

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY<sup>1/</sup>

Quarter-core samples from Union Pacific Railroad Company's El Paso  
44-3 corehole drilled in C SE $\frac{1}{4}$ SE $\frac{1}{4}$  (660 FSL, 660 FEL) of  
sec 3, T 15 N, R 109 W, Sweetwater County, Wyoming

Kelly bushing elevation: 6,297 feet  
Surface elevation: 6,291 feet  
Described interval: 314.0 to 2359.5 feet

From	To	Description
314.0	315.4	Limestone: Buff, oolitic, sandy to silty. Faint regular bedding; some dark shaly laminae. Dense grayish-brown dolomite in upper 0.2 foot. Sample of buff sandy oolitic limestone from 314.7 feet: X-ray-dolomite, calcite, quartz, feldspar.
315.4	319.0	Oil shale: Dark to medium brownish gray and grayish brown, calcareous. Faintly laminated; abundant very fine buff laminae and streaks in some zones in lower part. Regular to irregular, thick to very thin, parting. Sample of dark oil shale with very abundant buff laminae and streaks from 318.3 feet: X-ray-- aragonite, quartz, feldspar, calcite, illite.
319.0	319.4	Claystone: Dark to medium brownish gray. Faintly laminated. Grading to sandy siltstone near base.
319.4	320.0	Siltstone: Brownish and slightly olive gray to buff, dolomitic to calcareous, micaceous. Faintly bedded.
320.0	359.0	No sample
359.0	363.5	Siltstone and some mudstone: Olive gray and brownish gray, mostly calcareous. Very faint slightly irregular streaked bedding. Rare fine black carbonaceous streaks. Grading to very finely laminated marly claystone near base.
363.5	366.4	Oil shale: Dark and some medium brownish gray and olive gray, some nearly black near bottom, calcareous. Faint laminae and streaked bedding; some very fine light calcareous laminae and streaks. Rare very thin biotitic tuff laminae in upper part. Regular thick to very thin parting.
366.4	368.0	Mudstone and siltstone: Firm, muddy, olive-gray and brownish-gray mudstone (oil shale) in upper part grading to faintly mottled and variegated light gray sandy siltstone in lower part.
368.0	393.0	No sample
393.0	393.4	Mudstone: Olive gray, calcareous. Faint streaked bedding.
393.4	394.7	Oil shale: Medium to some dark olive gray and grayish brown, calcareous. Faintly laminated; some very fine buff earthy streaks. Regular to irregular thick to some thin parting. Thin vermiform gray oolitic limestone stringer in lower 0.2 foot.
394.7	395.7	Limestone: Gray to olive gray, commonly oolitic. Some thick to fine shredded and broken oil-shale stringers.
395.7	397.1	Oil shale: Medium to dark olive gray and grayish brown, calcareous. Faintly laminated. Regular to irregular thick to some thin parting. Buff to olive-gray sandy-textured analcime tuff at 396.0-396.3.

<sup>1/</sup> By L. G. Trudell, completed October 17, 1975

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Laramie Energy Research Center, Laramie, Wyoming

October 17, 1975

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Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
		Regular contact with sandstone below.
397.1	398.9	Sandstone and siltstone: Light gray to medium olive gray. Faintly banded. Micaceous.
398.9	538.2	No sample
538.2	538.3	Marlstone: Medium light olive gray, faintly streaked.
538.3	539.6	Oil Shale: Dark and rare medium brownish and olive gray to some black, dolomitic. Faint to some moderately distinct laminae and streaked bedding. Irregular to regular thick to some thin parting; hackly fracture. Sample of dark brownish-gray oil shale from 538.9 feet: X-ray-- dolomite, quartz, feldspar, illite, pyrite.
539.6	541.0	Siltstone: Light olive gray, slightly calcareous. Faintly streaked and laminated near top; faintly mottled and variegated elsewhere.
541.0	702.0	No sample
702.0	707.9	Siltstone: Light to medium gray and slightly brownish gray, slightly to moderately calcareous. Faintly streaked and layered; contorted bedding at 704.8 - 705.0.
707.9	709.6	Oil shale: Dark to medium slightly olive and brownish gray, dolomitic to calcareous. Faint very fine streaked bedding and some laminae. Irregular to vermiform gray siltstone and mudstone stringers in upper part; few fairly regular thin to fine gray siltstone laminae in lower part.
709.6	717.0	Siltstone: Medium and light gray to slightly brownish gray, mostly calcareous. Massive to faintly streaked and laminated.
717.0	723.8	Siltstone and mudstone: Light to medium gray and rare tan to buff, calcareous. Faint streaked bedding and irregular laminae. Sample of gray siltstone from 721.3 feet: X-ray-- calcite, quartz, analcime, illite, dolomite, pyrite, feldspar.
723.8	728.1	Oil shale: Medium to dark brownish gray, calcareous. Faintly laminated. Regular to irregular thick parting. Dark to light gray tight granular band at 726.3 - 726.5. Rare fine to small tan-buff earthy blebs.
728.1	728.7	Missing (?)
728.7	729.7	Oil shale: As above. A 2-inch white to brownish-gray silty to sandy tuff at 729.5.
729.7	735.0	Oil shale: Dark brownish gray, dolomitic. Faintly laminated. Regular to irregular thick to thin parting. Thin tan to light gray tuff laminae at 730.2 and 730.6.
735.0	740.1	Oil shale: Dark brownish gray, some medium brownish gray zones. Regular to irregular thick to thin parting.
740.1	744.2	Oil shale: Dark to some medium almost neutral gray, dolomitic. Very faint laminae and streaked bedding. Regular to irregular thick to thin parting. Sample of dark slightly brownish-gray oil shale from 740.7 feet: X-ray-- quartz, analcime, illite, feldspar, calcite, pyrite, dolomite.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
744.2	747.4	Oil shale: Dark brownish gray to some medium grayish brown and rare tan, dolomitic. Faint to rare distinct laminae. Regular to irregular thick to medium parting. Sample of distinctly laminated dark brownish-gray to tan oil shale from 746.3 - 746.5 feet: X-ray-- dolomite, quartz, analcime, feldspar, pyrite.
747.4	753.2	Oil shale: Dark to medium brownish gray and grayish brown, slightly to strongly calcareous. Faintly laminated; some zones with abundant very fine buff earthy laminae and streaks from 748.5 - 751.5. Regular thick to rare thin parting. A 1-inch gray silty to very fine sandy-textured tuff at 749.4 - 749.5; thin lamina at 750.8. (751.9 - 752.1 missing ?)
753.2	756.4	Oil shale: Dark and rare medium brownish gray becoming mostly black in lower part, dolomitic. Faint laminae to very faint very fine streaked bedding. Regular to irregular thick to some thin parting.
756.4	757.2	Siltstone: Slightly brownish gray. Finely streaked with black oil shale,
757.2	758.1	Oil shale: Medium brownish gray and grayish brown to some black, dolomitic. Moderately distinct to faint laminae. Irregular thick parting.
758.1	759.3	Oil shale: Very dark brownish gray to black, dolomitic. Very faint very fine laminae and streaked bedding. Regular thick to some thin parting. Sample of black oil shale from 758.8 feet: X-ray-- quartz, analcime, illite, calcite, feldspar, pyrite, dolomite.
759.3	765.0	Oil shale: Medium and some dark brownish gray, some light brownish gray and rare buff mostly in upper half, dolomitic to very slightly calcareous. Distinct to faint laminae. Regular to irregular thick parting. Sample of very finely laminated light to medium-dark oil shale from 761.8 - 762.0 feet: X-ray-- dolomite, quartz, analcime, feldspar, calcite.
765.0	765.1	Missing (?)
765.1	766.2	Oil shale: Very dark brownish gray to some black, dolomitic. Very faint very fine laminae and streaked bedding. Regular thick to medium parting.
766.2	767.3	Oil shale: Dark brownish gray, dolomitic. Faint very fine laminae. Regular to irregular thick to rare thin parting.
767.3	770.5	Oil shale: Dark to medium brownish gray, dolomitic. Faint to rare distinct laminae. Irregular to regular thick to rare thin parting. A 1-inch gray fine sandy-textured tuff at 770.2.
770.5	772.2	Oil shale: Medium and dark brownish gray to some tan and rare buff, dolomitic. Faint and some moderately distinct laminae and streaked bedding. Irregular to regular thick parting.
772.2	777.6	Marlstone and mudstone (lean oil shale): Grayish brown to tan and some buff, mostly calcareous. Faint streaked bedding and discon-

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
		tinuous laminae. Irregular thick parting. Sample of marlstone from 774.7 - 774.8 feet: X-ray-- dolomite, quartz, analcime, calcite, feldspar.
777.6	779.9	Siltstone: Gray buff, slightly calcareous. Faint slightly wavy streaked bedding. Porous and permeable.
779.9	821.2	No sample.
821.2	825.0	Siltstone: Light to medium slightly brownish gray, calcareous. Very faintly streaked, variegated, and mottled.
825.0	826.8	Mudstone and marlstone: Buff and gray buff to light and rare medium brownish gray, calcareous. Faint and rare moderately distinct slightly irregular laminae and streaked bedding. Sample of buff mudstone from 825.5 feet: X-ray-- quartz, dolomite, calcite, feldspar.
826.8	828.3	Siltstone: Light to some medium-dark slightly brownish gray, calcareous. Faintly streaked with some indistinct fairly regular banding.
828.3	830.0	Mudstone and marlstone: Gray buff and buff to light slightly brownish gray, some medium to dark brownish gray near bottom, calcareous. Faint streaks and laminae becoming distinct near bottom.
830.0	832.8	Siltstone and mudstone: Buff and gray buff, some light olive gray upper part, calcareous, sandy near top. Faintly streaked and laminated to massive.
832.8	834.4	Mudstone: Buff and light to rare medium and dark slightly brownish gray, calcareous. Faint to some moderately laminae.
834.4	843.0	Siltstone: Light slightly brownish gray to very light gray buff, strongly to slightly calcareous. Faint streaked bedding to very faintly mottled and massive. Mudstone as above at 835.0 - 835.6. Rare fone to thin dark oil-shale shreds at 835.6 - 836.0.
843.0	849.0	Siltstone and some mudstone: Gray buff and light to rare medium slightly brownish gray, moderately to slightly calcareous. Massive to faintly streaked; rarely laminated.
849.0	849.7	Mudstone and marlstone (lean oil shale in part): Buff to brownish gray. Faint very fine slightly crinkly laminae; contorted bedding near base.
849.7	850.3	Missing (?)
850.3	850.7	NOTE: Core samples appear to be mixed up from 850.3 to 853.1. Oil shale: Dark to medium brownish gray, dolomitic. Faintly laminated.
850.7	851.6	Mudstone: Buff to gray buff, calcareous. Faint streaked bedding; distorted near top.
851.6	852.7	Siltstone: Slightly brownish gray. Irregular streaked bedding in upper part becoming massive in lower part. Abundant fine black carbonaceous specks.
852.7	853.1	Mudstone and oil shale: Buff to medium and rare dark brownish gray, slightly calcareous. Distinct very fine crinkly laminae.
853.1	853.7	Siltstone: Dark to medium slightly brownish gray. Faint streaked bedding. Abundant very fine black carbonaceous specks. Oil shale

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
		as below in upper inch.
853.7	856.3	Oil shale: Medium to light and some dark brownish to almost neutral gray, mostly calcareous. Faint to some fairly distinct laminae. Regular thick to rare medium and thin parting. Thin earthy white tuff layer at 854.2. Regular dark slightly brownish-gray siltstone band at 855.15 - 855.5. Sample of dark slightly brownish-gray siltstone from 855.3 feet: X-ray-- analcime, quartz, feldspar. Sample of finely laminated brownish-gray and gray oil shale from 855.9 feet: X-ray-- quartz, K and Na feldspars, dolomite, analcime.
856.3	857.3	Siltstone: Medium to dark brownish gray. Faint streaked bedding and some laminae. Some oil shale near top and bottom. Buff mudstone band with some fine distinct dark brownish-gray laminae at 856.7 - 856.9.
857.3	859.4	Oil shale: Like 853.7 - 856.3. Dark slightly brownish-gray siltstone band at 857.9 - 858.35.
859.4	859.6	Missing (?)
859.6	860.7	Oil shale: Medium and some dark to rare light brownish gray, calcareous. Faint laminae and streaked bedding. Regular thick parting.
860.7	861.8	Oil shale: Medium to some light brownish gray, calcareous. Very faintly laminated; some very fine distinct buff earthy streaks in upper part. Irregular to regular thick parting.
861.8	865.8	Oil shale: Medium to dark brownish gray, calcareous. Faint laminae in thick to thin lighter and darker zones. Regular to irregular thick parting. Sample of medium to dark brownish-gray oil shale from 863.5 feet: X-ray-- quartz, calcite, dolomite, feldspar, analcime, pyrite.
865.8	869.8	Oil shale: Dark and medium brownish gray, calcareous. Faintly laminated. Regular thick parting. Few thin to fine gray limestone laminae in middle part.
869.8	871.4	Oil shale: Dark brownish gray with abundant very fine distinct buff laminae and streaks, slightly to moderately calcareous. Regular thick to rare thin parting. Very thin dense gray limestone laminae at top and 870.2. Sample of dark oil shale with buff laminae and streaks from 870.7 feet: X-ray-- quartz, aragonite, analcime, calcite.
871.4	873.1	Oil shale: Dark to some medium brownish gray, calcareous. Faintly laminated; abundant very fine distinct tan to buff laminae and streaks in some zones. Regular thick parting. Rare fine to very thin brownish-gray to gray limestone laminae in middle part. Sample of dark brownish-gray oil shale from 871.6 feet: X-ray-- quartz, calcite, analcime, aragonite, feldspar, pyrite, dolomite.
873.1	875.5	Oil shale: Dark to medium brownish to neutral gray, rare grayish brown to tan, moderately to slightly calcareous. Faint to fairly distinct laminae. Regular thick to rare medium and thin parting.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

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From	To	Description
		Sample of gray oil shale from 875.1 feet: X-ray-- Na and K feldspars, quartz, auagonite, calcite.
875.5	876.6	Oil shale: Dark brownish gray to some tan and buff, slightly calcareous. Distinctly laminated. Regular thick parting. Faintly laminated tan to buff marlstone in lower 0.1 foot. Rare very fine to thin gray limestone laminae.
		Sample of tan to buff marlstone from 876.6 feet: X-ray-- dolomite, quartz, feldspar.
876.6	877.0	Missing (?)
877.0	880.0	Oil shale: Medium to dark brownish gray, slightly calcareous. Faint and rare distinct laminae. Regular thick to rare thin parting. A 3/4-inch gray silty calcareous band at 879.8.
880.0	883.6	Oil shale: Dark to medium brownish gray, slightly to moderately calcareous. Faint very fine laminae and streaked bedding. Regular to irregular thick to rare thin parting. Fine gray limestone lamina at 882.0.
883.6	885.6	Oil shale: Dark to medium grayish brown, slightly to strongly calcareous. Faintly laminated; abundant very fine distinct buff earthy laminae and streaks in some zones. Regular thick to medium parting.
885.6	891.2	Oil shale: Medium and some dark brownish gray to tan and buff, dolomitic to slightly calcareous. Faint to fairly distinct commonly slightly distorted and displaced laminae. Irregular to regular thick parting. A 1 3/4-inch faintly streaked gray mudstone band at 889.4.
891.2	893.2	Marlstone and oil shale: Buff to some medium and rare dark brownish gray, dolomitic, slightly silty in lightest parts. Faint to distinct fairly regular laminae. Irregular to regular thick parting.
		Sample of distinctly laminated marlstone and oil shale from 891.4 - 891.8 feet: X-ray-- dolomite, quartz, analcime, feldspar.
893.2	897.0	Oil shale: Medium to some dark brownish gray, calcareous. Moderately distinct to faint very fine laminae. Regular thick parting.
897.0	898.0	Oil shale: Dark brownish gray, slightly calcareous to dolomitic. Faintly laminated to very faintly streaked. Fairly regular thick parting. Rare buff marlstone laminae in middle part.
		Sample of very dark brownish-gray oil shale from 897.3 - 897.5 feet: X-ray-- analcime, quartz, feldspar, pyrite, calcite, dolomite.
898.0	898.3	Missing (?)
898.3	899.0	Marlstone and oil shale: Buff to dark brownish gray, dolomitic. Very faintly laminated light marlstone in upper part becoming distinctly laminated with medium to dark oil shale in lower part. Irregular thick parting.
899.0	902.3	Oil shale: Medium to dark brownish gray, rare light zones, dolomitic to very calcareous. Faintly laminated. Regular to some irregular thick to medium parting. Rare very fine calcite laminae.

