rare buff in upper part to medium brownish gray in lower part, dolomitic. Faintly laminated in upper part to very faintly bedded in lower part. Irregular to regular thick parting; regular to conchoidal fracture.
1458.3	1460.3	Oil shale: Medium to very dark brownish gray, brown to tan in lower 0.1 foot, dolomitic. Very faintly bedded to faintly laminated. Regular to some irregular thick to thin parting; slightly irregular and conchoidal fracture. Some <u>very</u> fine disseminated crystals (like 1446.7?). A fine brown silty lamina at 1459.5.

Illustration No. SBR-5015P Sheet 57 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1478.9	1480.0	Mudstone: Buff to gray-buff, some light to medium gray streaks; slightly calcareous. Faint bands and laminae. Slightly irregular to irregular thick parting; regular to some irregular fracture.
1480.0	1481.2	Marlstone and rare oil shale: Buff to light brownish gray and rare medium to dark grayish brown; slightly calcareous to dolomitic. Faint to rare distinct laminae. Regular to irregular thick parting; slightly conchoidal fracture.
1481.2	1483.8	Marlstone and rare oil shale: Gray-buff to light and medium slightly olive gray, rare light to dark brownish gray, dolomitic. Massive to faint and rare distinct laminae. Irregular thick parting; conchoidal to irregular fracture; artificial (?) high-angle fractures thru most of interval. One-inch piece of buff earthy calcareous claystone with imbedded marlstone pebbles at 1482.1.
1483.8	1485.5	Marlstone: Medium slightly olive gray, dolomitic. Faint very fine discontinuous to regular laminae; rare medium to dark grayish-brown oil-shale laminae in upper part. Irregular thick to medium parting; irregular and conchoidal fracture.
1485.5	1487.0	Oil shale: Medium to some dark brownish gray and olive gray, dolomitic. Faint to some moderately distinct laminae. Irregular to some slightly irregular thick to rare thin parting; conchoidal to some irregular fracture.
1487.0	1488.4	Oil shale: Medium to rare light brownish gray, dolomitic. Moderately distinct laminae to very faint streaked bedding. Irregular to rare regular thick parting; moderately to slightly conchoidal fracture.
1488.4	1489.6	Oil shale: Dark to medium brownish to almost neutral gray, dolomitic. Faint discontinuous to regular laminae. Irregular to regular thick to rare medium and thin parting; slightly to moderately irregular fracture; irregular high-angle fracture with slight olive-gray coatings at 1489.3-1489.5.
1489.6	1491.7	Siltstone: Light gray and rare light to medium brownish gray; slightly calcareous to dolomitic. Faint regular to discontinuous and slightly irregular laminae and rare bands. Irregular parting and fracture. Irregular vertical fractures with brownish coatings thru most of interval; uneven sample split.
1491.7	1495.0	Mudstone: Gray-buff; very slightly calcareous to dolomitic. Faintly banded, laminated, and streaked to massive. Irregular thick parting; conchoidal and irregular fracture.
1495.0	1497.8	Mudstone: Gray-buff and light to rare medium gray; dolomitic to very slightly calcareous. Faint to some moderately distinct regular to discontinuous and rare distorted and displaced laminae; some massive bands. Irregular thick parting; slightly to moderately conchoidal fracture. Some fine gray crystalline blebs at 1496.9-1497.05.

