

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

Core samples from Humble Oil & Refining Company's Yellow Creek No. 1 corehole drilled in 1967 in NW1/4NE1/4NE1/4 (200 ft S of N line and 1124 ft W of E line), sec 2, T 1 S, R 98 W, Rio Blanco County, Colorado

Elevation, KB: 6234 feet
 Described interval: 637-2245 feet
 Mahogany marker: 787.5 feet

From	To	Description
637.0	651.0	Marlstone and lean oil shale: buff and tan to medium and very rare dark grayish brown. Distinct to some faint, smooth to very distorted laminae, streaks, and stringers. Common gray-buff mudstone and siltstone streaks and stringers. Some badly broken and mixed up core.
651.0	652.0	Missing.
652.0	653.0	Marlstone: buff and tan to rare medium grayish brown. Faint smooth laminae and streaked bedding. Common fine chalky white blebs and streaks near top--some with fine remnant radial structure. Irregular broken and mixed up core pieces. Sample of marlstone with chalky white blebs and streaks from 652.1 feet: X-ray - quartz, analcite, dolomite, calcite.
653.0	656.0	Oil shale: medium to dark brown. Moderately distinct to faint streaked bedding. Mostly badly broken and mixed up fragments. Rare fracture surfaces with very fine pyrite.
656.0	657.0	Missing.
657.0	661.0	Oil shale: light to dark brownish gray; some buff marlstone. Very badly broken and mixed up core. Rare fracture surfaces with pyrite.
661.0	665.0	Oil shale: medium to dark brownish gray. Mostly broken and mixed up fragments. Rare fracture surfaces with fine calcite crusts.
665.0	670.2	Oil shale: medium to dark grayish brown, rare tan to buff. Moderately distinct slightly distorted to smooth laminae and streaked bedding. Broken and mixed up core in middle part.
670.2	674.2	Missing.
674.2	679.0	Oil shale: dark to medium grayish brown, some tan to buff. Faint to distinct, smooth to slightly distorted laminae and streaked bedding. Some broken core. A 1-inch light gray siltstone band at 678.2 feet.
679.0	682.0	Oil shale: buff to medium and rare dark brownish gray. Distinct slightly distorted to smooth laminae and streaked bedding. Rare fairly tight irregular high angle fractures.

^{1/} By L. G. Trudell

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Some buff mudstone with contorted marlstone stringers in lower part. Some broken core.
682.0	683.0	Missing
683.0	689.4	Oil shale: medium to very dark brownish gray, some tan. Faint to moderately distinct distorted laminae, streaks, and stringers. Common gray-buff to light brownish gray siltstone and mudstone stringers. Commonly fractured, broken, and mixed up in middle part; calcite, pyrite, and brown bitumenous stains on some fracture surfaces.
689.4	690.9	Siltstone and mudstone: buff and gray-buff to medium brownish gray. Very common fine distorted to contorted marlstone and oil shale streaks, stringers, and shreds. Fractured and broken core in upper part with very common pyrite and some calcite on fracture surfaces.
690.9	693.0	Mudstone: light to medium brownish gray. Very common distorted to intricately contorted stringers of marlstone and rare oil shale.
693.0	694.3	Oil shale, mudstone, and siltstone: tan to medium brownish gray oil shale and buff to light brownish gray mudstone and siltstone. Irregular broken and mixed up fragments. Some fracture surfaces with pyrite and bitumen stains.
694.3	698.0	Oil shale: medium to dark brown and grayish brown, rare tan in lower part. Moderately distinct slightly distorted to smooth laminae and some faint streaked bedding; common fine to small loop structures and displacements. Sample of medium to dark grayish brown oil shale from 695.2 feet: X-ray - dolomite, quartz, analcite, calcite, siderite ?, feldspar.
698.0	699.4	Oil shale: medium to very dark grayish brown, some brownish black in lower part; some resinous to rare waxy luster in lower part. Distinct smooth to some distorted laminae; common fine loop structures and displacements in upper part. A thin grayish brown silty to fine sandy-textured tuff band at 698.7 feet. Common fine brown to tan streaks and blebs and some very fine pyrite in lower part.

Illustration No. SBR-4109P (Sheet 2 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of very dark oil shale with fine brown to tan streaks and blebs and very fine pyrite from 699.1 feet: X-ray - dolomite, quartz, analcite, ferroan, feldspar, illite?
699.4	701.4	Siltstone: light brownish gray, massive. Common fine carbonaceous specks. Wavy contact with some very fine oil-shale stringers at top. Irregular broken core pieces at base.
701.4	703.8	Oil shale: medium to very dark brown and grayish brown, tan to buff in lower 5 inches. Moderately distinct smooth laminae; common fine loop structures; some moderately large loop structures and displacements in lean zone at base. Some fine tuff stringers near top.
703.8	706.0	Siltstone: buff and gray-buff to light brownish gray, massive. Some fine oil-shale and marlstone shreds and rare thick stringers. Very badly broken and mixed up core in lower part with some grayish brown to tan and buff oil-shale fragments. Some fracture surfaces with pyrite and rare bitumen in lower part.
706.0	710.0	Oil shale, marlstone, and mudstone: dark brownish gray to yellowish tan and buff oil shale and marlstone; light to medium gray and brownish gray mudstone. Interbedded distorted to contorted stringers. Common fractures with pyrite and rare calcite. Some very irregular to badly broken core pieces in lower part.
710.0	712.0	Mudstone and siltstone: gray-buff to light brownish gray. Common fine oil-shale and marlstone streaks, stringers, and shreds. Common fractures with pyrite.
712.0	715.5	Oil shale: medium to dark brown. Faint to moderately distinct contorted streaks, stringers, and laminae. Some thin to thick contorted stringers of siltstone and mudstone as above; common jagged, shredded stringers of oil shale interfingering with clastics. Rare irregular fractures with pyrite. A very thin discontinuous buff-white to grayish brown earthy porous stringer near base. Sample of earthy porous stringer from 715.4 feet: X-ray - analcite, feldspar, calcite, high background.

Illustration No. SBR-4109P (Sheet 3 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
715.5	717.5	Siltstone: brownish gray and gray to gray-buff. Faintly mottled to massive. Rare very fine oil-shale streaks. Some irregular high angle fractures with fine patchy bitumen crusts and rare calcite. Irregular to badly broken and mixed up core pieces in upper part.
717.5	719.0	Oil shale: dark to medium brown. Faint to moderately distinct fairly smooth laminae; common fine loop structures. Very rare fine tan to grayish brown granular crystalline streaks. Rare irregular fractures with very fine disseminated crystals.
719.0	722.7	Oil shale: medium to dark brown and grayish brown, rare tan. Moderately distinct smooth laminae and streaked bedding; common fine loop structures. Some high angle fractures with very fine crystalline calcite in upper part. Light brownish gray siltstone stringers at 721.4-721.5 and 721.6-721.8 feet. Sample of medium to dark grayish brown oil shale from 721.3 feet: X-ray - dolomite, calcite, quartz, analcite, feldspar.
722.7	724.2	Oil shale: medium to very dark grayish brown and rare brownish black; some resinous luster. Fairly distinct smooth laminae; common fine loop structures in upper part. Regular thick to thin parting. Common very fine grayish brown to tan blebs and streaks in lower part (like 699.1 feet). Common very fine pyrite on parting surfaces and high angle fractures near base.
724.2	730.5	Siltstone, mudstone, and very fine grained sandstone: light gray and brownish gray to gray-buff. Massive to faintly streaked. Some intricately contorted marlstone stringers in middle part; some very fine marlstone and oil-shale streaks, shreds, and rare stringers in other parts. Some broken core. An irregular high angle fracture with common bitumen patches from 729.2 to 730.3 feet; some medium to high angle fractures with common very fine pyrite near top. Common very fine carbonaceous specks in some parts. Sample of siltstone from 724.9 feet: X-ray - quartz, feldspar, dolomite, ferroan.

Illustration No. SBR-4109P (Sheet 4 of 90)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
730.5	731.0	Oil shale: dark brown to brownish black; very common resinous to waxy luster. Faint streaked bedding to very regular laminae; common very fine distinct grayish brown to buff streaks and laminae in lower part. A 0.1-foot tan marly mudstone stringer at 730.7 feet.
731.0	731.8	Siltstone and mudstone: gray-buff to light brownish gray. Common very fine oil-shale shreds and rare thin stringers. Some short tight high angle bitumen-coated fractures near top. Smooth conformable contact with oil shale below.
731.8	733.0	Oil shale; very dark brownish gray to brownish black; very common satiny to resinous luster. Laminated with common very fine distinct brown to buff streaks and laminae in upper part; faint smooth to slightly distorted streaked bedding in lower part. Regular parting with common very fine pyrite in upper part. Sample of very dark satiny to resinous oil shale from 732.4 feet: X-ray - quartz, dolomite, analcite, feldspar, pyrite, illite, ferroan?
733.0	735.3	Oil shale: dark to medium brown. Faint fairly smooth laminae; common fine loop structures in upper part. Some medium to high angle fractures with common very fine pyrite and patchy calcite crusts. Badly broken and mixed up fragments in lower 0.7 foot.
Top A-groove		
735.3	739.0	Oil shale; buff and tan to medium and some dark grayish brown. Very distinct smooth laminae; common fine loop structures. Some medium to high angle fractures with slight calcite coatings and rare patchy crusts.
739.0	741.0	Oil shale: buff and tan to medium grayish brown. Distinct smooth laminae; some fine loop structures and displacements. Very regular thick parting. Some very thin to 0.1-foot zones with common very fine cavities. Dull black material with associated limonite stains on parting surfaces at 739.6 feet. Few very thin earthy white streaks at 740.0 feet. Sample of tan to grayish brown porous oil shale from 739.7 feet: X-ray - dolomite, quartz, calcite, feldspar.
741.0	742.2	Oil shale: buff and tan to medium and rare dark grayish brown. Distinct smooth laminae; some

Illustration No. SBR-4109P (Sheet 5 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		fine loop structures and displacements. Common medium to high angle fractures with slight bitumenous coatings. Some broken core.
742.2	744.5	Oil shale: medium and some dark grayish brown and brown to tan and buff. Faint to distinct contorted streaks and stringers to smooth laminae. Common fractured to brecciated, porous to spongy zones with bitumen impregnations and very fine drusy crystals. Sample of brecciated shale with drusy crystals from 742.9 feet: X-ray - dolomite, quartz, calcite, feldspar.
744.5	745.5	Oil shale: medium grayish brown to rare tan and buff. Faint smooth laminae and streaked bedding. Some tight calcite-coated high angle fractures. Some broken core.
745.5	746.5	Oil shale: tan and buff to medium and rare dark grayish brown. Distinct smooth laminae; common fine loop structures and displacements. Some high angle calcite-coated fractures. Sample of distinctly laminated lean oil shale from 746.3 feet: X-ray - dolomite, quartz, feldspar, ferroan, illite.
746.5	752.0	Mudstone: ^{Marlstone} very light buff to light brownish gray. Moderately distinct to faint smooth laminae; some very fine loop structures and displacements. Some very fine gray to black pyritic streaks and blebs. Rare high angle natural (?) fractures. Very regular thick parting. Sample of marlstone with rare fine pyritic streaks and blebs from 749.8 feet: X-ray - quartz, dolomite, feldspar, ferroan, pyrite.
752.0	753.4	Oil shale: buff and tan to medium and rare dark grayish brown. Distinct to faint, smooth to rare wavy laminae; rare very fine loop structures and displacements. Some very fine gray pyritic streaks and laminae in upper part. Fractured to broken core with very fine pyrite and rare small irregular cavities in lower 0.4 foot.
Bottom A-groove 753.4	754.8	Oil shale: medium brown and grayish brown. Faint smooth laminae and streaked bedding. Regular thick to medium parting.

Illustration No. SBR-4109P (Sheet 6 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
754.8	756.0	Oil shale: medium to dark grayish brown. Moderately distinct to faint distorted streaked bedding. Some fine brown silty-textured tuff streaks in upper part.
756.0	757.4	Oil shale: medium to dark and some light grayish brown. Moderately distinct distorted streaked bedding. Some fine tuff streaks and blebs. Some fine discontinuous medium to high angle open fractures with very fine drusy crystals. Tight jumbled breccia and some broken core in lower 0.4 foot.
757.4	758.4	Oil shale: very dark to medium grayish brown and brown, some black in upper part; common resinous to rare waxy luster in upper 0.5 foot. Moderately distinct to faint fairly smooth laminae; very common fine to small loop structures and displacements.
758.4	761.4	Oil shale: medium to dark grayish brown and brown, rare tan. Moderately distinct smooth to rare distorted laminae; very common fine loop structures and displacements. Distorted shale with common very irregular tight fractures with crystalline fillings and common pyrite at 759.2-759.4 feet. Some fine to small gray pyritic streaks and blebs in middle part. Sample of fractured oil shale from 759.2 feet: X-ray - dolomite, quartz, dawsonite, feldspar, pyrite, analcite?, cryolite?
761.4	762.4	Oil shale; medium grayish brown and brown to some tan and buff. Moderately distinct to very distinct smooth laminae; common fine loop structures and displacements. A high angle fracture with transparent bladed crystals in small radiating aggregates in upper 0.2 foot. Some small analcite lenses near base. Sample of fractured shale with transparent crystals and pyrite from 761.5 feet: X-ray - dolomite, quartz, analcite, feldspar.
762.4	763.4	Oil shale: medium to some dark grayish brown and rare tan. Moderately distinct smooth to slightly distorted laminae; common fine loop structures. Common thin grayish brown to buff tuff stringers and lenses. Some irregular pieces of light brownish gray siltstone at base. Some short tight bitumen-stained vertical fractures. Sample of fine sandy-textured grayish brown tuff lens from 762.5 feet: X-ray - analcite, feldspar, quartz.

Illustration No. SBR-4109P (Sheet 7 of 95)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
763.4	763.7	Missing
763.7	765.0	Oil shale: medium grayish brown to some black; some satiny to resinous luster in lower part. Distinct smooth to slightly distorted laminae; some fine loop structures and displacements. Some thin brown silty tuff lenses and stringers; a 0.1-foot tuff stringer at 764.5 feet.
765.0	766.0	Oil shale and tuff: dark brownish gray to black oil shale with common satiny luster and tan to medium brownish gray tuff. Oil shale with thin to 1-inch distorted tuff stringers and lenses in upper half; tuff with fine to thin contorted oil-shale stringers in lower half. Sample of tuff with fine oil-shale stringers from 765.7 feet: X-ray - quartz, feldspar.
766.0	767.1	Oil shale: very dark to some medium brownish gray and some brownish black; rare satiny to resinous luster. Distinct to faint, distorted to fairly smooth laminae; very common fine to small loop structures. A thin buff stringer at 766.2 feet; rare fine lenses and stringers in other parts. Some fine lacy black pyritic stringers at 766.3 feet.
767.1	770.0	Oil shale: medium to dark grayish brown and brown. Faint to moderately distinct, smooth and rare slightly distorted laminae; common fine loop structures. Rare fine tuff streaks and lenses.
770.0	771.0	Oil shale: dark grayish brown to black; common satiny to resinous luster in lower part. Faint smooth to slightly distorted laminae; common fine loop structures. Rare fine to small brown silty tuff lenses. Regular to slightly wavy, shaly to papery parting in lower part. Sample of dark brownish gray to brownish black, satiny to resinous oil shale from 770.9 feet: X-ray - quartz, analcite, dolomite, feldspar, pyrite, calcite, ferroan, illite.
771.0	772.0	Oil shale: dark grayish brown, some brownish black in upper part; some satiny luster. Moderately distinct smooth laminae to very faint streaked bedding. A 1-1/2-inch dense dark brown dolomite band at 771.3 feet. Rare fine to small brown tuff lenses and streaks.

Illustration No. SBR-4109P (Sheet 8 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
772.0	773.0	Oil shale: dark to medium grayish brown, Faint distorted to fairly smooth streaks and laminae. Common very irregular brown dense to silty tuff masses in upper 0.3 foot. Very irregular limonite-stained surface with gritty black material at base.
773.0	774.3	Missing?
774.3	775.1	Oil shale: medium to dark grayish brown. Faint smooth, slightly curved to flat laminae. Some vuggy limonite-stained masses with gritty black material. Rare high angle fractures with common very fine pyrite.
775.1	779.2	Oil shale; medium to rare dark grayish brown. Faint smooth laminae and streaked bedding. Rare high angle fractures with calcite crusts and very fine pyrite.
779.2	780.8	Oil shale: medium to dark grayish brown and very rare black. Faint fairly smooth laminae and streaked bedding; common fine loop structures.
780.8	781.0	Missing.
781.0	783.0	Oil shale: medium to dark grayish brown. Very faint very fine smooth laminae and streaks. Some small vuggy limonite-stained masses with irregular boxworks and very fine drusy quartz in lower 0.2 foot.
783.0	783.3	Missing.
783.3	785.0	Oil shale: medium to dark grayish brown and rare tan. Faint smooth to slightly distorted laminae and streaks. Rare fine brownish gray tuff stringers with common short vertical fractures. Some high angle fractures with slight calcite coatings and very fine pyrite.
785.0	785.5	Missing.
785.5	786.2	Oil shale: medium brownish gray to rare tan. Faint slightly distorted streaks and laminae. Some high and low angle fractures with slight blue-gray coatings. Rare very small black pyritic blebs.
786.2	787.0	Missing.
787.0	787.5	Oil shale: medium to some dark brownish gray. Faint smooth laminae and streaks. Some fine to thin, gray to brownish gray silty tuff streaks and stringers at 787.2-787.3 feet.

Illustration No. SBR-4109P (Sheet 9 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
Mahogany marker		
787.5	789.2	Tuff: brownish gray to tan; silty to fine sandy textured. Massive. Common irregular intersecting tight to slightly open fractures with calcite, pyrite, and patchy bitumen coatings. Some lean oil-shale stringers in upper part. Wavy conformable contact at top; smooth contact at base. (0.5 foot missing?) Sample of light brownish gray tuff from 788.7 feet: X-ray - quartz, analcite, feldspar.
789.2	793.0	Oil shale: medium brownish gray. Faint smooth laminae and streaked bedding; common very fine loop structures. Some nearly horizontal fractures with blue-gray to chalky white coatings; rare high angle fractures in upper half. Sample of oil shale from 790.0 feet: X-ray - quartz, dolomite, analcite, feldspar, dawsonite.
793.0	794.3	Oil shale: medium to rare dark brownish gray. Faint smooth and rare slightly distorted laminae and streaked bedding.
794.3	794.9	Tuff: light brownish gray to almost neutral gray; marly to silty textured. Massive to very faintly bedded. Some very fine high and low angle fractures with chalky white fillings. Ground core surface at top; smooth conformable contact at base. Sample of tuff from 794.8 feet: X-ray - quartz, dawsonite, feldspar, calcite, dolomite.
794.9	795.9	Oil shale: light to medium and rare dark brownish gray. Moderately distinct to faint smooth laminae; some very fine loop structures and displacements. Some tight vertical fractures.
795.9	797.1	Oil shale: dark grayish brown to brownish black; common resinous to some waxy luster. Moderately distinct to faint slightly distorted laminae and streaks; some small scale contortions. Some fine gray-buff silty streaks. An interfingering stringer of medium grayish brown and brown oil shale with intricately contorted streaks and laminae at 796.2-796.5 feet.
797.1	798.3	Tuff: medium to light brownish gray. Very faintly bedded. Some very fine oil-shale streaks; a very thin conformable oil-shale band at 798.0 feet. Some very fine fractures with white fillings.

Illustration No. SBR-4109P (Sheet 10 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
798.3	799.3	Oil shale: dark and rare medium grayish brown to some black; some satiny to resinous luster. Very faint to some moderately distinct smooth laminae; rare fine loop structures.
799.3	800.3	Oil shale: dark to rare medium grayish brown and rare black. Faint smooth laminae and streaked bedding.
800.3	801.6	Oil shale: dark to medium grayish brown. Very faint smooth laminae and streaked bedding. Some fine brown streaks at 800.7 and 801.4 feet.
801.6	802.9	Oil shale: medium to some dark and rare light grayish brown. Faint smooth laminae and streaked bedding; rare fine loop structures.
802.9	805.2	Oil shale: medium grayish brown and brown to rare tan, rare dark grayish brown in upper part. Moderately distinct to faint smooth laminae; very common very fine loop structures and displacements. A very irregular thin brown granular crystalline stringer at top; very distorted laminae in shale immediately below. Sample of thin brown granular crystalline stringer from 802.9 feet: X-ray - quartz; some calcite, dolomite. Sample of brown oil shale from 804.2 feet: X-ray - dolomite, aragonite, quartz, calcite.
805.2	805.7	Missing.
805.7	808.0	Oil shale: dark and rare medium grayish brown to some black; some satiny to very rare resinous luster. Faint smooth streaked bedding and some laminae. Common irregular fine to 1-inch, brown to tan streaks and lenses with granular crystalline patches at 807.2-807.3 feet.
808.0	808.2	Missing.
808.2	808.9	Oil shale: medium to some dark grayish brown. Faint smooth laminae. A small granular crystalline lens at 808.5 feet.
808.9	811.3	Oil shale: dark brownish gray; common satiny luster; some resinous to waxy black streaks in upper part. Faint slightly distorted to smooth streaked bedding. Rare thin massive brown streaks and lenses. Rare fine crystalline streaks and lenses in upper part.
811.3	812.7	Oil shale: dark brownish gray; some satiny luster in upper part. Faint distorted to smooth streaked bedding. Common fine to thin brownish gray streaks and stringers. Some brown laminae in middle part. Some very regular thin shaly parting in middle part.

Illustration No. SBR-4109P (Sheet 11 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of distorted brownish gray tuff (?) and very dark oil-shale stringers from 811.5 feet: X-ray - calcite, quartz, dolomite, feldspar, analcite, illite.
812.7	814.1	Oil shale: dark to medium brownish gray and brown. Distinct distorted to contorted streaks, stringers, and laminae. Very faintly bedded brownish gray tuff (?) with some fine to very thin oil-shale streaks and regular laminae in lower 0.3 foot. Rare irregular fractured core pieces with very fine pyrite. Sample of brownish gray tuff (?) from 813.9 feet: X-ray - calcite, quartz, dolomite, pyrite, illite.
814.1	815.3	Missing
815.3	816.3	Oil shale, very rich: very dark brownish gray to black; nearly all has resinous luster. Faint smooth to distorted laminae; common fine to 1/2-inch loop structures. Some regular to wavy, shaly to papery parting. A 1-inch grayish brown to brown oil-shale stringer at 815.8 feet.
816.3	818.0	Oil shale: very dark brownish gray to some black; very common satiny luster. Faint fairly smooth laminae to very faint streaked bedding. Rare fine crystalline analcite streaks.
818.0	819.6	Oil shale: very dark brownish gray; very common slight satiny luster. Very faint smooth streaked bedding. Sample of very dark very faintly bedded oil shale from 818.9 feet: X-ray - quartz, dolomite, analcite, feldspar, calcite, illite, pyrite, ferroan.
NX Con-Core samples from 819.6 to 831.0 feet.		
819.6	821.0	Oil shale: dark grayish brown to some black; some satiny luster. Faint fairly smooth laminae and streaked bedding. Some broken and mixed up core.
821.0	824.0	Missing?
824.0	827.0	Oil shale: very dark to medium brownish gray and grayish brown, some brownish black in upper part; some satiny to resinous luster in upper part. Mostly very irregular broken and mixed up core pieces. A 3-inch piece of dense heavy oil shale with some very fine tight high angle calcite-filled fractures in middle part. Rare vuggy fragments with coarse platy boxworks and very fine drusy calcite in lower part. True length very doubtful.