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From	To	Description
902.3	903.3	Oil shale and marlstone: Very dark brownish-gray oil shale becoming distinctly laminated and banded with tan to buff marlstone in lower half.
903.3	905.7	Oil shale: Medium to dark almost neutral gray, calcareous. Faint to some moderately distinct very fine regular laminae. Regular thick parting. Some very fine crystalline calcite laminae in lower part. Thin white calcareous lamina at 905.5. Sample of medium to dark gray oil shale from 904.2 - 904.4 feet: X-ray-- quartz, calcite, dolomite, analcime, feldspar.
905.7	908.2	Oil shale: Dark to some medium brownish gray and grayish brown, calcareous. Faint to moderately distinct laminae. Regular thick to rare medium and thin parting. Rare thin to fine gray silty to blebby tuff (?) laminae.
908.2	909.2	Sandstone: Light brownish gray, very fine grained, silty. Very faintly bedded with rare very fine dark oil-shale streaks. Irregular thick parting. Upper contact missing; sharp regular lower contact. Sample of sandstone from 908.2 - 909.2 feet: X-ray-- Na feldspar, quartz, dolomite, analcime.
909.2	910.3	Oil shale: Dark brownish gray, calcareous. Faintly laminated. Regular thick to thin parting. Irregular brownish-gray to gray analcime (?) stringer in lower 0.1 foot.
910.3	917.9	Oil shale and marlstone: Medium and rare dark brownish gray to buff (some very slight olive tint), dolomitic. Faint to moderately distinct laminae and rare bands. Irregular to regular thick parting. Medium to rare dark gray oil shale in lower 3 inches; abrupt change to brownish-black oil shale at base.
917.9	919.3	Oil shale: Brownish black to some light brownish gray and rare buff. Faint to distinct regular to irregular laminae. Regular to irregular thick to thin parting. Thin light brownish-gray silty dolomite (?) stringer at 918.0. Dense light brownish-gray to black stringer with sharply unconformable contacts at 918.6 - 919.1.
919.3	919.4	Missing (?)
919.4	920.2	Oil shale: Dark to medium brownish gray, dolomitic to slightly calcareous. Faint laminae; distorted, shredded, and sharply displaced in middle part. Irregular thick parting. Rare fine coarsely crystalline calcite streaks in middle part.
920.2	924.2	Oil shale: Dark and some medium brownish gray, dolomitic. Faintly laminated. Regular to irregular thick parting. Rare indistinctly bounded dense dark gray lenses and stringers in upper part.
924.2	930.2	Oil shale: Dark brownish gray to some black, dolomitic. Very faint very fine laminae. Regular to irregular thick to rare thin parting. Rare dark gray massive bands and laminae in lower part. Sample of dark brownish-gray oil shale from 927.9 feet: X-ray-- quartz, analcime, calcite, dolomite, illite, feldspar, pyrite.

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From	To	Description
930.2	931.0	Oil shale: Dark brownish gray in upper part grading to medium brownish gray in lower part, slightly to moderately calcareous. Faint very fine laminae and some streaked bedding. Regular thick to medium parting. Thin dense grayish-brown dolomite band at bottom.
931.0	931.7	Oil shale: Dark brownish gray, slightly calcareous. Faintly laminated. Regular thick parting.
931.7	935.3	Oil shale: Dark brownish gray to some black, slightly to strongly calcareous. Faintly laminated. Regular thick parting. Massive gray silty tuff at 933.6 - 933.9. Sample of gray silty tuff from 933.6 - 933.9 feet: X-ray-- Na feldspar, quartz, dolomite, pyrite.
935.3	936.3	Oil shale: As above. Dense dark slightly brownish gray mudstone with some oil-shale streaks at 935.5 - 935.8 and 936.2 - 936.3. Very abrupt change to lighter oil shale at base. Sample of dark gray mudstone from 935.6 - 935.7 feet: X-ray-- quartz, dolomite, analcime, feldspar, pyrite, illite.
936.3	937.2	Oil shale: Medium to dark brownish gray and grayish brown, dolomitic. Faint laminae in upper part becoming discontinuous in middle part to streaked in lower part. Regular to irregular medium to thick parting.
937.2	938.0	Oil shale: Grayish brown to some tan and buff, dolomitic. Faint to fairly distinct slightly wavy laminae; thin black angular platy oil-shale inclusions in very faintly streaked medium to light oil shale at 937.5. Irregular thick parting. Rare fine irregular crystal cavities.
938.0	938.4	Missing (?)
938.4	939.4	Oil shale: Grayish brown to rare tan and buff, dolomitic. Faint and rare distinct laminae and streaked bedding. Irregular to regular thick to rare thin parting. Abundant thin to fine porous drusy quartz (?) layers and streaks with fine black mineral grains; some near top have hackly boxwork rims. Sample of oil shale with porous drusy streaks and laminae from 939.0 - 939.2 feet: X-ray-- dolomite, quartz, K feldspar.
939.4	940.4	Oil shale: Dark to medium brownish gray and rare tan to buff, dolomitic. Faint to rare distinct slightly irregular and discontinuous to regular and continuous laminae. Some porous drusy laminae and streaks as above.
940.4	940.6	Missing (?)
940.6	943.9	Oil shale: Dark to medium brownish gray, dolomitic. Faint to moderately distinct distorted streaked bedding and discontinuous laminae. Slightly irregular to regular thick parting. Abundant fine dense to crystalline blebby mineral streaks in some zones. A 1-inch dense medium-dark gray mudstone stringer at 941.2 (like 935.6).

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From	To	Description
		Sample of dark oil shale with very abundant blebby crystalline streaks from 940.8 - 940.9 feet: X-ray-- calcite, quartz, dolomite, analcime, feldspar, pyrite.
943.9	945.0	Oil shale: Dark to some medium almost neutral to brownish gray, dolomitic. Moderately distinct to faint laminae; distorted in upper part. Irregular to regular thick parting. Wavy-bedded dense brownish-gray dolomitic stringers at 944.2 - 944.4.
945.0	946.0	Oil shale: Medium to dark brownish gray, dolomitic. Faint laminae inclined about 40°. Irregular thick parting. A large brown dolomite (?) lens or tapered band at 945.5 - 945.7. A 2-inch dark grayish-brown silty band with abundant gray-buff round mineral grains at base. Sample of brown dolomite (?) from 945.5 - 945.7 feet: X-ray-- dolomite, feldspar, quartz, analcime.
946.0	946.7	Oil shale: Very dark brownish gray to black, dolomitic. Very faintly laminated. Regular thick to thin parting. A thin dark brownish-gray silty to very fine sandy-textured tuff band at 946.2. Sample of dark grayish-brown band with round mineral blebs from 945.9 feet: X-ray-- Na feldspar, quartz, analcime, pyrite.
946.7	948.0	Mudstone (oil shale): Olive gray, dolomitic. Massive with some <u>very</u> faint laminae. Irregular thick parting; tight, dense. Sample of olive-gray mudstone from 947.3 - 947.6 feet: X-ray-- dolomite, quartz, feldspar, calcite.
948.0	951.0	Oil shale: Dark to rare medium brownish gray, dolomitic to slightly calcareous. Faint regular to discontinuous laminae and some streaked bedding. Regular to some irregular thick parting. Irregular 1/4- and 3/4-inch brown dolomite (?) layers at 948.0 and 948.15. A 1-inch dark gray slightly silty lens at 949.05.
951.0	956.0	Oil shale: Dark and rare medium brownish gray and grayish brown to some black, dolomitic becoming calcareous in lower foot. Faintly laminated. Regular to irregular thick to rare thin parting. Dense blebby recrystallized tuff laminae at 953.3 (3/16-inch), 953.4 (5/16-inch), 954.05 (1/8-inch), and 954.2 (1/16-inch). A 1-inch faintly mottled gray-buff and buff silty band at 954.6 - 954.7. Sample of mottled silty band from 954.6 - 954.7 feet: X-ray-- quartz, analcime, feldspar, pyrite.
956.0	957.0	Oil shale: Dark to some medium grayish brown, calcareous. Faintly laminated; some distinct very fine tan-buff earthy laminae and streaks. Regular thick to medium parting.
957.0	961.8	Oil shale: Dark brownish gray and grayish brown to some black, slightly calcareous to dolomitic. Faint laminae and streaked bedding; rare distinct brown to tan dolomite streaks and laminae. Regular to some irregular thick parting. A 1-inch brownish-gray silty to very fine sandy-textured band at 958.3; a 1/2-inch band at bottom.
961.8	963.7	Missing

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From	To	Description
963.7	964.5	Oil shale: Grayish brown, dolomitic. Very faintly laminated. Irregular thick to some thin parting.
964.5	969.2	Oil shale: Gray brown to tan and buff, dolomitic. Faint to distinct laminae and streaked bedding. Irregular to some regular thick to rare thin parting. Some fine crystal cavities and rare small vugs with platy boxworks.
969.2	976.3	Oil shale: Dark to rare medium brownish gray and some grayish brown, dolomitic to slightly calcareous. Faint to some moderately distinct very fine laminae and streaked bedding. Fairly regular thick to rare thin parting. Thin dark gray silty lamina at 974.7. Sample of dark brownish-gray oil shale from 975.2 feet: X-ray-- quartz, feldspar, dolomite, pyrite, biotite.
976.3	976.8	Tuff: Dark grayish brown becoming buff in lower 2 inches, dolomitic to hydrophobic. Faintly streaked and variegated. Irregular parting and fracture; tight and silty-textured becoming slightly porous and very fine sandy-textured in lower part. Sample of dark grayish-brown tuff from 976.5 - 976.6 feet: X-ray-- analcime, quartz, feldspar.
976.8	978.5	Oil shale: Dark brownish gray, calcareous. Faint very fine laminae and streaked bedding. Regular thick parting.
978.5	979.4	Oil shale: Dark grayish brown to some light brownish gray and rare buff, calcareous. Moderately distinct very fine lenticular to regular laminae. Regular to some irregular thick parting. A 3/4-inch tight gray mudstone band at 978.8. Slightly irregular 1 1/2-inch light brownish-gray to buff marlstone band at 979.0.
979.4	981.6	Oil shale: Dark and rare medium brownish gray, dolomitic to calcareous. Faint to some moderately distinct irregular streaked bedding to regular laminae. Irregular to regular thick to rare thin parting. A 3/4-inch tight dark gray band at 980.4 and a 1 1/4-inch dark brownish-gray band at 981.5.
981.6	982.6	Oil shale: Dark to some medium brownish to almost neutral gray, some medium to light grayish-brown in upper half. Faint to some fairly distinct laminae. A 1-inch very faintly laminated brown marlstone band at 982.0 - 982.1.
982.6	983.5	Oil shale: Dark brownish gray, mostly dolomitic, calcareous near base. Faint regular to some irregular laminae and streaked bedding. Slightly irregular thick to rare thin parting.
983.5	984.2	Marlstone and oil shale: Buff and tan to some dark brownish gray, dolomitic. Distinctly laminated; becoming blebby near base. Regular to some irregular thick to thin parting.
984.2	988.7	Oil shale: Dark brownish gray, tan to buff zone at 987.1 - 987.2, some light gray laminae at 987.4 - 987.7, calcareous. Faint to rare moderately distinct laminae; some streaked bedding in upper foot. Regular thick to some medium parting. A 2-inch tight dark gray mudstone band at 986.7.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
		Sample of dark gray mudstone from 986.7 feet: X-ray-- quartz, analcime, calcite, dolomite, feldspar, pyrite.
988.7	990.1	Oil shale: As above, interbedded with some medium to light grayish-brown oil shale. A 1 1/4-inch medium to light olive-gray tuff band with some biotite at 988.8.
990.1	990.3	Missing
990.3	1,005.7	Oil shale: Dark and some medium brownish to almost neutral gray, calcareous. Very faint to some moderately distinct laminae. Regular to some irregular thick to rare medium parting. Large slightly brownish-gray silty biotitic tuff nodules at 1,005.2 - 1,005.4. Rare dark gray mudstone bands in lower part (like 986.7).
1,005.7	1,006.7	Oil shale: Medium to some dark slightly brownish and olive gray, dolomitic. Very faintly laminated. Slightly irregular thick to medium parting; very dense.
		Sample of dense oil shale from 1,006.1 feet: X-ray-- dolomite, calcite, quartz, feldspar, pyrite, illite.
1,006.7	1,008.8	Oil shale: Dark to medium brownish gray, dolomitic to calcareous. Very faint to moderately distinct laminae. Regular to some irregular thick to thin parting.
		Sample of dark to medium brownish-gray oil shale from 1,008.4 feet: X-ray-- calcite, quartz, feldspar, pyrite, dolomite.
BOTTOM OF LANEY MEMBER TOP OF WILKINS PEAK MEMBER		
1,008.8	1,011.0	Marlstone: Medium to light olive gray, dolomitic. Faint streaked bedding and some irregular layers. Irregular thick parting. Some gray to buff limestone layers.
		Sample of medium to light olive-gray marlstone from 1,009.2 - 1,009.6 feet: X-ray-- dolomite, quartz, feldspar.
1,011.0	1,012.2	Shale and limestone: Interlaminated olive-gray shale and light gray to gray-buff limestone. Irregular to regular medium to very thin parting.
1,012.2	1,014.7	Limestone: Light to medium gray and some gray buff, silty to sandy. Abundant regular to irregular oil-shale and marlstone laminae. Very abundant biotite on some parting surfaces.
		Sample of light gray silty limestone (or very calcareous siltstone?) from 1,012.4 feet: X-ray-- calcite, quartz, feldspar, dolomite, analcime, illite.
1,014.7	1,015.4	Missing (?)
1,015.4	1,016.2	Mudstone and marlstone: Gray buff to medium olive gray and grayish brown, dolomitic to calcareous. Irregularly laminated; some indistinct conglomerate in mudstone. Irregular to regular thick to medium parting.
1,016.2	1,018.0	Oil shale: Medium to dark olive gray and brownish gray, dolomitic to slightly calcareous. Moderately distinct to faint regular to