Illustration No. SBR-5015P Sheet 59 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1521.4	1522.4	Oil shale: Medium to very dark brownish gray and some black, rare satiny luster, dolomitic. Faint discontinuous laminae and streaked bedding. Irregular to regular thick to rare medium parting; irregular and rare coarse hackly fracture.
1522.4	1523.7	Oil shale: Medium to dark brownish to slightly olive gray, dolomitic. Faint streaked bedding and discontinuous to regular laminae. Irregular to regular thick to rare medium and thin parting; irregular fracture. A thin pinch-and-swell dark gray silty pyritic stringer at top.
1523.7	1524.7	Mudstone, siltstone, and rare fine sandstone: Buff to light and some medium slightly brownish and olive gray, very dolomitic. Moderately distinct slightly irregular and nonparallel laminae. Irregular to slightly irregular thick parting; slightly irregular fracture.
1524.7	1525.0	Missing?
1525.0	1527.0	Siltstone and mudstone: Buff to light gray; calcareous to dolomitic. Faint slightly irregular, discontinuous, and displaced laminae to some massive. Irregular thick parting; irregular to slightly irregular and conchoidal fracture.
1527.0	1529.5	Claystone (mostly oil shale): Medium slightly olive gray to medium and rare dark brownish gray, dolomitic. Faint to some fairly distinct laminae; some bands in upper part. Irregular to rare regular thick to medium parting; slightly to moderately conchoidal and some irregular fracture. Sample of slightly olive-gray claystone from 1527.4 feet: X-ray--dolomite, quartz, feldspar, analcime, pyrite.
1529.5	1530.7	Missing
1530.7	1531.0	Claystone: As above.
1531.0	1534.2	Oil shale: Medium to very dark brownish gray, dolomitic. Faint irregular and discontinuous laminae to very faint streaked bedding. Irregular to rare regular thick to medium parting; slightly irregular to irregular fracture. A thin dark gray silty lens at 1531.9.
1534.2	1538.3	Marlstone and mudstone: Gray-buff to medium slightly olive and brownish gray, dolomitic. Faint to moderately distinct laminae and bands. Irregular to regular thick parting; slightly irregular to conchoidal fracture. Some gray siltstone streaks and laminae.
1538.3	1541.9	Mudstone: Buff to gray-buff; dolomitic to very slightly calcareous. Massive to faintly laminated and streaked; some moderately distinct oil-shale laminae in lower 0.4 foot. Irregular thick to rare medium parting; slightly to moderately conchoidal fracture.
1541.9	1544.3	Mudstone: Medium slightly olive gray, dolomitic. Faint regular to discontinuous laminae and rare bands. Irregular to regular

Illustration No. SBR-5015P Sheet 61 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1559.8	1560.3	Mudstone (lean oil shale): Buff to light and some medium brownish gray, very dolomitic. Faint discontinuous laminae. Irregular thick parting; conchoidal fracture.
1560.3	1562.3	Siltstone and mudstone: Buff and gray-buff to light gray; slightly to moderately calcareous. Faint discontinuous to regular laminae and rare massive bands. Irregular thick parting; slightly irregular and conchoidal fracture.
1562.3	1563.3	Mudstone: Buff to medium slightly brownish gray; slightly calcareous to dolomitic. Moderately distinct to faint regular to discontinuous laminae and streaked bedding; rare fine displacements in upper part. Irregular thick parting; slightly conchoidal to irregular fracture.
1563.3	1565.8	Oil shale: Very dark to some medium slightly brownish and olive gray, dolomitic. Faint streaked bedding. Irregular thick to rare medium parting; irregular to slightly conchoidal fracture.
1565.8	1567.0	Oil shale: Dark to medium slightly brownish and olive gray, dolomitic. Faint streaked bedding. Irregular thick parting; slightly to moderately conchoidal fracture.
1567.0	1569.2	Mudstone and marlstone: Medium brownish gray, gray, and grayish brown to buff; dolomitic to slightly calcareous. Faint to rare distinct streaked bedding and discontinuous to rare regular laminae and bands; bedding commonly slightly disrupted by gray silty blebs, streaks, and patches (bioturbations?). Irregular thick parting; moderately to slightly irregular fracture. A 2-inch silty to sandy-textured grayish-brown tar-stained band at 1568.4.
1569.2	1570.3	Oil shale: Medium to some light and rare dark slightly olive and brownish gray, dolomitic. Faint streaked bedding and discontinuous laminae. Irregular thick parting; irregular fracture.
1570.3	1571.3	Oil shale: Medium and rare dark grayish brown to some tan and rare buff, dolomitic. Faint to some moderately distinct discontinuous to regular laminae. Irregular thick parting; slightly to moderately irregular fracture.
1571.3	1572.3	Oil shale: Tan and rare buff to medium and rare dark grayish brown, dolomitic. Faint to moderately distinct regular to discontinuous laminae. Irregular thick parting; slightly conchoidal and irregular fracture.
1572.3	1573.3	Oil shale: Medium to some dark brownish gray, dolomitic. Faint to rare moderately distinct discontinuous laminae and streaked bedding; rare slight cross bedding. A 1 1/2-inch dense brownish-gray dolomite band near bottom.
1573.3	1574.3	Oil shale: Medium and rare dark grayish brown, dolomitic. Faint and rare distinct streaked bedding and discontinuous laminae. Irregular to slightly irregular thick parting; slightly to moderately irregular and conchoidal fracture.