Illustration No. SBR-4109P (Sheet 12 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
827.0	831.0	Missing?
831.0	832.5	Oil shale: medium to dark grayish brown, rare tan to buff streaks. Faint to rare distinct, smooth to slightly distorted streaks and laminae. A 3-inch piece of buff mudstone with contorted stringers and shreds of marlstone and lean oil shale at top. A high angle fracture with very fine crystalline calcite crusts at 831.5-831.9 feet.
832.5	834.0	Oil shale: medium to very dark grayish brown and some black; common satiny to resinous luster. Moderately distinct smooth laminae to very faint streaked bedding. Rare irregular low angle fractures with very fine pyrite.
834.0	836.2	Oil shale: medium to dark grayish brown and rare black; some satiny luster. Faint to moderately distinct, fairly smooth to distorted streaks and rare laminae. Rare fractures with very fine pyrite and limonite stains.
836.2	837.4	Oil shale: medium to dark grayish brown. Faint distorted and displaced laminae and streaks. A fine striated brittle black organic streak at 837.0 feet.
837.4	838.9	Oil shale: medium to rare dark grayish brown. Faint slightly distorted to smooth laminae and streaked bedding. Some high angle fractures with very fine pyrite and slight calcite coatings.
838.9	840.6	Oil shale: medium to rare dark grayish brown. Faint to moderately distinct smooth laminae. Sample of medium grayish brown oil shale from 839.3 feet: X-ray - dolomite, quartz, calcite, feldspar, illite.
840.6	841.7	Oil shale: medium to rare dark grayish brown and brown. Faint very distorted stringers to smooth laminae and streaked bedding. Some fine lacy black pyritic stringers and very small irregular limonite-stained vugs at 840.9-841.0 feet. Some irregular fractures with very fine pyrite in lower part. Sample of vuggy limonite-stained oil shale with black pyritic material from 841.0 feet: X-ray - dolomite, quartz, feldspar, calcite, pyrite.

Illustration No. SBR-4109P (Sheet 13 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
841.7	843.3	Oil shale: medium to dark grayish brown; rare fine satiny black streaks in lower part. Faint smooth to slightly distorted streaked bedding. Some irregular low angle fractures with very fine pyrite in lower part.
843.3	844.7	Oil shale: medium to dark grayish brown. Faint to moderately distinct smooth laminae and streaks. Fairly common very fine tight intersecting calcite-filled fractures; some fractures with very common very fine pyrite near top.
844.7	845.8	Oil shale: medium to rare dark grayish brown. Faint to rare distinct, smooth to slightly distorted laminae and streaked bedding; very common fine loop structures and displacements. Contorted bedding with some buff mudstone stringers in lower 0.2 foot. Some tight medium to high angle fractures with rare calcite.
845.8	846.9	Oil shale: medium grayish brown to tan. Moderately distinct fairly regular laminae to very faint bedding; common fine loop structures. A 0.2-foot band of massive buff mudstone at top. Some high angle fractures in lower part. A thin earthy weathered breccia zone in middle. Sample of massive buff mudstone from 845.9 feet: X-ray - quartz, dolomite, calcite, feldspar, analcite.
846.9	848.5	Oil shale: very dark to medium grayish brown. Moderately distinct smooth to distorted streaked bedding; some stringers with faint unconformable laminae in lower part. Some very fine brown silty-textured streaks and lenses in upper part.
848.5	849.8	Oil shale: medium grayish brown and brownish gray; common fine black satiny to resinous streaks and stringers. Moderately distinct to faint slightly distorted streaked bedding. Vuggy limonite-stained surfaces with irregular boxworks and drusy calcite at 849.1 feet. A thin brownish gray silty to very fine crystalline tuff with fine oil-shale stringers at 849.3 feet.
849.8	850.3	Missing.
850.3	851.5	Oil shale: dark to medium grayish brown. Faint to moderately distinct fairly smooth laminae; common fine to small loop structures. Rare irregular tight high angle fractures.

Illustration No. SBR-4109P (Sheet 14 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
851.5	852.8	Oil shale: medium to some dark grayish brown. Faint fairly smooth laminae; common fine loop structures. Rare medium to low angle fractures with slight chalky coatings and very fine pyrite. Sample of medium to dark grayish brown oil shale from 852.0 feet: X-ray - quartz, dolomite, feldspar, calcite.
852.8	853.9	Oil shale: medium grayish brown to tan. Faint smooth to some distorted laminae and streaked bedding; some fine to small loop structures. Rare small irregular vugs with drusy calcite.
853.9	855.8	Oil shale: dark grayish brown. Very faint slightly distorted to smooth streaked bedding. Vuggy limonite-stained surfaces at top and bottom. An irregular mass of fine lacy black pyritic stringers with some waxy to vitreous black bituminous material and fine crystal blebs at 854.3 feet.
855.8	857.3	Oil shale: medium grayish brown to tan. Faint distorted streaked bedding. Some large irregular limonite-stained vugs with blebby black rims. Some very irregular high angle fractures. Irregular core pieces; uneven sample split.
857.3	859.3	Oil shale: dark grayish brown. Faint smooth to distorted streaked bedding. Some limonite-stained vugs and fractured to brecciated zones. Irregular core pieces; uneven sample split.
859.3	862.7	Oil shale: very dark to some medium grayish brown. Faint to moderately distinct, smooth to some distorted laminae and streaks. Common thin grayish brown silty to earthy tuff stringers, streaks, and blebs at 860.5-860.6 feet. Several high angle fractures with rare very fine pyrite in lower part. Common fine loop structures and displacements in lower part.
862.7	864.7	Oil shale: medium to dark grayish brown. Faint to distinct fairly smooth streaks and laminae; common fine to fairly large loop structures and displacements in lower part. Common fine high to low angle calcite-filled fractures. A 0.1-foot spongy breccia zone with very common drusy calcite at 863.3 feet. Sample of spongy breccia with drusy crystals from 863.3 feet: X-ray - calcite; some quartz, dolomite.

Illustration No. SBR-4109P (Sheet 15 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
864.7	867.9	Oil shale: dark grayish brown; common very fine black satiny to resinous streaks. Faint smooth to slightly distorted streaked bedding. Some irregular fractures with rare pyrite in upper part. A vuggy limonite-stained surface at base.
867.9	871.0	Oil shale: medium to some dark grayish brown and brown; rare satiny to resinous streaks and laminae. Faint to distinct, smooth to some distorted streaks and laminae. A fragment of spongy limonite-stained breccia with very fine drusy crystals and dull black material at top; some small limonite-stained porous masses in other parts. Some fine to small loop structures in lower part.
871.0	871.8	Oil shale; Dark brown to tan. Distinct distorted laminae to faint fairly smooth streaked bedding. Part of an irregular vug with very common drusy crystals near top. Fairly common tight to slightly open fractures with crystalline calcite. Sample of oil shale with limonite-stained drusy vug from 871.1 feet: X-ray - dolomite, quartz, calcite, feldspar, ferroan.
871.8	872.0	Missing?
872.0	875.7	Oil shale: medium to dark brown and grayish brown, some tan in upper part. Distinct to faint, slightly distorted to smooth laminae and streaks; very common fine to small loop structures and displacements in upper part. Very common fine intersecting calcite-filled fractures with short open drusy sections in middle part; occasional tight calcite-filled fractures in other parts. Some fine gray pyritic crystalline blebs. Vuggy limonite-stained surface at 874.6 feet.
875.7	877.2	Oil shale: medium and rare dark brown to some tan and buff. Faint to distinct fairly smooth laminae with some fine loop structures. A large spongy breccia mass with drusy crystals at top; a large vug with moderately coarse to very fine boxworks and drusy crystals in fractured shale at base. A very fine dense gray crystalline streak at 876.4 feet. Sample of gray crystalline streak in tan oil shale from 876.4 feet: X-ray - dolomite, analcite, feldspar, quartz, calcite, dawsonite?

Illustration No. SBR-4109P (Sheet 16 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
877.2	878.7	Oil shale: medium brown to rare tan. Faint smooth to slightly distorted laminae and streaks; common fine to small loop structures in lower part. Irregular limonite-stained parting surface at 878.0 feet.
878.7	880.2	Oil shale: medium and some dark brown to tan. Distinct to faint, smooth to distorted laminae and streaks; common fine to small loop structures. Some limonite-stained vugs with platy boxworks and drusy crystals (some crystals are slightly iridescent to pearly). Sample of vuggy oil shale with drusy crystals from 880.0 feet: X-ray - dolomite, quartz, calcite, feldspar, analcite.
880.2	882.5	Oil shale: medium to dark grayish brown. Moderately distinct to faint, slightly distorted to smooth laminae; fairly common fine to small loop structures and displacements. Some irregular tight diagonal fractures with very slight blue-gray to white coatings and very fine pyrite. Sample of oil shale from 882.2 feet: X-ray - dolomite, quartz, dawsonite, feldspar, calcite?
882.5	883.9	Oil shale: medium to some dark grayish brown and brown. Very faint smooth laminae and streaked bedding. Rare very fine dark brown to buff crystalline streaks and lenses.
883.9	886.0	Oil shale: medium and some dark grayish brown to tan and rare buff. Fairly distinct contorted laminae with common small to large loop structures and spongy breccia in upper 0.5 foot; faint fairly smooth laminae and streaked bedding with some fine loop structures in lower part. Some black porous limonite-stained pyritic material in upper part. Common irregular to fractured and broken core pieces.
886.0	888.6	Oil shale: medium grayish brown. Faint smooth laminae to very faint bedding. Common high angle fractures with spotty bitumen coatings in upper and lower parts; irregularly fractured to brecciated in middle part. Some very badly broken and mixed up core.

Illustration No. SBR-4109P (Sheet 17 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
.888.6	892.0	Oil shale: dark to some medium brownish gray. Faint smooth to slightly distorted streaked bedding. Rare irregular limonite-stained surfaces with gritty gray material. Very rare fine vitreous black organic streaks. Sample of dark brownish gray oil shale from 890.2 feet: X-ray - dolomite, feldspar, quartz, pyrite.
892.0	892.4	Missing.
892.4	894.0	Oil shale: medium to some dark brownish gray. Faint smooth laminae. Some fine dark gray pyritic streaks. Some high and low angle fractures with very common pyrite in middle part (some pyrite shows beautiful blue, purple, and reddish violet iridescence--like bornite). Rare small gray silty nodules. A 2-inch finely brecciated zone at top. Sample of oil shale with iridescent pyrite from 893.2 feet: X-ray - dolomite, quartz, analcite, feldspar, pyrite.
894.0	894.8	Oil shale and tuff: brownish gray to buff oil shale. Small to large dark to medium gray silty to blebby nodules and stringers in contorted oil shale. Sample of gray nodules from 894.1 feet: X-ray - quartz, analcite, feldspar, ferroan, pyrite.
894.8	896.0	Oil shale: medium to some dark grayish brown. Faint smooth laminae; some fine loop structures and displacements. Some fine gray silty pyritic streaks. Some high angle fractures with slight chalky coatings and rare vertical slickensides.
896.0	897.1	Oil shale: medium to dark brownish gray. Faint to some moderately distinct smooth laminae; rare fine loop structures and displacements.
897.1	898.6	Oil shale: dark grayish brown to some black; some satiny luster. Faint smooth laminae and streaked bedding; some fine to small loop structures. Some medium to high angle fractures with very fine pyrite. A spongy mass of partly collapsed vugs in middle part.
898.6	900.0	Oil shale: medium to dark grayish brown and rare black. Fairly distinct smooth laminae; common fine loop structures. Some tight diagonal fractures with slight chalky coatings. Rare fine gray streaks.

Illustration No. SBR-4109P (Sheet 18 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
900.0	901.0	Oil shale: dark grayish brown to rare black. Faint smooth laminae; common fine loop structures. Few diagonal fractures with very fine pyrite in upper part.
901.0	902.0	Oil shale: dark grayish brown to black; common satiny to resinous luster. Faint smooth laminae and streaked bedding; some fine loop structures. Some high angle fractures with pyrite. Sample of satiny to resinous black oil shale from 901.6 feet: X-ray - quartz, dolomite, analcite, feldspar, ferroan.
902.0	903.0	Oil shale: dark to medium grayish brown, some tan to buff in lower part. Faint to very distinct smooth laminae; very common fine to fairly large loop structures. Rare high angle fractures with drusy calcite and very fine pyrite. Vuggy limonite-stained surface at base.
903.0	903.3	Missing.
903.3	904.4	Oil shale: medium grayish brown. Very faint smooth laminae. Some very fine gray streaks and laminae. Some tight diagonal fractures with chalky coatings.
904.4	904.5	Missing.
904.5	906.0	Oil shale: medium to dark grayish brown, some tan to buff in upper part, rare black in lower part. Distinct smooth laminae; some fine loop structures and displacements. Rare fine gray streaks and lenses. Rare short tight vertical fractures with chalky coatings.
906.0	906.4	Missing.
906.4	907.7	Oil shale: dark grayish brown. Very faint smooth streaks and laminae. Some high to medium angle fractures with very fine pyrite and some patchy calcite.
907.7	909.0	Oil shale: dark to medium grayish brown and brown. Very faint bedding. Very common fine tight intersecting calcite-filled fractures with some very fine dark pyritic specks. Lighter colored parts are probably slightly bleached. Good solid core. Sample of fractured oil shale from 908.5 feet: X-ray - calcite, dolomite, quartz, feldspar, analcite.
909.0	910.5	Oil shale: medium to rare dark brown and grayish brown. Very faint streaked bedding to rare distinct laminae. Common very fine irregular calcite-filled fractures.

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
910.5	914.0	Oil shale and marlstone: medium grayish brown to tan and buff. Faint slightly distorted and commonly displaced laminae. Common irregular poorly defined fractures and earthy bleached streaks, patches, and zones. Mostly irregular core pieces to broken and mixed up fragments; true length very doubtful.
914.0	915.5	Oil shale: medium to dark grayish brown; some satiny to resinous black laminae and streaks in lower part. Fairly distinct slightly distorted streaks and laminae in upper part to distinct smooth laminae with common fine to small loop structures in lower part. A vuggy parting surface with irregular coarse boxworks and drusy calcite at 914.4 feet. Some irregular calcite-filled fractures in middle part.
915.5	916.6	Oil shale: dark grayish brown to black; common satiny luster. Faint contorted streaks, stringers, and laminae. Some thin distinct grayish brown to tan tuff (?) stringers.
Lower wavy bed?		
916.6	919.6	Tuff: medium to some dark grayish brown. Common fine very distorted oil-shale stringers, streaks, and shreds. Dark dense massive tuff (?) with common fine pyrite blebs and streaks at 916.9-917.6 feet. Buff-white chalky porous tuff stringers from 917.8 to 918.3 feet. Sample of medium grayish brown tuff with rare fine oil-shale streaks from 916.7 feet: X-ray - quartz, feldspar, dolomite. Sample of very dark dense massive tuff from 917.3 feet: X-ray - feldspar, quartz. Sample of buff chalky tuff from 918.1 feet: X-ray - quartz, feldspar, analcite, pyrite.
919.6	921.2	Oil shale: dark grayish brown to some black; rare satiny luster. Faint laminae with common fine to small loop structures in upper part; very faint distorted laminae and streaks in lower part. Thin brown tuff stringers at 920.1 and 920.9 feet.
921.2	922.0	Tuff: grayish brown. Common fine to thick very distorted oil-shale streaks and stringers.

Illustration No. SBR-4109P (Sheet 20 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
922.0	924.0	Oil shale: medium to dark grayish brown and brown. Moderately distinct smooth laminae in upper part to distorted streaks and stringers in lower part. Common fine tight calcite-filled fractures. A 2-inch tuff band at base.
924.0	926.0	Oil shale: medium to some dark grayish brown and brown. Faint smooth to some distorted laminae and streaks; some very faintly bedded thick bands. Common calcite-filled fractures. Some thin to 1-inch tuff streaks, stringers, and lenses. Common fine to small dense gray blebs and nodules in lower part. Sample of oil shale with very small gray blebs from 925.5 feet: X-ray - quartz, dolomite, calcite, analcite, feldspar.
926.0	934.0	Oil shale: medium to dark grayish brown. Faint smooth to distorted streaked bedding and laminae. Very common tight to open fractures with calcite and pyrite. Some brown to tan earthy porous zones in middle part. Some very irregular to badly broken and mixed up core.
934.0	939.0	Oil shale: as above. Some small collapsed vugs with drusy crystals in upper part. Some zones with common very fine white calcite streaks.
939.0	940.5	Oil shale: medium to dark grayish brown. Distorted streaked bedding to smooth and slightly curved laminae; common very fine loop structures. Some fine white calcite streaks in upper part. Irregular fractured core pieces near base.
940.5	942.5	Oil shale: medium and rare dark grayish brown. Faint smooth to rare distorted streaked bedding and laminae. Common very fine disseminated crystals. Common fine tan to white calcite streaks in upper part. Some small vugs with irregular platy boxworks at 941.5-941.8 feet; some gray pyritic material and rare green translucent crystals in vug at 941.7 feet. Sample of gray pyritic material and rare green crystals from vug at 941.7 feet: X-ray - Marcasite, pyrite; some dolomite, feldspar? Sample of oil shale with very common very fine disseminated crystals from 942.1 feet: X-ray - feldspar, dolomite, ferroan.

Illustration No. SBR-4109P (Sheet 21 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
942.5	944.5	Missing.
944.5	951.0	Oil shale: medium grayish brown to dark brownish gray. Very badly broken and mixed up rubble. Common fracture surfaces with pyrite. Some brown to buff fragments with common fine dark speckles and very fine disseminated pyrite. Sample lengths very doubtful.
951.0	954.0	Oil shale: dark to medium brownish gray. Faint smooth to distorted streaked bedding. Common fine white calcite streaks in upper part. Very fractured to brecciated. Some marlstone as below in lower part. Commonly very broken and mixed up; true length doubtful.
954.0	960.0	Marlstone: buff, earthy. Faint contorted and broken to some smooth laminae. Common very fine dull gray to black specks and streaks. Mostly irregular core pieces to mixed up rubble; sample lengths very doubtful. Sample of marlstone with very fine dark specks from 957.5 feet: X-ray - dolomite, feldspar, quartz, calcite, illite.
960.0	966.0	Oil shale and marlstone: brownish gray to buff. Faint to fairly distinct smooth laminae. Very common very fine dark specks (common needle and blade shapes). Common medium to high angle fractures with pyrite. Common irregular, broken, and mixed up core; sample lengths doubtful. Sample of marlstone with fine dark needles and blades from 964.3 feet: X-ray - dolomite, feldspar, ferroan, illite.
966.0	968.0	Oil shale: medium brownish gray to some dark grayish brown. Faint smooth laminae and streaked bedding. Some fine buff to white calcite blebs and some fine cavities. Some fractures with pyrite. Earthy porous oil shale in lower 0.3 foot. Irregular discontinuous core pieces; length doubtful.
968.0	970.8	Oil shale and marlstone: grayish brown to buff. Faint smooth to contorted and broken streaked bedding. Some tight breccia near base. Common irregular core pieces to broken and mixed up rubble; sample length doubtful.
970.8	974.0	Oil shale: dark to some medium grayish brown and rare black; some resinous to waxy luster in lower part. Smooth to some distorted streaked bedding.

Illustration No. SBR-4109P (Sheet 22 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Some high to low angle fractures with pyrite. Common fine disseminated crystals and crystalline blebs near top. Some irregular vuggy core pieces with boxworks in middle part. (0.5 foot missing)
974.0	975.8	Sample of oil shale with common fine crystals and crystalline blebs from 971.2 feet: X-ray - dolomite, calcite, quartz, feldspar. Oil shale: dark grayish brown to tan and buff. Very distinct smooth laminae (some inclined about 25°); rare small loop structures and displacements. Some very fine gray to black streaks and specks. Rare irregular high angle fractures with pyrite. Sample of distinctly laminated oil shale from 975.2 feet: X-ray - dolomite, calcite, quartz, feldspar, pyrite.
975.8	978.0	Oil shale: dark to some medium grayish brown; common resinous to waxy black streaks. Fairly smooth streaked bedding. Rare fine flat cavities with papery boxworks. Rare diagonal fractures with pyrite. A 2-inch fragment of tan earthy porous breccia at base.
978.0	978.6	Missing?
978.6	981.7	Oil shale: medium to dark grayish brown and rare black; common satiny to resinous luster. Fairly distinct to faint, smooth and rare distorted laminae; common fine to small loop structures in upper part. Some medium to high angle fractures with very fine pyrite. Rare small vugs with irregular earthy boxworks in upper part. Rare small brown to tan tuff (?) lenses in lower part.
981.7	982.1	Missing?
982.1	987.8	Oil shale: medium to dark grayish brown and tan; rare resinous to waxy black laminae. Distinct smooth laminae; some fine to small loop structures and displacements. A 2-inch massive tan band at 983.4 feet and a 3/4-inch band at 983.9 feet. Common very irregular contorted medium to dark brownish gray stringers at 986.1-986.5 feet. Rare diagonal fractures. Good tight solid core. Sample of massive tan band from 983.4 feet: X-ray - feldspar, quartz, pyrite, ferroan, dolomite? Sample of oil shale with contorted brownish gray stringers from 986.3 feet: X-ray - K - feldspar, pyrite.

Illustration No. SBR-4109P (Sheet 23 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
987.8	989.3	Oil shale: medium to dark grayish brown, some tan near top. Faint smooth laminae and streaked bedding. Some medium to high angle fractures with very fine calcite crusts and rare pyrite. Some very fine dark gray streaks.
989.3	990.7	Oil shale: buff and tan to dark grayish brown; some satiny luster. Distinct smooth laminae; some thick dark faintly bedded zones. Some thin zones with very common very fine disseminated crystals in upper part. Rare high angle fractures with pyrite. Sample of dark grayish brown oil shale with very common fine disseminated crystals from 989.7 feet: X-ray - calcite, dolomite, quartz, feldspar.
990.7	992.0	Marlstone and oil shale: buff and tan to some medium and rare dark grayish brown. Distinct to faint smooth laminae at 990.7-991.0 and 991.2-991.3 feet; distorted and displaced laminae with common irregular tight fractures, fine black pyritic blebs, and some fine cavities at 991.0-991.2 feet; very coarse breccia with some open fractures 991.3-991.8 feet; very fractured shale in lower 0.2 foot. Breccia held together very well during drilling and sawing; good core. Sample of smoothly laminated marlstone from 990.8 feet: X-ray - dolomite, quartz, calcite, feldspar. Sample of very fractured marlstone with some black pyritic blebs from 991.1 feet: X-ray - dolomite, calcite, quartz, feldspar, analcite, pyrite.
992.0	994.0	Marlstone and oil shale: buff and tan to some medium grayish brown. Faint to fairly distinct laminae. Very fractured to brecciated and crushed. A 2-inch vug with coarse radial boxworks near base.
994.0	995.1	Oil shale: tan to medium grayish brown. Faint smooth laminae and streaked bedding (some slightly curved). A large irregular brecciated to finely crushed porous mass at base.
995.1	996.5	Oil shale: medium to some dark and rare light brownish gray. Faint smooth to broadly curved laminae and streaked bedding. Common irregular fractures with very fine crystals. A vuggy

Illustration No. SBR-4109P (Sheet 24 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		limonite-stained surface with some very fine drusy crystals at 995.7 feet. Some irregular discontinuous core pieces.
996.5	996.9	Missing?
996.9	999.7	Oil shale: medium and rare dark grayish brown to tan and rare buff. Distinct and some faint smooth laminae; some fine loop structures in upper part. A very irregular thin white chalky to crystalline stringer at 998.7 feet. Some high angle fractures with very fine crystals and rare dull black crusts in lower part.
999.7	1001.5	Oil shale: dark brownish gray to rare black; some satiny luster. Faint smooth to distorted laminae and streaked bedding. Some small irregular dark brownish gray lenses, blebs, and streaks at 1000.9 feet (probably like 986.3 feet).
1001.5	1002.2	Oil shale: as above. Some irregular 3/4- to 1-inch medium brown oil-shale stringers and lenses. An irregular natural (?) high angle fracture extends through interval.
1002.2	1002.3	Missing?
1002.3	1008.0	Oil shale: medium to dark brownish gray and grayish brown, rare tan. Fairly distinct to faint, smooth to very contorted laminae, stringers, and streaks. Common very irregular massive brownish gray stringers in contorted zones.
1008.0	1010.5	Marlstone(?): medium brownish gray. Massive with common distorted to fairly smooth stringers, streaks, and shreds of oil shale as above. Some natural (?) high angle fractures in lower part. Sample of marlstone from 1008.8 feet: X-ray - calcite, dolomite, quartz, feldspar.
1010.5	1012.0	Oil shale: medium to dark brownish gray, rare tan to buff. Moderately distinct smooth laminae in upper part; some small folds at 1011.1-1011.2 feet: moderately distinct smooth streaked bedding in lower part. Some high angle fractures with chalky to crystalline white coatings in upper part. Rare fine medium to dark gray laminae in upper part.
1012.0	1013.7	Oil shale: medium to rare dark brownish gray, rare tan to buff zones. Faint and rare distinct smooth laminae and streaked bedding. Some high angle fractures with white coatings. Some irregular fragments of fractured to brecciated oil shale and rare vuggy limonite-stained parting surfaces in lower part.