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LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
		distorted streaks and discontinuous laminae; fairly regular laminae in lower 0.2 foot. Irregular medium to thick parting.
		Sample of oil shale from 1,016.6 feet: X-ray-- dolomite, quartz, calcite, feldspar, illite.
1,018.0	1,021.4	Marlstone and siltstone: Interlaminated and banded olive-gray to buff marlstone and light gray to gray-buff calcareous siltstone. Abundant biotite in some parts. Irregular to regular thick to rare shaly parting.
1,021.4	1,025.7	Siltstone: Gray buff to light and medium gray, very calcareous. Abundant regular to irregular marly and shaly laminae; some braided bedding. Regular to irregular thick to rare thin parting. (1,023.8 - 1,023.9 missing?)
1,025.7	1,033.8	Oil shale and siltstone: Olive-gray and brownish-gray oil shale with abundant laminae and bands of gray calcareous siltstone. Dark brownish-gray oil shale at 1,032.1 - 1,032.4.
1,033.8	1,038.4	Siltstone and oil shale: As above and below but mostly siltstone. Buff-white slightly earthy tuff at 1,034.2 - 1,034.4.
1,038.4	1,038.5	Missing (?)
1,038.5	1,044.3	Oil shale and siltstone: Medium to dark brownish-gray and olive-gray oil shale laminated and banded with gray calcareous siltstone (or silty limestone). Irregularly laminated and banded. Abundant biotite? Some pyrite (and pyrrhotite?).
1,044.3	1,047.1	Oil shale: Olive gray, slightly to moderately calcareous. Faint streaked bedding; occasional fine to thin gray calcareous siltstone laminae and stringers. Irregular thick to medium parting.
1,047.1	1,048.2	Oil shale: Olive gray, dolomitic to calcareous. Very faint streaked bedding. Irregular thin to thick parting; irregular hackly fracture; some rubble. Sample of olive-gray oil shale from 1,047.7 feet: X-ray-- dolomite, quartz, montmorillonite, illite, feldspar.
1,048.2	1,050.4	Oil shale: Medium-dark olive gray, some olive brown in lower part, calcareous. Faint streaked bedding. Irregular thick parting. A 2-inch light slightly greenish gray mudstone band with some very small pyrite blebs at 1,048.3 - 1,048.4.
1,050.4	1,052.7	Oil shale: Medium-light olive gray and olive green, calcareous to dolomitic. Faintly streaked to laminated. Rare fine calcite crystals.
1,052.7	1,062.5	Oil shale: Medium-dark olive gray, dolomitic to slightly calcareous. Faint streaked bedding and rare laminae. Irregular thick to medium parting. Abundant gray calcareous streaks in some zones. Abundant very fine disseminated pyrite (and pyrrhotite?) in upper part.
1,062.5	1,065.2	Oil shale: Medium and rare dark olive gray to olive, slightly to moderately calcareous. Very faint streaked bedding in upper part, becoming faintly laminated in lower part. Irregular thick to medium parting. Some fine disseminated white calcite crystals. Some

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
		very fine disseminated pyrite.
1,065.2	1,066.9	Oil shale: Medium-dark to some light olive gray, calcareous. Faint streaked bedding and slightly irregular laminae. Irregular thick to medium parting. Abundant very fine pyrrhotite in lower part. A 3-inch light gray massive quartz band with very abundant fine dark submetallic pyrrhotite (?) flecks at bottom. Sample of light gray band with very abundant dark submetallic flecks from 1,066.7 feet: X-ray-- quartz, analcime, pyrrhotite, feldspar, calcite.
1,066.9	1,067.0	Missing (?)
1,067.0	1,069.0	Marlstone (oil shale?): Medium-dark almost neutral gray, calcareous. Faint streaks and some irregular laminae. Irregular thick parting.
1,069.0	1,071.3	Oil shale: Medium and rare light olive gray, calcareous. Faint streaked bedding and some laminae. Irregular thick to some thin parting. Very fine disseminated crystals becoming abundant in lower part. Sample of olive-gray oil shale with abundant very fine disseminated crystals from 1,071.1 feet: X-ray-- calcite, dolomite, quartz, feldspar, illite.
1,071.3	1,073.4	Oil shale: Medium to some dark olive gray and rare brownish gray, slightly calcareous to dolomitic. Faint to some moderately distinct streaked bedding; becoming faintly laminated in lower part. Some fine disseminated pyrrhotite in upper part. Some fine calcite crystals in lower part.
1,073.4	1,074.0	Oil shale: Medium to dark slightly olive and brownish gray, dolomitic. Faint slightly irregular laminae. A 3-inch dark gray mudstone band in lower part with abundant fine blue iridescent flecks and pyrite. Sample of dark gray band with iridescent flecks from 1,073.8 feet: X-ray-- quartz, calcite, analcime, dolomite, feldspar, illite.
1,074.0	1,079.0	Oil shale: Olive gray, dolomitic to calcareous. Faint laminae and streaked bedding. Irregular thick parting. Some disseminated pyrite and calcite crystals. A thin dark gray tight fine-grained band with pyritic blebs at 1,078.1 and a thin medium to light gray band at 1,078.5.
1,079.0	1,080.0	Oil shale: Medium to some dark olive gray and some buff, calcareous to dolomitic. Faint to distinct laminae. Slightly irregular thick to rare thin parting. A thin brownish-gray silty lamina at 1,079.3 and a thin dark gray lamina at 1,079.7.
1,080.0	1,083.0	Marlstone and mudstone (oil shale?): Medium to some dark almost neutral gray, calcareous. Faint streaks and slightly irregular laminae. Irregular to regular thick parting. Sample of slightly olive gray mudstone from 1,081.1 feet: X-ray-- quartz, dolomite, calcite, analcime, feldspar, pyrite, illite, montmorillonite.
1,083.0	1,085.0	Oil shale: Medium and rare dark olive gray, calcareous. Faint streaks and laminae. Irregular thick parting.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,085.0	1,086.0	Oil shale: Medium to some dark olive to brownish gray, dolomitic. Faint streaks and laminae. Irregular to regular thick parting.
1,086.0	1,086.4	Mudstone: Dark gray, massive, sharp regular contacts. Sample of dark gray mudstone from 1,086.2 feet: X-ray-- quartz, calcite, feldspar, pyrite, dolomite, analcime, illite.
1,086.4	1,091.0	Marlstone and limestone: Medium to dark olive-gray marlstone and medium to light gray silty-textured limestone. Irregularly inter-laminated. Irregular to regular thick to thin parting.
1,091.0	1,092.4	Oil shale: Medium-dark olive gray, calcareous. Faint irregular laminae. Irregular thick to rare thin parting.
1,092.4	1,103.7	Missing
1,103.7	1,108.3	Marlstone and limestone: Medium to dark slightly olive and brownish-gray marlstone and medium to light gray silty limestone. Moderately distinct to faint slightly irregular laminae and some bands. Irregular thick parting. Some moderately coarse disseminated calcite crystals. (1,106.6 - 1,106.8 missing?)
1,108.3	1,109.6	Marlstone: Olive gray, dolomitic. Very faint laminae and streaked bedding. Fairly regular to irregular thick parting. Fairly abundant moderately coarse disseminated calcite crystals (commonly with pyrite).
1,109.6	1,110.6	Oil shale: Medium olive gray to medium and dark grayish brown, dolomitic. Faint streaked bedding to fairly distinct discontinuous and displaced laminae. Irregular thick parting. Abundant fine calcite crystals concentrated in streaks and patches.
1,110.6	1,111.6	Oil shale: Dark brownish gray to medium brown, dolomitic to slightly calcareous. Faint to distinct streaks and laminae; slightly crosslaminated in lower part. Irregular thick parting.
1,111.6	1,114.1	Marlstone: Medium slightly olive gray, calcareous. Faint streaks and laminae. Irregular to regular thick parting. Abundant medium-fine disseminated calcite crystals in some zones.
1,114.1	1,115.1	Oil shale: Olive gray to brownish gray, dolomitic. Very faint laminae and streaked bedding. Irregular to fairly regular thick to medium parting. Abundant fine calcite crystals.
1,115.1	1,116.3	Oil shale: Medium to dark brownish gray, dolomitic. Faint laminae and some streaked bedding. Irregular to fairly regular thick to medium parting. Some calcite crystals. Sample of medium to dark brownish-gray oil shale from 1,116.0 feet: X-ray-- calcite, quartz, dolomite, feldspar.
1,116.3	1,116.9	Oil shale: Dark brownish gray, dolomitic. Faint laminae and streaked bedding. Slightly irregular thick parting. A thin dark gray massive band at 1,116.5.
1,116.9	1,117.1	Mudstone: Dark gray, tight, massive. Interfingered upper contact; sharp regular lower contact.
1,117.1	1,117.35	Siltstone and very fine sandstone: Gray to grayish-brown, tight, dolomitic. Faint regular layers. Regular thick to thin parting. (Layered tuff?)

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
		Sample of grayish-brown sandstone from 1,117.2 feet: X-ray-- K feldspar, analcime, quartz, pyrite.
1,117.35	1,117.5	Oil shale: Black to dark brownish gray. Very faintly laminated. Regular thin parting.
1,117.5	1,123.4	Siltstone: Medium to light gray, very calcareous. Irregularly interbedded and laminated with slightly olive and brownish gray marlstone and mudstone. Irregular to some regular thick to rare thin parting.
		Sample of very calcareous gray siltstone from 1,119.4 feet: X-ray-- quartz, calcite, dolomite, feldspar, pyrite.
1,123.4	1,123.5	Missing (?)
1,123.5	1,124.8	Marlstone and oil shale: Tan to grayish brown, dolomitic. Faintly laminated. Irregular thick to thin parting.
		Sample of tan marlstone from 1,124.2 feet: X-ray-- dolomite, calcite, feldspar, quartz, montmorillonite.
1,124.8	1,126.6	Oil shale: Medium to dark brownish gray and rare black, dolomitic. Faint to rare distinct laminae and some streaked bedding. Fairly regular thick to medium parting. Abundant very fine pyrite. A thin slightly olive-gray mudstone band at 1,126.3.
1,126.6	1,127.2	Marlstone and mudstone: Brownish to slightly olive gray, dolomitic to very calcareous. Faintly streaked to laminated.
1,127.2	1,131.6	Mudstone, siltstone, and marlstone: Medium to dark and some light gray to slightly olive and brownish gray. Faint to distinct streaks, laminae, and bands. Irregular to some regular thick parting. Grades to grayish-brown oil shale near bottom.
1,131.6	1,132.1	Oil shale: Medium to dark brownish gray and rare black, dolomitic. Moderately distinct to faint laminae. Regular thick to medium parting. Some very fine disseminated calcite crystals and crystal-line streaks.
1,132.10	1,132.25	Marlstone conglomerate: Light brownish-gray to tan-buff, dolomitic, oolitic.
1,132.25	1,135.7	Marlstone and mudstone: Olive gray and olive green, calcareous. Faintly streaked and mottled. Irregular thick to thin parting; mostly rubble in lower part. (1,134.9 - 1,135.4 missing?)
		Sample of olive-gray marlstone from 1,134.1 feet: X-ray-- calcite, quartz, dolomite, illite, feldspar, montmorillonite, analcime.
1,135.7	1,136.2	Mudstone: Dark slightly brownish gray, calcareous. Massive to very faintly streaked. Irregular thick parting.
		Sample of dark gray mudstone from 1,135.7 - 1,136.2 feet: X-ray-- quartz, calcite, dolomite, feldspar, illite, pyrite, Mg-siderite, montmorillonite.
1,136.2	1,138.0	Marlstone and marly claystone: Olive gray and olive green, calcareous. Faint streaked bedding. Very irregular thick to thin parting; mostly rubble.