Illustration No. SBR-5015P Sheet 63 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1587.8	1588.8	Oil shale: Tan and some buff to medium and rare dark grayish brown; slightly calcareous to dolomitic. Moderately distinct to faint laminae; some displacements in upper part. Irregular to slightly irregular thick parting; slightly conchoidal to some irregular fracture. A 3/4-inch gray silty layer near bottom with thin to fine vermiform stringers extending one inch into oil shale below.
1588.8	1589.8	Oil shale: Medium to dark brownish gray, dolomitic. Faint discontinuous laminae and streaked bedding. Slightly irregular to irregular thick to rare medium parting; slightly to moderately irregular fracture.
1589.8	1592.4	Marlstone: Buff to tan; dolomitic, some calcareous zones in upper part. Faint discontinuous laminae to massive. Irregular thick parting; slightly conchoidal fracture. Rare fine oil-shale shreds near bottom.
1592.4	1593.4	Oil shale: Medium to some dark brownish gray and rare tan, dolomitic. Faint to rare moderately distinct very fine discontinuous to regular laminae; cut by a thick vertical stringer of massive tan marlstone with rare oil-shale shreds in upper 0.3 foot. Irregular thick parting; irregular to slightly conchoidal fracture. Fine dark gray silty pyritic streaks at 1593.3.
1593.4	1594.4	Oil shale: Tan and some buff to medium and rare dark brownish gray, dolomitic. Faint commonly discontinuous and displaced laminae to very faint streaked bedding. Slightly irregular to irregular thick parting; slightly irregular and conchoidal fracture.
1594.4	1595.4	Oil shale: Medium to rare dark grayish brown, dolomitic. Faint very fine discontinuous laminae. Irregular thick parting; slightly to moderately conchoidal and irregular fracture.
1595.4	1596.6	Oil shale: Black to dark and some medium brownish gray, dolomitic. Very faint streaked bedding. Irregular thick parting; irregular and conchoidal fracture.
1596.6	1600.0	Oil shale: Very dark to medium-dark brownish gray, dolomitic. Very faint streaked bedding and some very fine discontinuous laminae. Irregular to rare regular thick to medium parting in upper 1 1/2 feet and irregular thick parting in other parts; slightly irregular to some irregular fracture.
1600.0	1602.0	Oil shale: Dark to some medium brownish gray, dolomitic. Very faint streaked bedding and some very fine discontinuous laminae. Irregular thick parting; slightly to moderately conchoidal fracture.
1602.0	1602.5	Oil shale: Medium to some dark and light brownish gray, dolomitic. Faint streaked bedding and discontinuous and displaced laminae. Irregular thick parting; conchoidal and irregular fracture. A thin displaced dolomite layer near top. A thin gray to brownish-gray dense to blebby-crystalline siliceous stringer at 1602.3.

Illustration No. SBR-5015P Sheet 65 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		oil shale below. Irregular thick parting; irregular and conchoidal fracture.
1616.4	1617.5	Oil shale: Light to medium and rare dark brownish gray; slightly calcareous to dolomitic. Faint to rare moderately distinct laminae; some fine to small displacements. Irregular to fairly regular thick parting; regular to slightly conchoidal fracture.
1617.5	1618.5	Oil shale: Medium and some light rare dark brownish gray, dolomitic. Faintly laminated; rare fine displacements. Slightly irregular to irregular thick to rare medium parting; slightly to moderately irregular fracture.
1618.5	1620.1	Oil shale: Dark to some medium brownish gray, dolomitic. Faint streaked bedding and some discontinuous laminae. Irregular to slightly irregular thick to medium parting; irregular and some slight hackly fracture. A natural (?) vertical fracture in upper half. Rare black fossil streaks.
1620.1	1623.1	Mudstone and siltstone: Buff to light and rare medium gray; slightly to moderately calcareous. Faint regular to discontinuous and displaced laminae. Irregular thick parting; slightly irregular to irregular fracture.
1623.1	1624.9	Mudstone and siltstone: Medium slightly olive and brownish gray to some buff, slightly calcareous. Faint to rare moderately distinct discontinuous to regular laminae. Irregular to slightly irregular thick parting; slightly to moderately irregular and conchoidal fracture.
1624.9	1625.4	Oil shale: Medium to some dark slightly olive and brownish gray, dolomitic. Faint to rare moderately distinct discontinuous laminae. Slightly irregular thick to medium parting; irregular slightly hackly fracture.
1625.4	1626.4	Mudstone: Light to medium slightly olive and brownish gray and some buff, slightly calcareous. Faint discontinuous laminae; some fine displacements. Irregular thick parting; slightly conchoidal to irregular fracture.
1626.4	1627.4	Oil shale: Very dark to some medium and rare light brownish gray, dolomitic. Faint and rare distinct discontinuous laminae to very faint streaked bedding. Irregular to fairly regular thick to rare medium parting; slightly irregular to irregular fracture.
1627.4	1628.7	Oil shale: Dark brownish gray, dolomitic. Faint streaked bedding. Regular to some irregular thick parting; slightly to moderately irregular fracture.
1628.7	1629.5	Oil shale: Medium to light olive gray, dolomitic. Faint streaked bedding and discontinuous laminae. Regular to irregular thick to rare medium parting; slightly irregular fracture.
1629.5	1632.4	Mudstone and some lean oil shale: Light to medium olive gray, some light to medium brownish gray in lower part; slightly to moderately calcareous. Faint to rare moderately distinct