Illustration No. SBR-4109P (Sheet 25 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1013.7	1015.1	Missing.
1015.1	1017.2	Oil shale: medium to some dark brownish gray and brown. Faintly laminated brownish gray oil shale with common fairly distinct brown laminae; some small displacements in upper part. Some diagonal and horizontal fractures with chalky white coatings in upper part. Very distorted and displaced laminae in lower 0.2 foot. An irregular parting surface with some black pyritic material at base.
1017.2	1018.3	Missing.
1018.3	1019.6	Oil shale: dark to medium brownish gray. Faint smooth laminae and streaked bedding. Several small limonite-stained vugs in fractured shale at 1018.9-1019.1 feet. Some irregular high angle fractures with calcite coatings and crusts near base. Sample of medium to dark brownish gray oil shale from 1018.4 feet: X-ray - dolomite, feldspar, quartz, pyrite, ferroan, calcite.
1019.6	1020.7	Oil shale: medium to light brownish gray. Faint smooth to some distorted laminae and streaked bedding. Common medium to high angle fractures in upper part. A thin distorted zone with very common very fine lacy fractures with crystalline fillings at 1020.2 feet. Rare small white crystalline blebs in lower part. Sample of finely fractured oil shale with crystalline fillings from 1020.2 feet: X-ray - calcite, dolomite, quartz, feldspar, analcite, illite.
1020.7	1021.8	Oil shale: medium to dark grayish brown, some light brownish gray in upper part. Faint slightly distorted to smooth streaked bedding; some distinct brown to tan streaks and lenses.
1021.8	1024.0	Oil shale: medium to some dark grayish brown. Faint smooth to some distorted streaked bedding with common fine distinct brown streaks and broken inclusions. A 1-inch vug with platy bladed boxworks at 1022.2 feet; a small irregular vuggy fragment near base. Sample of oil shale from 1022.0 feet: X-ray - dolomite, feldspar, quartz, calcite, pyrite, ferroan.

Illustration No. SBR-4109P (Sheet 26 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1024.0	1025.0	Oil shale: medium to rare dark grayish brown. Faint distorted to smooth laminae and streaked bedding with common fine brown streaks; common large to fine irregular loop structures and displacements (large loop structure at 1024.2 feet has brown center).
1025.0	1027.0	Oil shale: dark to medium grayish brown and brownish gray. Fairly smooth to distorted streaked bedding with common distinct brown streaks, lenses, and rare laminae. A 3-inch limonite-stained vug with boxworks at 1026.1 feet (not in sampled quarter).
1027.0	1028.0	Oil shale: medium grayish brown. Faint smooth streaked bedding. Common high to low angle fractures with patchy calcite crusts. Irregular core pieces; uneven sample split.
1028.0	1029.3	Oil shale: medium to dark grayish brown. Faint smooth streaked bedding with some very fine brown streaks and lenses (one small brown inclusion has faint contorted internal laminae). Broken core with some boxworks at base.
1029.3	1030.6	Missing.
1030.6	1032.0	Oil shale: medium and rare dark grayish brown to some tan and buff. Faint to distinct smooth laminae. Badly broken and mixed up core in upper part. Very regular thick to thin parting in lower part.
1032.0	1035.6	Oil shale: very dark to medium grayish brown; common satiny luster. Distinct very distorted to fairly smooth streaked bedding. A 3-inch vug with platy bladed boxworks at 1032.2 feet; an irregular vuggy fragment at 1033.5 feet. Some irregular fractured core pieces in lower part.
1035.6	1036.7	Oil shale: medium to dark grayish brown, some tan to buff near top. A thin breccia zone with drusy calcite at top with wavy curved laminae immediately below; fairly distinct distorted streaks and stringers in middle part. A 4-inch yellowish buff porous calcareous band with rare fine oil-shale stringers and gray blebs at base. Sample of buff calcareous band with rare gray blebs from 1036.5 feet: X-ray - quartz, feldspar; some calcite, pyrite.

Illustration No. SBR-4109P (Sheet 27 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1036.7	1037.8	Oil shale: medium to some dark brownish gray; some satiny black laminae in upper part. Moderately distinct smooth laminae with common fine loop structures in upper part; faint streaked bedding in lower part.
1037.8	1038.8	Oil shale: dark brownish gray; rare fine satiny black streaks. Faint smooth streaked bedding. A thin tan dolomitic stringer at 1038.0 feet.
1038.8	1040.2	Oil shale: medium to light brownish gray. Faint to moderately distinct smooth laminae; common fine to small loop structures.
1040.2	1041.2	Oil shale: dark to medium brownish gray. Faint smooth streaked bedding in upper 0.4 foot; fairly distinct smooth laminae with common fine loop structures and displacements in lower part. A small gray cryptocrystalline nodule at 1040.2 feet. Sample of small gray nodule with some oil shale from 1040.2 feet: X-ray - dolomite, feldspar, quartz, pyrite, dawsonite?
1041.2	1042.3	Oil shale: very dark to medium brownish gray. Faint to moderately distinct smooth laminae; very common fine loop structures and displacements. Some very thin dark brownish gray very fine crystalline streaks at 1041.9 feet.
1042.3	1045.3	Oil shale and marlstone: medium brownish gray to buff. Faint smooth laminae and streaked bedding. Common very regular thick to thin parting. Rare high to low angle fractures with chalky white coatings.
1045.3	1046.0	Missing?
1046.0	1047.0	Marlstone: buff to light and rare medium brownish gray. Faint smooth laminae. Some fractures with common very fine pyrite. Badly broken and mixed up; true length doubtful.
1047.0	1047.6	Missing?
1047.6	1048.7	Oil shale: dark brownish gray, rare grayish brown to tan in upper part; some fine satiny black streaks. Moderately distinct to faint smooth streaked bedding and rare laminae. Some irregular fractured vuggy core pieces at top.
1048.7	1049.4	Oil shale: medium to rare dark grayish brown. Faint to moderately distinct smooth laminae; some fine loop structures and displacements.

Illustration No. SBR-4109P (Sheet 28 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1049.4	1050.6	Oil shale: dark to rare medium brownish gray; rare satiny black streaks and laminae. Faint smooth streaked bedding and rare laminae.
1050.6	1054.0	Oil shale and mudstone(?): dark to medium brownish gray. Faint smooth streaked bedding and rare laminated zones in upper part grading to very faintly bedded hard tight mudstone (?) in lower part. Rare medium to high angle fractures with earthy white crusts and resinous to dull black smudges. Sample of mudstone (?) from 1053.4 feet: X-ray - quartz, dolomite, calcite, feldspar, dawsonite, pyrite, illite.
1054.0	1055.4	Oil shale: medium and rare dark grayish brown. Faint smooth laminae and streaked bedding. Rare short tight diagonal fractures. A 1/2- to 1-inch tan silty stringer at 1054.3 feet; rare fine brown silty stringers and small irregular lenses in other parts.
1055.4	1056.6	Oil shale: medium to dark grayish brown. Faint smooth laminae in upper part to slightly distorted streaked bedding in lower part. Some fine black pyritic streaks at 1056.5 feet.
1056.6	1058.2	Oil shale: dark to medium grayish brown and some brown. Moderately distinct distorted streaked bedding.
1058.2	1059.3	Oil shale: medium to some dark grayish brown. Faint slightly distorted to smooth laminae and streaked bedding. Rare fine black pyritic laminae near base.
1059.3	1060.6	Oil shale: medium grayish brown. Faint smooth laminae. Rare fine gray to black pyritic laminae and streaks. Some high to low angle fractures.
1060.6	1062.5	Oil shale and marlstone: medium and rare dark grayish brown to tan and buff. Very fractured dark to medium grayish brown porous oil shale with buff earthy fracture coatings in upper 0.4 foot; faint smooth curved to flat laminae and streaked bedding with limonite-stained fractured to brecciated zones and rare small vugs in other parts. Rare very fine diagonal calcite-filled fractures. Sample of tan to buff marlstone with calcite-filled fracture from 1062.0 feet: X-ray - dolomite, feldspar, quartz, calcite.

Illustration No. SBR-4109P (Sheet 29 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1062.5	1064.0	Oil shale: dark to medium grayish brown with common very fine satiny black streaks in upper 0.4 foot; medium grayish brown to some tan and buff in lower part. Moderately distinct slightly curved streaked bedding in upper part; faint to moderately distinct, flat to slightly curved laminae and streaks with some small loop structures in lower part. A 2-inch vug with irregular fine spongy boxworks and common very fine pyrite at top; a vuggy fractured zone at 1063.5 feet.
1064.0	1065.0	Oil shale: dark to rare medium grayish brown; very common fine satiny to resinous black streaks. Moderately distinct slightly distorted to smooth streaked bedding. Rare very fine brown crystalline streaks. Sample of oil shale from 1064.8 feet: X-ray - quartz, dolomite, feldspar, calcite, analcite, pyrite.
1065.0	1066.3	Oil shale: medium to dark grayish brown; some satiny to resinous black streaks. Faint fairly smooth to very distorted laminae and streaked bedding. A thin pinched out brown silty stringer at 1065.6 feet.
1066.3	1067.3	Oil shale: medium grayish brown and brown to tan and rare buff. Faint to rare distinct, smooth to distorted laminae and streaked bedding. Common fractures and irregular porous breccia masses in lower part.
1067.3	1070.4	Oil shale and marlstone: medium grayish brown and brown to tan and buff. Faint to moderately distinct smooth laminae; common fine loop structures and displacements. Common irregular tight fractures with very fine pyrite. Some earthy porous crushed zones near base.
1070.4	1073.0	Oil shale: medium to some dark grayish brown, some tan to buff in lower part; rare very fine satiny black streaks. Moderately distinct fairly smooth to distorted streaked bedding. Very common very fine cavities--some with black pyritic fillings. Sample of medium to dark grayish brown porous oil shale from 1070.9 feet: X-ray - dolomite, quartz, feldspar, pyrite, analcite.

Illustration No. SBR-4109P (Sheet 30 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February, 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1073.0	1074.1	Oil shale: medium to dark grayish brown; some very fine satiny to resinous black streaks. Moderately distinct slightly distorted streaked bedding. Common very fine cavities and black pyritic specks. Some irregular diagonal fractures.
1074.1	1075.2	Oil shale: tan to dark grayish brown; some resinous to waxy black laminae in upper part. Very distinct to faint, slightly curved to flat laminae; common fine to small loop structures. Some very fine gray pyritic streaks. Vuggy limonite-stained parting surface with platy boxworks at top.
1075.2	1076.3	Oil shale: medium to some dark grayish brown. Faint fairly smooth laminae; common fine loop structures.
1076.3	1077.3	Oil shale: medium grayish brown to some black; some satiny to resinous luster in lower part. Moderately distinct fairly smooth laminae with very common fine to small loop structures in upper part; slightly distorted streaked bedding in lower 0.3 foot. Common fine brown to tan dense dolomite (?) streaks and lenses in lower part. A 1-inch massive tan stringer with some fine to thin shredded oil-shale stringers at 1077.1 feet. Sample of massive tan stringer from 1077.1 feet: X-ray - dolomite, quartz, analcite, feldspar, calcite.
1077.3	1079.3	Marlstone (?), dolomitic: medium and light brownish gray in upper part to buff in lower part. Very common fine distorted dark oil-shale streaks becoming less common in lower part. Some natural (?) high angle fractures throughout. Sample of brownish gray marlstone (?) with very fine oil-shale streaks from 1077.7 feet: X-ray - quartz, dolomite, analcite, feldspar, calcite, illite.
1079.3	1082.6	Marlstone, dolomitic to calcareous: light brownish gray and buff in upper part to buff-white in lower part. Massive with locally abundant fine dark oil-shale streaks. Fairly common irregular medium to high angle natural (?) fractures. Some irregular discontinuous core pieces; sample lengths uncertain. Sample of massive buff-white calcareous marlstone from 1082.5 feet: X-ray - quartz, dolomite, feldspar, analcite, calcite.

Illustration No. SBR-4109P (Sheet 31 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1082.6	1084.6	Oil shale: medium to dark grayish brown and brown (more dark in lower part). Moderately distinct laminae--contorted in small tight horizontal folds in upper part, smooth with common fine loop structures in lower part. Rare fine gray laminae and streaks in upper part (appear blue-gray against brown shale). Common very regular thick to some thin parting. Some very short tight irregular high angle fractures near base.
1084.6	1086.3	Oil shale and marlstone: dark grayish brown to buff. Faint to distinct smooth laminae; common fine loop structures. Common very regular medium to thin parting. Common vertical fractures with very fine pyrite. Rare very fine black pyritic streaks.
1086.3	1089.0	Marlstone and some oil shale: buff and tan to some medium and rare dark grayish brown. Faint to some very distinct smooth laminae; very common fine loop structures. Some irregular high angle fractures with very fine pyrite; a 3-inch fragment of very fractured to crushed marlstone near top. Fairly regular thick to rare thin parting. Rare fine black pyritic streaks.
1089.0	1090.2	Oil shale: medium to dark grayish brown, some tan in upper part. Moderately distinct to faint smooth laminae; very common fine loop structures. Some short tight diagonal fractures in upper part. Rare very fine gray to black pyritic streaks. Sample of medium to dark grayish brown shale from 1089.6 feet: X-ray - analcite, dolomite, quartz, feldspar, ferroan.
1090.2	1092.7	Oil shale: medium to light brownish gray. Jumbled rubble with common fracture surfaces with very fine pyrite; few very fractured fragments larger than 2 inches maximum dimension. Some irregular thin "curly" fragments of dark grayish brown oil shale in lower part. True length very doubtful; grab sampled.
1092.7	1093.7	Oil shale: dark to medium grayish brown; some very fine satiny to resinous black streaks. Faint fairly regular streaked bedding. Some thin "curly" fragments at top. Some thin dense grayish brown streaks and blebs in upper part grading to common fine to thin interbedded streaks and stringers in lower part.

Illustration No. SBR-4109P (Sheet 32 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1093.7	1096.0	Marlstone (?), dolomitic: medium to light brownish gray. Very common fine slightly distorted dark oil-shale streaks and shreds.
1096.0	1103.0	Marlstone, dolomitic: buff to buff-white. Very common fine dark oil-shale streaks and shreds in upper part to rare in lower part. Broken and mixed up core at 1098.0-1099.0 and 1101.0-1103.0 feet; sample lengths doubtful below 1098.0 feet.
1103.0	1104.0	Oil shale: medium to dark brownish gray and some tan to buff. Faint smooth to wavy laminae and streaked bedding. Discontinuous core pieces to very small rubble. 0.3-foot core piece with wavy bedding and very common irregular fractures at base. Length doubtful.
1104.0	1105.0	Oil shale: medium to dark grayish brown. Faint slightly wavy to smooth streaked bedding. Rare very fine grayish brown to dark gray crystalline streaks. Some very fine flat cavities and chalky buff streaks in lower part. A small mass of spongy breccia on surface at top.
1105.0	1106.0	Oil shale: medium to dark brownish gray; hard and dense. Very faintly bedded. Badly broken and mixed up fragments; length doubtful. Sample of hard dense oil shale from 1104.5 feet: X-ray - dolomite, quartz, analcite, feldspar, ferroan.
1106.0	1107.2	Oil shale: dark grayish brown to some black; some satiny luster. Faint to moderately distinct, smooth to some very distorted laminae; very common fine to small loop structures in middle part. A very thin black very fine grained crystalline stringer at 1106.1 feet. Sample of thin black crystalline stringer from 1106.1 feet: X-ray - analcite, feldspar, ferroan.
1107.2	1108.5	Oil shale: dark to some medium grayish brown; rare black satiny laminae and streaks. Moderately distinct slightly distorted to intricately contorted laminae, stringers, and streaks. A smooth diagonal fracture with rare very fine pyrite at 1107.8 feet.
1108.5	1109.5	Oil shale: medium to some dark brown and grayish brown; rare very fine satiny black streaks. Moderately distinct to faint, contorted to slightly distorted streaked bedding. Some irregular fractures with very fine pyrite in lower part.

Illustration No. SBR-4109P (Sheet 33 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	to	Description
1109.5	1116.0	Oil shale: medium and rare dark grayish brown to some tan and rare buff. Faint streaked bedding and some distinct laminae--mostly obscured. Very common very fine collapsed to partly open crystal cavities. Mostly very fractured. Some small to 1-inch vugs, commonly partly collapsed and filled with oil-shale breccia. A fine brittle vitreous black organic seam at 1113.0 feet. Some broken and mixed up core.
1116.0	1118.0	Oil shale: dark to medium grayish brown. Faint smooth streaked bedding; some thin distinct frayed streaks in lower part. Very common very fine collapsed cavities. Rare very small vugs with papery boxworks in lower part. Some natural (?) diagonal fractures.
1118.0	1120.8	Oil shale: medium to some dark grayish brown and brown. Jumbled rubble. Faint to some distinct lamina; some dark porous to vuggy shale as above. True length very doubtful.
1120.8	1122.0	Oil shale: medium to dark grayish brown, some tan to buff in lower part. Fairly distinct smooth laminae; very common fine to small loop structures. A fine tan earthy laminae at 1121.8 feet. Some short tight fractures near base.
1122.0	1123.0	Oil shale: medium to dark brown and grayish brown. Moderately distinct to faint smooth laminae. Common fractures with very fine pyrite. Mostly broken and mixed up core; sample length doubtful.
1123.0	1126.5	Oil shale: medium to dark grayish brown. Fairly distinct smooth laminae. Fairly distinct smooth laminae; rare fine loop structures. Fairly common very fine pyrite streaks in middle; rare in other parts. Rare very fine brown earthy to very fine crystalline streaks and laminae in upper part. Few irregular high angle fractures with pyrite near top.
1126.5	1132.0	Oil shale: as above and below. Mostly rubble and irregular fractured core pieces with pyrite. Few fragments of tan to buff laminated marlstone. Rare pipe dope stains in upper part. Sample lengths very doubtful.
1132.0	1133.0	Oil shale: medium to dark brownish gray. Faint to moderately distinct smooth laminae and streaked bedding. Few irregular fractures with pyrite. Rare very fine gray pyritic streaks.

Illustration No. SBR-4109P (Sheet 34 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1133.0	1136.0	Oil shale: medium to dark grayish brown. Faint to some distinct smooth laminae in upper part; very common fine loop structures in some parts. Very irregular fractured core pieces with common pyrite in upper part to jumbled rubble with rare small vugs in lower part. Length very doubtful.
1136.0	1142.0	Missing.
1142.0	1146.3	Oil shale: medium to dark grayish brown. Irregular, fractured and mixed up core pieces. Some spongy to earthy crushed boxworks masses. Sample lengths doubtful.
1146.3	1147.0	Missing?
1147.0	1148.2	Oil shale: medium to dark grayish brown. Faint to some moderately distinct smooth laminae and streaked bedding; some fine loop structures.
1148.2	1150.7	Oil shale: medium and dark grayish brown to brown and tan. Faint to distinct smooth laminae in thin to 5-inch darker and lighter zones; common fine loop structures. Some medium to high angle fractures in lower part.
1150.7	1152.2	Oil shale: medium to dark grayish brown. Faint to moderately distinct smooth laminae with common fine loop structures and displacements; some distinct tan to buff zones in lower part. Irregular fractured core pieces at base.
1152.2	1152.6	Missing?
1152.6	1153.8	Oil shale: medium to dark grayish brown; rare satiny black laminae in lower part. Faint to distinct, slightly curved to flat laminae; some fine loop structures. An irregular surface with moderately coarse platy bladed boxworks at top.
1153.8	1155.2	Oil shale: medium to dark grayish brown. Faint smooth laminae; some fine loop structures. Rare short tight diagonal fractures. Very rare fine brown crystalline streaks.
1155.2	1158.0	Oil shale: dark grayish brown to tan and buff. Very distinct smooth laminae with common fine loop structures and displacements; a small horizontal fold at 1155.5 feet. Some small white earthy to chalky lenses at 1155.9 feet. Few small to large very irregular cavities with drusy crystals in lower part. Occasional irregular diagonal fractures. Sample of distinctly laminated oil shale from 1157.2 feet: X-ray - dolomite, feldspar, analcite, ferroan, pyrite.

Illustration No. SBR-4109P (Sheet 35 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1158.0	1158.3	Missing?
1158.3	1159.5	Oil shale: medium to dark grayish brown and some brown to tan. Distinct smooth to slightly distorted laminae; some fine loop structures. Some very irregular drusy cavities in upper part.
1159.5	1162.3	Oil shale: medium to rare dark grayish brown and brownish gray. Faint smooth laminae to very faint streaked bedding; some fine to rare small loop structures. Rare high to medium angle fractures with sparse pyrite. Irregular vuggy parting surface at base.
1162.3	1165.0	Oil shale: medium to rare dark brownish gray and rare yellowish buff to tan. Faint laminae and streaked bedding. Common irregular fractured and rare vuggy core pieces; sample lengths doubtful.
1165.0	1166.1	Oil shale: medium to some dark brownish gray and grayish brown; common brown to tan and rare buff streaks. Distinct to faint, wavy to flat streaks and laminae. Some short tight irregular fractures. Some porous streaks in lower part.
1166.1	1167.3	Oil shale: medium to rare dark brownish gray and grayish brown. Faint smooth to distorted laminae and streaked bedding. Common irregular fractures and thin porous zones of collapsed crystal cavities. Few small limonite-stained vugs with papery boxworks in middle.
1167.3	1168.7	Oil shale: medium to some dark grayish brown. Faint wavy to smooth streaked bedding. Common thin wavy to flat parting. Rare fine cavities. Common tight high and low angle fractures in lower part.
1168.7	1171.0	Oil shale: medium to dark grayish brown and brownish gray. Faint slightly wavy and distorted to smooth streaked bedding. A 1-1/2-inch vug with fine platy boxworks at top.
1171.0	1172.0	Oil shale: medium grayish brown. Faint very fine smooth laminae and streaked bedding; some fine loop structures and displacements. Irregular vuggy parting surface near top. Common <u>very</u> fine dark gray to black specks and streaks.
1172.0	1173.0	Oil shale: medium to some dark grayish brown. Faint to moderately distinct fairly smooth laminae; some very fine loop structures and displacements. Common <u>very</u> fine dark specks. Some tight irregular fractures.

Illustration No. SBR-4109P (Sheet 36 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of faintly laminated grayish brown oil shale with very common very fine dark specks from 1172.5 feet: X-ray - feldspar, dolomite, analcite, ferroan, dawsonite?
1173.0	1174.6	Oil shale: medium to very dark grayish brown, some tan to buff; some satiny to resinous black laminae. Irregular fractured core pieces with faint slightly inclined to nearly vertical laminae in upper part; distinct very contorted and broken laminae in lower part. Some thin contorted buff-white earthy to chalky stringers in lower part. Fairly smooth laminae with large to fine irregular loop structures and displacements lower 0.1 foot.
1174.6	1176.0	Oil shale: medium to very dark brownish gray and some black; some satiny to resinous luster. Moderately distinct to faint, smooth to slightly distorted laminae; common fine to small loop structures. Rare fine tan to buff streaks.
1176.0	1179.6	Oil shale: medium to dark grayish brown. Irregular fractured core pieces with moderately distinct smooth to wavy laminae near top and bottom; very coarse contorted breccia to earthy porous crushed oil shale with common pyrite in middle. Irregular core pieces to mixed up rubble. (1177.0-1178.0 missing)
1179.6	1181.0	Oil shale: medium to dark grayish brown and rare black; some satiny luster. Moderately distinct to faint, smooth to distorted laminae; common fine to small loop structures and displacements. Rare short tight high to low angle natural (?) fractures; a smooth diagonal fracture in middle. A very irregular mass of finely brecciated to crushed oil shale with common fine white specks in lower 0.1 foot. Sample of dark grayish brown to black oil shale from 1180.6 feet. X-ray - feldspar, dolomite, calcite, pyrite, ferroan, quartz,
1181.0	1183.5	Oil shale and marlstone: medium and rare dark brownish gray and olive gray to buff-white. Faint fairly smooth to distorted laminae and streaked bedding. Very common fine chalky to crystalline white specks and very fine cavities. Some buff earthy crumbly zones. Common very fine pyrite.