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LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,138.0	1,138.8	Limestone and shale: Thinly interlaminated medium and light gray to slightly brownish-gray silty limestone and olive-gray to brownish-gray shale. Irregular shaly to papery parting. Fine-sandy-textured limestone with very fine slightly stylonitic shaly partings at 1,138.5 - 1,138.7. Sample of fine-grained limestone from 1,138.6 feet: X-ray-- calcite, quartz, dolomite, feldspar, biotite.
1,138.8	1,144.8	Mudstone: Olive gray, slightly calcareous. Faintly variegated to massive; interbedded with light gray calcareous siltstone at 1,140.1 - 1,141.2 (some crossbedding). Irregular thick parting.
1,144.8	1,146.3	Mudstone: Olive gray to some light brownish gray, slightly calcareous. Massive to very faintly streaked. Irregular thick to thin parting. Sample of olive-gray mudstone from 1,145.6 feet: X-ray-- calcite, quartz, dolomite, illite, feldspar, montmorillonite, analcime, Mg-siderite.
1,146.3	1,149.6	Mudstone and siltstone: Olive gray to medium and light gray, some tan to buff limestone. Irregularly layered; some disrupted bedding in lower part.
1,149.6	1,150.1	Marlstone: Olive gray to some medium and dark brownish gray, dolomitic. Faint slightly disrupted streaked bedding and some laminae. Irregular thick parting. Very irregular buff marlstone stringer disrupting bedding near base.
1,150.1	1,154.0	Siltstone: Medium to light gray, very calcareous. Distinctly interlaminated with medium to dark brownish-gray mudstone and oil shale. Irregular to regular thick parting. (1,150.6 - 1,150.9 missing ?)
1,154.0	1,156.0	Oil shale: Dark to medium brownish gray, few resinous black streaks mostly in upper part, dolomitic. Faint to rare distinct distorted streaks and rare regular laminae. Irregular to fairly regular thick to medium parting. Some very fine disseminated crystals in upper part.
1,156.0	1,156.2	Algal dolomite: Tan to grayish brown. Faint to fairly distinct wavy laminae (stromatolitic).
1,156.2	1,166.0	Siltstone: Medium to light gray, very calcareous. Irregularly streaked and laminated with medium to dark olive-gray mudstone and marlstone. Irregular to some regular thick to medium parting.
1,166.0	1,168.8	Siltstone and oil shale: Very limy gray siltstone (or silty limestone) laminated with medium to dark olive-gray oil shale. Irregular thick to medium parting. (1,167.3 - 1,167.5 missing)
1,168.8	1,170.3	Oil shale: Medium to dark olive gray, moderately to slightly calcareous. Faintly laminated. Irregular to fairly regular thick to rare thin parting. Abundant fine disseminated calcite crystals in middle part. Sample of olive-gray oil shale with fine disseminated crystals from 1,169.6 feet: X-ray-- calcite, quartz, dolomite, feldspar,

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
		illite.
1,170.3	1,171.6	Oil shale: Olive gray to brownish gray, dolomitic to slightly calcareous. Faintly layered; some irregular gray limy streaks and blebs in upper part. Irregular thick parting.
1,171.6	1,172.6	Limestone: Buff to light gray, silty. Abundant very fine wavy dark brownish-gray laminae. Slightly wavy to irregular thick parting.
1,172.6	1,174.7	Siltstone and mudstone: Gray siltstone interlaminated to streaked with olive-gray mudstone, very calcareous. Irregular thick to thin parting.
1,174.7	1,176.6	Oil shale: Olive gray to brownish gray, dolomitic to calcareous. Very faint streaked bedding and some moderately distinct irregular laminae; some very limy gray siltstone streaks and laminae. Irregular to rare regular thick to medium parting. A 2-inch very dark slightly brownish-gray mudstone band at 1,176.1.
1,176.6	1,178.0	Oil shale: Medium olive gray to medium and some dark brownish gray, dolomitic. Faintly streaked to very faintly laminated. Fairly regular to irregular thick to medium parting. Sample of dark brownish-gray oil shale from 1,177.8 feet: X-ray-- dolomite, quartz, calcite, feldspar, illite, montmorillonite.
1,178.0	1,180.0	Oil shale: Like 1,174.7 - 1,176.6. Abundant thin irregular gray limy siltstone laminae and streaks.
1,180.0	1,181.3	Limestone: Buff and some tan to gray buff, very fine sandy to silty texture. Abundant very fine slightly stylolitic dark brownish-gray stringers. Irregular thick to thin parting.
1,181.3	1,182.6	Mudstone: Gray buff, very calcareous. Very faint streaks and irregular laminae. Regular to irregular thick to rare thin parting. Sample of very calcareous gray-buff mudstone from 1,181.7 feet: X-ray-- quartz, analcime, feldspar, calcite, pyrite, Mg-siderite, dolomite.
1,182.6	1,184.7	Siltstone: Medium to light gray, very calcareous. Irregularly laminated with medium to dark olive-gray and brownish-gray marlstone and mudstone. Slightly wavy to irregular thick to thin parting. Becoming mostly marlstone (oil shale?) in lower part.
1,184.7	1,185.5	Oil shale: Medium to light and very rare dark olive gray and brownish gray, dolomitic to slightly calcareous. Distinctly streaked and laminated with gray to buff limestone. Irregular to regular thick to medium parting.
1,185.50	1,185.64	Tuff: Buff, silty, slightly earthy. Regular band; very thin gray lamina near top. Abundant biotite.
1,185.64	1,185.72	Mudstone: Dark gray. Massive regular band. Fine dark brownish-gray oil-shale laminae above and below.
1,185.72	1,185.80	Dolomite: Tan to buff, very fine blebby texture. Regular massive band.
1,185.80	1,185.84	Mudstone: Like 1,185.64 - 1,185.72.

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LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,185.84	1,185.92	Dolomite: Like 1,185.72 - 1,185.80. Finely laminated with dark brownish-gray oil shale.
1,185.92	1,189.90	Marlstone, mudstone, and siltstone: Medium to dark slightly olive gray marlstone and mudstone irregularly laminated and banded with gray very calcareous siltstone; becoming mostly light gray calcareous siltstone in lower part. Irregular to some fairly regular thick to rare thin parting.
1,189.9	1,190.9	Limestone: Gray buff to buff, silty. Faint irregular bedding; very fine irregular to stylolitic dark brownish-gray stringers becoming abundant in lower part. Irregular to regular thick to thin parting.
1,190.9	1,191.9	Oil shale: Medium to some dark grayish brown. dolomitic. Distinctly streaked and laminated with buff limestone. Irregular thick to very thin parting; very hackly fracture.
1,191.9	1,192.0	Missing (?)
1,192.0	1,192.9	Limestone and oil shale: As above.
1,192.9	1,193.8	MAIN TUFF: Buff and white to gray buff, slightly earthy. Faintly banded and laminated; abundant very fine brown discolored specks and streaks; thicker bands laced with very fine tight fractures. Fairly abundant very fine biotite. Sample of white to buff tuff from 1,193.2 - 1,193.4 feet: X-ray-- K and Na feldspars, biotite, quartz.
1,193.8	1,195.0	Oil shale and limestone: Olive-gray and brownish-gray oil shale interlaminated and banded with buff silty to blebby limestone. Irregular to regular thick parting.
1,195.0	1,196.4	Mudstone and limestone: Light to rare medium slightly greenish and olive gray, very calcareous. Faintly variegated to irregularly streaked, laminated, and banded. Irregular to regular thick parting.
1,196.4	1,197.2	Oil shale: Light to dark brownish-gray oil shale interlaminated with buff and tan silty to blebby dolomitic limestone. Regular thick parting. Thin light gray silty biotitic tuff band at 1,197.1.
1,197.2	1,203.2	Siltstone and mudstone: Medium to light gray very calcareous siltstone finely laminated, streaked, and stringered with dark to medium slightly olive gray mudstone (decreasing toward bottom). Irregular to rare regular thick to rare thin parting.
1,203.2	1,205.8	Siltstone and some very fine sandstone: Medium to light gray to slightly greenish gray, very calcareous. Faintly variegated with occasional very fine streaks and stringers. Irregular thick parting. Sample of very fine-grained gray calcareous sandstone from 1,205.2 feet: X-ray-- quartz, dolomite, calcite, feldspar.
1,205.8	1,206.6	Mudstone: Medium to dark slightly olive gray, calcareous. Very faint streaked bedding; abundant gray calcareous siltstone streaks in upper part. Irregular to fairly regular thick parting.
1,206.6	1,210.0	Siltstone: Medium to light gray, very calcareous. Occasional fine dark streaks, stringers, and laminae. Irregular to slightly regular thick parting.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,210.0	1,215.1	Siltstone: As above with abundant fine dark muddy to shaly laminae and stringers. Irregular to regular thick to some thin parting.
1,215.1	1,216.1	Mudstone: Medium to dark slightly olive gray, calcareous. Very faint streaked bedding. Irregular thick parting. Some light gray siltstone in upper part.
1,216.1	1,218.2	Siltstone and very fine sandstone: Light gray to gray buff, very calcareous. Some very fine irregular dark gray shaly laminae and stringers. Irregular to regular and wavy thick to rare thin parting.
1,218.2	1,220.5	Siltstone: Medium to dark gray, calcareous. Massive with some very faint streaks. Slightly irregular thick parting.
1,220.5	1,232.6	Siltstone and some mudstone: Medium to some dark gray with some slight olive to brownish tint, calcareous. Faint regular to irregular laminae, stringers, and streaks; few massive zones. Irregular to some regular thick to rare thin parting.
1,232.6	1,235.0	Siltstone: Light gray to gray buff, very calcareous. Abundant faint to distinct regular to contorted dark slightly brownish gray laminae and stringers. Regular to irregular thin to thick parting.
1,235.0	1,238.0	Siltstone: Medium and some light to rare dark gray, very calcareous. Faintly streaked; rare faint to distinct laminae. Slightly wavy to irregular thick to rare thin parting.
1,238.0	1,242.0	Mudstone and siltstone: Medium to dark gray, rare dark brownish gray, very calcareous. Faint to some moderately distinct irregular to regular laminae and streaks. Irregular to some regular thick to rare thin parting.
1,242.0	1,243.3	Mudstone: Medium to dark gray to slightly brownish gray, very calcareous. Faint streaked bedding and some very fine laminae. Regular to irregular thick to medium parting.
1,243.3	1,244.3	Mudstone, marlstone, and limestone: Olive gray and dark slightly brownish to neutral gray, calcareous. Faintly laminated and streaked to massive. Irregular to slightly wavy thick to medium parting. Sample of olive-gray silty limestone from 1,243.9 feet: X-ray-- calcite, dolomite, quartz, feldspar.
1,244.3	1,246.4	Marlstone and limestone: Medium and rare dark olive gray and brownish gray to rare buff, calcareous. Faint to distinct thin to fine laminae; some blebby streaked bedding near top. Irregular thick to rare medium and thin parting. A 1-inch regular massive dark gray to brownish-black mudstone band at 1,245.8 - 1,245.9. Sample of dark mudstone band from 1,245.8 feet: X-ray-- quartz, illite, dolomite, feldspar, analcime, calcite, pyrite.
1,246.4	1,248.9	Oil shale: Olive gray to medium and some dark grayish brown, calcareous to dolomitic. Faintly laminated and streaked to massive. Irregular thick to rare thin parting. Some limy streaks in upper part. Sample of massive grayish-brown oil shale from 1,248.2 feet: X-ray-- dolomite, calcite, quartz, feldspar.