Illustration No. SBR-5015P Sheet 67 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		Irregular thick parting; slightly conchoidal to irregular fracture. Sample of mudstone from 1642.7 feet: X-ray--dolomite, quartz, calcite, feldspar, analcime.
1642.9	1644.3	Mudstone and marlstone: Buff to some medium grayish brown, calcareous. Faint laminae and bands; abundant fine light gray silty streaks, blebs, and short vermiform stringers (bioturbations?). Irregular parting and fracture.
1644.3	1645.1	Marlstone and oil shale: Buff and tan to some medium brownish gray; calcareous to dolomitic. Faint discontinuous and displaced to rare regular laminae. Irregular thick parting; conchoidal to irregular fracture. A 3/4- to 1/2-inch gray mudstone band at bottom.
1645.1	1646.4	Oil shale: Medium to some dark grayish brown and rare black, dolomitic. Distinct shredded streaks and stringers in upper part to very faint very fine discontinuous and rare regular laminae in lower part. Irregular to slightly irregular thick parting; irregular to slightly conchoidal fracture.
1646.4	1647.5	Oil shale: Very dark to some medium grayish brown, dolomitic. Very faint streaked bedding to faint discontinuous and some regular laminae. Regular to some irregular thick parting; slightly irregular to rare hackly fracture. Sample of brownish-black oil shale from 1646.9 feet: X-ray--dolomite, quartz, feldspar, calcite, analcime, illite, pyrite.
1647.5	1648.4	Oil shale: Medium to light and some dark brownish gray, dolomitic. Moderately distinct to faint regular to slightly discontinuous laminae. Irregular to slightly irregular thick to rare thin parting; slightly irregular and rare hackly fracture. A fine vitreous black organic seam near bottom.
1648.4	1649.1	Mudstone and oil shale: Light to medium and rare dark brownish gray; dolomitic to slightly calcareous. Faint to rare distinct laminae; rare fine displacements. Irregular to slightly irregular thick parting; slightly irregular to conchoidal fracture.
1649.1	1651.0	Mudstone: Light to rare medium and dark slightly olive and brownish gray, slightly calcareous. Very faint to rare moderately distinct laminae and rare bands; some fine displacements. Irregular thick parting; moderately to slightly conchoidal and irregular fracture.
1651.0	1653.9	Oil shale: Medium to light brownish to slightly olive gray, rare buff in upper part, dolomitic. Faint to some moderately distinct discontinuous and displaced to regular laminae. Irregular thick to rare medium parting; slightly to moderately irregular fracture.
1653.9	1656.8	Marlstone and mudstone: Buff and tan to some medium brownish gray; dolomitic to slightly calcareous. Faint to some moderately