Illustration No. SBR-4109P (Sheet 37 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of buff earthy marlstone with common very fine pyrite from 1182.4 feet: X-ray - dolomite, feldspar, quartz, calcite, pyrite nahcolite, ferroan, illite.
1183.5	1185.2	Oil shale: medium to light and rare dark olive gray and brownish gray. Faint smooth to some distorted streaked bedding. Very common very fine white crystalline pseudomorphs, not completely filling molds. Common very fine pyrite.
		Sample of oil shale with common pseudomorphs from 1184.6 feet: X-ray - calcite, feldspar, dolomite, quartz, illite pyrite.
1185.2	1188.0	Oil shale: medium to light brownish gray and olive gray. Broken core to jumbled rubble. Rare yellowish buff to tan earthy fragments. Common very fine cavities and <u>very</u> fine marcasite (?) blades in lower part. True length very doubtful; grab sampled.
1188.0	1191.0	Marlstone: very light buff to light and rare medium olive gray. Finely speckled with largely obscured smooth bedding. Very fine buff-white specks are mostly chalky to earthy; some crystalline pseudomorphs in upper part.
1191.0	1192.5	Marlstone and oil shale: buff to tan and some medium grayish brown, rare medium to light olive gray. Faint to moderately distinct, smooth to distorted streaked bedding. Very common fine buff-white specks. Common very fine pyrite.
1192.5	1195.0	Oil shale: buff and tan to medium and some dark grayish brown. Faint to some distinct distorted to smooth laminae and streaked bedding. Very common fine buff-white earthy to chalky spots; mostly very fine chalky to milky crystalline needles and blades in lowerpart--some in stellate aggregates.
		Sample of oil shale with common white needles and blades from 1194.9 feet: X-ray - dolomite, quartz, feldspar, magnesite, illite.
1195.0	1197.0	Oil shale: medium to very rare dark grayish brown and olive gray, rare tan in upper part. Moderately distinct to faint; slightly wavy to smooth laminae in upper part grading to very faint smooth streaked bedding in lower part. Some small irregular cavities and white earthy masses near top. Common fine tan earthy porous spots and some crystals at 1195.3-1195.5 feet. A very contorted and fractured to finely brecciated zone at 1196.3-1196.8 feet.

Illustration No. SBR-4109P (Sheet 38 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of grayish brown oil shale with common fine tan porous spots and some colorless transparent crystals from 1195.4 feet: X-ray - dolomite, magnesite, quartz, feldspar, illite.
1197.0	1204.0	Oil shale: medium to dark brownish gray and olive gray (commonly almost neutral gray); some medium to dark grayish brown in lower 0.5 foot. Faint very smooth streaked bedding and some very fine laminae. A tan to buff fractured to brecciated zone with common fine pyrite and some fine cavities at 1199.4-1199.8 feet. Common very fine buff-white earthy streaks below 1200.0 feet. Sample of dark brownish gray oil shale from 1198.5 feet: X-ray - feldspar, dolomite, quartz, pyrite, nahcolite, ferroan, illite.
1204.0	1207.2	Oil shale and marlstone: medium grayish brown to tan and buff. Faint to some moderately distinct, distorted to smooth streaked bedding and some laminae. Common fine buff-white earthy porous specks with very fine pyrite. Some very irregular fine to small porous white to gray crystalline patches in middle part.
1207.2	1212.5	Oil shale: medium to dark brownish gray and olive gray (some almost neutral); rare grayish brown to tan. Faint slightly distorted to smooth streaked bedding and rare laminae. Common fine buff-white earthy porous specks and some white to colorless crystals. Common irregular discontinuous fractures.
1212.5	1214.1	Oil shale: medium to light olive gray and grayish brown. Faint very fine smooth laminae; contorted and broken laminae to porous breccia in lower 0.4 foot. Common fine white crystalline pseudomorphs with pyrite. Some jumbled rubble.
1214.1	1215.3	Oil shale: medium to dark olive gray and some grayish brown to tan. Faint very contorted and broken laminae and streaked bedding in upper part to wavy and distorted streaked bedding in lower part. Very common very irregular tight to open fractures. Common small irregular cavities in lower part--commonly with tan to dirty buff earthy porous fillings.
1215.3	1218.0	Mudstone: light olive gray and brownish gray, massive. Very badly broken and mixed up rubble.

Illustration No. SBR-4109P (Sheet 39 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Some fragments of medium to dark olive gray and brownish gray oil shale with fine buff earthy streaks. Length very doubtful; grab sampled. Sample of mudstone from 1216? feet: X-ray - quartz, feldspar, dolomite, nahcolite, calcite, illite, pyrite.
1218.0	1224.0	Oil shale(?): light to medium and rare dark olive gray and brownish gray. Very badly broken and jumbled rubble. Some irregular pieces of tan to buff marlstone with very fine faint laminae in lower part. Sample lengths very doubtful; grab sampled.
1224.0	1225.5	Oil shale(?): dark to medium olive gray. Very faint smooth streaked bedding and very fine laminae. Common very fine buff earthy porous streaks in upper part to pinpoint cavities in lower part. Some irregular broken core. Sample of oil shale with very fine cavities from 1225.2 feet: X-ray - feldspar, dolomite, quartz, pyrite, illite, nahcolite.
1225.5	1229.0	Oil shale and marlstone: medium and some dark olive gray to tan and buff. Distinct fairly regular to very distorted and broken laminae and bands. Very common pinpoint cavities and crystalline pseudomorphs. Common irregular fractured to badly broken core pieces.
1229.0	1230.0	Oil shale: medium to dark olive gray. Faint distorted to fairly smooth streaked bedding. Common fine cavities with muddy porous fillings. Very common tight irregular fractures.
1230.0	1235.0	Oil shale: as above. Mostly rubble. Common very fine cavities and white pseudomorphs. Sample lengths very doubtful; grab sampled. Sample of oil shale with very common pseudomorphs from 1231.9 feet: X-ray - dolomite, calcite, feldspar, quartz, pyrite.
1235.0	1242.0	Missing.
1242.0	1245.0	Marlstone and some oil shale: buff-white to light and rare medium brownish gray; commonly crumbly and earthy. Mostly 1-inch to powdery rubble; grab sampled.
1245.0	1251.0	Oil shale: medium to dark brownish gray and olive gray. Very faintly bedded to massive. Common very fine white pseudomorphs and cavities in lower part.

Illustration No. SBR-4109P (Sheet 40 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Large to small jumbled rubble. Sample lengths very doubtful; grab sampled.
1251.0	1257.0	Marlstone and oil shale: very light buff to some medium grayish brown and brown; some dark olive gray at top. Obscure to faint and rare distinct, smooth to distorted laminae; very common irregular displacements. Very common irregular obscure discontinuous fractures; some breccia in middle part. Common fine pseudomorphs and cavities in upper part. Good core.
1257.0	1264.0	Oil shale: medium to some dark grayish brown and rare tan to buff. Faint to moderately distinct smooth laminae. Jumbled rubble to irregular discontinuous fractured core pieces. Common very fine buff earthy streaks and specks near top. Some very fractured to brecciated fragments near base. Sample lengths very doubtful; grab sampled.
1264.0	1266.0	Marlstone: very light buff to rare tan. Few large core pieces of tight earthy marlstone breccia at top. Mostly small jumbled rubble with few oil-shale fragments. Sample length very doubtful; grab sampled.
1266.0	1272.0	Missing.
1272.0	1273.0	Marlstone: buff to light brownish gray. Very faint smooth bedding. Very common very fine buff-white earthy streaks and specks. Mostly small rubble--commonly displaying very regular thin parting. Length doubtful; grab sampled. Sample of marlstone with earthy specks from 1272.1 feet: X-ray - feldspar, dolomite, ferroan, nahcolite.
1273.0	1275.0	Oil shale: medium to dark grayish brown. Faint distorted streaked bedding. Very fractured; rare irregular brecciated to finely crushed masses. A small vug with fine irregular boxworks in lower part. Some very regular to badly broken core pieces; length doubtful; partly grab sampled. Sample of medium to dark grayish brown fractured oil shale from 1274.5 feet: X-ray - feldspar, dolomite, ferroan, nahcolite, illite, pyrite.
1275.0	1284.0	Oil shale: medium to dark brownish gray and brown, some olive gray. Jumbled rubble and some irregular fractured core pieces; some solid core in middle. Rare pieces of tan to buff earthy marlstone. Sample lengths very doubtful; grab sampled.

Illustration No. SBR-4109P (Sheet 41 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1284.0	1285.0	Missing.
1285.0	1287.0	Oil shale: mostly rubble as above. A 6-inch piece of faintly laminated oil shale with several vertical and horizontal fractures with vitreous black organic fillings.
1287.0	1290.0	Oil shale: medium to dark brownish gray and olive gray. Faint smooth laminae and streaked bedding. Mostly rubble; grab sampled.
1290.0	1293.0	Oil shale: dark olive gray near top, tan to medium and rare dark grayish brown and brown in other parts. Faint smooth laminae and streaked bedding near top; tight brecciated to fractured oil shale from 1290.4 to 1291.1 feet; irregular fractured core pieces and rubble in lower part. Length doubtful; grab sampled.
1293.0	1296.0	Oil shale: medium to dark grayish brown, some brown to tan in upper part. Moderately distinct to faint, smooth to distorted and wavy streaked bedding. Some irregular fractures in upper part to common in lower part. An irregular 0.1-foot zone of porous crushed oil shale at 1295.0 feet with common fine flaky to papery fragments (collapsed boxworks?).
1296.0	1298.0	Oil shale: medium to dark grayish brown and brownish gray. Tightly brecciated to very fractured in upper part; faint smooth streaked bedding in lower part with some very fine tan earthy porous streaks. Some very regular thin shaly parting in lower part. Some broken core and rubble; length doubtful. Sample of oil shale with fine tan earthy streaks from 1297.6 feet: X-ray - feldspar, dolomite, magnesite, quartz, illite pyrite, marcasite?
1298.0	1299.0	Oil shale: medium grayish brown to tan and rare buff. Faint to moderately distinct, distorted to smooth laminae. Common very fine cavities. Common irregular tight fractures.
1299.0	1300.0	Marlstone: tan and buff to rare medium brown. Very faint smooth laminae and streaked bedding. Some fine cavities. Irregular fractured core pieces to rubble. Length very doubtful; partly grab sampled.
1300.0	1302.0	Missing?

Illustration No. SBR-4109P (Sheet 42 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1302.0	1305.0	Marlstone: buff to light and some medium brownish gray, rare tan in upper part. Faint distorted streaks and stringers. Common fine irregular buff to white specks and streaks. Irregular core pieces to rubble in lower half. Length very doubtful; partly grab sampled. Sample of marlstone with fine white specks and streaks from 1303.2 feet: X-ray - dolomite, quartz, feldspar, pyrite.
1305.0	1306.0	Missing?
1306.0	1310.2	Oil shale: dark brownish gray. Faint fairly smooth to distorted streaked bedding; fine to coarse fairly tight breccia at 1306.8-1307.2 and 1309.6-1310.2 feet. Common fine cavities with buff earthy fillings. Common tarry impregnation in breccia at base.
1310.2	1313.7	Oil shale: tan to medium and some dark brownish gray. Faint fairly smooth to distorted streaked bedding. Commonly porous and earthy to very fractured and finely brecciated.
1313.7	1315.7	Oil shale: tan and buff to some medium and rare dark brownish gray. Porous and earthy to very fractured. Rubble in upper part. Sample length doubtful; partly grab sampled.
1315.7	1321.8	Marlstone and oil shale: buff and tan to some medium grayish brown. Faint smooth to distorted streaked bedding and rare laminae; some very indistinct tight breccia in lower part. Commonly earthy and slightly porous; common fine chalky white specks in some parts. Some irregular core pieces in upper part to mostly rubble in lower part. Sample lengths doubtful; partly grab sampled.
1321.8	1323.7	Marlstone and oil shale: tan and buff to medium and rare dark grayish brown and brown. Indistinct porous breccia in upper 0.5 foot; faint to some moderately distinct, fairly smooth to very distorted and commonly displaced laminae and streaked bedding. Commonly porous and earthy.
1323.7	1325.0	Oil shale: tan to dark grayish brown and brown. Faint brecciated to distorted and fractured streaked bedding. Commonly porous and some earthy. Rare small irregular vugs with spongy fillings near base.

Illustration No. SBR-4109P (Sheet 43 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1325.0	1328.2	Oil shale: dark brownish gray. Faint smooth to slightly distorted streaked bedding. Some fine to thin buff earthy to silty porous streaks and rare small vugs. Some fractured zones.
1328.2	1330.8	Oil shale: medium brown and grayish brown; some dark brownish gray near top. Very faint smooth to distorted bedding. Common fine cavities and thin earthy porous to finely brecciated zone. Vuggy rubble near top.
1330.8	1332.0	Oil shale and marlstone: brown and tan to buff. Very faint distorted to smooth bedding. Earthy and porous in upper part to common fine irregular cavities in middle. Marlstone rubble with very faint smooth bedding and some very regular thin parting in lower part. Length doubtful; partly grab sampled.
1332.0	1332.6	Missing?
1332.6	1334.0	Oil shale: tan to some medium grayish brown. Obscured bedding in upper part; faint distorted streaked bedding in middle; coarsely brecciated to finely crushed with some faint laminae in lower part. Mostly earthy and porous. Some white to pale yellowish gray crystal grains in lower part.
1334.0	1339.0	Oil shale: dark to rare medium brownish gray; some very fine satiny to resinous black streaks. Faint smooth to distorted streaked bedding. Fairly common small to 2-inch vugs with fine spongy boxworks and associated powdery white coatings. Fairly common <u>very</u> fine disseminated crystals and some fine crystalline blebs. Some irregular fractures and collapsed vugs in upper 0.7 foot. Sample of dark brownish gray oil shale with very fine crystals from 1338.6 feet: X-ray - feldspar, dolomite, quartz, ferroan, pyrite, nahcolite?
1339.0	1340.2	Oil shale: dark and rare medium grayish brown. Faint distorted streaked bedding. Common very fine disseminated crystals and some very small crystalline blebs. Common porous streaks and discontinuous fairly tight fractures with white coatings in upper 0.3 foot. Rare very fine vitreous black streaks.
1340.2	1343.0	Oil shale: medium grayish brown to tan and rare buff. Faint to moderately distinct, slightly distorted to smooth laminae and streaked bedding.

Illustration No. SBR-4109P (Sheet 44 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Common tight discontinuous fractures with white coatings in upper part. Rare vuggy masses with blebby black rims. Mostly rubble in lower part. Length very doubtful; partly grab sampled.
1343.0	1344.5	Oil shale: medium to dark grayish brown. Very faint slightly distorted streaked bedding. Some fine cavities and fine porous streaks. Common fine to small black pyritic masses in upper part--some with fine irregular radial structure and hackly edges. Some very fine disseminated crystals.
1344.5	1346.1	Oil shale: as above. Commonly fractured. Rare irregular vuggy masses.
1346.1	1347.4	Oil shale: dark grayish brown. Very faint distorted streaked bedding in upper part; faint very distorted and fractured laminae and streaked bedding with common thin irregular porous brecciated to finely crushed zones in lower part. Some fine pale yellowish gray to white quartz(?) grains in crushed zones.
1347.4	1349.8	Oil shale: medium and rare dark brown to tan and some yellowish buff. Faint distorted to fairly smooth streaked bedding and some laminae. Very common fine partly collapsed cavities with tan to buff earthy to granular porous material in upper part; common thin earthy porous zones in lower part. Rare very small vugs with yellowish brown crystal grains and black pyritic rims in lower part. Sample of brown oil shale with very common fine cavities from 1348.0 feet: X-ray - quartz, dolomite, dawsonite, feldspar.
1349.8	1351.0	Oil shale: medium grayish brown to some tan and buff. Faint slightly distorted laminae and streaked bedding. Common discontinuous fractures. Some fine cavities and earthy porous streaks with fine black pyritic blebs. A 0.3-foot white to buff chalky stringer near top. Sample of white to buff chalky stringer from 1350.1 feet: X-ray - quartz, dawsonite, feldspar, ferroan, dolomite.
1351.0	1353.0	Oil shale: dark to medium grayish brown and brown. Faint fairly smooth streaked bedding. Common <u>very</u> fine disseminated crystals. Some fine porous streaks.
1353.0	1355.0	Oil shale: as above. Common fine to thin, tan to buff porous streaks. Some discontinuous open

Illustration No. SBR-4109P (Sheet 45 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		fractures. A large fractured and broken, tan to buff, massive to very fine crystalline lens at 1354.1 feet.
		Sample of tan to buff lens from 1354.1 feet: X-ray - dolomite; trace quartz, feldspar.
1355.0	1359.7	Oil shale: dark to medium grayish brown and brown. Faint slightly distorted streaked bedding. Some fine porous streaks. Few small to large vugs with platy to papery boxworks. Very fractured near base.
1359.7	1359.9	Missing?
1359.9	1362.4	Oil shale: as above. Rare vugs.
1362.4	1363.8	Oil shale: medium to dark brown and grayish brown. Faint distorted streaked bedding. Common fine tan porous streaks. Rare irregular tan to buff silty masses (like 1354.1 feet?).
1363.8	1365.3	Oil shale: dark brownish gray to brownish black; some satiny to rare resinous luster. Faint very fine smooth laminae; very faint wavy streaked bedding near base. Common <u>very</u> fine disseminated crystals. Common fine marcasite (?) blades in lower part. Some irregular open fractures in lower part. Sample of tight smoothly laminated dark brownish gray oil shale from 1364.5 feet; X-ray - quartz, dawsonite, ferroan, feldspar, dolomite, pyrite.
1365.3	1366.3	Oil shale: dark to medium brown and rare tan. Faint to moderately distinct, brecciated to distorted and fractured streaked bedding; common irregular displacements and some irregular loop structures. Common small to 2-inch partly collapsed vugs with dull black rims and some earthy buff fillings. Good core.
1366.3	1367.2	Oil shale: dark to medium brown; some satiny to resinous luster <u>in lower part</u> . Faint distorted and fractured to smooth bedding; some faint smooth laminae in lower part. Very common very fine collapsed cavities; some very small to 1-inch broken vugs in upper part. Some chalky white efflorescent powder on sawed and cored surfaces. Sample of porous brown oil shale from thin zone with efflorescent powder from 1367.0 feet: X-ray - dolomite, quartz, feldspar, ferroan, illite.
1367.2	1368.0	Oil shale: medium brown to tan and some buff. Faint smooth bedding. Very common very fine collapsed to open cavities with common black pyritic fillings.

Illustration No. SBR-4109P (Sheet 46 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1368.0	1370.0	Oil shale: medium brown to tan and some buff. Distinct fairly smooth to distorted streaked bedding. Fairly common fine cavities and some small to 1-inch vugs with fine boxworks. Some fine to small black pyritic blebs.
1370.0	1371.0	Oil shale: tan to dark brown. Vuggy oil shale with distinct streaked bedding as above in upper half; faint smooth bedding with very common very fine collapsed cavities in lower part.
1371.0	1374.0	Oil shale: medium brown to tan and buff, rare dark brown to black in lower part. Moderately distinct to very faint, smooth to some distorted laminae and streaked bedding. Common fine earthy porous streaks. Some vugs and very fractured zones in lower part.
1374.0	1377.0	Oil shale: medium brown to some tan and buff. Faint fairly smooth to distorted streaked bedding. Very common fine open to collapsed cavities and some buff earthy streaks. Common fine black pyritic blebs in upper part. A very irregular fractured and broken, tan to buff mass at 1374.4 feet (like 1354.1 feet).
1377.0	1380.0	Oil shale: medium and rare dark brown to tan. Faint distorted to fairly smooth streaked bedding; rare moderately distinct contorted laminae in lower part. Mostly irregular vuggy fractured core pieces; length doubtful.
1380.0	1383.0	Oil shale: medium brown and grayish brown. Faint distorted to fairly smooth streaked bedding. Some fine to small black pyritic blebs. Common fractures and some very irregular small to large broken vugs in lower part. Broken core at base; length doubtful.
1383.0	1384.3	Marlstone: buff and tan to some medium brown. Moderately distinct smooth curved laminae; some very fine loop structures and displacements. Very fractured and broken core at top; some irregular fractures throughout. Length doubtful. Sample of laminated marlstone from 1383.8 feet: X-ray - dolomite, quartz, feldspar, dawsonite.
1384.3	1385.8	Oil shale: tan and rare buff to medium brown. Moderately distinct to faint, smooth to distorted laminae and streaked bedding. Some irregular fractures in upper part. Mostly irregular vuggy core pieces and mixed up rubble in lower part. Length very doubtful; partly grab sampled.

Illustration No. SBR-4109P (Sheet 47 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (cont.)

From	To	Description
1385.8	1386.2	Missing?
1386.2	1390.0	Oil shale: medium brown and grayish brown; common to rare very fine dark resinous streaks. Faint fairly smooth to some distorted streaked bedding. Very common fine pyrite blebs. Common fine cavities and porous streaks in upper part. Common very fine disseminated crystals in lower part. Few 1- to 2-inch brown to black radiating nahcolite masses at 1387.5-1388.1 feet. Sample of porous brown oil shale from 1387.2 feet: X-ray - quartz, dolomite, feldspar, dawsonite, ferroan, illite. Sample of grayish brown oil shale with very common very fine disseminated crystals from 1389.5 feet: X-ray - quartz, dolomite, feldspar, nahcolite, ferroan, dawsonite, pyrite.
1390.0	1392.7	Oil shale and nahcolite: medium grayish brown oil shale as above. Medium to dark brown very fine grained massive nahcolite at 1390.2-1390.7 feet; a 3-inch massive nahcolite lens at 1391.5 feet grades laterally to very abundant disseminated crystals in oil shale; some thin nahcolite stringers and zones of very abundant crystals in lower part. Sample of very fine grained massive nahcolite from 1390.4 feet: X-ray - nahcolite, dolomite, quartz. Sample of fine grained nahcolite with interstitial oil shale from 1392.0 feet: X-ray - nahcolite, dolomite, quartz, dawsonite, feldspar, pyrite, ferroan.
1392.7	1395.0	Nahcolite: grayish brown and brown; very fine grained. Very faint bedding most evident as fine ridges on outside surface of core; smoothly curved in a large overturned fold in upper part, fairly smooth and flat in lower part. Medium to dark grayish brown oil shale with common very fine disseminated crystals and nahcolite streaks at 1394.1-1394.4 feet. Few fine irregular fractures with recrystallized nahcolite near top and bottom. Sample of nahcolite from 1393.4 feet: X-ray - nahcolite.
1395.0	1400.0	Oil shale: medium grayish brown; some very fine dark resinous streaks. Faint smooth to slightly distorted streaked bedding. Some zones with very

Illustration No. SBR-4109P (Sheet 48 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		common very fine disseminated crystals grading to thin massive nahcolite stringers. Some fine to small irregular pyrite masses. A 4-inch dark coarsely crystalline radiating nahcolite mass at 1398.5 feet.
1400.0	1401.3	Oil shale: medium grayish brown and brown to tan. Faint distorted to smooth streaked bedding; interfingering shredded tan oil-shale stringers with irregular internal bedding in upper part. Fairly common fine pyrite blebs. A 1-inch radiating nahcolite mass at 1400.8 feet.
1401.3	1402.3	Oil shale: medium grayish brown. Faint slightly distorted to smooth streaked bedding. Some fine to small irregular pyrite blebs. Rare small vugs with boxworks and some pale grayish yellow crystals.
1402.3	1403.3	Oil shale: medium to dark grayish brown and brown; rare resinous to waxy black streaks and laminae in lower part. Faint smooth streaked bedding in upper part to moderately distinct distorted streaks and laminae in lower part. Some small vugs and irregular vuggy parting surfaces in lower part.
1403.3	1404.5	Oil shale: medium grayish brown to tan. Irregular fractured core pieces to jumbled rubble. Some finely crushed porous oil shale. Length doubtful; uneven sample split.
1404.5	1413.5	Oil shale: medium grayish brown. Very faint smooth to rare distorted streaked bedding. Some <u>very</u> fine disseminated crystals. Some thin to 3-inch spongy to vuggy zones. Rare radiating nahcolite masses (none in sampled 1/4). Irregular fractured vuggy core pieces near base.
1413.5	1416.5	Missing
1416.5	1420.0	Oil shale: medium to dark grayish brown; rare resinous luster in lower part. Moderately distinct to faint, very distorted to some smooth laminae and streaks. Common irregular fractured to vuggy core pieces.
1420.0	1424.0	Oil shale: medium grayish brown to some tan. Jumbled rubble and some irregular fractured core pieces. Length very doubtful; grab sampled.
1424.0	1426.3	Oil shale: medium grayish brown. Very faint smooth and rare distorted streaked bedding. Some very fine disseminated crystals. A 3-inch vug with irregular spongy boxworks near top.