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LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,248.9	1,250.3	Oil shale: Medium and dark brownish gray to olive gray, dolomitic. Faint very fine laminae. Irregular to slightly irregular thick to medium parting. Abundant fine white to colorless calcite crystals in lower part. Sample of dark olive-gray oil shale with fine disseminated calcite crystals from 1,250.0 feet: X-ray-- calcite, quartz, dolomite, feldspar, montmorillonite.
1,250.3	1,251.4	Siltstone: Gray, very calcareous. Abundant medium to dark olive-gray streaks and discontinuous laminae in upper part. Irregular thick parting.
1,251.4	1,257.0	Siltstone: Medium to light gray, very calcareous. Faintly streaked to massive with some fine dark shaly laminae, stringers, and streaks. Irregular thick parting.
1,257.0	1,263.6	Siltstone: As above with sparse shaly laminae and stringers in most parts becoming moderately abundant in lower foot.
1,263.6	1,265.1	Siltstone, marlstone, and oil shale: Gray calcareous siltstone inter-laminated with buff to dark brownish-gray oil shale. Regular to irregular thick to rare thin parting.
1,265.1	1,266.1	Oil shale and marlstone: Dark slightly brownish gray to buff, calcareous. Distinct to faint laminae. Regular to irregular thick parting. Some gray calcareous siltstone laminae in upper part.
1,266.1	1,268.2	Mudstone and marlstone (oil shale in part): Dark to medium gray and slightly brownish gray, some buff, calcareous. Faint to rare distinct fine to thin laminae and bands. Regular to irregular thick parting. Some siltstone laminae and streaks in lower part.
1,268.2	1,281.2	Siltstone and mudstone: Medium to some dark and light gray, very calcareous. Faint streaks and discontinuous laminae; abundant dark to medium slightly olive gray shaly to marly streaks and laminae in some zones. Irregular to some regular thick parting.
1,281.2	1,282.2	Mudstone (oil shale?): Dark slightly brownish and olive gray, calcareous. Irregularly streaked and laminated with gray calcareous siltstone. Irregular to regular thick parting.
1,282.2	1,284.3	Mudstone and siltstone: Dark to medium gray and olive-gray mudstone interlaminated and streaked with very abundant gray calcareous siltstone. Slightly irregular thick to medium parting.
1,284.3	1,286.5	Mudstone: Dark slightly olive and brownish gray, calcareous. Some gray silty laminae and streaks. Irregular to regular thick to medium parting.
1,286.5	1,287.7	Siltstone: Gray, very calcareous. Becoming abundantly streaked and laminated with dark slightly olive-gray mudstone in lower part. Irregular to regular thick to medium parting.
1,287.7	1,295.0	Oil shale: Dark to medium almost neutral to olive gray, calcareous. Faintly laminated. Regular to irregular thick to some thin parting. Abundant gray silty calcareous laminae and streaks in some zones in upper part. Some very fine massive pyrite streaks in lower part.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,295.0	1,298.0	Oil shale: Medium to rare dark olive gray and some olive brown, calcareous. Faintly laminated to very faintly bedded. Irregular thick to medium parting. Abundant fine disseminated calcite crystals. Some gray-buff to gray silty limestone laminae and streaks in lower part. Sample of oil shale with fine calcite crystals from 1,296.1 feet: X-ray-- calcite, dolomite, quartz, feldspar, illite.
1,298.0	1,299.0	Limestone and oil shale: Buff and buff-white to light gray silty limestone with distinct regular to slightly wavy and nonparallel medium to dark brownish and olive-gray oil-shale laminae. Fairly regular thick parting. Sample of buff silty limestone (or very calcareous siltstone) from 1,298.3 feet: X-ray-- calcite, quartz, dolomite, analcime, feldspar, Mg-siderite.
1,299.0	1,303.8	Siltstone: Gray buff to light and medium gray, very calcareous. Abundant very fine regular to irregular dark shaly laminae, streaks, and stringers. Irregular to fairly regular thick to thin parting.
1,303.8	1,304.0	Missing?
1,304.0	1,307.0	Siltstone and fine sandstone: Gray buff, calcareous. Massive to faintly streaked; some very faint nonparallel laminae in lower part. Regular to irregular thick parting. Sample of gray-buff calcareous sandstone from 1,304.6 feet: X-ray-- quartz, calcite, dolomite, feldspar.
1,307.0	1,313.0	Siltstone and some fine to medium-grained micaceous sandstone: medium to some light and dark gray, calcareous. Abundantly streaked and irregularly laminated with dark mudstone and claystone; occasional slight crossbedding. Irregular to rare regular thick parting.
1,313.0	1,318.4	Siltstone and silty mudstone: Medium and some dark to rare light gray and slightly brownish gray, calcareous. Faint regular to irregular laminae and streaks; some massive to faintly variegated zones. Irregular thick parting. Sample of medium-dark gray silty mudstone from 1,317.6 feet: X-ray-- quartz, dolomite, calcite, feldspar, analcime, illite.
1,318.4	1,319.4	Siltstone and mudstone: Light to dark gray, calcareous. Distinctly laminated. Regular thick to medium parting.
1,319.4	1,320.2	Mudstone: Dark to medium brownish to neutral gray, calcareous. Faintly streaked and variegated. Irregular thick parting.
1,320.2	1,320.6	Missing
1,320.6	1,325.3	Mudstone: Dark to medium neutral to slightly brownish gray, calcareous. Massive; laminated and streaked with light gray siltstone in some zones. Regular to irregular thick to rare medium and thin parting. Abundant very fine disseminated pyrrhotite?
1,325.3	1,326.5	Marlstone and mudstone (oil shale?): Medium to dark brownish and neutral gray, slightly calcareous. Moderately distinct to faint laminae; dark massive mudstone as above in lower 3 inches (probably out of place). Regular thick parting. Abundant fine sparry pyritic calcite laminae and streaks in upper part.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,326.5	1,327.7	Oil shale: Medium to some dark olive brown and brownish gray, calcareous. Faint to some moderately distinct laminae. Regular thick parting. Abundant fine disseminated calcite crystals. Sample of oil shale with very abundant calcite crystals from 1,327.5 feet: X-ray-- calcite, dolomite, quartz, feldspar, Mg-siderite, illite.
1,327.7	1,329.1	Oil shale: Dark to medium neutral gray and some olive gray and brownish gray, calcareous. Faint laminae and streaked bedding. Regular to irregular thick to medium parting. Abundant very fine disseminated crystals and crystalline streaks in most parts. Abundant very fine pyrite.
1,329.1	1,329.5	Missing?
1,329.5	1,330.5	Oil shale: Medium olive brown and brown to medium and dark brownish gray, calcareous to dolomitic. Faint to rare distinct laminae. Regular to irregular thick parting. Abundant fine to moderately coarse calcite crystals. Abundant very fine pyrite in lower part.
1,330.5	1,331.5	Oil shale: Dark brownish gray in upper part to dark and medium olive gray in lower part, dolomitic to calcareous. Faintly laminated. Irregular thick to medium parting. Abundant very fine disseminated pyrite and some fine calcite crystals in upper part; very abundant fine to moderately coarse calcite in lower part; some irregular medium to high angle fractures filled with calcite. Sample of dark brownish-gray oil shale with disseminated pyrite from 1,330.7 feet: X-ray-- dolomite, Na and K feldspars, quartz, calcite, illite, pyrite.
1,331.5	1,333.7	Marlstone (oil shale?): Medium to rare light olive gray and olive green with some thick dark gray zones, dolomitic to slightly calcareous. Faint laminae and bands with some fine distinct gray-buff limestone laminae and streaks. Regular to irregular thick to medium parting. Abundant very fine disseminated calcite and pyrite near top. Sample of olive-green marlstone from 1,333.4 feet: X-ray-- dolomite, quartz, feldspar, calcite, illite.
1,333.7	1,335.7	Oil shale: Olive gray, dolomitic. Very faintly bedded to massive; few fine distinct gray-buff limestone laminae in upper part. Irregular thick to medium parting. Abundant thin irregular fine to moderately coarse crystalline calcite streaks and patches below 1,334.4. Sample of oil shale with crystalline streaks and patches from 1,334.6 feet: X-ray-- calcite, dolomite, quartz, feldspar, illite.
1,335.7	1,337.2	Marlstone: Dark gray, some olive gray in lower part, dolomitic to slightly calcareous. Very faintly bedded with some faint laminae. Slightly irregular thick parting. Abundant fine to moderately coarse crystalline calcite blebs and streaks.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,337.2	1,338.6	Oil shale: Medium to dark olive gray and rare dark brownish gray to black, dolomitic. Faint streaked bedding and some laminae. Irregular to fairly regular thick to rare thin parting. Abundant fine to moderately coarse calcite crystals and crystalline streaks. Abundant very fine disseminated pyrite and pyrrhotite.
1,338.6	1,339.6	Mudstone and silty limestone: Dark to medium gray, very calcareous. Faint to moderately distinct slightly irregular laminae and some bands. Regular thick parting. Abundant very fine disseminated calcite crystals in upper part.
1,339.6	1,342.7	Siltstone: Gray, very calcareous. Abundantly laminated with dark gray mudstone and shale. Irregular to regular thick to some thin parting. Sample of gray calcareous siltstone from 1,341.8 feet: X-ray-- calcite, quartz, dolomite, feldspar.
1,342.7	1,343.7	Limestone, mudstone, and shale: Gray buff to dark gray and some medium olive gray, very calcareous. Fairly distinct to faint slightly irregular fine to thin laminae and rare bands. Slightly irregular thick to some thin parting. Abundant moderately coarse crystalline calcite layers and patches in middle part. Sample of very thin crystalline calcite layer with some shale from 1,343.1 feet: X-ray-- calcite, dolomite, quartz, feldspar.
1,343.7	1,347.3	Marlstone: Dark gray, dolomitic to slightly calcareous. Laminated with very fine light calcareous layers and streaks. Irregular thick parting. Abundant fine to moderately coarse light calcite blebs and patches. Some very fine disseminated pyrite and/or pyrrhotite. Sample of dark gray marlstone with very fine disseminated pyrite or pyrrhotite from 1,344.7 feet: X-ray-- dolomite, quartz, feldspar, pyrite, illite.
1,347.3	1,348.3	Marlstone and oil shale: Dark gray to medium olive gray, slightly calcareous. Faintly laminated. Irregular thick to medium parting. Abundant very fine crystalline calcite laminae and streaks; some fine to moderately coarse disseminated crystals.
1,348.3	1,348.4	Missing?
1,348.4	1,350.3	Oil shale: Medium olive gray to medium and dark brownish gray, rare black in middle part. (Faint and rare distinct disrupted streaked bedding to irregular and regular laminae.) Irregular to regular thick to rare thin parting. Very abundant fine to moderately coarse calcite blebs, patches, and disseminated crystals.
1,350.3	1,351.3	Oil shale: Olive gray and olive green, calcareous. Faintly laminated. Fairly regular thick to thin parting. Abundant fine disseminated crystals in upper part. Abundant fine dense gray limy laminae in lower part. A thin buff earthy limestone (?) band at bottom.
1,351.3	1,355.0	Oil shale, limestone, and mudstone: Brownish-gray and olive-gray oil shale laminated and streaked with gray-buff to gray limestone and with occasional bands of massive dark slightly brownish-gray mudstone. Fairly regular to irregular thick to rare thin parting.

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LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,355.0	1,358.5	Limestone and very calcareous siltstone: Gray limestone and siltstone finely laminated with olive-gray to dark gray shale and mudstone. Limestone layers are commonly composed of moderately coarse sparry crystals. Irregular to regular thick to thin parting.
1,358.5	1,358.8	Missing
1,358.8	1,363.1	Limestone and mudstone: Medium to dark gray. Irregularly laminated to blebby. Regular to irregular thick to thin parting. Olive-gray sparry limestone with olive-gray lacy shale stringers in lower half foot. Sample of dark gray sparry limestone from 1,361.3 feet: X-ray-- shortite, quartz, dolomite, feldspar.
1,363.1	1,366.6	Mudstone and limestone: Dark to medium gray, dense. Regularly inter-laminated mudstone and limestone to massive mudstone with moderately coarse crystalline calcite blebs and patches. Irregular to regular thick parting. Sample of dense gray calcareous mudstone from 1,365.7 feet: X-ray-- dolomite, quartz, shortite, feldspar.
1,366.6	1,371.0	Oil shale: Medium to dark olive gray and brownish gray, some black in lower part. Faint streaked bedding; some laminae in lower part. Regular to irregular thick parting. Very abundant fine to moderately coarse disseminated calcite crystals. Sample of dark brownish-gray oil shale with disseminated crystals from 1,368.5 feet: X-ray-- shortite, dolomite, quartz, feldspar, illite.
1,371.0	1,371.4	Missing?
1,371.4	1,377.5	Marlstone: Slightly olive gray, dolomitic. Very faintly laminated to massive. Finely speckled with dark calcite crystals. Regular to irregular thick to rare thin parting; dense. Sample of dense gray dolomitic marlstone from 1,375.0 feet: X-ray-- dolomite, quartz, feldspar, illite.
1,377.5	1,380.0	Oil shale: Dark brownish gray to black. Faint streaked bedding. Irregular parting and fracture; irregular core pieces and rubble in lower part. Very abundant moderately coarse disseminated crystals.
1,380.0	1,383.5	Marlstone: Medium to light olive gray, dolomitic. Very faintly laminated. Regular to irregular thick to some thin parting. Abundant thin gray sparry calcite layers and fine disseminated crystals. Sample of crystalline calcite (or shortite?) layer from 1,382.7 feet: X-ray-- shortite; some dolomite, quartz, feldspar.
1,383.5	1,384.9	Marlstone: Slightly olive and brownish gray, dolomitic. Very faintly laminated to massive. Irregular thick parting; dense. Abundant fine dark gray calcite blebs and streaks. Abrupt change to dark oil shale below.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,384.9	1,385.9	Oil shale: Brownish black to some medium brownish and olive gray, dolomitic. Faint streaked bedding. Slightly irregular thick parting. Abundant fine to moderately coarse calcite crystals. Sample of brownish-black oil shale with disseminated crystals from 1,385.5 feet: X-ray--dolomite, quartz, feldspar, shortite, illite.
1,385.9	1,387.0	Oil shale grading to marlstone: Brownish gray to medium and light gray green, dolomitic. Faintly laminated to massive. Slightly irregular thick to medium parting. Abundant fine crystals.
1,387.0	1,392.0	Marlstone: Medium to light gray green, slightly calcareous. Laminated, streaked, and speckled with gray sparry calcite. Fairly regular thick to thin parting.
1,392.0	1,392.2	Missing
1,392.2	1,398.3	Shaly marlstone: Medium to some light gray green and olive green, dolomitic to calcareous. Faint laminae and streaked bedding. Irregular to regular thick to very thin parting; very crumbly in some parts. Abundant fine to rare coarse shortite(?) crystals and crystalline streaks.
1,398.3	1,401.9	Marlstone: As above with very abundant crystals. Commonly crumbly to powdery from exposure to moisture. Brownish-gray powdery mudstone at 1,398.8 and 1,399.6.
1,401.9	1,403.7	Trona: Medium to very dark grayish brown. Indistinctly layered. Dense to rare coarsely crystalline. Fluted outer core surface from differential solution. Chalky, nasty coating on exposed surfaces. Sample of trona from 1,401.9-1,403.7 feet: X-ray-- trona; some dolomite, quartz.
1,403.7	1,404.6	Oil shale: Black, resinous luster. Very faint streaked bedding. Irregular thick to medium parting. Abundant fine to moderately coarse disseminated crystals. Sharp irregular contact with trona above; sharp regular contact with leaner oil shale below.
1,404.6	1,405.6	Oil shale: Medium olive to gray green, dolomitic. Faint streaked bedding. Irregular thick parting. Abundant fairly coarse crystals and crystalline streaks. Abundant very fine pyrite.
1,405.6	1,408.3	Marlstone: Gray green to olive green, dolomitic to slightly calcareous. Massive to faintly streaked and laminated. Irregular thick to medium parting. Abundant fairly coarse crystalline streaks, patches, and layers.
1,408.3	1,410.4	Marlstone: Medium to some light and rare dark olive gray and olive green. Faint irregular non parallel laminae in upper part to massive in lower part. Fairly regular to irregular thick to medium parting. Abundant crystals.
1,410.4	1,411.4	Oil shale: Medium to dark olive gray and brownish gray. Faint streaked bedding and some discontinuous laminae. Irregular thick parting. Abundant moderately coarse disseminated crystals.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,411.4	1,413.8	Oil shale grading to marlstone: Olive gray and olive green to gray green. Faint streaked bedding; some very faint laminae in lower part. Irregular to fairly regular thick to medium parting. Abundant fine crystals. Samples of olive-green oil shale with very abundant crystals from 1,411.7 feet: X-ray-- dolomite, shortite, quartz, feldspar, illite.
1,413.8	1,418.4	Marlstone: Gray green to olive green. Faintly laminated and streaked to massive. Regular to irregular thick to very thin parting; firm in upper part to crumbly in lower part. Abundant crystals.
1,418.4	1,420.8	Oil shale: Olive gray. Faint streaked bedding. Irregular to regular thick parting. Very abundant moderately coarse to fine disseminated crystals.
1,420.8	1,424.0	Marlstone: Medium to light olive green. Faintly streaked. Irregular thick to some thin parting. Very abundant disseminated crystals.
1,424.0	1,427.6	Marlstone: Medium to light olive gray. Laminated with fine to 3/4-inch coarse to fine-grained crystalline layers. Irregular to regular thick to rare thin parting.
1,427.6	1,430.1	Oil shale: Medium and rare light olive gray and olive green, medium and rare dark brownish gray in lower 0.7 foot, dolomitic. Massive with few thin light and dark laminae. Irregular to rare regular thick to medium parting. Abundant fine to coarse crystals.
1,430.1	1,431.3	Oil shale: Olive and olive green. Faint regular streaks and discontinuous laminae. Irregular to regular thick parting. Very abundant fine disseminated crystals.
1,431.3	1,433.8	Marlstone: Olive green and greenish gray, dolomitic. Massive to faintly laminated; fairly abundant distinct dark gray sparry laminae. Regular to irregular thick to rare thin parting. Abundant fine disseminated crystals. Greenish-buff marlstone with abundant variously oriented coarse tabular crystals at 1,433.3-1,433.7. Sample of marlstone with very abundant coarse tabular crystals from 1,433.3-1,433.7 feet: X-ray-- shortite; some dolomite, quartz, feldspar.
1,433.8	1,435.0	Oil shale: Olive gray, dolomitic. Indistinctly banded with layers of coarse tabular crystals as above. Irregular to regular thick to rare thin parting.
1,435.0	1,437.0	Marlstone: Like 1,431.3-1,433.8. Fine-grained yellow-buff marlstone conglomerate at 1,436.2-1,436.9. Sample of marlstone conglomerate from 1,436.6 feet: X-ray-- dolomite; some quartz, feldspar.
1,437.0	1,438.0	Oil shale: Olive gray, dolomitic to slightly calcareous. Massive; laced with fine crystalline stringers and streaks (some prismatic). Irregular thick parting.