Illustration No. SBR-5015P Sheet 69 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1670.0	1671.0	Oil shale: Medium to rare light and dark slightly olive and brownish gray, dolomitic. Faint to rare moderately distinct discontinuous and displaced laminae and some streaked bedding. Irregular to slightly irregular thick parting; irregular to slightly conchoidal fracture.
1671.0	1672.1	Oil shale: Light to medium slightly olive and brownish gray; dolomitic to slightly calcareous. Faint to moderately distinct discontinuous and displaced laminae and streaked bedding. Irregular thick parting; slightly conchoidal and irregular fracture. Rare gray silty streaks.
1672.1	1673.2	Oil shale: Medium to some light olive and brownish gray, slightly calcareous. Faint to moderately distinct slightly discontinuous and displaced to regular laminae. Irregular to slightly irregular thick to rare medium and thin parting; irregular to slightly conchoidal fracture.
1673.2	1674.3	Oil shale: Tan and rare buff to medium brownish gray, becoming dark near bottom; slightly calcareous to dolomitic. Moderately distinct to faint discontinuous and displaced laminae. Slightly irregular to irregular thick to rare thin parting; slightly conchoidal to irregular fracture.
1674.3	1677.5	Oil shale: Dark brownish gray to black, dolomitic. Very faint streaked bedding and some very fine discontinuous laminae. Irregular to fairly regular thick to rare thin parting; slightly irregular to irregular and rare coarse hackly fracture. A 1- x 2-inch massive dense silty brown lens near top. A 1/2-inch pinch-and-swell black chalcedony layer with fine disseminated pyrite and rare fine crystalline blebs at 1674.5. Artificial (?) vertical fractures from 1675.2 to 1677.0.
1677.5	1678.6	Oil shale: Dark brownish gray and some black with occasional thin to 1-inch medium grayish-brown layers, dolomitic. Very faint very fine laminae and streaked bedding. Irregular to regular thick to rare thin parting; irregular to some coarse hackly fracture. Sample of dark brownish-gray oil shale from 1678.5 feet: X-ray--quartz, analcime, illite, Mg-siderite, feldspar, pyrite.
1678.6	1682.6	Oil shale: Dark to medium brownish gray, dolomitic. Faint discontinuous and displaced laminae and streaked bedding. Irregular to rare regular thick to some thin parting; irregular to coarse hackly fracture. One gar scale at 1679.5.
1682.6	1683.8	Oil shale and shale: Medium brownish gray to neutral gray, dolomitic. Faint very fine regular to very discontinuous and displaced laminae. Irregular thick to medium parting; slightly irregular fracture.
1683.8	1686.0	Oil shale: Medium and rare dark brownish to rare neutral gray, dolomitic. Faint discontinuous and displaced to regular laminae.

Illustration No. SBR-5015P Sheet 71 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
		in upper part. Irregular to slightly irregular thick to rare medium and thin parting; slightly conchoidal to irregular and rare coarse hackly fracture. Some small to 1-inch dense slightly silty dark to medium grayish-brown lenses in upper part.
1699.4	1700.7	Oil shale: Dark brownish gray to black, dolomitic. Faint streaked bedding; rarely slightly distorted. Irregular to rare regular thick to some medium parting; irregular fracture. Rare small dark grayish-brown dense and slightly silty lenses.
1700.7	1702.0	Oil shale: Dark brownish gray to black, dolomitic. Faint streaked bedding and some discontinuous laminae. Slightly irregular to irregular thick to thin parting; irregular to hackly fracture. Sample of very dark oil shale from 1701.4 feet: X-ray--quartz, illite, dolomite, analcime, Mg-siderite, pyrite.
1702.0	1703.2	Oil shale: Very dark to some medium grayish brown, dolomitic. Faint discontinuous laminae and streaked bedding. Regular to irregular thick to rare thin parting; irregular fracture.
1703.2	1705.7	Oil shale and claystone: Medium to light brownish gray and medium slightly olive gray to gray-buff; dolomitic to slightly calcareous. Faint to rare moderately distinct slightly displaced to very discontinuous laminae and some bands. Irregular thick parting; slightly to moderately conchoidal and irregular fracture. A 1-inch patch of fine lacy gray silty stringers at 1704.6. Sample of light slightly olive-gray claystone from 1704.7 feet: X-ray--dolomite, quartz, calcite, illite, feldspar, analcime.
1705.7	1706.8	Oil shale: Medium to light and some dark brownish gray, dolomitic. Moderately distinct to faint very discontinuous and displaced laminae; rare cross-laminated slivers. Irregular thick parting; irregular to slightly conchoidal fracture.
1706.8	1707.8	Marlstone: Buff to tan; calcareous to dolomitic. Faintly laminated. Irregular thick to medium parting; conchoidal to irregular fracture. Irregularly laminated gray mudstone and siltstone at 1707.2-1707.4. Tight vertical fracture with varnish-like coatings at 1707.1-1707.4.
1707.8	1708.7	Oil shale: Light to medium brownish gray, slightly calcareous. Moderately distinct to faint laminae. Irregular thick to medium parting; conchoidal fracture.
1708.7	1712.2	Oil shale: Medium and dark brownish gray in upper part to very dark brownish gray and black in lower part, dolomitic. Faint discontinuous to fairly regular laminae and some streaked bedding. Irregular to fairly regular thick to medium parting; slightly conchoidal to irregular and rare hackly fracture. A 3/4- x 2-inch buff dolomite lens in medium-dark oil shale at 1708.8;