Illustration No. SBR-4109P (Sheet 49 of

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1426.3	1429.3	Oil shale: medium grayish brown and brown to tan and rare buff. Faint to moderately distinct, smooth to distorted streaked bedding. Common thin porous zones. Fairly common fine to small black pyritic blebs. Common irregular fractures and some irregular porous breccia masses in lower part. Some small vugs.
1429.3	1430.3	Oil shale: medium to dark grayish brown and brownish gray; some very dark resinous laminae in upper part. Moderately distinct to faint, slightly distorted to smooth laminae; common small to very fine loop structures. Rare irregular vuggy fractured parting surfaces.
1430.3	1431.8	Oil shale: tan and buff to medium and rare dark grayish brown. Faint smooth streaked bedding and very fine laminae. Common very thin flat to some wavy parting. Some porous leached streaks with very fine pyrite. Partly broken and mixed up; length doubtful.
1431.8	1433.0	Oil shale: very dark to some medium and brown and tan; common satiny to resinous luster. Faint smooth to slightly distorted streaked bedding; some distinct laminae in upper part. Some small to 2-inch vugs with boxworks. Common irregular fractures in lower part. Sample of very dark brown to tan oil shale from 1432.2 feet: X-ray - quartz, dolomite, feldspar, dawsonite, ferroan.
1433.3	1435.4	Oil shale: dark to medium brown and grayish brown; common satiny to resinous luster. Faint fairly smooth to distorted streaked bedding. Common irregular open fractures. Some fine porous pyritic leached stringers and rare small vugs.
1435.4	1437.0	Oil shale: tan to some medium brown. Irregular vuggy, fractured, and porous core pieces to jumbled rubble. Length very doubtful; grab sampled. Sample of vuggy tan oil shale from 1436.0 feet: X-ray - dolomite, quartz, feldspar, dawsonite, ferroan.
1437.0	1438.0	Oil shale: tan to medium grayish brown. Moderately distinct fine wavy laminae near top; faint fairly smooth streaked bedding in other parts. Rare small cross-laminated inclusions. Some fine pyrite blebs. Rare fine porous streaks and flat cavities.

Illustration No. SBR-4109P (Sheet 50 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1438.0	1442.0	Oil shale: grayish brown, some medium brown and rare tan in lower part. Faint fairly smooth to distorted streaked bedding. Fairly common fine to small pyrite blebs. Occasional very small nahcolite masses with pyritic rims. A 2-inch irregular fine grained nahcolite mass at 1438.6 feet.
1442.0	1445.0	Oil shale: grayish brown and brown to rare tan. Faint to some moderately distinct, distorted to fairly smooth streaked bedding. Some very small to large coarse radiating nahcolite masses--commonly with pyritic rims. Common fine to small pyrite blebs in some parts.
1445.0	1446.0	Oil shale and nahcolite: grayish brown to tan and buff oil shale. Faint distorted streaked bedding. A 6-inch very dark coarse radiating nahcolite mass in lower part; continues into sample below.
1446.0	1447.0	Oil shale: grayish brown to black; common resinous luster. Distinct wavy to fairly smooth laminae and streaked bedding; some fine irregular loop structures and displacements in upper part. Part of large coarse nahcolite mass in upper 2 inches. Sample of dark resinous oil shale from 1446.8 feet: X-ray - feldspar, quartz, dolomite, ferroan, pyrite, dawsonite.
1447.0	1448.2	Oil shale and nahcolite: medium to dark grayish brown and brown, rare black; some satiny to rare resinous luster. Moderately distinct very wavy laminae and streaks distorted around nahcolite. Dark coarse nahcolite in radiating masses up to 4 inches.
1448.2	1449.7	Oil shale and nahcolite: tan and buff to some brown. Fairly distinct wavy to smooth laminae and streaks in upper part; very faint wavy bedding in lower part. Some large very irregular fine grained nahcolite masses in upper part; a 4-inch coarse radiating mass in lower part. Sample of fine grained nahcolite from 1448.6 feet: X-ray - nahcolite, quartz.
1449.7	1451.7	Oil shale and nahcolite: medium to dark brown and some tan oil shale; rare resinous black shale in lower part. Distinct to faint laminae distorted around nahcolite. Coarse radiating nahcolite masses up to 5 inches; some coarse to fine disseminated nahcolite in lower part.

Illustration No. SBR-4109P (Sheet 51 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of very coarse nahcolite from 1450.5 feet:
		X-ray - nahcolite, dolomite, quartz.
1451.7	1453.4	Oil shale: tan to medium brown. Faint to some moderately distinct, smooth to distorted laminae and streaked bedding. Porous to earthy leached oil shale in upper part. Some irregular fractured core pieces and rare small to large limonite-stained vugs.
		Sample of tan to brown porous oil shale from 1451.9 feet:
		X-ray - quartz, dolomite, calcite, dawsonite, feldspar, ferroan.
1453.4	1466.5	Oil shale: medium to some dark grayish brown. Faint smooth to distorted streaked bedding. Very common fine disseminated nahcolite and pyrite crystals; some small to large fine grained nahcolite masses and irregular stringers. Brown to tan oil shale with some very small coarse crystalline nahcolite aggregates at 1457.0-1457.4 feet. Common small stellate pyrite masses with some nahcolite near base.
		Sample of oil shale with common fine disseminated crystals from 1464.6 feet:
		X-ray - quartz, dolomite, dawsonite, feldspar, ferroan.
1466.5	1467.5	Oil shale: dark grayish brown to medium brown and tan. Faint distorted streaked bedding in upper part; distinct wavy to smooth laminae with common fine loop structures and displacements in lower part. Few 1- to 2-inch coarse radiating nahcolite masses.
1467.5	1469.0	Nahcolite and oil shale: 3- to 4-inch coarse radiating nahcolite masses with thin separations of oil shale in upper 0.5 foot. One very large very coarse nahcolite mass with interstitial oil shale in lower part.
1469.0	1470.3	Oil shale and nahcolite: medium grayish brown to tan oil shale. Faint smooth to wavy streaked bedding and some moderately distinct laminae. A 7-inch coarse radiating nahcolite mass in lower part.
1470.3	1471.0	Oil shale: tan to medium and rare dark brown. Distinct to faint, smooth to wavy laminae and streaked bedding, common fine to small loop structures. Few small irregular nahcolite masses in lower part.

Illustration No. SBR-4109P (Sheet 52 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of tan to brown laminated oil shale from 1470.4 feet:
1471.0	1473.7	X-ray - quartz, dolomite, dawsonite, feldspar. Oil shale and nahcolite: medium brown and grayish brown oil shale, some tan in upper part. Moderately distinct contorted and displaced laminae and streaks in upper part; very faint smooth bedding in lower part. Common large irregular coarse nahcolite masses in upper part. Very common fine to fairly coarse nahcolite in lower part; occurs in zones ranging from nahcolite with very fine interstitial oil-shale partings to oil shale with disseminated nahcolite.
1473.7	1476.3	Oil shale and nahcolite: medium brown oil shale. Faint smooth to very distorted bedding with common fine distinct tan to buff streaks. Common large coarse radiating to irregular nahcolite masses in upper part; few in lower part.
1476.3	1477.8	Oil shale and nahcolite: tan to medium and rare dark grayish brown oil shale. Distinct to faint, smooth to slightly wavy laminae; very common fine to small loop structures and displacements. A 5-inch coarse radiating nahcolite mass in lower part.
1477.8	1479.0	Oil shale: medium brown and grayish brown. Faint fairly smooth to very wavy, distorted, and displaced streaked bedding. A large coarse radiating nahcolite mass with pyritic rims in middle (almost none in sampled quarter).
1479.0	1480.0	Oil shale: grayish brown to brownish gray. Faint distorted to smooth streaked bedding. A diagonal fracture with some very fine nahcolite crusts in middle.
1480.0	1484.3	Oil shale: medium to rare dark brownish gray. Very faint smooth to slightly distorted streaked bedding. Sparse very fine disseminated crystals.
1484.3	1488.1	Oil shale: brown to tan, some dark grayish brown in upper part. Distinct to faint, smooth and rare wavy laminae with common fine loop structures and displacements; some very faint streaked bedding in upper and middle parts. A coarse radiating nahcolite mass at 1487.1-1487.3 feet; some irregular masses with pyrite in middle part (almost none in sample). Rare short tight vertical fractures.
1488.1	1489.1	Nahcolite: very dark brownish gray. Very coarsely crystalline near top and bottom to fine in middle. Coarse to fine radiating interstitial shale partings.

Illustration No. SBR-4109P (Sheet 53 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1489.1	1497.2	Oil shale: medium to very dark brownish gray; very common fine resinous black streaks. Faint smooth and rare distorted streaked bedding. Common <u>very</u> fine disseminated crystals. Some small irregular coarse nahcolite masses at 1492.0-1492.3 feet. Some irregular fractured core pieces near base. Sample of oil shale from 1491.0 feet: X-ray - quartz, feldspar, dolomite, pyrite, ferroan, nahcolite?
1497.2	1498.3	Oil shale and nahcolite: brown to tan and rare buff oil shale. Faint to some distinct, distorted and displaced to wavy streaks and laminae. Common coarse to fine nahcolite crystals in very irregular small patches and streaks in upper 0.4 foot.
1498.3	1499.5	Nahcolite: very dark brownish gray to some medium brown. Very coarsely crystalline. Common fine irregular interstitial shale partings. Sample of very coarse nahcolite from 1499.0 feet: X-ray - nahcolite, trace quartz.
1499.5	1502.6	Oil shale: dark to medium brownish gray, some medium brown in upper part; fairly common fine satiny to resinous black streaks. Faint slightly distorted to smooth streaked bedding. Some fine dark brown crystalline blebs and streaks.
1502.6	1506.0	Oil shale: medium grayish brown. Very faint fine smooth laminae and streaked bedding. Common very fine disseminated crystals. Some irregular tight high angle fractures in lower half.
1506.0	1508.6	Oil shale: medium to some dark brownish gray. Faint fine smooth laminae and streaked bedding. Common very fine disseminated crystals. Common gar scales, up to 3/8 inch long, at 1506.6 feet.
1508.6	1510.2	Oil shale: medium to dark grayish brown; some satiny to resinous black laminae in lower part. Faint to moderately distinct smooth laminae--becoming slightly curved and inclined about 45° at base. Some very fine dark gray laminae and streaks in upper part.
1510.2	1512.0	Nahcolite: dark brownish gray; fine to coarse grained. Common fine irregular interstitial oil-shale partings and some thin stringers.

Illustration No. SBR-4109P (Sheet 54 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1512.0	1513.0	Oil shale and nahcolite: dark to medium brown oil shale, some tan near base. Very faint slightly distorted to smooth streaked bedding; some fine smooth laminae near base. Common coarse to fine grained nahcolite bands, stringers, and streaks with interstitial oil shale. Sample of medium grained nahcolite from 1512.3 feet: X-ray - nahcolite, dolomite, quartz, feldspar.
1513.0	1514.7	Nahcolite: medium to dark brown, dolomitic? Dense, very faintly bedded. Some bands and laminae of tan oil shale in middle part. Sample of dense brown nahcolite from 1513.0 feet: X-ray - nahcolite, dolomite, quartz, ferroan.
1514.7	1520.0	Oil shale and nahcolite: medium to dark grayish brown oil shale. Very faint distorted streaked bedding. Very common irregular fine to coarse grained nahcolite stringers and patches with interstitial oil shale; rare dense massive dolomitic stringers.
1520.0	1523.4	Oil shale and nahcolite: tan to dark grayish brown oil shale. Faint distorted streaked bedding. Common fine to medium grained nahcolite with interstitial oil shale; common dense massive dolomitic nahcolite stringers in lower part.
1523.4	1525.5	Nahcolite: grayish brown to white; moderately coarse crystalline to some dense. Irregularly banded to mottled. Rare fine oil-shale laminae. Occasional fine solution cavities. Sample of medium grained white nahcolite from 1523.6 feet: X-ray - nahcolite. Sample of dense grayish brown dolomitic(?) nahcolite from 1524.4 feet: X-ray - nahcolite. Sample of moderately coarse white nahcolite from 1525.1 feet: X-ray - nahcolite.
1525.5	1526.8	Oil shale and nahcolite: medium grayish brown to some tan. Faint distorted to smooth streaked bedding. Very common fine nahcolite blebs, streaks, and patches. Common fine buff-white, slightly chalky dawsonite (?) blebs in lower part.

Illustration No. SBR-4109P (Sheet 55 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of oil shale with fine buff-white dawsonite (?) blebs from 1526.5 feet: X-ray - quartz, dolomite, feldspar, nahcolite, calcite, ferroan
1526.8	1529.2	Nahcolite: grayish brown to white; medium grained to dense. Irregularly banded to mottled. Some fine cavities. Rare tan to buff oil-shale laminae. Sample of crystalline nahcolite with dense grayish brown dolomitic stringers from 1527.0 feet: X-ray - nahcolite. Sample of moderately coarse white to pale brown nahcolite from 1528.5 feet: X-ray - nahcolite.
1529.2	1530.3	Nahcolite: tan to buff, dense to very fine crystalline, dolomitic. Faint smooth to distorted bedding. Some streaks and thin stringers of medium to dark grayish brown oil shale. Some very fine vertical to horizontal nahcolite-filled fractures in upper part. Few thin zones of very coarse colorless transparent nahcolite crystals near base. Sample of buff very fine grained dolomitic(?) nahcolite from 1529.9 feet: X-ray - nahcolite, dolomite, quartz, feldspar, dawsonite. Sample of coarse colorless transparent nahcolite from 1530.2 feet: X-ray - nahcolite.
1530.3	1531.3	Oil shale and nahcolite: very dark grayish brown oil shale with some satiny luster. Very common irregular patches and stringers of fine to moderately coarse nahcolite with interstitial oil shale. Sample of nahcolite with interstitial oil shale from 1530.6 feet: X-ray - nahcolite, dolomite, quartz, feldspar, dawsonite.
1531.3	1534.5	Nahcolite: tan to grayish brown and some white. Dense faintly bedded dolomitic nahcolite with common thin to thick, white to transparent crystalline stringers and bands. Some oil-shale laminae and thin bands in lower part.
1534.5	1536.1	Oil shale: very dark brownish gray to black; common satiny luster. Very faint slightly distorted streaked bedding. Very common very fine disseminated crystals. Rare small vugs with boxworks.

Illustration No. SBR-4109P (Sheet 56 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of oil shale with very fine disseminated crystals from 1535.6 feet: X-ray - quartz, dolomite, feldspar, pyrite ferroan.
1536.1	1537.9	Nahcolite: white to grayish brown, medium to fine crystalline. Common laminae to some thick stringers of medium to very dark grayish brown oil shale. Few thin bands of dense tan dolomitic nahcolite. Some irregular tight high angle fractures in lower part.
		Sample of very pale grayish brown fine grained nahcolite from 1536.5 feet: X-ray - nahcolite.
1537.9	1540.6	Oil shale: very dark brownish gray to black; very common satiny luster, some resinous to waxy near base. Very faint smooth to slightly distorted streaked bedding. Very common very fine disseminated crystals. Some tight high angle fracture. Very irregular coarse hackly parting surface at base.
1540.6	1541.0	Missing?
1541.0	1543.4	Nahcolite: medium to dark brown; coarse to medium crystalline. Common interstitial oil shale as above; some thin broken oil-shale stringers.
1543.4	1545.0	Oil shale and nahcolite: medium brown to tan oil shale. Faint distorted bedding. Common large masses of medium grained nahcolite with interstitial oil shale; common small irregular dark coarsely crystalline masses in lower part. Some short tight high angle fractures.
1545.0	1548.0	Oil shale and nahcolite: medium to dark brown oil shale; some satiny luster. Faint distorted streaked bedding. Fairly common small to 3-inch, irregular to radiating coarse nahcolite masses. Some high angle fractures near base.
1548.0	1549.0	Nahcolite; Brown to brownish black; medium to coarse crystalline, some radiating aggregates. Common very dark interstitial oil shale.
1549.0	1550.6	Nahcolite and oil shale: large irregular masses of medium grained nahcolite in dark to medium brown oil shale. Few dark coarse radiating nahcolite masses. Some fractured shale in lower part.
1550.6	1551.6	Nahcolite: medium to very pale grayish brown and rare white; dense to fine and rare coarse crystalline. Massive with some thin wavy laminae of brown oil shale. Nahcolite very eroded by drilling fluid

Illustration No. SBR-4109P (Sheet 57 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		(in some parts the core is only 1-3/4 inches wide); uneven sample split.
1551.6	1553.0	Oil shale and nahcolite: medium and rare dark brown to tan oil shale. Moderately thick to fine, irregular and fractured to brecciated filaments of oil shale separating very irregular fine to moderately coarse nahcolite masses with interstitial oil shale. Nahcolite deeply etched.
1553.0	1554.5	Nahcolite: medium grayish brown to white; fine to coarse crystalline. Common fine to thin wavy oil-shale laminae. Some dense tan dolomitic nahcolite near top. Very eroded; uneven sample split. Sample of very eroded white to pale brown nahcolite from 1554.1 feet: X-ray - nahcolite; some dolomite, quartz, dawsonite?
1554.5	1558.5	Oil shale: grayish brown to tan. Very fractured to brecciated. Some coarse white to transparent nahcolite in breccia; some small vugs and rare small dark nahcolite masses. Irregular core pieces to jumbled rubble. Sample lengths doubtful; grab sampled. Sample of coarse transparent nahcolite from 1557? feet: X-ray - nahcolite.
1558.5	1560.0	Oil shale: medium to dark grayish brown. Faint smooth to distorted streaked bedding. Mostly very fractured with common fine nahcolite seams. Few small to 2-inch coarse radiating nahcolite masses.
1560.0	1561.3	Nahcolite and oil shale: very dark to medium brownish gray, coarse to fine crystalline nahcolite with interstitial resinous black oil shale. Deeply etched.
1561.3	1562.3	Nahcolite and oil shale: grayish brown fine grained nahcolite with interstitial and interbedded dark to medium brown oil shale. Few small coarse nahcolite blebs with pyritic rims in oil shale. Sample of fine grained nahcolite with interstitial oil shale(?) from 1562.2 feet: X-ray - nahcolite, dolomite, quartz,
1562.3	1563.7	Oil shale and nahcolite: brown to tan oil shale. Faint very wavy to some smooth laminae. Common small to 3-inch dark coarse radiating nahcolite masses. Some irregular fractured core pieces in middle.

Illustration No. SBR-4109P (Sheet ⁵⁸59 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1563.7	1564.8	Oil shale and some nahcolite: medium to some dark brown and grayish brown oil shale. Faint slightly distorted to smooth laminae and streaked bedding. Few thin fine grained nahcolite stringers; rare small coarse radiating masses. Some very fine black pyritic (?) specks and streaks in lower part. Few irregular tight high angle fractures. Sample of oil shale with some very fine black streaks from 1564.5 feet: X-ray - quartz, dolomite, feldspar, calcite, dawsonite, pyrite, ferroan.
1564.8	1566.0	Nahcolite: Faintly bedded dense brown dolomitic nahcolite in upper 0.7 foot; grayish brown to white, moderately coarse to fine crystalline. nahcolite with wavy fractured oil-shale bands and laminae in lower part. Deeply eroded. Sample of dense dolomitic nahcolite from 1565.1 feet: X-ray - nahcolite.
1566.0	1572.4	Nahcolite: grayish brown to white; dense to moderately coarse crystalline. Faintly bedded to irregularly banded. Fairly common irregular streaks and laminae to 2-inch bands of grayish brown to buff oil shale. Some nahcolite-filled fractures in oil shale. Dark coarse nahcolite with interstitial oil shale at 1571.0-1571.7 feet. Some parts deeply eroded. Sample of moderately coarse white nahcolite from 1569.1 feet: X-ray - nahcolite.
1572.4	1577.8	Oil shale and nahcolite: medium to dark grayish brown oil shale. Faint distorted to smooth streaked bedding. Common very fine disseminated crystals. Common small irregular fine grained nahcolite blebs, streaks, and stringers. Common very fine disseminated pyrite in some parts. Sample of oil shale with disseminated crystals from 1574.5 feet: X-ray - quartz, dolomite, dawsonite, feldspar, pyrite.

Illustration No. SBR-4109P (Sheet ⁵⁹58 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1577.8	1579.1	Nahcolite and oil shale: medium to dark brown, fine crystalline to dense nahcolite; medium grayish brown oil shale. Faintly bedded to massive nahcolite with fine to thick distorted oil-shale stringers and bands. Sample of brown nahcolite from 1578.9 feet: X-ray - nahcolite.
1579.1	1580.1	Oil shale: dark grayish brown. Very faint fairly smooth streaked bedding. Common very fine disseminated crystals. Some fine nahcolite streaks and very small blebs.
1580.1	1581.2	Oil shale and nahcolite: dark grayish brown oil shale as above. Very common very fine disseminated nahcolite crystals; predominantly nahcolite in some parts. Some thin zones with common coarse nahcolite crystals.
1581.2	1583.9	Oil shale and nahcolite: dark to medium grayish brown oil shale. Very faint distorted streaked bedding. Common fine disseminated nahcolite and irregular dense dolomitic nahcolite stringers; rare small coarsely crystalline masses.
1583.9	1585.3	Oil shale: medium to dark brownish gray and rare black; common very fine satiny to waxy laminae and streaks. Faint to moderately distinct, slightly wavy to smooth laminae; common fine loop structures. Rare very fine disseminated crystals. A thin irregular brown to grayish brown, slightly earthy to dense stringer at 1584.6 feet. Sample of thin brown stringer from 1584.6 feet: X-ray - feldspar, ferroan.
1585.3	1586.3	Oil shale: brownish gray to some black; common satiny to some waxy luster. Faint smooth laminae with common small to fine loop structures in upper part grading to very faint streaked bedding in lower part. Some <u>very</u> fine disseminated crystals. Some very thin dark coarse nahcolite streaks in upper part. Sample of dark brownish gray to black oil shale from 1585.6 feet: X-ray - quartz, dawsonite, ferroan, pyrite, feldspar, dolomite.
1586.3	1587.0	Oil shale: medium grayish brown and brown. <u>Very</u> faint smooth to slightly curved bedding. Some thin zones with common fine disseminated nahcolite.

Illustration No. SBR-4109P (Sheet 60 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of grayish brown oil shale from 1586.8 feet: X-ray - quartz, dolomite, dawsonite, feldspar, calcite?
1587.0	1591.5	Oil shale and nahcolite: dark to medium grayish brown oil shale. Very faint fairly smooth streaked bedding. Very common fine disseminated nahcolite grading to zones of nahcolite with interstitial oil shale.
1591.5	1592.5	Nahcolite and oil shale: fine to moderately coarse nahcolite with interstitial oil shale.
1592.5	1594.0	Oil shale and nahcolite: medium grayish brown and brown oil shale. Faint wavy streaked bedding and rare very fine laminae. Common small to 1-inch dark coarsely crystalline radiating nahcolite masses; some irregular fine grained masses.
1594.0	1603.0	Oil shale and some nahcolite: medium to dark grayish brown and brownish gray. Very faint smooth streaked bedding and rare very fine laminae. Common <u>very</u> fine disseminated crystals. Few very small radiating pyrite masses and rare small coarse nahcolite masses in upper 2.0 feet. Occasional 1- to 3-inch coarse radiating nahcolite masses below 1596.0 feet.
1603.0	1606.0	Oil shale and nahcolite: grayish brown to tan oil shale. Faint to fairly distinct, smooth to very wavy and distorted laminae; common very fine loop structures and displacements. Common small to 3-inch dark coarse radiating to irregular nahcolite masses.
1606.0	1607.0	Nahcolite and oil shale: dark to medium grayish brown oil shale. Very faint slightly wavy bedding. Fine to fairly coarse brown to black nahcolite with interstitial oil shale from 1606.2 to 1606.9 feet. Sample of nahcolite with interstitial oil shale from 1606.6 feet: X-ray - nahcolite, dolomite, quartz, feldspar, dawsonite.
1607.0	1609.0	Oil shale and nahcolite: dense grayish brown to some tan oil shale. Faint smooth bedding with some distinct tan laminae and streaks. Common very fine disseminated nahcolite crystals and some small dark coarse blebs. Several thick dense faintly bedded grayish brown to brown dolomitic nahcolite bands. A very fine vertical nahcolite-filled fracture in middle part.