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LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,438.0	1,454.2	Mudstone: Gray green, some olive gray at 1,438.0-1,439.0, 1,446.3-1,447.3, and 1,452.4-1,454.2. Massive and rarely streaked; laced with abundant fine gray crystalline stringers. Irregular thick parting. Faintly streaked light gray very calcareous siltstone at 1,440.2-1,440.6. Sample of gray-green mudstone laced with crystalline stringers from 1,446.2 feet: X-ray-- shortite, illite, dolomite, feldspar, quartz.
1,454.2	1,456.0	Oil shale: Olive gray and olive green, dolomitic. Massive; laced with crystalline stringers as above down to 1,455.4; laminated with very thin to fine crystalline layers in lower part. Irregular thick to some thin parting.
1,456.0	1,457.0	Shortite: Pale slightly greenish, yellowish, and brownish; translucent to transparent. Coarse crystals, sometimes in small rosettes. Finely streaked and laminated with oil shale as above and below; wavy bedding in lower part. Sample of shortite from 1,456.8 feet: X-ray-- shortite.
1,457.0	1,458.8	Oil shale: Olive gray and olive green, some olive brown in lower part. Faint streaked bedding. Irregular thick to some thin parting. Abundant fine disseminated crystals and some crystalline streaks. Abundant very fine pyrite in browner parts.
1,458.8	1,461.0	Marlstone: Greenish gray, dolomitic, shaly. Massive; abundant irregular bands of fine to coarse crystalline shortite. Fairly regular to irregular thick to very thin parting.
1,461.0	1,465.0	Marlstone and mudstone: Medium-dark to some light greenish gray. Massive to faintly streaked; common thin to thick shortite layers. Irregular to fairly regular thick to rare thin parting. Colorless to brownish silky trona at 1,463.2-1,463.3 and 1,464.1-1,464.5. Some very fine disseminated pyrite and pyrrhotite. Sample of silky trona from 1,463.2 feet: X-ray-- trona.
1,465.0	1,476.0	Shortite and marlstone: Thin to thick layers of crystalline shortite laminated and banded with medium and light greenish to olive-gray marlstone. Regular to irregular thick to some thin parting.
1,476.0	1,479.0	Missing
1,479.0	1,480.0	Marlstone: Medium to light olive gray, dolomitic. Faintly banded to laminated. Irregular to fairly regular thick parting. Abundant coarse to fine disseminated shortite.
1,480.0	1,486.0	Oil shale: Medium olive gray and olive green and some medium to rare dark brownish gray. Faintly streaked and laminated to massive. Fairly regular to irregular thick to some medium parting; irregular slight to coarse hackly fracture. Very abundant fine to moderately coarse crystals. Sample of olive-gray oil shale with abundant crystals from 1,481.3 feet: X-ray-- shortite, dolomite, quartz, illite, feldspar, trona.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,486.0	1,489.4	Oil shale: Olive green and olive gray, dolomitic. Faintly streaked and laminated. Irregular thick to medium parting; some very thin irregular shaly parting in middle part. Abundant crystals. (1,488.3-1,488.4 missing?)
1,489.4	1,494.6	Oil shale: As above. Abundant crystals commonly concentrated in thin to 3/4-inch layers. Sample of olive-gray oil shale without crystals from 1,492.7 feet: X-ray-- dolomite, quartz, illite, feldspar.
1,494.6	1,498.1	Oil shale: Medium olive gray and medium to some dark brownish gray. Faint streaked bedding. Slightly irregular thick parting. Very abundant fairly coarse disseminated crystals; very coarse crystals at 1,495.2 - 1,495.8.
1,498.1	1,509.9	Marlstone and oil shale: Medium and some light olive gray to gray green. Faint streaked bedding and some laminae and bands. Irregular thick to medium parting. Very abundant fine to coarse shortite commonly concentrated in thin to thick layers.
1,509.9	1,511.4	Oil shale: Olive gray and olive brown, brownish gray to brownish black in lower half foot. Irregular thick parting. Abundant crystalline patches and streaks. Sample of dark brownish-gray oil shale from 1,511.2 feet: X-ray-- dolomite, quartz, feldspar, pyrite.
1,511.4	1,513.4	Oil shale: Olive gray and olive green, dolomitic. Faint streaked bedding. Irregular thick to medium parting. Abundant crystals; becoming laminated with dark gray sparry layers in lower part. Sample of olive-gray oil shale with dark gray sparry layers from 1,513.2 feet: X-ray-- dolomite, quartz, shortite, feldspar, calcite.
1,513.4	1,516.0	Shortite and oil shale: Thick to thin light brownish-gray to dark gray crystalline layers interbedded with oil shale as above. Very thin white earthy biotitic tuff at 1,515.4. Sample of very thick crystalline layer from 1,514.1 feet: X-ray-- shortite, bradleyite, dolomite, quartz.
1,516.0	1,518.2	Oil shale (?): Olive gray to gray green, dolomitic. Faintly streaked. Irregular thick to thin parting. Abundant moderately coarse crystals commonly concentrated in streaks and patches.
1,518.2	1,519.4	Marlstone and shortite: Olive-green and gray-green marlstone distinctly laminated and streaked with dark gray sparry shortite (like 1,513.2).
1,519.4	1,521.5	Marlstone and shortite: Medium to light olive-gray marlstone with abundant streaks, laminae, and bands of coarsely crystalline shortite. Becoming predominantly shortite in lower part.
1,521.5	1,522.6	Oil shale: Olive gray and olive brown, dolomitic. Very faint streaked bedding and rare laminae. Irregular thick to thin parting; irregular hackly fracture. Rare shortite streaks. (Incorrect core sequence; about 20 percent of the interval is gray-green marlstone with abundant shortite as below.) Sample of olive-brown oil shale from 1,522.4 feet: X-ray-- dolomite, quartz, feldspar, illite.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,522.6	1,522.7	Missing?
1,522.7	1,525.0	Shaly marlstone: Gray green, slightly calcareous to dolomitic. Faintly streaked and laminated. Irregular thick to very thin parting; hackly fracture. Abundant very thin to 1-inch shortite layers. Sample of gray-green shaly marlstone from 1,522.9 feet: X-ray-- dolomite, loughlinitite, illite.
1,525.0	1,529.4	Shortite and marlstone: Thick layers of coarsely crystalline slightly greenish to brownish shortite laminated with gray-green marlstone as above. Marlstone becoming brownish near bottom. Orangish-tan to white banded tuff at 1,526.7 - 1,527.2. Sample of orangish-tan tuff from 1,526.8 feet: X-ray-- K feldspar, halite, loughlinitite, pyrite. Sample of white tuff from 1,527.2 feet: X-ray-- K feldspar, pyrite, halite. Sample of thick coarsely crystalline layer from 1,528.8 feet: X-ray-- shortite, bradleyite.
1,529.4	1,530.5	Marlstone and mudstone: Olive gray to gray green, dolomitic to slightly calcareous. Very faintly streaked to massive. Irregular thick to medium parting. Abundant moderately coarse to fine disseminated crystals and crystalline streaks.
1,530.5	1,547.0	Mudstone: Gray green to olive green, slightly to moderately calcareous. Faintly streaked and variegated to massive; rarely laminated. Irregular thick parting. Abundant fine dark gray irregular to lacy crystalline streaks and stringers (like 1,446.2); very abundant pyrite in some stringers. Some gray calcareous siltstone from 1,537.0 to 1,539.0.
1,547.0	1,549.0	Mudstone: Olive green and olive gray to dark slightly brownish gray, dolomitic. Faintly streaked and laminated to irregularly layered. Irregular thick to medium parting. Abundant dense to coarsely crystalline streaks, layers, patches, and blebs.
1,549.0	1,550.7	Marlstone: Light brownish gray, calcareous. Mottled and streaked with coarse elongated crystals (occasionally in rosette aggregates). Irregular thick parting. Samples of light brownish-gray marlstone with abundant crystals from 1,549.9 feet: X-ray-- shortite, quartz, bradleyite, feldspar.
1,550.7	1,551.7	Marlstone and oil shale: Light brownish gray to medium and rare dark olive gray, calcareous to dolomitic. Irregularly streaked to regularly banded. Irregular to regular thick to medium parting. Abundant coarse shortite crystals commonly concentrated in thin to thick layers.
1,551.7	1,555.2	Oil shale: Medium to rare dark olive gray and olive brown. Faint streaked bedding and some irregular laminae. Slightly irregular thick parting. Very abundant moderately coarse to fine disseminated crystals and small crystalline blebs. Thin slightly wavy tan algal (?) dolomite layer at 1,553.8. (1,554.4 - 1,554.6 missing?)

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LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,555.2	1,557.3	Marlstone: Olive gray and olive green, dolomitic. Abundant fine dark gray sparry layers. Abundant fine disseminated crystals. Fairly regular to irregular thick to medium parting. A 2-inch slightly brownish-gray mudstone band with disseminated crystals near bottom.
1,557.3	1,559.5	Shortite and marlstone: Thin to thick layers of coarsely crystalline shortite laminated with medium to light olive-gray and brownish-gray marlstone. Becoming mostly marlstone with abundant disseminated shortite crystals in lower half foot. Regular medium to thick parting.
1,559.5	1,561.4	Oil shale: Medium to rare dark and light olive gray. Faintly laminated to streaked. Regular to irregular medium to thick parting. Very abundant shortite commonly concentrated in thin regular layers to irregular streaks and blebs. (1,560.6 - 1,560.8 missing?) Sample of oil shale with abundant crystalline streaks and blebs from 1,560.2 feet: X-ray-- quartz, shortite, dolomite, feldspar.
1,561.4	1,563.5	Oil shale: Olive gray and olive green, some medium to dark brownish gray in lower part, dolomitic. Faint streaked bedding. Regular to irregular thick to medium parting. Abundant medium-fine disseminated crystals and crystalline streaks.
1,563.5	1,565.7	Mudstone and siltstone: Medium slightly olive and brownish gray to light gray, calcareous. Faintly streaked and mottled; some irregular banding. Irregular to regular thick parting. Abundant crystalline blebs and streaks. Sample of light gray siltstone from 1,564.4 feet: X-ray-- quartz, dolomite, feldspar, shortite.
1,565.7	1,569.6	Marlstone, mudstone, and limestone (?): Medium to dark slightly olive and brownish-gray marlstone and mudstone faintly layered and streaked with dense dark gray limestone. Irregular to fairly regular thick to some medium parting. Some very fine disseminated pyrite and pyrrhotite. Sample of dark gray limestone (?) with some marlstone from 1,566.2 feet: X-ray-- quartz, shortite, dolomite, calcite, pyrite, illite. Sample of dark slightly brownish-gray mudstone from 1,569.3 feet: X-ray-- quartz, shortite, dolomite, calcite, analcime, feldspar, illite.
1,569.6	1,575.5	Marlstone and mudstone: Greenish gray and olive gray, slightly calcareous to dolomitic. Faint streaked bedding. Irregular to fairly regular thick to medium parting. Abundant dense dark to medium gray calcite blebs, streaks, and layers.
1,575.5	1,578.3	Marlstone (oil shale in part): Olive gray and olive green to brownish gray, dolomitic. Faintly laminated. Irregular to fairly regular thick to rare thin parting. Abundant dense to fine-crystalline streaks and laminae.

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LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,578.3	1,579.1	Oil shale: Dark brownish gray to black and rare medium to dark brown. Faint very fine streaked bedding and discontinuous laminae. Irregular to fairly regular thick parting. Abundant fine disseminated crystals.
1,579.1	1,580.5	Oil shale: Medium and dark brownish gray to olive green. Faint very fine streaked bedding and crystal-disrupted laminae. Fairly regular to irregular thick to medium parting. Thin to fine interconnected fine-grained crystalline stringers in upper 0.4 foot; very abundant medium-fine disseminated crystals in lower part.
1,580.5	1,583.1	Marlstone: Olive gray and olive green, dolomitic to calcareous. Faintly laminated to massive. Irregular thick to medium parting. Abundant dense to moderately coarse crystalline laminae and disseminated crystals. (1,580.8 - 1,581.0 missing?)
1,583.1	1,584.2	Limestone(?): Olive-gray to grayish-brown moderately coarse to fine-grained crystalline layers with some fine regular to non parallel marlstone laminae as above and below. Sample of olive-gray crystalline layer from 1,583.6 feet: X-ray-- shortite, quartz, feldspar, dolomite.
1,584.2	1,584.9	Oil shale: Olive gray to grayish brown and some dark brownish gray, dolomitic. Very faint bedding with some fine distinct regular non parallel laminae. Irregular thick to some thin parting. Some fine-grained crystalline streaks and layers--mostly in darker parts.
1,584.9	1,585.7	Oil shale: Black to dark and rare medium brownish gray, dolomitic. Faint streaked bedding and some irregular laminae. Slightly irregular thick parting. Abundant fine crystalline streaks and disseminated crystals. Sample of black to dark brownish-gray oil shale with fine crystals from 1,585.1 feet: X-ray-- dolomite, quartz, shortite, feldspar.
1,585.7	1,594.0	Mudstone: Olive gray, slightly to moderately calcareous. Massive to faintly variegated. Irregular thick to some medium parting. Some silty laminae in upper part. Thin pebbly limestone conglomerate with abundant massive pyrite blebs at top. Sample of olive-gray mudstone from 1,588.9 feet: X-ray-- illite, feldspar, analcime, quartz, dolomite, calcite, pyrite.
1,594.0	1,597.1	Mudstone: Medium-dark olive gray, slightly to moderately calcareous. Massive to very faintly streaked. Very irregular thin to thick parting; some rubble.
1,597.1	1,599.0	Marlstone: Olive gray, slightly calcareous to dolomitic. Faint streaked bedding. Irregular medium to thin parting. Occasional light olive-gray limy streaks.
1,599.0	1,600.2	Oil shale: Olive gray and olive brown, dolomitic. Very faintly streaked. Irregular to regular thin to thick parting. Becoming laminated and banded with very fine crystalline light brownish-gray to buff limestone (?) in lower half. Sample of limestone (?) with some fine wavy oil-shale laminae from 1,599.7 feet: X-ray-- calcite, quartz, dolomite.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,600.2	1,601.6	Oil shale: Olive gray and olive brown to some medium and rare dark grayish brown, dolomitic. Very faint to some moderately distinct streaked bedding and discontinuous laminae. Irregular medium to thick parting. Rare fine limestone streaks. Thin light brownish-gray calcareous siltstone laminae at bottom.
1,601.6	1,618.0	Mudstone and marlstone: Olive gray and greenish gray, slightly calcareous. Faintly streaked and variegated to massive; some very faint disrupted laminae. Irregular thick to some medium parting. Some very fine vertical to lacy gray calcite stringers in lower part.
1,618.0	1,626.4	Marlstone and mudstone: As above with abundant gray calcite streaks, stringers, and layers.
1,626.4	1,627.6	Oil shale: Olive gray and brownish gray, some dark brownish gray to rare black in lower part, dolomitic. Very faintly laminated and streaked. Irregular thick to medium parting. Abundant fine dense crystalline streaks, laminae, and blebs.
1,627.6	1,628.6	Oil shale: Black to dark brownish gray, dolomitic. Faint streaked bedding. Slightly irregular thick to medium parting. Abundant fine disseminated crystals and crystalline streaks. Sharp slightly wavy contact with shortite below.
1,628.6	1,629.0	Shortite (?): Brown to brownish gray. Coarse blebby to tabular crystals in upper part; faint thin slightly irregular dense layers in lower 2 inches. Some open to tar-filled intercrystalline cavities in tabular part. Sample of coarse brown crystals from 1,628.7 feet: X-ray--shortite, quartz, dolomite, feldspar. Sample of dense brownish-gray rock from 1,628.9 feet: X-ray--shortite, analcime, dolomite, quartz, calcite, illite.
1,629.0	1,629.9	Marlstone: Olive gray, some buff and light brownish gray in upper part. Moderately distinct to faint laminae and bands. Irregular to regular thick to thin parting. Common thin to fine dense dark gray to gray-buff crystalline laminae. Faintly laminated dense grayish brown band at 1,629.3 - 1,629.5 (like 1,628.9).
1,629.9	1,630.0	Missing
1,630.0	1,632.1	Marlstone: Medium to some light greenish gray and olive green, dolomitic. Moderately distinct to faint laminae and rare bands. Irregular to fairly regular thick to some medium parting. Abundant thin to 3/4-inch dark gray to light brownish-gray dense crystalline layers.
1,632.1	1,634.4	Marlstone: Medium to some light olive gray and olive brown. Faint laminae and rare bands. Regular to irregular thick parting. Abundant fine brownish-gray crystalline laminae; few thin to thick bands in upper part.
1,634.4	1,636.5	Marlstone: Olive gray and olive green, dolomitic. Faintly laminated. Irregular to regular thick to medium parting. Fairly abundant fine dense crystalline laminae.