Illustration No. SBR-5015P Sheet 73 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1724.5	1726.1	Oil shale: Medium to dark brownish gray, dolomitic. Faint discontinuous laminae; distinct streaked bedding near top. Irregular thick to rare thin parting; irregular hackly fracture. A 1-inch gray mudstone band at 1725.8.
1726.1	1727.5	Oil shale: Medium to rare light and dark brownish to slightly olive gray, dolomitic. Faintly laminated. Irregular thick to rare thin parting; irregular to hackly fracture; some broken core in upper part.
1727.5	1730.5	Claystone, mudstone, and some siltstone: Light to medium slightly olive gray and some light to medium grayish brown, slightly calcareous. Faint regular to discontinuous and displaced laminae. Irregular thick to some medium parting; slightly conchoidal to irregular fracture.
1730.5	1731.5	Oil shale: Medium to some dark brownish to slightly olive gray, dolomitic. Very faint and rare distinct discontinuous laminae and streaked bedding. Irregular medium to thin parting; hackly fracture. Sample of brownish-gray fissile oil shale from 1731.0 feet: X-ray--dolomite, quartz, illite, calcite, analcime, feldspar.
1731.5	1732.8	Oil shale: Medium to dark brownish gray, some black near bottom, dolomitic. Faint streaked bedding and discontinuous and displaced laminae. Irregular thick to rare thin parting; irregular to some coarse hackly fracture. Light to medium brownish-gray silty to sandy tuff layer at 1732.35-1732.6; very wavy contact with dark oil shale below.
1732.8	1733.8	Oil shale: Medium and rare dark brownish to slightly olive gray, dolomitic. Faint slightly irregular and discontinuous laminae. Irregular to rare regular thick to some thin parting; irregular to hackly fracture.
1733.8	1735.2	Oil shale: Medium and rare light olive to slightly brownish gray; dolomitic to slightly calcareous. Faintly laminated; some fine displacements. Irregular to fairly regular thick to rare thin parting; hackly to irregular fracture.
1735.2	1742.7	Claystone and some oil shale: Medium to light olive to almost neutral gray, some light to medium grayish brown; slightly to moderately calcareous. Faint to some distinct laminae; some fine to small displacements. Irregular thick parting; moderately to slightly conchoidal fracture. Rare small gray silty patches in lower part. A 1/2-inch black oil-shale layer at 1740.0.
1742.7	1743.7	Oil shale: Medium and rare dark brownish and slightly olive gray; slightly calcareous to dolomitic. Moderately distinct to faint laminae; some fine displacements. Irregular to regular thick to medium parting; irregular to slightly conchoidal fracture.