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of dense grayish brown oil shale from 1608.3 feet: X-ray - quartz, dawsonite, dolomite, ferroan, feldspar.
		Sample of dense nahcolite from 1608.5 feet: X-ray - nahcolite, dawsonite, quartz, dolomite, feldspar, ferroan.
1609.0	1616.5	Oil shale: dark grayish brown. Very faint smooth streaked bedding. Dense tight core; conchoidal fracture. Very common very fine disseminated crystals (nahcolite?); some thin fine grained nahcolite streaks in upper part; very rare small to 2-inch coarse radiating masses. Common fine pyrite blebs and rare streaks and small radiating masses.
		Sample of oil shale with very fine disseminated crystals from 1615.0 feet: X-ray - quartz, dolomite, nahcolite, feldspar, ferroan, dawsonite.
1616.5	1617.5	Oil shale: as above. Some small to 2-inch coarse radiating nahcolite masses. Some badly broken core.
1617.5	1618.5	Oil shale: dark to medium brownish gray. Faint very smooth fine laminae. Very regular thick parting; dense and heavy.
		Sample of dark brownish gray oil shale from 1617.7 feet: X-ray - quartz, dawsonite, ferroan, dolomite, feldspar, pyrite.
1618.5	1619.6	Oil shale: dark to medium brownish gray, some grayish brown and rare tan in upper part. Very faint to rare distinct smooth laminae and streaked bedding. Common <u>very</u> fine disseminated crystals. Some fine pyrite blebs and very fine lacy stringers in upper part.
1619.6	1623.8	Oil shale: dark to medium brownish gray. Faint to moderately distinct very smooth laminae. Common <u>very</u> fine disseminated crystals in some parts. Some very fine vertical nahcolite-filled fractures in lower 0.4 foot.
1623.8	1624.8	Oil shale: medium to rare dark brownish gray and grayish brown. Moderately distinct to very faint smooth laminae; some very fine loop structures and displacements. A very fine nahcolite-filled vertical fracture in upper 0.1 foot.

Illustration No. SBR-4109P (Sheet 62 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1624.8	1626.0	Oil shale and nahcolite: medium to dark grayish brown oil shale. Very faint distorted bedding. Very common fine disseminated nahcolite and some small to large coarsely crystalline masses.
1626.0	1627.0	Nahcolite: black to pale brown. Coarse to fine crystalline. Common very fine interstitial partings of tan to buff marlstone. Sample of moderately coarse dark to pale brown nahcolite from 1626.6 feet. X-ray - nahcolite, trace quartz.
1627.0	1628.0	Oil shale and nahcolite: grayish brown to tan and rare buff oil shale. Fairly distinct wavy to flat laminae; some fine displacements. Common small to 2-inch coarse irregular to radiating nahcolite masses.
1628.0	1629.0	Oil shale and nahcolite: medium to some dark grayish brown and rare tan oil shale. Moderately distinct to faint, smooth to slightly distorted laminae; some fine to small loop structures and displacements. A 4-inch coarse radiating nahcolite mass in middle.
1629.0	1630.0	Oil shale and nahcolite: medium to dark brownish gray oil shale. Faint smooth laminae to very faint streaked bedding. Some irregular fine to coarse crystalline nahcolite stringers in lower part.
1630.0	1632.0	Oil shale and nahcolite: dark to medium grayish brown and some tan oil shale. Very faint smooth streaked bedding and some distinct distorted laminae. Common small to large dark coarse nahcolite masses. A 4-inch coarse piece of dense dolomitic nahcolite with fine wavy oil-shale laminae in lower part. Some irregular high angle fractures. Irregular core pieces; uneven sample split.
1632.0	1633.0	Nahcolite and oil shale: dark grayish brown oil shale with very common fine disseminated nahcolite crystals grading to moderately coarse nahcolite with interstitial oil shale.
1633.0	1640.1	Oil shale: medium to dark grayish brown. Very faint smooth to slightly distorted streaked bedding. Common fine nahcolite blebs and disseminated crystals; rare small to 1-inch coarse masses. Common fine pyrite blebs.
1640.1	1641.1	Nahcolite: dark to medium and some pale brown. Medium to fine crystalline with interstitial oil shale and rare thin oil-shale stringers.

Illustration No. SBR-4109P (Sheet 63 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1641.1	1642.2	Oil shale: medium grayish brown to dark brownish gray. Very faint smooth bedding. Rare small coarse nahcolite masses and some fine disseminated nahcolite near top. Common <u>very</u> fine disseminated crystals in lower part (dawsonite?).
1642.2	1643.3	Oil shale: dark brownish gray. Very faint smooth bedding. Very common very fine disseminated crystals. Sample of oil shale with very fine crystals from 1643.0 feet: X-ray - quartz, dolomite, dawsonite, feldspar, pyrite.
1643.3	1645.0	Nahcolite and oil shale: dark to medium grayish brown oil shale, common tan streaks at 1643.9-1644.1 feet. Faint smooth to distorted streaked bedding. Common very fine disseminated dawsonite. common large irregular to radiating coarse nahcolite masses; coarse to fine, dark to pale brown nahcolite with rare oil-shale stringers at 1644.4-1644.8 feet (no interstitial oil shale). Sample of fairly coarse dark to pale brown nahcolite from 1644.5 feet: X-ray - nahcolite, trace quartz.
1645.0	1648.5	Oil shale: dark brownish gray. Very faint smooth streaked bedding. Very common very fine disseminated crystals. A 0.1-foot zone of common coarse disseminated nahcolite crystals at 1646.0 feet. Some fine black pyritic blebs, streaks, and small irregular masses in lower half.
1648.5	1650.3	Oil shale: very dark brownish gray to some medium grayish brown; rare satiny luster. Very faint smooth streaked bedding and some very fine laminae. Common very fine disseminated crystals. A small coarsely crystalline nahcolite mass at 1649.0 feet.
1650.3	1651.3	Nahcolite and oil shale: black to brown, medium to coarse grained nahcolite with interstitial oil shale and oil-shale stringers as above.
1651.3	1653.2	Oil shale and nahcolite: dark to medium grayish brown and some tan oil shale. Faint to distinct, smooth to wavy laminae and some streaked bedding. Very common laminae to 3-inch bands of fine crystalline to dense and faintly bedded nahcolite; some very small to 1-inch coarse radiating masses. Nahcolite is eroded up to 3/4-inch deep.

Illustration No. SBR-4109P (Sheet 64 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of thin fine grained nahcolite band from 1652.3 feet: X-ray - nahcolite, dolomite, dawsonite, quartz,
1653.2	1654.4	Nahcolite: brown, dense, dolomitic, faintly bedded to massive. Deeply eroded. Rare thin oil-shale stringers. Sample of dense brown dolomitic nahcolite from 1653.9 feet: X-ray - nahcolite, dolomite.
1654.4	1657.6	Oil shale and nahcolite: tan to dark grayish brown oil shale. Distinct to some faint, wavy to smooth laminae. Very common laminae to 2-inch bands of fine grained to dense nahcolite; rare small to 1-inch coarse radiating masses in upper part. Nahcolite is deeply eroded. Sample of distinctly laminated oil shale from 1656.9 feet: X-ray - quartz, dolomite, dawsonite, feldspar, ferroan.
1657.6	1672.4	Oil shale and nahcolite: medium to dark grayish brown oil shale. Faint smooth to very distorted streaked bedding. Common very fine disseminated dawsonite (?) crystals, Very common nahcolite as fine to coarse disseminated crystals and small irregular aggregates to 3-inch radiating masses; rare thin to 2-inch very fine grained stringers and bands. Sample of oil shale with very fine dawsonite and rare fine nahcolite from 1668.2 feet: X-ray - quartz, dolomite, dawsonite, feldspar.
1672.4	1676.2	Nahcolite and oil shale: very large irregular coarse nahcolite masses to coarse disseminated crystals in brownish black to very dark grayish brown oil shale. Abrupt change to lighter colored oil shale with fine disseminated nahcolite at base.
1676.2	1678.0	Oil shale and nahcolite: dark grayish brown to medium brown oil shale. Very faint slightly wavy to smooth bedding. Very common very fine disseminated nahcolite crystals grading to zones of fine grained nahcolite with interstitial oil shale. Sample of fine grained nahcolite from 1677.5 feet: X-ray - nahcolite, dolomite, trace quartz.
1678.0	1680.0	Oil shale and nahcolite: medium brown and grayish brown to rare tan oil shale. Faint smooth bedding. Very common fine disseminated nahcolite crystals.

Illustration No. SBR-4109P (Sheet 65 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of oil shale with disseminated nahcolite from 1678.6 feet: X-ray - quartz, dolomite, dawsonite, nahcolite, calcite, feldspar.
1680.0	1683.0	Oil shale: medium brown and grayish brown. Faint fairly smooth streaked bedding. Common <u>very</u> fine disseminated crystals (nahcolite? and dawsonite?). Rare small dense to coarsely crystalline nahcolite masses.
1683.0	1686.0	Oil shale and nahcolite: oil shale as above. Some fine to 1-inch coarse nahcolite masses. Dense to very fine crystalline dolomitic nahcolite with irregular oil-shale stringers at 1683.0-1683.7 and 1685.2-1685.8 feet. Sample of dense dolomitic nahcolite from 1685.3 feet: X-ray - nahcolite, dolomite, trace quartz.
1686.0	1690.5	Oil shale and nahcolite: dark to medium grayish brown and brown oil shale. Faint fairly smooth to distorted streaked bedding. Common nahcolite as disseminated crystals and small to rare large coarse masses.
1690.5	1694.0	Oil shale and nahcolite: medium grayish brown and brown to some tan and buff oil shale. Faint distorted streaked bedding with some distinct tan to buff streaks and stringers. Common small to 3-inch coarse radiating to irregular coarse nahcolite masses.
1694.0	1695.7	Nahcolite and oil shale: very large medium to coarse crystalline nahcolite masses in oil shale as above.
1695.7	1697.4	Nahcolite: brownish black to dark brown. Very coarse crystals radiating from multiple centers. Very fine interstitial oil-shale partings. Sample of very coarse nahcolite from 1696.5 feet: X-ray - nahcolite.
1697.4	1700.0	Oil shale and nahcolite: medium to dark grayish brown oil shale. Faint wavy to fairly smooth streaked bedding and some laminae. Common nahcolite in 3- to 5-inch coarse radiating masses and some small irregular blebs. Some very fine disseminated crystals (dawsonite?) in lower part.
1700.0	1702.0	Oil shale and nahcolite: medium grayish brown and brown oil shale. Faint wavy to smooth streaked bedding. Common 1- to 3-inch coarse radiating

Illustration No. SBR-4109P(Sheet 66 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		to irregular nahcolite masses in upper part; a 2-inch mass near base. Some very fine disseminated dawsonite (?) crystals.
1702.0	1705.0	Oil shale and nahcolite: medium to some dark brown and grayish brown oil shale. Moderately distinct to very faint, distorted and wavy streaked bedding; some faint laminae with loop structures. Common small to 2-inch coarse radiating nahcolite masses; massive very fine grained nahcolite with some small coarse radiating masses at 1702.5-1703.1 and 1704.2-1704.4 feet.
1705.0	1706.0	Oil shale and nahcolite: medium to dark grayish brown oil shale. Faint distorted to fairly smooth streaked bedding. Common very fine disseminated dawsonite. Common small coarse nahcolite masses and disseminated crystals to large irregular medium grained masses.
1706.0	1707.0	Oil shale and nahcolite: oil shale as above. Very common thin streaks of fine to medium grained nahcolite with interstitial oil shale.
1707.0	1715.5	Oil shale and nahcolite: dark to some medium grayish brown. Very faint smooth to some wavy streaked bedding. <u>Very</u> common very fine disseminated crystals (nahcolite?). Some small to large nodules of massive fine grained nahcolite in upper part (very eroded); rare small nodules and fine streaks below 1710.0 feet. Sample of massive fine grained nahcolite from large nodule at 1708.6 feet: X-ray - nahcolite, pyrite, trace quartz. Sample of oil shale with very common very fine disseminated nahcolite (?) from 1713.7 feet: X-ray - quartz, dawsonite, dolomite, ferroan, feldspar, nahcolite.
1715.5	1716.5	Oil shale and nahcolite: oil shale with very fine disseminated crystals as above. A 0.4-foot very coarse radiating nahcolite mass in upper part; a 3-inch zone of medium to fine grained nahcolite with interstitial oil shale at base.
1716.5	1719.0	Oil shale and nahcolite: dark to medium grayish brown oil shale; some brownish black resinous shale at 1717.2-1717.4 feet. Faint to moderately distinct wavy streaked bedding. Common small to very large, irregular to radiating nahcolite masses (very eroded and some broken). Common very fine disseminated crystals in upper part.

Illustration No. SBR-4109P (Sheet 67 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1719.0	1720.7	Oil shale and nahcolite: medium to dark brown and grayish brown oil shale; rare satiny black streaks. Faint to moderately distinct, wavy to smooth streaked bedding. Common very fine disseminated crystals (dawsonite?). A 5-inch very coarse radiating nahcolite mass at 1719.5 feet (<u>very</u> eroded).
1720.7	1721.6	Nahcolite and oil shale: medium to fine grained nahcolite with interstitial oil shale as above.
1721.6	1722.4	Oil shale and nahcolite: medium to dark grayish brown and brown oil shale; common very fine waxy black laminae. Fairly distinct to very faint wavy laminae; some fine to small loop structures. Common small to large coarse radiating to irregular and fractured nahcolite masses. Sample of dark grayish brown oil shale with fine waxy black laminae from 1721.8 feet: X-ray - quartz, dawsonite, dolomite, ferroan, feldspar, pyrite.
1722.4	1723.5	Oil shale and nahcolite: medium grayish brown and brown oil shale. Very faint wavy bedding. Common very large coarse radiating nahcolite masses.
1723.5	1725.1	Oil shale and nahcolite: medium and rare dark grayish brown oil shale. Very faint smooth bedding to faint wavy streaks and laminae. Some large coarse radiating nahcolite masses.
1725.1	1727.7	Oil shale: medium to rare dark grayish brown and brownish gray. Faint smooth laminae and streaked bedding; common very fine loop structures and displacements; thin contorted zones at 1726.9 feet. Slightly hackly fracture. Very common <u>very</u> fine disseminated crystals in upper part.
1727.7	1728.7	Oil shale and nahcolite: oil shale as above. Few large coarse radiating nahcolite masses.
1728.7	1732.0	Oil shale and nahcolite: dark brown to tan and some buff oil shale; rare thin very dark resinous zones in upper part. Faint to very distinct, very wavy to some smooth laminae; very common fine loop structures and displacements. Very common very fine disseminated crystals. A 6-inch very coarse radiating nahcolite mass near top; common 1- to 3-inch radiating masses in other parts (deeply eroded). Sample of distinctly laminated oil shale with very fine disseminated crystals from 1730.5 feet: X-ray - dolomite, quartz, dawsonite, feldspar.

Illustration No. SBR-4109P (Sheet 68 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1

From	To	Description
1732.0	1733.0	Oil shale and nahcolite: medium to dark brown and grayish brown oil shale. Moderately distinct smooth streaked bedding. Very common very fine disseminated crystals (mostly nahcolite?). Rare very small coarse nahcolite blebs. Massive very fine grained nahcolite at 1732.2-1732.7 feet (very eroded).
1733.0	1737.0	Oil shale and nahcolite: oil shale with very common very fine disseminated crystals as above. Very common small to very large, coarse to medium grained, radiating to very irregular nahcolite masses (up to 60% nahcolite in lower half).
1737.0	1739.0	Oil shale and some nahcolite: medium grayish brown and brown oil shale. Moderately distinct to faint, slightly distorted to smooth streaked bedding. Common very fine to rare coarse disseminated crystals (dawsonite and nahcolite). Some thin fine grained nahcolite streaks and very small to rare large fine to coarse masses.
1739.0	1740.8	Oil shale and nahcolite: medium grayish brown and brown to some tan oil shale. Moderately distinct to faint, distorted to rare smooth streaked bedding. Common small to 3-inch coarse radiating to irregular nahcolite masses.
1740.8	1741.8	Oil shale and nahcolite: medium brown to tan and rare buff oil shale. Fairly distinct very distorted and wavy streaked bedding. Some large coarse nahcolite masses.
1741.8	1743.0	Oil shale and nahcolite: medium to dark brown and grayish brown oil shale; some very fine dark resinous streaks. Faint smooth streaked bedding. Coarse radiating nahcolite masses at 1741.8-1742.3 and 1742.6-1742.8 feet.
1743.0	1744.5	Oil shale: dark to rare medium grayish brown; rare fine black waxy streaks. Faint smooth to slightly wavy streaked bedding. Some very fine disseminated crystals in upper part.
1744.5	1746.0	Nahcolite and oil shale: very large dark coarse irregular to radiating nahcolite masses. A 0.3-foot zone of grayish brown to black oil shale with common resinous luster in middle; moderately distinct distorted streaks and laminae with some fairly large irregular loop structures. Interstitial oil shale and thin stringers in other parts.

Illustration No. SBR-4109P (Sheet 69 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1746.0	1747.0	Oil shale: very dark to medium grayish brown; some fine resinous to waxy black streaks. Faint smooth streaked bedding. Some very fine disseminated crystals. Sample includes very small amount of nahcolite at top.
1747.0	1749.7	Oil shale: dark to medium brownish gray; some fine satiny to waxy black streaks. Very faint smooth streaked bedding. Some to common very fine disseminated crystals. A 3-inch coarse radiating nahcolite mass at base.
1749.7	1750.1	Sample length correction; nothing missing.
1750.1	1751.2	Oil shale: medium grayish brown to black; common resinous to waxy streaks and laminae. Faint smooth streaked bedding in upper part to wavy laminae with common fine to small loop structures in lower part; slight unconformity at 1751.0 feet. Small amount of nahcolite at top.
1751.2	1758.7	Oil shale: medium brown and grayish brown; some very fine dark satiny to resinous streaks. Moderately distinct smooth streaked bedding; some fine distinct tan to buff marlstone streaks and lenses. Fairly common very fine disseminated crystals. A 4-inch very coarsely crystalline radiating nahcolite mass at 1758.3 feet. Abrupt change to very rich laminated oil shale at base. (0.2-foot sample length correction at 1758.0 feet; nothing missing)
1758.7	1760.9	Oil shale, very rich: brownish black to dark and some medium grayish brown; very common satiny to waxy luster. Moderately distinct to faint smooth to slightly wavy laminae and streaked bedding; very common fine to small loop structures. Common very fine disseminated crystals. Small amount of nahcolite at base.
1760.9	1761.1	Sample length correction; nothing missing.
1761.1	1763.5	Oil shale and nahcolite: medium brown oil shale. Very faint wavy to smooth bedding. Common small to 1-inch coarse radiating nahcolite masses. Rare very fine colorless crystalline streaks. Sample of very faintly bedded brown oil shale from 1762.1 feet: X-ray - quartz, dolomite, dawsonite, feldspar.
1763.5	1766.8	Oil shale and nahcolite: medium brown and grayish brown oil shale; some very fine dark resinous to waxy streaks. Faint to moderately distinct, smooth to slightly distorted streaked bedding.

Illustration No. SBR-4109P (Sheet 70 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Common coarse to fine disseminated nahcolite crystals in upper and lower parts; some in middle.
1766.8	1767.0	Missing?
1767.0	1768.0	Oil shale: medium brown; some fine dark resinous to waxy streaks. Moderately distinct smooth streaked bedding. Some very fine disseminated crystals and crystalline streaks. Sample of shale with rare very fine crystals and crystalline streaks from 1767.5 feet: X-ray - quartz, dolomite, dawsonite, feldspar.
1768.0	1770.0	Oil shale and some nahcolite: oil shale as above with some fine disseminated nahcolite and few large coarsely crystalline masses.
1770.0	1771.5	Oil shale and nahcolite: oil shale as above and below with common large coarse nahcolite masses.
1771.5	1773.5	Oil shale: medium to dark brown and grayish brown; some fine satiny to resinous streaks. Moderately distinct fairly smooth streaked bedding. Some fine disseminated nahcolite in upper part; rare in lower part.
1773.5	1775.0	Oil shale and nahcolite: medium brown and grayish brown to some tan oil shale; some fine dark resinous streaks in upper part. Faint smooth to distorted streaked bedding. Common fine to coarse disseminated nahcolite crystals and irregular 1- to 2-inch masses.
1775.0	1776.3	Nahcolite and oil shale: fine to some coarse nahcolite with interstitial oil shale grading to zones of brown oil shale with very common very fine disseminated nahcolite crystals. Sample of moderately coarse nahcolite from 1775.5 feet: X-ray - nahcolite.
1776.3	1777.6	Oil shale, very rich: brownish black to dark and some medium grayish brown; very common satiny to waxy luster. Faint wavy to smooth laminae and streaks with common fine to some large loop structures. Sample of oil shale from 1777.0 feet: X-ray - quartz, dawsonite, feldspar, pyrite, dolomite.
1777.6	1778.7	Oil shale: dark to medium grayish brown; common fine satiny to resinous streaks. Faint fairly smooth to distorted streaked bedding; some shreds with irregular internal laminae. Common very fine disseminated crystals.

Illustration No. SBR-4109P (Sheet 71 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1778.7	1780.0	Oil shale: medium brown to dark grayish brown; common very fine satiny to waxy streaks. Fairly distinct distorted streaks and shreds with thick interfingering massive brown stringers. Some very fine discontinuous diagonal nahcolite-filled fractures at 1779.0 feet.
1780.0	1784.0	Oil shale: medium and rare dark grayish brown; rare fine satiny to resinous streaks. Faint fairly smooth streaked bedding.
1784.0	1785.7	Oil shale: medium to dark grayish brown and some black. Faint fairly smooth streaked bedding and some laminae. Common very fine disseminated crystals in lower part.
1785.7	1788.0	Oil shale: medium to rare dark grayish brown and brownish gray. Faint very fine smooth laminae and streaked bedding. Regular thick to thin shaly and rare papery parting; slight hackly fracture. Very common very fine crystalline laminae, streaks, and disseminated crystals--commonly slightly prismatic. Sample of oil shale with common crystalline laminae, streaks, and disseminated crystals from 1786.6 feet: X-ray - calcite, quartz, dawsonite, dolomite, feldspar, pyrite.
1788.0	1789.0	Oil shale, very rich: dark grayish brown to some black; nearly all has resinous luster. Faint smooth laminae; very common fine loop structures. Common very fine disseminated crystals near top. a fine vitreous black organic streak at 1788.3 feet.
1789.0	1790.2	Oil shale, <u>very</u> rich: very dark grayish brown to black; all has resinous to waxy luster. Faint smooth to slightly distorted laminae and streaked bedding; common fine to rare large loop structures and displacements. Very rare very fine distinct buff streaks.
1790.2	1791.4	Oil shale, very rich: dark grayish brown to some black; very common resinous to waxy luster. Faint smooth laminae and streaked bedding; some fine loop structures and displacements. Common very fine disseminated crystals.
1791.4	1793.9	Oil shale, rich: dark grayish brown to rare black; very common resinous to some waxy luster. Faint smooth laminae and streaked bedding; common fine to small loop structures and displacements.
1793.9	1794.9	Oil shale, very rich: very dark grayish brown to black; all has resinous luster. Faint smooth

Illustration No. SBR-4109P (Sheet 72 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek (Cont.)