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LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,636.5	1,638.5	Marlstone: Medium to light olive green, dolomitic. Faint to moderately distinct laminae and bands. Irregular to regular thick to some medium parting. Abundant dense gray to brownish-gray crystalline laminae, disseminated crystals, and fine lacy stringers. Sample of light olive-green marlstone with lacy crystalline stringers from 1,638.2 feet: X-ray-- shortite, dolomite, quartz, feldspar.
1,638.5	1,638.9	Oil shale (?): Dark slightly brownish gray. Faintly streaked. Irregular thick to thin parting. Abundant fine high-angle crystalline streaks.
1,638.9	1,639.7	Shortite (?) and marlstone: Coarse to fine crystalline brownish shortite interbedded with greenish-gray marlstone in upper part: 3-inch massive shortite band at bottom.
1,639.7	1,640.8	Oil shale: Medium to dark olive gray and brownish gray. Faint to moderately distinct streaked bedding and crystal-disrupted laminae. Fairly regular thick parting. Very abundant medium-fine disseminated crystals. Sample of oil shale with disseminated crystals from 1,640.5 feet: X-ray-- dolomite, shortite, quartz, feldspar.
1,640.8	1,641.4	Oil shale: Medium and rare dark olive gray to olive green. Faint to some distinct streaked bedding. Slightly irregular thick parting. Abundant fine disseminated crystals. Thin brown medium-coarse crystalline layer at bottom.
1,641.4	1,641.6	Missing?
1,641.6	1,643.0	Mudstone: Gray green and some neutral gray, olive-brown oil shale in lower 3 inches. Mottled to massive to slightly wavy laminae. Irregular thick parting. Some dense crystalline laminae and bands in lower part. (Section could be upside down.)
1,643.0	1,644.3	Mudstone: Greenish gray, dolomitic to slightly calcareous. Faintly streaked with gray siltstone. Abundant biotite in silty parts.
1,644.3	1,648.1	Siltstone and very fine sandstone: Light gray and gray buff, slightly calcareous. Faint slightly irregular streaked bedding and some discontinuous laminae. Irregular to some fairly regular thick to medium parting. Abundant muscovite and biotite. Few olive-gray and brownish-gray mudstone bands.
1,648.1	1,649.0	Mudstone: Medium-dark olive gray, dolomitic. Faintly streaked to massive. Irregular thick to medium parting.
1,649.0	1,649.1	Missing?
1,649.1	1,655.1	Mudstone: Medium and rare dark olive green to olive brown, dolomitic. Faintly streaked and mottled to massive; rarely laminated. Irregular thick to rare thin parting. Light gray siltstone with vitreous black carbonaceous streak in upper 2 inches.
1,655.1	1,657.3	Oil shale: Olive green in upper part to olive gray and brownish gray in lower part, dolomitic. Faint laminae and thin bands. Irregular thick to some thin parting. Abundant dense gray to brownish-gray crystalline laminae in upper part; abundant fine dense crystalline blebs in lower part. Sample of crystalline laminae from 1,655.9 feet: X-ray-- calcite, shortite; trace quartz, feldspar.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,657.3	1,660.0	Mudstone: Light slightly greenish and olive gray, moderately to slightly calcareous. Massive to faintly mottled and some very faint slightly irregular laminae. Irregular to fairly regular thick parting. A 1-inch pebbly dolomite conglomerate at top. Sample of light slightly greenish-gray mudstone from 1,658.5 feet: X-ray-- Na and K feldspars, pyrite, dolomite, quartz, illite.
1,660.0	1,662.1	Mudstone: Olive gray to grayish brown, dolomitic, massive. Fairly regular to irregular thick parting. Rare woody plant fragments on parting surfaces in lower part.
1,662.1	1,665.5	Siltstone and mudstone: Medium brownish and olive gray to gray buff and light gray, slightly to moderately calcareous. Faint streaked bedding; some slight crossbedding. Irregular thick to rare medium and thin parting. Abundant muscovite and biotite. (1,662.6 - 1,662.7 missing?) Sample of light slightly greenish-gray siltstone with abundant mica from 1,665.3 feet: X-ray-- quartz, Na and K feldspars, dolomite, mica.
1,665.5	1,685.0	Mudstone: Medium and rare light olive gray and olive green, moderately to very slightly calcareous. Faintly streaked and rarely laminated to variegated and amssive. Irregular thick parting. (1,673.3 - 1,673.5 and 1,680.9 - 1,681.1 missing?)
1,685.0	1,697.0	Mudstone: As above. Some dense gray calcareous streaks and blebs. Dark brownish-gray mudstone at 1,696.0 - 1,696.3.
1,697.0	1,698.0	Marlstone and limestone (?): Olive-gray marlstone laminated and banded with light slightly olive and brownish-gray dense very fine crystalline limestone. Slightly irregular thick parting.
1,698.0	1,698.7	Limestone (?) and oil shale: Light brownish-gray to medium grayish-brown fine to medium-fine crystalline limestone (?) irregularly laminated and streaked with medium to dark olive-gray and brownish-gray oil shale. Sample of medium-fine crystalline limestone (?) with fine dark oil-shale laminae and streaks from 1,698.4 feet: X-ray-- dolomite, shortite, quartz, feldspar.
1,698.7	1,699.7	Oil shale: Medium and rare dark olive brown to olive green. Faint streaked bedding. Irregular to fairly regular thick parting. Abundant fine crystalline streaks and blebs to moderately coarse disseminated crystals.
1,699.7	1,701.4	Oil shale: Olive gray to grayish green, dolomitic. Faint streaked bedding. Irregular thick to thin parting. Abundant fine to moderately coarse crystalline streaks and blebs. Sample of grayish-green marlstone (oil shale?) from 1,701.1 feet: X-ray-- dolomite, quartz, loughlinite, feldspar, illite.
1,701.4	1,710.0	Marlstone and limestone (?): Greenish-gray marlstone banded and laminated with very fine crystalline almost neutral gray limestone. Irregular to fairly regular thick to medium parting. A 1-inch

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
		faintly laminated buff-white mudstone band at 1,709.0.
		Sample of fine-grained crystalline band from 1,706.7 feet: X-ray-- shortite, northupite, quartz, feldspar.
1,710.0	1,713.0	Oil shale and limestone (?): Olive-green and olive-gray oil shale banded, laminated, and streaked with limestone (?) as above. Irregular thick to thin parting; hackly fracture. Abundant moderately coarse disseminated crystals in oil shale in upper part. (1,711.7 - 1,711.9 missing?)
1,713.0	1,714.3	Oil shale: Olive gray to olive brown. Faint streaked bedding. Irregular thick to thin parting. Abundant fine crystalline stringers, streaks, and blebs.
1,714.3	1,715.5	Oil shale: Olive gray and olive green, dolomitic. Faint streaked bedding and some laminae. Irregular thick to medium parting. Abundant fine dark gray crystalline streaks and disseminated crystals.
1,715.5	1,716.7	Marlstone: Olive green, dolomitic. Faintly streaked. Irregular to regular thick parting. Abundant fine dark gray crystalline streaks and disseminated crystals.
1,716.7	1,718.0	Marlstone and shortite (?): Marlstone as above laminated and banded with dense very fine to moderately coarse crystalline shortite.
1,718.0	1,729.0	Oil shale: Olive gray and olive green to some brownish gray, dolomitic. Faint streaked bedding. Irregular thick to rare thin parting. Abundant moderately coarse to fine crystalline blebs, streaks, stringers, and laminae. Sample of olive-gray oil shale from 1,719.6 feet: X-ray-- dolomite, quartz, feldspar, illite.
1,720.0	1,722.4	Oil shale: As above with very abundant moderately coarse disseminated crystals.
1,722.4	1,727.0	Oil shale: Medium to rare light olive green and olive gray, dolomitic. Faint and rare distinct laminae and streaked bedding. Irregular to regular thick to thin parting. Abundant disseminated crystals and crystalline laminae and streaks.
1,727.0	1,728.0	Oil shale: Olive gray to dark grayish brown. Faint streaked bedding. Irregular thick to medium parting. Abundant moderately coarse to fine disseminated crystals. Thin irregular dense brown dolomite band in middle. Sample of dark grayish-brown oil shale with abundant disseminated crystals from 1,727.4 feet: X-ray-- dolomite, quartz, shortite, feldspar, illite.
1,728.0	1,729.5	Oil shale: Olive gray to olive green. Faint streaked bedding. Regular to irregular thick to rare thin parting. Abundant disseminated crystals as above.
1,729.5	1,730.6	Marlstone: Medium-light olive green to olive gray. Faint streaked bedding and some laminae. Irregular thick parting. Abundant disseminated crystals and crystalline layers. Thin dense buff dolomite band with disseminated crystals near top. Very thin flat rounded dolomite pebbles at 1,725.7.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,730.6	1,732.6	Shortite (?): Medium to dark brownish to neutral gray dense coarse to fine crystalline shortite (?) with some laminae and streaks of medium to dark olive to brownish-gray marlstone and oil shale. Irregular to fairly regular thick to medium parting. Sample of very thick dense fine-grained crystalline layer from 1,732.0 feet: X-ray-- northupite, shortite, trona.
1,732.6	1,735.3	Oil shale: Olive gray and olive green to some grayish brown. Faint streaked bedding. Fairly regular to irregular thick parting. Abundant fine crystalline streaks and blebs.
1,735.3	1,736.3	Oil shale: Olive green, becoming dark slightly brownish gray near bottom. Very faintly streaked. Irregular thick to medium parting. Abundant fine to coarse disseminated crystals.
1,736.3	1,736.4	Missing?
1,736.4	1,744.0	Marlstone and limestone (?): Gray-green marlstone streaked, laminated, and banded with very fine-grained gray to brownish-gray limestone. Irregular thick to medium parting.
1,744.0	1,745.0	Marlstone: Medium to some light olive green and olive gray. Faint distorted streaked bedding and some irregular laminae. Irregular thick to medium parting. Abundant irregular fine-grained crystalline stringers, patches, and laminae. A 2-inch light to medium gray biotitic tuff at bottom. Sample of light gray tuff from 1,744.9 feet: X-ray-- K and Na feldspars, biotite, trona, northupite.
1,745.0	1,750.0	Marlstone and limestone (?): Green to greenish-gray marlstone interbedded with very thick to thin dense greenish-gray to brownish-gray limestone. Abundant disseminated dense crystal blebs in marlstone. Irregular to regular thick to medium parting. Sample of greenish-gray marlstone with disseminated crystals from 1,748.2 feet: X-ray-- shortite, northupite, quartz.
1,750.0	1,751.9	Limestone (?): Dark brownish and greenish gray, dense, very fine crystalline. Massive; some faint interbedded marlstone. Irregular thick parting; conchoidal fracture. Sample of dense dark brownish to greenish-gray limestone (?) from 1,751.0 feet: northupite, shortite, quartz.
1,751.9	1,753.4	Oil shale: Medium-dark olive gray, dolomitic. Very faint streaked bedding. Irregular thick to medium parting. Abundant disseminated crystals and crystalline blebs and streaks.
1,753.4	1,753.6	Missing?
1,753.6	1,756.1	Oil shale: Medium to dark olive gray and some brownish gray. Faint streaked bedding. Irregular thick parting. Very abundant coarsely crystalline blebs, streaks, and patches.
1,756.1	1,757.5	Oil shale: Olive gray. Very faintly streaked to massive. Irregular thick to medium parting. Fairly abundant crystals concentrated in thin to thick zones.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,757.5	1,759.5	Oil shale: Black to some dark and rare medium brownish gray. Faint streaked bedding. Irregular thick parting. Abundant fairly coarse disseminated crystals and crystalline streaks. Some fine tan to buff tuff stringers in lower part. Large dense black to brownish-gray blebby nodule at 1,758.4. Sample of black oil shale with disseminated crystals from 1,757.9 feet: X-ray-- dolomite, quartz, shortite, northupite, feldspar.
1,759.5	1,760.2	Oil shale: Medium brownish gray to olive gray. Faintly streaked. Irregular thick parting. Abundant disseminated crystals. Thin buff earthy stringer at bottom.
1,760.2	1,761.4	Oil shale: Olive green and olive gray, dolomitic. Massive to faintly streaked. Irregular thick to rare thin parting. Abundant disseminated to layered crystals.
1,761.4	1,764.2	Marlstone: Medium to light greenish gray and olive green, dolomitic. Massive to laminated. Irregular to fairly regular thick to medium parting. Abundant crystals becoming mostly layered in lower part.
1,764.2	1,765.2	Marlstone: Olive green and olive gray. <u>Very</u> abundant coarse disseminated crystals. Few dense buff laminae in lower part.
1,765.2	1,765.4	Missing
1,765.4	1,767.6	Shortite and oil shale: Fairly coarse crystalline layers with occasional oil-shale streaks grading to medium to dark brownish-gray oil shale with very abundant disseminated crystals. Irregular thick parting.
1,767.6	1,768.2	Oil shale: Dark brownish gray to black. Faint very distorted streaked bedding. Irregular thick parting. Very abundant fine-grained crystalline streaks, stringers, and blebs.
1,768.2	1,769.6	Oil shale: Dark brownish gray to medium olive gray. <u>Very faint</u> streaked bedding. Fairly regular thick parting. Very abundant crystalline blebs and disseminated crystals.
1,769.6	1,771.8	Oil shale: Olive gray to olive green. Very abundant crystals and crystalline layers.
1,771.8	1,772.8	Oil shale: Medium to dark olive gray. Very abundant disseminated crystals.
1,772.8	1,773.8	Oil shale: Medium olive gray becoming brownish gray near bottom. Faintly streaked to massive. Fairly abundant disseminated crystals. Irregular thick to medium parting.
1,773.8	1,775.4	Oil shale: Brownish gray to black. Faint to moderately distinct distorted to regular streaks and laminae. Irregular to fairly regular thick to rare thin parting. Abundant crystalline streaks, blebs, and patches.
1,775.4	1,776.4	Oil shale: Dark brownish gray to medium olive gray. Faintly streaked to massive. Irregular thick parting. Very abundant disseminated crystals. Sample of brownish-gray oil shale with <u>very</u> abundant crystals from 1,775.8 feet: X-ray-- northupite, shortite, quartz, feldspar.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,776.4	1,778.7	Oil shale and marlstone: Medium to light olive gray and olive green. Very abundant crystals.
1,778.7	1,780.7	Limestone (?): Dark to light brownish gray. Laminated and banded to massive. Irregular to regular thick parting. Dense and fine-grained with some coarse disseminated crystals. Some marlstone laminae in upper part. Sample of light brownish-gray fine-grained crystalline rock from 1,779.6 feet: X-ray-- shortite, northupite, quartz. Sample of dense dark brownish-gray rock with disseminated crystals from 1,780.3 feet: X-ray-- northupite, shortite, quartz.
1,780.7	1,781.7	Trona: Tan to dark brownish gray, dense to fine crystalline. Irregularly banded and laminated. Differential solution has produced deep grooves and ridges on outside of core. Dark brownish-gray zones are like dense rock above (1,780.3).
1,781.7	1,782.0	Missing?
1,782.0	1,785.9	Trona: Dark grayish brown to pale honey brown, dense to coarsely crystalline. Mostly eroded to 1- to 2-inch diameter core; few resistant bands and laminae. Discontinuous core pieces; length and continuity questionable. Outside of core coated with white powder. Sample of coarsely crystalline pale honey-brown trona from 1,784.2 feet: X-ray-- wegscheiderite.
1,785.9	1,786.9	Oil shale: Very dark brownish gray. Faint streaked bedding becoming inclined about 25° in lower part. Fairly regular thick parting. Tan to buff marlstone stringer in lower 1/4 inch.
1,786.9	1,787.0	Missing?
1,787.0	1,788.7	Oil shale (??) and mudstone: Very finely interlaminated and streaked dark brownish-gray dense rock (like 1,780.3?) and oil shale, with few thick bands of medium slightly brownish-gray mudstone with fine dark dense crystalline streaks. Bedding irregularly inclined up to 30°. Irregular to regular thick to medium parting. Sample of brownish-gray mudstone with fine dark dense crystalline streaks from 1,787.5 feet: quartz, feldspar, shortite, northupite, pyrite. Sample of dark dense crystalline rock with very fine oil-shale (?) streaks and laminae from 1,787.8 feet: X-ray-- shortite, northupite, quartz.
1,788.7	1,789.8	Marlstone (oil shale?): Dark to some medium brownish gray and rare medium olive gray, mostly dense to coarsely crystalline. Irregular thick parting.
1,789.8	1,791.2	Marlstone (oil shale?): Medium olive gray to dark brownish gray. Faintly streaked to mottled. Irregular to regular thick parting. Very abundant coarse crystals.
1,791.2	1,792.4	Marlstone: Like 1,788.7-1,789.8.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,792.4	1,793.7	Oil shale: Dark brownish gray and some black. Faintly laminated to massive. Irregular to regular thick parting. Very abundant coarse disseminated crystals from 1,792.6 to 1,793.3; some in lower 0.4 foot.
1,793.7	1,795.4	Oil shale: Dark to medium grayish brown and olive gray, calcareous. Faint streaked bedding and rare laminae. Regular to irregular thick parting. Abundant medium to fine disseminated crystals.
1,795.4	1,796.1	Marlstone: Brownish gray to almost neutral gray. Faintly streaked to mottled. Irregular thick parting. Abundant moderately coarse disseminated crystals in upper part. Fairly abundant dense dark gray mineral blebs in lower part.
1,796.1	1,796.5	Marlstone (?): Buff to tan. Faintly laminated to massive; distinctly mottled with dark gray and grayish-brown mineral blebs. Sample of buff marlstone with dark mineral blebs from 1,796.4 feet: X-ray-- K feldspar, quartz, shortite, northupite, pyrite.
1,796.5	1,796.6	Missing?
1,796.6	1,798.3	Marlstone: Medium to some light olive green and greenish gray, rare tan to buff, dolomitic. Faint to distinct laminae and bands. Irregular thick to rare thin parting. Abundant thin to 3/4-inch dense dark slightly brownish-gray crystalline layers.
1,798.3	1,799.4	Oil shale (?): Medium to dark brownish gray and olive gray. Faintly streaked to laminated and banded. Irregular thick to rare thin parting. Abundant thin to thick fine-grained crystalline layers. Some thin buff to brown marlstone stringers in upper part.
1,799.4	1,800.3	Oil shale: Dark brownish gray to brownish black. Faint regular to distorted streaked bedding. Slightly irregular thick parting. Abundant fine disseminated crystals and crystalline blebs. Sharp fairly regular contact with mudstone below. Sample of dark brownish-gray oil shale with crystalline blebs from 1,800.1 feet: X-ray-- dolomite, quartz, shortite, northupite, feldspar.
1,800.3	1,804.0	Mudstone: Medium to light gray green, dolomitic to calcareous. Faintly streaked to finely mottled. Irregular thick parting. Abundant fine pyrite specks. Sample of gray-green mudstone from 1,800.4 feet: X-ray-- K and Na feldspars, illite.
1,804.0	1,806.0	Siltstone and very fine sandstone: Gray-buff with green streaks and patches, very calcareous. Fairly distinct streaked bedding; some slight crossbedding. Slightly irregular thick parting. Abundant micaceous streaks. Sample of very fine-grained micaceous sandstone from 1,805.1 feet: X-ray-- Na and K feldspars, quartz, biotite, halite, shortite, siderite, hornblende?
1,806.0	1,813.0	Mudstone: Like 1,800.3 - 1,814.0. Abundant very silty streaks in some zones. (1,809.8 - 1,810.0 missing?)