Illustration No. SBR-5015P Sheet 75 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1757.1	1758.3	Oil shale and mudstone: Medium and rare dark brownish gray to buff; dolomitic to slightly calcareous. Moderately distinct to very faint laminae, commonly disrupted by abundant fine light gray silty blebs and streaks. Irregular thick parting; conchoidal and irregular fracture.
1758.3	1759.7	Oil shale: Light to some dark brownish gray and some buff, dolomitic. Moderately distinct to faint laminae; fairly abundant fine light gray silty streaks and blebs mostly in lighter parts; a fine to thin vermiform light brownish-gray to buff marlstone stringer from 1759.0 to 1759.4. Slightly irregular to irregular thick parting; slightly irregular to irregular fracture.
1759.7	1760.5	Oil shale: Medium to some light and dark brownish gray, rare black in lower part, dolomitic. Moderately distinct to faint laminae. Irregular to regular thick to medium parting; slightly conchoidal to irregular fracture.
1760.5	1761.5	Oil shale: Medium to some light brownish gray and rare buff, dolomitic. Moderately distinct to faint laminae; some fine displacements. Irregular to slightly irregular thick parting; irregular to slightly conchoidal fracture.
1761.5	1762.0	Missing?
1762.0	1762.5	Oil shale: Medium to dark brownish gray, dolomitic. Faint discontinuous to regular laminae. Irregular to rare regular thick to medium parting; irregular to coarse hackly fracture. Some thin to fine dense brown dolomite lenses and streaks in upper part.
1762.5	1763.4	Oil shale: Dark to some medium brownish gray and some black, dolomitic. Faint discontinuous to regular laminae. Regular to irregular thick to medium parting; slightly irregular to slight and rare coarse hackly fracture. Few very fine vertical to horizontal massive pyrite streaks in upper part.
1763.4	1764.1	Oil shale: Dark to medium brownish to slightly olive gray, dolomitic. Faint regular to discontinuous laminae. Irregular and rare regular thick to rare medium parting; irregular and hackly to slightly conchoidal fracture.
1764.1	1765.1	Oil shale: Medium to light brownish gray, dolomitic to slightly calcareous. Faint to moderately distinct laminae; some fine displacements. Irregular thick parting; slightly conchoidal fracture.
1765.1	1766.2	Oil shale: Medium to some dark and rare light brownish gray, dolomitic. Faint regular to discontinuous laminae. Irregular to regular thick to rare thin parting; slightly conchoidal to irregular fracture. A thin dark brownish-gray tight silty-textured band at 1765.5.
1766.2	1767.2	Oil shale: Dark to some medium brownish gray and rare black, dolomitic. Very faint laminae and streaked bedding. Irregular

Illustration No. SBR-5015P Sheet 77 of 80

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Oil Company's Long Ridge Corehole LR4-75

From	To	Description
1781.6	1782.6	Oil shale: Medium and rare dark grayish brown to tan and buff, slightly calcareous. Faint to distinct slightly discontinuous and displaced laminae. Slightly irregular thick parting; slightly conchoidal fracture. Few very fine vermiform stringers in upper part.
1782.6	1784.1	Oil shale: Medium to some dark grayish brown and brownish gray, dolomitic. Moderately distinct to faint regular to discontinuous laminae. Fairly regular to irregular thick to rare medium parting; slightly conchoidal to some irregular fracture.
1784.1	1786.3	Oil shale: Grayish brown to black, dolomitic. Moderately distinct laminae to very faint streaked bedding; abundant fine displacements in some lighter zones. Slightly irregular to irregular thick to rare medium parting; slightly conchoidal to coarse hackly fracture. Sample of black oil shale from 1784.9 feet: X-ray-- quartz, illite, analcime, feldspar, pyrite, calcite, dolomite.
1786.3	1788.2	Oil shale: Buff to some medium and rare dark brownish gray; very slightly calcareous to dolomitic. Faint to rare distinct laminae; common fine to small displacements. Fairly regular to irregular thick to some medium parting; slightly irregular to irregular fracture.
1788.2	1792.2	Oil shale: Dark and some medium brownish gray to black, dolomitic. Faint regular to discontinuous and rare disrupted laminae and some very faint streaked bedding. Irregular to rare regular thick to rare thin parting; irregular and some coarse hackly fracture. A thick dense dark brownish-gray stringer at 1789.05-1789.5; very irregular shredded contact with oil shale. A thin to thick medium brownish-gray vermiform stringer at 1790.85-1791.05.
1792.2	1795.7	Oil shale: Medium to some dark brownish gray and some tan to buff; dolomitic to very slightly calcareous. Faint to distinct regular to slightly irregular laminae; some fine displacements. Irregular to slightly irregular thick to some thin parting; slightly conchoidal to irregular and some coarse hackly fracture. Tan slightly silty dolomite band at 1793.8-1794.0.
1795.7	1797.1	Oil shale: Dark to some medium brownish gray, dolomitic. Very faint irregular laminae and streaked bedding. Irregular to slightly irregular thick to some thin parting; irregular and coarse hackly fracture. Artificial (?) vertical fracture thru most of interval.
1797.1	1799.1	Oil shale: Dark brownish gray and rare black to medium grayish brown and rare tan to buff, dolomitic. Very faintly bedded dark oil shale with 1- to 2-inch massive to irregularly laminated lighter zones. Irregular to slightly irregular thick to rare thin parting; irregular and coarse hackly fracture.

Illustration No. SBR-5015P Sheet 79 of 80