From	To	Description
		to slightly distorted streaked bedding. An irregular coarsely crystalline nahcolite stringer up to 3/4-inch thick near base.
1794.9	1796.9	Oil shale, very rich: dark grayish brown, some black upper part; nearly all has satiny to resinous luster. Faint smooth to distorted streaked bedding. Rare very small nahcolite blebs and streaks and very fine nahcolite-filled fractures in lower part.
1796.9	1798.2	Oil shale and some nahcolite: dark rich oil shale as above. Common fairly coarse disseminated nahcolite crystals (blade shaped) and few moderately large irregular masses.
1798.2	1800.0	Nahcolite and oil shale: fairly coarse to fine grained nahcolite with intersitital oil shale grading to zones of dark grayish brown oil shale with very common disseminated nahcolite. Nahcolite is moderately to deeply eroded.
1800.0	1801.0	Oil shale and nahcolite: dark to medium brown oil shale; common fine waxy black streaks in upper part. Moderately distinct distorted laminae and streaks with common fine loop structures in upper part; very faint bedding with rare distinct laminae and streaks in lower part. A 3-inch coarse radiating nahcolite mass in upper part.
1801.0	1802.5	Nahcolite and oil shale: very large coarse radiating nahcolite masses in brown to tan oil shale.
1802.5	1803.5	Oil shale and nahcolite: brown to tan oil shale. Very faint slightly distorted to smooth streaked bedding; some very fine laminae with loop structures in upper part. Some irregular coarse nahcolite masses near top; fine grained nahcolite with interstitial oil shale at 1803.0-1803.3 feet.
1803.5	1804.5	Oil shale and nahcolite: medium brown to grayish brown oil shale. Faint smooth streaked bedding. Oil shale with very common very fine disseminated nahcolite crystals in upper part grading to nahcolite with interstitial and interbedded oil shale in lower part. A 1-inch coarse radiating nahcolite mass at 1804.2 feet.
1804.5	1807.5	Oil shale: medium grayish brown and brown. Moderately distinct slightly distorted streaked bedding. Some fine to small, tan to buff marlstone inclusions. Rare fine black pyritic blebs. A 2-inch coarse radiating nahcolite mass at 1805.0 feet and a 1-inch mass at 1806.3 feet.

Illustration No. SBR-4109P (Sheet 73 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1807.5	1809.0	Oil shale and nahcolite: oil shale as above with very large coarse nahcolite masses.
1809.0	1817.0	Oil shale and some nahcolite: medium brown oil shale. Moderately distinct smooth to slightly distorted streaked bedding; some fine to small tan streaks and inclusions. Some fine to fairly coarse disseminated nahcolite crystals and small masses; some large fine to coarse masses at 1813.5-1814.2 and 1816.7-1817.0 feet.
1817.0	1818.4	Oil shale and nahcolite: medium brown to tan oil shale. Moderately distinct to very faint, smooth to wavy streaked bedding. Common 1- to 2-inch zones of moderately coarse to fine grained nahcolite with interstitial oil shale from 1817.6 to 1818.2 feet; 1-inch coarse radiating masses near base.
1818.4	1819.4	Oil shale: medium brown. Moderately distinct smooth to distorted streaked bedding. Rare thin fine grained pyritic nahcolite streaks.
1819.4	1821.1	Oil shale and nahcolite: oil shale as above with 2- to 5-inch coarse radiating nahcolite masses.
1821.1	1821.9	Oil shale: medium to some very dark brown and grayish brown, rare tan; some resinous to waxy laminae and streaks. Faint to very distinct, smooth to slightly distorted laminae; common fine loop structures and displacements in lower part.
1821.9	1822.6	Oil shale, very rich: medium brown to brownish black; nearly all has resinous to waxy luster. Distinct fairly smooth laminae; common fine to small loop structures and displacements. Abrupt change to lean oil shale at base.
1822.6	1824.0	Oil shale: buff and tan to medium brown in upper part grading to medium and some dark brownish gray in lower part. Fairly distinct to faint smooth laminae; some fine to small loop structures and displacements in upper part. Light olive gray to buff mudstone bands with rare fine oil-shale streaks at 1823.1-1823.3 and 1823.5-1823.8 feet; some mudstone laminae between and below bands. Sample of light olive gray mudstone from 1823.2 feet: X-ray - quartz, dawsonite, feldspar, ferroan, dolomite, pyrite.
1824.0	1825.3	Oil shale: medium and rare dark brown to tan. Faint to distinct, smooth to very distorted laminae, stringers, and streaks; common fine loop structures; some large displacements and unconformable

Illustration No. SBR-4109P (Sheet 74 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1825.3	1827.0	stringers in middle part. Common fine black pyritic blebs and some small irregular masses. Oil shale and nahcolite: medium and some dark brown to tan and buff oil shale; some resinous luster. Distinct distorted to contorted laminae and streaks; common fine to large loop structures and displacements; some unconformities. Very large very coarse nahcolite masses at top and bottom; some fine to small nahcolite streaks and blebs in middle. Sample of brown to buff oil shale from 1826.4 feet:
1827.0	1828.0	X-ray - dolomite, quartz, dawsonite, feldspar. Oil shale: medium brown. Very faint fairly smooth to contorted streaked bedding. Some small patches of very fine black pyritic specks. Some small nahcolite blebs in upper part. Sample of oil shale from 1827.4 feet:
1828.0	1830.5	X-ray - quartz, dolomite, dawsonite, feldspar. Oil shale: medium to dark brownish gray. Faint fairly smooth streaked bedding. Uniform and featureless.
1830.5	1831.8	Oil shale: as above with few small coarse nahcolite masses and some fine black pyritic blebs.
1831.8	1834.0	Nahcolite and oil shale: coarse to fine grained nahcolite with interstitial oil shale. Some zones of very dark brown oil shale with common fine disseminated nahcolite.
1834.0	1835.0	Oil shale and nahcolite: medium to some dark grayish brown oil shale. Faint distorted streaked bedding. Very common irregular coarsely crystalline nahcolite masses.
1835.0	1837.8	Oil shale and nahcolite: medium brown oil shale. Faint distorted to smooth streaked bedding. Very common <u>very</u> fine disseminated crystals. Common 1- to 3-inch coarse radiating nahcolite masses. Sample of oil shale with very fine disseminated crystals from 1837.2 feet:
1837.8	1839.1	X-ray - quartz, dolomite, dawsonite, feldspar. Nahcolite and oil shale: coarse radiating nahcolite masses and 1- to 4-inch zones of coarse to medium grained nahcolite with interstitial oil shale. About 40% oil shale as above in 1- to 2-inch zones. Nahcolite is very eroded.

Illustration No. SBR-4109P (Sheet 75 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1839.1	1839.6	Oil shale: medium brown to tan and buff. Distinct very fine smooth laminae; common very fine loop structures. Very common very fine disseminated crystals. A fine very irregular fracture filled with dark brown oil shale in upper half.
1839.6	1850.5	Oil shale: dark brownish gray. Very faint smooth streaked bedding. Very common very fine disseminated crystals. Rare fine pyrite streaks and blebs. Coarse nahcolite masses at 1842.3-1842.6 and 1844.8-1845.0 feet. A zone of medium brown oil shale at 1842.9-1843.2 feet.
1850.5	1852.2	Nahcolite and oil shale: <u>very</u> large dark coarse nahcolite masses with interstitial oil shale. About 20% solid oil shale as above. Nahcolite is deeply to moderately eroded. Sample of coarsely crystalline nahcolite with <u>very</u> fine interstitial oil-shale partings from 1851.2 feet: X-ray - nahcolite.
1852.2	1855.9	Oil shale and nahcolite: medium brown and grayish brown to tan and buff oil shale. Faint to distinct, fairly smooth to wavy and distorted laminae and streaked bedding; common loop structures and displacements in laminated parts. Common very fine disseminated crystals. Common very large coarse radiating to irregular nahcolite masses (very eroded). (0.2 foot missing?)
1855.9	1868.1	Oil shale: medium grayish brown. Faint smooth streaked bedding. Common <u>very</u> fine disseminated crystals. 3-inch coarse radiating nahcolite masses at 1857.0 and 1857.6 feet. A thin dark gray to black gritty limonite-stained stringer and some coarse nahcolite near base.
1868.1	1869.1	Nahcolite: dark coarsely crystalline radiating nahcolite with interstitial oil shale.
1869.1	1875.0	Oil shale: medium grayish brown; some dark resinous streaks near base. Faint slightly distorted to smooth streaked bedding. Some very fine disseminated crystals. Irregular coarse nahcolite masses at 1869.4-1869.6 and 1873.0-1873.3 feet.
1875.0	1876.0	Oil shale and nahcolite: very dark to some medium grayish brown oil shale; common satiny to resinous luster. Faint to fairly distinct, very wavy to slightly distorted laminae and streaks; some fine irregular loop structures. Some large coarse radiating to irregular nahcolite masses.

Illustration No. SBR-4109P (Sheet 76 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1876.0	1877.0	Oil shale: medium to very dark grayish brown and brown; some resinous luster. Faint to very distinct, distorted and wavy to fairly smooth streaked bedding and rare laminae. Some very fine crystalline streaks in middle.
1877.0	1879.0	Oil shale: dark grayish brown, some medium in upper part. Faint fairly smooth streaked bedding. Some very fine crystalline streaks near top. Some very fine disseminated crystals in lower part. Sample of oil shale with very fine crystalline streaks from 1877.1 feet: X-ray - quartz, dolomite, dawsonite, calcite, feldspar, pyrite.
1879.0	1881.0	Oil shale: as above. Bedding distorted to contorted below 1879.5 feet with very fine lacy fracture networks with black crystalline fillings. Sample of oil shale riddled with very fine crystal-filled fractures from 1880.1 feet: X-ray - quartz, dolomite, feldspar, pyrite, dawsonite.
1881.0	1883.5	Oil shale: dark to medium grayish brown. Moderately distinct very distorted streaks and stringers in upper 0.3 foot; faint slightly distorted to smooth streaked bedding in other parts. Very common very fine disseminated crystals. Fine lacy black fracture fillings with some nahcolite (?) at 1882.0-1882.2 feet.
1883.5	1885.5	Oil shale; medium to dark grayish brown. Faint smooth streaked bedding; smoothly laminated zone at 1884.0-1884.2 feet. Common very fine disseminated crystals. Sample of dark oil shale from 1885.4 feet: X-ray - quartz, dolomite, dawsonite, feldspar, pyrite, calcite?
1885.5	1887.1	Oil shale: dark to some medium brownish gray; some resinous black streaks near base. Faint very fine smooth laminae and streaked bedding. Common fine dawsonite crystals and streaks. Common fine irregular nahcolite-filled fractures in upper 0.5 foot. Sample of oil shale with disseminated dawsonite and nahcolite-filled fractures from 1885.7 feet: X-ray - quartz, dawsonite, feldspar, pyrite, dolomite, nahcolite?

Illustration No. SBR-4109P (Sheet 77 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1887.1	1888.1	Oil shale: dark brownish gray to brownish black; very common satiny to waxy luster in lower half. Faint smooth streaked bedding in upper part to fine laminae with some loop structures in lower part. Common very fine disseminated crystals in upper part.
1888.1	1891.1	Oil shale: medium to dark brown and grayish brown; all has satiny to resinous luster. Faint smooth streaked bedding with fairly common very distinct fine buff streaks and lenses. Common <u>very fine</u> disseminated crystals. A diagonal fracture with patchy nahcolite crusts at 1890.4 feet.
1891.1	1892.1	Oil shale: medium to dark grayish brown and brown; some satiny to resinous streaks. Moderately distinct to faint distorted streaked bedding. Very common very fine disseminated crystals.
1892.1	1894.2	Oil shale: medium to very dark grayish brown and brown, rare black; some satiny to resinous streaks. Moderately distinct to faint, distorted to smooth streaked bedding; some very irregular truncated brown oil shale stringers and small inclusions. Very common very fine disseminated crystals. Sample of dark grayish brown oil shale with disseminated crystals from 1893.7 feet: X-ray - quartz, dawsonite, dolomite, feldspar, ferroan, pyrite.
1894.2	1895.2	Oil shale: very dark brownish gray. Very faint very fine very smooth laminae. Fairly common very fine disseminated crystals. Rare very fine dark gray laminae and streaks. Very regular thick parting.
1895.0	1901.0	Oil shale: dark to some medium brownish gray. Faint very smooth laminae and streaked bedding. Very common <u>very fine</u> disseminated crystals. Some very fine dark gray laminae and streaks. Mostly very regular thick parting. Some very fine tight vertical fractures with very slight blue-gray coatings at 1895.8-1896.2 feet. Sample of dark brownish gray oil shale with very fine crystals and some fine dark gray laminae from 1897.2 feet: X-ray - quartz, dawsonite, ferroan, feldspar, dolomite.

Illustration No. SBR-4109P (Sheet 78 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1901.0	1904.0	Oil shale: very dark brownish gray. Faint smooth laminae. Common very fine disseminated crystals. Rare dark gray laminae and streaks.
1904.0	1909.0	Oil shale: dark to medium brownish gray. Faint smooth laminae and streaked bedding. Common <u>very</u> fine disseminated crystals in upper part.
1909.0	1913.0	Oil shale: medium to rare dark brownish gray and grayish brown. Faint smooth to distorted laminae and streaked bedding; common fine loop structures. Some irregular lacy black pyritic masses.
1913.0	1915.0	Oil shale: medium grayish brown and some tan to buff. Distinct to faint, wavy and distorted to smooth laminae and streaked bedding. Some fine gray to black limonite-stained stringers.
1915.0	1919.0	Oil shale: medium brownish gray. Faint distorted to smooth laminae and streaked bedding. Some neutral gray laminae and streaks. Some very fine disseminated crystals. Some black pyritic stringers in upper part.
1919.0	1920.0	Oil shale: medium brownish gray and grayish brown; some resinous to waxy black laminae and streaks in lower part. Faint to some distinct, smooth to slightly distorted laminae and streaked bedding; common fine loop structures in lower part. Common fine lacy black pyritic stringers at 1719.2-1719.4 feet.
1920.0	1924.0	Oil shale and nahcolite: medium brownish gray and grayish brown oil shale; rare dark resinous streaks and laminae. Faint to some fairly distinct, smooth to wavy laminae and streaked bedding. Common 3- to 5-inch coarsely crystalline radiating nahcolite masses.
1924.0	1925.0	Oil shale and nahcolite: medium grayish brown and brown oil shale. Fairly distinct very wavy laminae and streaks. Some large coarse radiating nahcolite masses; common fine irregular nahcolite-filled fractures.
1925.0	1926.0	Oil shale and nahcolite: medium to some dark grayish brown oil shale; rare resinous black laminae. Faint wavy to smooth laminae. Some large coarse radiating nahcolite in upper part; some thin medium to fine grained stringers in lower part. Some very fine disseminated crystals in oil shale.
1926.0	1927.0	Oil shale and nahcolite: medium grayish brown oil shale. Faint smooth laminae and streaked bedding. Common <u>very</u> fine disseminated crystals.

Illustration No. SBR-4109P (Sheet 79 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Some thin to 2-inch fine grained nahcolite bands (with interstitial oil shale?). Sample of fine grained nahcolite band from 1926.8 feet: X-ray - nahcolite.
1927.0	1930.8	Oil shale and nahcolite: medium to rare dark grayish brown and brown oil shale. Faint smooth to slightly wavy laminae and streaked bedding. Common very fine disseminated nahcolite crystals and thin to 3-inch fine grained bands and stringers with interstitial oil shale.
1930.8	1933.7	Oil shale and nahcolite: medium brown and grayish brown oil shale. Faint slightly distorted streaked bedding. Common fine disseminated nahcolite and very small patches; few thin to thick fine grained stringers; rare small coarsely crystalline masses.
1933.7	1935.4	Nahcolite and oil shale: small to 5-inch coarse irregular to radiating nahcolite masses in brown to tan oil shale.
1935.4	1936.4	Oil shale and nahcolite: medium to rare dark grayish brown oil shale. Faint distorted streaked bedding to fairly smooth laminae. Common thin to thick fine grained nahcolite stringers and some disseminated crystals.
1936.4	1937.4	Oil shale and nahcolite: medium brown oil shale. Faint slightly wavy to smooth streaked bedding. Common disseminated nahcolite grading to zones of nahcolite with interstitial oil shale; some small radiating masses in upper part.
1937.4	1939.2	Nahcolite and oil shale: 2- to 4-inch coarse irregular to radiating nahcolite masses in oil shale as above and below. Some fine nahcolite-filled fractures.
1939.2	1940.5	Oil shale and nahcolite: medium to rare dark brown and grayish brown oil shale. Faint wavy streaked bedding and some laminae. Common large coarse to fine grained nahcolite masses.
1940.5	1941.5	Oil shale and nahcolite: medium brown and grayish brown oil shale. Faint to very faint fairly smooth streaked bedding. Common thin fine grained nahcolite bands and disseminated crystals in upper half.
1941.5	1950.0	Oil shale and nahcolite: medium brown oil shale. Faint slightly distorted to smooth streaked bedding.

Illustration No. SBR-4109P (Sheet 80 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1950.0	1953.0	Common fine disseminated nahcolite crystals and small, fine to coarse grained patches. Oil shale and nahcolite: as above with common small to large irregular nahcolite masses.
1953.0	1957.0	Oil shale and nahcolite: medium to rare dark grayish brown and brown oil shale. Faint fairly smooth to very wavy and distorted streaked bedding. Common 2- to 7-inch, coarse to medium crystalline, irregular to radiating nahcolite masses.
1957.0	1959.0	Oil shale: medium to dark grayish brown; some satiny luster in upper part. Faint distorted to smooth streaked bedding. Common <u>very</u> fine disseminated crystals. A large irregular coarse nahcolite mass at 1957.6 feet.
1959.0	1960.0	Oil shale: medium to dark grayish brown. Faint slightly distorted to smooth streaked bedding; common fine distinct brown to tan streaks, lenses, and inclusions.
1960.0	1961.0	Oil shale: medium to dark grayish brown and brownish gray; common very fine satiny to waxy streaks. Moderately distinct to faint, slightly distorted to smooth streaked bedding. Some very fine disseminated crystals.
1961.0	1964.4	Oil shale: medium to dark grayish brown; common fine satiny to waxy laminae and streaks; a 0.1-foot black waxy band at top. Faint to distinct smooth laminae and streaked bedding; common fine loop structures and displacements. Common very fine disseminated crystals in some parts.
1964.4	1965.5	Oil shale and nahcolite: dark brownish gray and black resinous oil shale in upper part grading to medium and dark grayish brown in lower part. Very faint bedding in upper part to faint and some distinct wavy laminae in lower part. Common coarse nahcolite with interstitial oil shale in thin to 3-inch zones; some small irregular masses in lower part.
1965.5	1971.3	Oil shale and nahcolite: medium brown to tan oil shale. Faint wavy streaked bedding. Common irregular to radiating coarse nahcolite masses-- closely spaced small to 2-inch masses in upper part to more widely spaced 2- to 4-inch masses in lower part; very common fine to coarse nahcolite crystals with interstitial oil shale at 1966.8-1967.3 feet.

Illustration No. SBR-4109P (Sheet 81 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1971.3	1972.7	Oil shale: medium brown to tan and some buff: few very dark brown resinous laminae in upper part. Distinct to faint fairly smooth laminae with common fine loop structures in upper part to very faint slightly distorted streaked bedding in lower part. Common coarse disseminated nahcolite crystals and very small masses in lower 4 inches. Sample of very dark brown to tan laminated oil shale from 1971.6 feet: X-ray - quartz, dolomite, dawsonite, feldspar, ferroan, pyrite.
1972.7	1974.7	Nahcolite and oil shale: brown oil shale with very common fine to coarse disseminated nahcolite crystals grading to zones of nahcolite with interstitial oil shale.
1974.7	1976.2	Oil shale and nahcolite: medium brown to tan oil shale. Very faint wavy bedding. Common very small to 1-inch coarse radiating to irregular nahcolite masses; some zones of very common coarse disseminated crystals in upper part. Few fine short nahcolite-filled fractures in lower part.
1976.2	1978.0	Oil shale and nahcolite: medium brown to tan oil shale. Very faint fairly smooth bedding. Very common zones of fine to coarse disseminated nahcolite grading to thin to 1-inch bands of nahcolite with interstitial oil shale.
1978.0	1979.0	Oil shale and nahcolite: oil shale as above with common fine to coarse disseminated nahcolite crystals and some very small to 1-inch coarse masses.
1979.0	1980.0	Oil shale and nahcolite: medium brown and some tan oil shale. Very faint fairly smooth bedding. Common very fine to rare coarse disseminated nahcolite in upper part; medium grained nahcolite with interstitial oil shale at 1979.3-1979.5 feet; <u>very</u> common very fine disseminated crystals in lower part. Sample of oil shale with very common very fine disseminated nahcolite from 1979.8 feet: X-ray - nahcolite, quartz, dolomite, dawsonite, feldspar.
1980.0	1981.0	Oil shale and nahcolite: medium brown to tan and some buff oil shale. Very faint fairly smooth to wavy streaked bedding and some laminae. Very common fine to coarse nahcolite crystals in upper 0.4 foot; few small coarse masses in middle; two thin nahcolite bands with interstitial oil shale at 1980.7-1980.8 feet.

Illustration No. SBR-4109P (Sheet 82 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
1981.0	1982.0	Oil shale and nahcolite: brown to tan oil shale. Very faint wavy streaked bedding. Very common small irregular closely packed coarse nahcolite blebs in upper and lower parts; some small to 1-inch radiating masses in middle.
1982.0	1986.0	Oil shale and nahcolite: brown to tan oil shale. Very faint fairly smooth bedding and some faint wavy laminae. <u>Very</u> common fine to coarse disseminated nahcolite crystals grading to bands of nahcolite with interstitial oil shale; some thick zones with sparser disseminated nahcolite and small coarse blebs. Sample of medium grained nahcolite with interstitial oil shale from 1985.2 feet: X-ray - nahcolite.
1986.0	1987.5	Oil shale and nahcolite: medium brown oil shale. Very faint smooth bedding. Very common very fine to some coarse disseminated nahcolite crystals.
1987.5	1988.5	Nahcolite and oil shale: medium to dark grayish brown oil shale with <u>very</u> common very fine disseminated nahcolite crystals grading to fine to fairly coarse nahcolite with interstitial oil shale.
1988.5	1995.6	Oil shale and nahcolite: tan to brown oil shale. Faint smooth to wavy streaked bedding and some laminae. Common coarse disseminated nahcolite crystals and small blebs in intervals 1988.5-1991.0 and 1992.0-1993.1; small to 2-inch coarse irregular to radiating masses in other parts.
1995.6	2007.0	Oil shale and nahcolite: medium brownish gray and grayish brown oil shale. Faint smooth to some wavy and distorted streaked bedding. Fairly common <u>very</u> fine disseminated crystals. Common coarse disseminated nahcolite crystals and very small blebs to rare large irregular masses; 2- to 5-inch coarse radiating masses in interval 1999.0-2000.0 feet. Sparse nahcolite in intervals 1997.0-1998.0, 2004.0-2005.0 and 2006.0-2007.0 feet. Irregular rounded core piece at base.
2007.0	2008.4	Oil shale: medium to dark brownish gray; common very fine black satiny to resinous laminae and streaks. Faint contorted streaks and stringers near top; faint smooth laminae and streaked bedding in other parts. Sample of medium to dark brownish gray oil shale from 2007.5 feet: X-ray - quartz, feldspar, dawsonite, dolomite, pyrite.

Illustration No. SBR-4109P (Sheet 83 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
2008.4	2012.0	Nahcolite and oil shale: very dark fairly coarse nahcolite with dark brownish gray to black interstitial oil shale in upper part grading to dark grayish brown oil shale with <u>very</u> common medium to fine disseminated nahcolite crystals in lower part.
2012.0	2013.3	Oil shale and nahcolite: medium brown oil shale with very common fine to coarse nahcolite crystals in upper part grading to nahcolite with interstitial oil shale in lower part.
2013.3	2015.1	Oil shale and nahcolite: medium brown and grayish brown to tan oil shale. Faint wavy bedding. Common small to 2-inch dark coarse radiating nahcolite masses.
2015.1	2016.6	Oil shale: medium brown and grayish brown to tan and buff. Moderately distinct to faint, distorted to smooth laminae and streaked bedding; common fine loop structures and displacements.
2016.6	2018.0	Oil shale: medium brown to tan and rare buff. Faint to some moderately distinct, wavy to fairly smooth streaked bedding and rare laminae. Rare small to 1-inch coarse nahcolite masses.
2018.0	2023.0	Oil shale: as above with fairly common 1- to 4-inch coarse radiating to irregular nahcolite masses. Rare fine discontinuous nahcolite-filled fractures.
2023.0	2024.0	Oil shale: medium brown to dark grayish brown; some very fine resinous to waxy black streaks in lower part. Moderately distinct to faint, slightly wavy to smooth streaked bedding. Part of a large irregular coarse nahcolite mass at top. A very fine discontinuous diagonal nahcolite-filled fracture near middle.
2024.0	2025.3	Oil shale: dark grayish brown; fairly common very fine resinous to waxy black streaks. Faint smooth to slightly wavy and distorted streaked bedding. Some <u>very</u> fine disseminated crystals (Pyrite?). Part of a large irregular coarse nahcolite mass at base.
2025.3	2025.5	Missing?
2025.5	2026.5	Oil shale: medium brown and grayish brown; few thin dark brown resinous stringers at top. Very faint slightly distorted to smooth streaked bedding. Vuggy parting surface at top.
2026.5	2029.2	Oil shale: medium to some dark grayish brown and brown; rare very fine dark resinous streaks. Very faint to moderately distinct, smooth to slightly

Illustration No. SBR-4109P (Sheet 84 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		distorted streaked bedding; some fine distinct tan to buff streaks and lenses in lower part.
2029.2	2030.2	Oil shale: as above but with common fine tan to buff streaks, lenses, and inclusions. Distorted streaked bedding near base.
2030.2	2031.3	Oil shale: medium to dark brown and grayish brown, some tan; some brownish black resinous streaks and stringers. Distinct distorted to smooth streaks, stringers, and laminae; some fine to small loop structures in lower part. Rare fine discontinuous nahcolite-filled fractures.
2031.3	2033.1	Oil shale: dark to some medium grayish brown; brownish black resinous oil shale in lower 0.2 foot; some satiny to resinous streaks in other parts. Faint slightly distorted to smooth streaked bedding; rare laminae with fine to small loop structures. Some <u>very</u> fine disseminated crystals.
2033.1	2034.5	Nahcolite and oil shale: dark, medium to coarse grained nahcolite with interstitial and interbedded oil shale as above.
2034.5	2036.2	Oil shale: tan to medium brown and grayish brown; rare dark resinous streaks. Very faint distorted to smooth bedding. Rare fine lacy black pyritic stringers and blebs.
2036.2	2046.1	Oil shale: medium grayish brown. Faint slightly distorted to smooth streaked bedding. Common very fine disseminated crystals. Distorted zones with fine lacy black pyritic stringers and rare small nahcolite masses at 2037.2-2038.2, 2038.5-2038.7, 2039.4-2039.6, and 2040.4-2040.6 feet. Sample of oil shale with very fine disseminated crystals from 2042.0 feet: X-ray - dawsonite, dolomite, quartz, feldspar, ferroan, pyrite.
2046.1	2049.0	Oil shale: medium to dark brownish gray. Faint smooth streaked bedding and some laminae. Some fine hackly fracture. Common very fine disseminated crystals in upper part becoming sparse in lower part. Some black pyritic stringers and a fine diagonal nahcolite-filled fracture near top. Sample of brownish gray oil shale with hackly fracture from 2048.9 feet: X-ray - dolomite, quartz, feldspar, dawsonite, ferroan, pyrite.

Illustration No. SBR-4109P (Sheet 85 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
2049.0	2051.4	Oil shale: medium to some dark brownish gray. Faint to moderately distinct smooth laminae and streaked bedding. Common fine hackly fracture. Sparse to common very fine disseminated crystals. Very faintly bedded light brownish gray (slightly olive) mudstone at 2051.1-2051.3 feet (darkly stained on sawed surfaces); some thin mudstone bands and laminae in other parts. Sample of mudstone from 2051.2 feet: X-ray - quartz, dawsonite, dolomite, feldspar, ferroan.
2051.4	2052.6	Oil shale: medium to light brownish gray. Faint to fairly distinct very fine smooth laminae; rare fine loop structures. Fine hackly fracture in upper part. Common very fine disseminated crystals--mostly concentrated in darker laminae. A 3/8-inch horizontal wavy nahcolite-filled fracture at 2052.1 feet; few fine discontinuous streaks immediately below.
2052.6	2054.8	Marlstone: tan and buff to some medium brownish gray. Faint to some distinct very fine smooth laminae. Common very fine disseminated crystals. Some white powder on sawed surfaces. Sample of buff marlstone with rare very fine disseminated crystals from 2052.7 feet: X-ray - quartz, dolomite, dawsonite, feldspar, ferroan.
2054.8	2056.0	Oil shale: light to medium and rare dark brownish gray, some buff in upper part. Distinct to faint smooth laminae; distorted streaked bedding near base. Common very fine disseminated crystals. Some very fine discontinuous horizontal nahcolite-filled fractures near base.
2056.0	2057.0	Oil shale: dark brownish gray and brownish black; some satiny to resinous luster in upper half. Faint smooth laminae and streaked bedding. Very common very fine dawsonite crystals and streaks. Common very fine pyrite. Sample of oil shale with common dawsonite from 2056.7 feet: X-ray - quartz, dawsonite, feldspar, dolomite, ferroan, pyrite.
2057.0	2058.0	Oil shale: medium to dark brownish gray and some black. Faint smooth laminae and streaked bedding. Very common very fine dawsonite crystals and streaks.

Illustration No. SBR-4109P (Sheet 85 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
2058.0	2060.0	Oil shale: dark to medium brownish gray. Very faint to moderately distinct smooth laminae and streaked bedding. Very common <u>very</u> fine disseminated crystals. Some neutral gray laminae in lower part. A very thin very pyritic gray laminae at 2059.8 feet.
2060.0	2062.0	Oil shale: medium to rare dark brownish gray. Faint to moderately distinct smooth laminae. Very common very fine dawsonite crystals. Common almost neutral gray laminae and thin bands in lower part.
2062.0	2065.0	Oil shale: medium to dark brownish gray. Faint to moderately distinct smooth laminae. Common very fine dawsonite crystals and streaks.
2065.0	2066.6	Oil shale: medium to some dark brownish gray and grayish brown. Moderately distinct to faint smooth laminae. Common <u>very</u> fine disseminated crystals. Some almost neutral gray laminae and thin bands in upper part.
2066.6	2067.8	Oil shale: medium to dark grayish brown and some black; some satiny to resinous luster in lower part. Faint smooth to some distorted laminae; common fine loop structures in lower part. Common <u>very</u> fine disseminated crystals. Some very irregular black pyritic stringers and blebs in upper part. Sample of medium to very dark grayish brown oil shale from 2067.5 feet: X-ray - quartz, dawsonite, feldspar, ferroan.
2067.8	2073.0	Nahcolite and oil shale: dark, medium to coarse grained nahcolite with interstitial and interbedded dark brownish gray to black oil shale.
Core sequence doubtful from 2073.0 to 2079.0 feet.		
2073.0	2077.2	Oil shale and nahcolite: buff and tan to medium and rare dark brown oil shale. Distinct to faint very fine wavy laminae. Very common small to 2-inch dark coarse radiating to irregular nahcolite masses; rare thick, medium grained zones with interstitial oil shale.
2077.2	2085.0	Oil shale: medium grayish brown. Very faint smooth to some distorted streaked bedding. Large coarse radiating nahcolite masses at 2078.0-2078.3 and 2082.4-2082.9 feet. Common very irregular black pyritic stringers and patches at 2081.6-2082.3 feet; rare in other parts.

Illustration No. SBR-4109P (Sheet 87 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of oil shale with black pyritic stringers and patches from 2081.9 feet: X-ray - pyrite, quartz, dolomite, dawsonite, feldspar, calcite.
2085.0	2089.0	Oil shale and some nahcolite: tan to brown and grayish brown oil shale. Moderately distinct to faint, smooth to some distorted and displaced laminae. Few small to 2-inch coarse radiating nahcolite masses.
2089.0	2089.9	Oil shale: medium to dark grayish brown, some medium brown near top. Very faint smooth streaked bedding. Sample includes small amount of nahcolite at base.
2089.9	2093.2	Nahcolite and oil shale: very large coarse radiating nahcolite masses in oil shale as above. Middle sample is mostly oil shale.
2093.2	2099.0	Oil shale: brown to tan. Moderately distinct to very faint, fairly smooth to some distorted and wavy streaked bedding. Rare irregular black pyritic stringers. Part of a large irregular nahcolite mass at 2094.3 feet. Common fine lacy nahcolite-filled fractures at 2094.9-2095.1 feet.
2099.0	2100.0	Oil shale: medium to dark brown and grayish brown, rare black; some satiny to waxy laminae and stringers in upper part. Distinct fairly smooth to contorted and displaced laminae in upper half; faint fairly smooth streaked bedding in lower half. Some very fine crystalline blebs and streaks. Rare fine black pyritic stringers.
2100.0	2101.0	Oil shale: grayish brown to some brown and tan. Faint smooth to distorted streaked bedding. Some fine crystalline blebs and streaks. Common very fine black lacy stringers and some fine discontinuous nahcolite-filled fractures near base.
2101.0	2103.0	Oil shale: tan to some medium brown and grayish brown. Faint slightly distorted to smooth streaked bedding and some laminae. Some fine crystalline blebs and streaks.
2103.0	2109.0	Oil shale: medium brownish gray; some very fine dark resinous streaks in lower part. Faint fairly smooth streaked bedding. Common very fine disseminated crystals.
2109.0	2110.0	Oil shale: medium to very dark brownish gray, medium to dark brown near base; common very fine resinous streaks and some laminae. Faint smooth streaked bedding in upper part to faint and some

Illustration No. SBR-4109P (Sheet 83 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		moderately distinct laminae with fine loop structures in lower part. Common very fine disseminated crystals. Sample of dark brownish gray oil shale from 2109.3 feet: X-ray - quartz, dawsonite, dolomite, feldspar, pyrite, calcite.
2110.0	2112.0	Oil shale: grayish brown to tan. Faint smooth streaked bedding. Some fine lacy black pyritic stringers in upper part. Some fine calcite streaks in lower part. Sample of tan oil shale with fine crystalline calcite streaks from 2111.8 feet: X-ray - feldspar, dolomite, calcite, quartz, nahcolite?
2112.0	2115.0	Oil shale: medium to dark grayish brown; common satiny to waxy streaks. Faint slightly distorted to smooth streaked bedding. Some very fine disseminated crystals. Sample of medium to dark grayish brown oil shale from 2113.8 feet: X-ray - dolomite, quartz, feldspar.
2115.0	2115.2	Missing?
2115.2	2116.6	Oil shale: medium to light brownish gray. Faint very fine smooth laminae. Very common very fine disseminated crystals and crystalline streaks. Slightly hackly fracture. Sample of oil shale with common disseminated crystals and crystalline streaks from 2115.5 feet: X-ray - quartz, dawsonite, feldspar, dolomite, pyrite.
2116.6	2117.9	Oil shale: medium to dark brownish gray. Very faint fine smooth laminae and streaked bedding. Very common <u>very</u> fine disseminated crystals.
2117.9	2118.9	Oil shale: medium to dark grayish brown and brown; common fine resinous to waxy black streaks. Moderately distinct to faint, distorted to smooth streaked bedding. Common very fine disseminated crystals.
2118.9	2119.9	Oil shale: dark brownish gray to black; common satiny to resinous luster. Faint distorted streaked bedding to smooth laminae. Some very fine disseminated crystals and crystalline streaks.

Illustration No. SBR-4109P (Sheet 89 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of dark brownish gray to black oil shale from 2119.6 feet: X-ray - quartz, dolomite, feldspar, pyrite.
2119.9	2122.0	Oil shale: dark to medium brownish gray. Faint very fine smooth laminae and streaked bedding. Common very fine disseminated crystals and crystalline streaks. (0.1 foot missing)
2122.0	2123.0	Oil shale: medium brownish gray and rare neutral gray. Faint fine smooth laminae. Some <u>very</u> fine disseminated crystals.
2123.0	2124.0	Oil shale: medium to dark brownish gray; common resinous laminae in lower 0.3 foot. Faint to moderately distinct smooth laminae; common fine loop structures in lower part.
2124.0	2131.7	Oil shale: medium to light brownish gray and neutral gray, some dark in lower part. Faint to moderately distinct smooth laminae (very distinct on sawed surfaces in upper part). Common very fine crystals and crystalline streaks in some parts. Some hackly fracture. Sample of brownish gray and gray oil shale from 2125.5 feet: X-ray - quartz, dolomite, feldspar, pyrite, dawsonite.
2131.7	2132.7	Oil shale: dark to some medium grayish brown; common satiny to waxy black laminae and streaks. Faint smooth to distorted laminae and streaked bedding; very common fine to small loop structures and displacements.
2132.7	2138.0	Oil shale: medium to dark grayish brown; common very fine resinous streaks. Faint smooth to some distorted streaked bedding. Common very fine disseminated crystals.
2139.0	2139.2	Oil shale: medium grayish brown; rare dark resinous streaks. Moderately distinct distorted to smooth streaked bedding. Some fine crystalline streaks and blebs.
2139.2	2140.5	Oil shale: dark brownish gray to black. Very faint smooth laminae and streaked bedding. Some very fine crystalline blebs and streaks.
2140.5	2142.0	Oil shale: very dark to medium brownish gray. Very faint smooth streaked bedding to faint and rare distinct laminae. A 3/8-inch dark brown crystalline lamina at 2141.0 feet.

Illustration No. SBR-4109P (Sheet 90 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of dark brown crystalline lamina from 2141.0 feet: X-ray - dawsonite, analcite, feldspar.
2142.0	2143.0	Missing.
2143.0	2144.0	Oil shale: dark to medium brownish gray. Very faint smooth laminae and streaked bedding. Rare fine dark dense lenses and streaks. Regular thick to thin parting and hackly fracture.
2144.0	2145.0	Oil shale: dark to medium brownish gray and some medium brown; very rich black waxy zone at 2144.2-2144.4 feet. Faint to some distinct, smooth to distorted laminae and streaks; common irregular loop structures and displacements in middle part.
2145.0	2148.0	Oil shale: medium to dark brownish gray. Faint smooth laminae and streaked bedding. Common very fine crystalline streaks in some parts. Regular thick to thin parting; hackly fracture. Sample of dark hackly shale from 2146.9 feet: X-ray - illite, quartz, feldspar, pyrite.
2148.0	2149.0	Oil shale: as above grading to very rich brownish black resinous oil shale in lower half.
2149.0	2151.0	Oil shale: medium to dark grayish brown and rare black; some resinous to waxy streaks and stringers in upper part to very common in lower 0.4 foot. Distinct distorted to contorted streaks and stringers.
2151.0	2154.0	Oil shale: medium grayish brown and brown to some black; common resinous to waxy luster. Faint to distinct, distorted to smooth streaks, stringers, and rare laminae. Some large massive brown lenses near base. Sample of medium to dark grayish brown oil shale with very common fine waxy black streaks from 2153.4 feet: X-ray - dolomite, quartz, illite, feldspar, pyrite.
2154.0	2155.5	Oil shale: dark to medium brownish gray. Faint smooth laminae and streaked bedding. Common very fine crystalline streaks with common pyrite in lower part. Regular thick to thin shaly parting; hackly fracture. Sample of dark shale with pyritic streaks from 2155.3 feet: X-ray - quartz, illite, feldspar, pyrite.
2155.5	2156.5	Oil shale: dark to medium brownish gray (almost neutral). Very faint smooth bedding. Regular to irregular shaly parting; unctuous parting surfaces. Irregular broken core pieces in lower part.

Illustration No. SBR-4109P (Sheet 91 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of unctuous shale from 2156.0 feet: X-ray - illite, quartz, feldspar, pyrite, ferroan, dolomite.
2156.5	2158.0	Missing.
2158.0	2160.0	Oil shale: gray and brownish gray. Faint smooth bedding and laminae. Unctuous in upper part.
2160.0	2162.0	Oil shale: medium to dark brownish gray and some grayish brown. Faint smooth laminae and streaked bedding. Shaly to papery parting; hackly fracture. Sample of dark brownish gray papery shale from 2161.8 feet: X-ray - illite, quartz, dolomite, feldspar, ferroan, pyrite.
2162.0	2164.0	Oil shale: as above becoming very finely inter-laminated with gray shale in lower part.
2164.0	2168.0	Oil shale: medium to rare dark brownish gray and neutral gray. Moderately distinct to very faint smooth laminae. Regular to some irregular, thick to thin parting. Some fine prismatic calcite laminae in upper part. An irregular natural high angle fracture in lower 0.6 foot.
2168.0	2173.0	Oil shale: dark to medium brownish gray (some almost neutral). Very faint smooth streaked bedding and some laminae. Irregular to regular, thick to thin parting; slightly unctuous parting surfaces. Common very fine pyrite blebs and streaks in lower part.
2173.0	2182.0	Missing.
2182.0	2185.0	Oil shale: dark to medium brownish gray, some grayish brown in upper part. Faint smooth laminae and streaked bedding. Irregular to regular, medium to very thin shaly parting; broken and mixed up core in upper part.
2185.0	2186.9	Oil shale: dark to medium brownish gray and some tan; some resinous luster in lower part. Very faint to some distinct smooth laminae; some fine loop structures.
2186.9	2190.0	Oil shale: medium to dark grayish brown and some black; rare satiny to resinous luster. Moderately distinct to very faint, smooth to slightly distorted laminae and streaked bedding. Some <u>very</u> fine disseminated crystals and crystalline streaks. A 1-inch dark gray silty textured pyritic band with some fine crystalline streaks at base.

Illustration No. SBR-4109P (Sheet 92 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of dark gray silty textured band from 2190.0 feet:
2190.0	2193.9	X-ray - pyrite, marcasite, feldspar, Oil shale: medium to dark brownish gray (some almost neutral). Faint smooth laminae and streaked bedding. Regular thick to thin shaly parting.
2193.9	2195.0	Oil shale: very dark to rare medium grayish brown; common satiny to resinous luster. Very faint smooth to slightly distorted streaked bedding.
2195.0	2196.0	Oil shale: dark brownish gray. Very faint smooth streaked bedding. Shaly to very fine papery parting. A thin dark brown silty to dense crystalline stringer at top.
		Sample of dark brown stringer from 2195.0 feet:
		X-ray - feldspar, analcite, dawsonite, quartz, dolomite.
2196.0	2198.5	Oil shale: medium to dark brownish gray (almost neutral in upper part). Faint smooth streaked bedding. Rare prismatic calcite laminae in lower part.
2198.5	2199.5	Oil shale: dark brownish gray. Faint smooth streaked bedding and very fine laminae. Very common fine crystalline calcite streaks and laminae.
2199.5	2200.8	Oil shale: dark to medium brownish gray; some satiny to resinous luster in upper part. Faint very fine smooth laminae. Regular thick to thin parting.
2200.8	2202.8	Oil shale: medium to rare dark brownish gray and grayish brown. Faint slightly distorted to smooth streaks and laminae. Irregular thick to rare thin parting.
2202.8	2203.8	Oil shale: dark brownish gray. Very faint smooth laminae and streaked bedding.
2203.8	2205.0	Oil shale: dark to some medium brownish gray and grayish brown; some satiny to resinous luster near top. Faint smooth streaked bedding and laminae. Regular medium to thin shaly parting; fine hackly fracture.
2205.0	2206.0	Oil shale: medium to dark grayish brown. Faint to moderately distinct smooth laminae and streaked bedding. Regular to irregular medium to thin parting; irregular coarse hackly fracture.
		Sample of medium to dark grayish brown laminated oil shale from 2205.3 feet:
		X-ray - quartz, illite, dolomite, feldspar.

Illustration No. SBR-4109P (Sheet 93 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
2206.0	2210.5	Oil shale: dark brownish gray, some grayish brown in upper part. Faint smooth laminae and streaked bedding. Thick to thin shaly and rare papery parting; hackly fracture. Common very fine buff streaks and specks in upper part. Some very fine silty textured pyrite streaks in lower part.
2210.5	2212.5	Oil shale: medium to dark grayish brown and brown, very dark brownish gray to black in lower 0.5 foot. Faint to fairly distinct smooth laminae; some fine loop structures. Thick to thin shaly parting.
2212.5	2214.5	Oil shale: medium and rare dark brownish gray to some neutral gray. Faint to moderately distinct smooth laminae and streaked bedding. Sample of brownish gray oil shale from 2212.8 feet: X-ray - quartz, illite, feldspar, pyrite, ferroan, dolomite.
2214.5	2218.0	Oil shale: dark brownish gray to black, some dark to medium grayish brown in lower part. Very faint smooth streaked bedding; some moderately distinct laminae in lower part. Shaly to papery parting; hackly fracture. A yellowish buff dense to slightly earthy tuff (?) band at 2216.5-2216.8 feet with a thin distorted oil-shale stringer one inch from top. Sample of buff tuff (?) from 2216.7 feet: X-ray - analcite, feldspar, quartz, ferroan.
2218.0	2219.1	Oil shale: medium to rare dark grayish brown and brown. Moderately distinct smooth laminae to very faint distorted streaked bedding.
2219.1	2221.4	Oil shale: dark brownish gray. Very faint smooth streaked bedding. Regular thick to thin parting.
2221.4	2222.4	Oil shale: dark brownish gray to black; very common satiny to resinous luster. Very faint smooth streaked bedding. Shaly to papery parting. Rare fine brown silty streaks and stringers.
2222.4	2223.5	Oil shale: medium to dark brownish gray; some satiny to resinous streaks. Faint smooth streaked bedding.
2223.5	2224.7	Oil shale: medium to dark brownish gray and some black; common resinous to waxy luster in upper half. Faint slightly distorted to smooth laminae and streaked bedding; common fine loop structures and displacements in upper part. Slightly wavy thick parting in upper part; shaly to papery parting in lower part.

Illustration No. SER-4109P (Sheet 94 of 96)

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
		Sample of waxy black oil shale from 2223.8 feet: X-ray - illite, quartz, pyrite, ferroan, feldspar, dolomite.
2224.7	2227.0	Oil shale: medium to dark brownish gray. Faint smooth streaked bedding and some laminae. Irregular to regular, thick to rare thin parting. A 1-1/2-inch dark brown to black dense to porous and tar-stained stringer at top; fine buff-white earthy zone at upper surface.
		Sample of tar-impregnated stringer from 2224.8 feet: X-ray - analcite, ferroan, quartz, feldspar, pyrite.
2227.0	2229.0	Oil shale: dark brownish gray. Faint smooth streaked bedding and very fine laminae. Rare fine irregular resinous black organic streaks (fossils?).
2229.0	2232.0	Oil shale: dark to medium brownish gray (grayer than above and below). Very faint smooth laminae and streaked bedding. Irregular thick to thin shaly parting; slightly unctuous; some irregular fracture surfaces with resinous coatings.
2232.0	2234.5	Oil shale: medium and dark brownish gray in upper part to very dark brownish gray and black in lower part. Very faint smooth streaked bedding. Shaly to some papery parting.
2234.5	2239.0	Oil shale: dark brownish gray to black, some dark to medium grayish brown in lower part. Very faint smooth bedding to some faint laminae. Thick to thin shaly parting. Some irregular double-cut core pieces.
2239.0	2240.3	Oil shale: medium and rare dark grayish brown and brown. Faint to moderately distinct smooth to distorted streaked bedding. Irregular thick parting.
		Sample of grayish brown and brown oil shale from 2239.9 feet: X-ray - dolomite, quartz, illite, feldspar.
2240.3	2241.5	Oil shale: medium to dark brownish gray. Faint smooth streaked bedding and very fine laminae. Thick to medium shaly parting. Common fine crystalline calcite streaks in middle part.
		Sample of oil shale with calcite streaks from 2241.0 feet: X-ray - calcite, quartz, illite, dolomite.

Illustration No. SBR-4109P (Sheet 94 of 96)

Laramie Petroleum Research Center, Laramie, Wyoming February 15, 1968

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Humble Oil & Refining Company's
Yellow Creek No. 1 (Cont.)

From	To	Description
2241.5	2243.0	Oil shale: dark brownish gray; some resinous luster. Very faint smooth streaked bedding. Thick to thin shaly and rare papery parting. Rare very fine calcite streaks in upper part. Sample of oil shale from 2242.5 feet: X-ray - quartz, illite, pyrite, feldspar, dolomite.
2243.0	2245.0	Oil shale: dark to medium brownish gray. Very faint smooth streaked bedding. Regular to irregular, thin to thick parting; some slightly unctuous parting surfaces. Some dense dark brown dolomite laminae in lower part (buff on sawed surfaces). Sample of unctuous shale from 2244.3 feet: X-ray - illite, quartz, pyrite, feldspar, dolomite, Sample of dense dolomite lamina from 2244.6 feet: X-ray - dolomite.

Bottom of core.