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LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,813.0	1,817.0	Mudstone: Slightly greenish and olive gray, dolomitic. Faint to fairly distinct streaks and rare laminae. Regular thick parting. Some fine to thin dense dark gray very fine-grained crystalline streaks and laminae.
1,817.0	1,818.3	Marlstone: Dark to medium brownish gray, mostly dense fine-grained crystalline texture. Faint irregular layers and streaks. Slightly irregular thick parting.
1,818.3	1,819.0	Marlstone: Dark slightly brownish and olive gray, dense fine-grained crystalline texture. Faintly streaked and laminated. Irregular thick parting. Sample of dense dark brownish-gray rock from 1,818.5 feet: X-ray-- quartz, northupite, shortite.
1,819.0	1,819.6	Marlstone: Medium to dark olive gray. Faint streaked bedding. Irregular thick parting. Very abundant moderately coarse disseminated crystals.
1,819.6	1,820.4	Oil shale: Brownish black to dark brownish gray. Faint streaked bedding. Regular to irregular thick parting. Abundant fine disseminated crystals.
1,820.4	1,822.4	Marlstone: Dark to medium olive gray. Faint streaked bedding. Irregular thick to medium parting. Abundant crystalline patches, streaks, and blebs. Thin buff tuff (?) band at 1,822.0
1,822.4	1,825.3	Marlstone: Medium to light gray green. Laced with fine gray crystalline stringers; becoming laminated and banded with dense gray limestone (?) in lower part. Irregular to regular thick parting.
1,825.3	1,826.8	Limestone (?) and marlstone: Dark gray to medium and rare light slightly brownish and olive gray. Faint laminae and bands. Irregular thick parting. Abundant medium-fine disseminated crystals.
1,826.8	1,828.0	Limestone (?): Medium to dark brownish gray, dense fine-grained crystalline texture. Massive with some faint layering. Irregular thick parting.
1,828.0	1,830.0	Limestone (?) and trona: Dark to pale grayish brown, fine to moderately coarse crystalline. Irregularly interbedded. Irregular ridges and grooves on outside of core from differential solution. Sample of dark brownish-gray limestone (?) and trona from 1,829.1 feet: X-ray-- northupite, quartz, trona, shortite, searlesite.
1,830.0	1,833.0	Trona: Pale honey-brown to some medium and dark grayish brown, coarsely crystalline. Irregularly eroded to 2-inch diameter; covered with chalky white coating.
1,833.0	1,834.2	Oil shale: Brownish black to dark brownish gray. Faint streaked bedding and some laminae. Irregular to fairly regular thick parting. Very abundant moderately coarse disseminated crystals and dense crystalline streaks. A 3/4-inch medium brown slightly earthy tuff (?) stringer near base. Sample of oil shale with very abundant crystals from 1,833.3 feet: X-ray-- quartz, shortite, northupite, feldspar.
1,834.2	1,835.7	Oil shale: Dark to medium brownish gray and olive gray. Faintly streaked to massive. Slightly irregular thick parting. Very abundant coarse disseminated crystals.



## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,835.7	1,837.8	Marlstone and limestone: Dark to some light brownish and olive gray becoming almost neutral in lower part; mostly dense fine-grained crystalline texture. Faint irregular laminae and bands. Irregular thick parting.
1,837.8	1,839.1	Limestone (?): Medium to light and rare dark grayish brown, mostly dense fine to medium-fine crystalline texture. Faint irregular laminae and thin bands. Fairly regular to irregular thick parting. Sample of fine-grained limestone (?) from 1,838.3 feet: X-ray-- quartz, shortite, northupite, feldspar.
1,839.1	1,839.7	Missing
1,839.7	1,847.0	Trona and halite: Pale to medium grayish brown, coarsely crystalline. Irregularly eroded to very small diameter; rare chalky white coatings. Rare dark dense fine-grained crystalline bands. (Length and continuity uncertain; 1,842.0 - 1,843.6 missing?) Sample of trona and halite from 1,841.5 feet: X-ray-- halite, trona.
1,847.0	1,847.4	Oil shale: Dark to medium brownish gray. Faintly streaked. Very abundant medium-fine disseminated crystals.
1,847.4	1,848.4	Trona: Dark brownish gray to medium brown, dense to coarsely crystalline. Irregularly layered to massive. Irregular thick parting; some eroded core with chalky white coatings. Sample of dense dark brownish-gray trona (?) from 1,847.5 feet: X-ray-- trona, shortite, northupite.
1,848.4	1,848.9	Missing?
1,848.9	1,850.1	Oil shale: Black to dark brownish gray. Faint streaked bedding. Slightly irregular thick parting. Very abundant fairly coarse to fine disseminated crystals.
1,850.1	1,852.2	Oil shale: Dark to medium olive gray to brownish gray. Faint streaked bedding. Irregular to fairly regular thick parting. Abundant moderately coarse disseminated crystals and crystalline streaks.
1,852.2	1,852.3	Missing?
1,852.3	1,854.7	Oil shale: As above. Some 1/2- to 1-inch brown dense fine-grained crystalline stringers mostly in upper part. Sample of brown fine-grained crystalline stringer from 1,853.6 feet: X-ray-- nahcolite, dolomite.
1,854.7	1,858.1	Oil shale: Dark brownish gray to black. Faint streaked bedding. Irregular thick parting. Abundant moderately coarse to fine crystalline streaks, stringers, and patches. A 1-inch dense brown biotitic lens at 1,857.3.
1,858.1	1,859.5	Mudstone: Gray green, dolomitic. Faintly streaked to massive. Irregular thick parting. Some coarse crystalline blebs and patches. Abundant pyrite and pyrrhotite.
1,859.5	1,861.4	Mudstone: Medium-light slightly greenish gray, dolomitic to slightly calcareous. Massive; rare streaks and layers. Abundant very fine pyrrhotite (?) flecks. Few fine crystalline stringers. Sample of mudstone with very fine pyrrhotite (?) from 1,861.2 feet: X-ray-- Na and K feldspars, dolomite, pyrrhotite.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,861.4	1,863.5	Marlstone: Medium-light slightly greenish gray to dark brownish gray. Irregularly streaked and layered with fine to rare coarse crystalline carbonates. Irregular to regular thick parting; core slightly etched by drilling fluid in lower part.
1,863.5	1,863.7	Missing?
1,863.7	1,865.9	Oil shale: Olive gray to some medium and dark brownish gray. Faint streaked bedding. Irregular to fairly regular thick parting. Abundant fairly coarse disseminated crystals. Some massive crystalline bands in upper part.
1,865.9	1,866.9	Oil shale: Dark brownish and olive gray. Faint streaked bedding and discontinuous laminae. Irregular thick to medium parting. Abundant disseminated crystals and crystalline streaks and blebs.
1,866.9	1,867.8	Marlstone: Greenish gray. Faintly streaked. Irregular thick parting. Abundant fairly coarse to fine crystals concentrated in thin to very thick bands.
1,867.8	1,874.0	Mudstone: Like 1,859.5 - 1,861.4 with abundant fine to thin dense dark gray limestone laminae and bands. Fairly regular to irregular thick parting. Fine lacy crystalline stringers becoming abundant in lower part. Sample of dense dark gray limestone with some mudstone from 1,871.0 feet: X-ray-- Na and K feldspars, northupite, illite.
1,874.0	1,875.2	Marlstone and limestone: Medium and some dark slightly greenish gray to medium and some light grayish brown, mostly dense fine-grained crystalline texture. Irregularly laminated and banded.
1,875.2	1,875.6	Missing?
1,875.6	1,877.6	Oil shale: Dark brownish gray. Faint streaked bedding. Irregular thick parting; rubble in upper 0.4 foot. Very abundant disseminated crystals. Some trona at 1,876.0 - 1,876.2 and 1,876.7 - 1,877.1. Thin buff to tan slightly earthy and silty tuff stringer at bottom.
1,877.6	1,878.6	Missing?
1,878.6	1,880.0	Rubble: Oil shale and mudstone as above and below.
1,880.0	1,881.1	Mudstone: Slightly greenish gray. Finely laminated and streaked with dark gray limestone. Regular to irregular thick parting. Grades to dark brownish-gray oil shale with abundant disseminated crystals in lower part.
1,881.1	1,886.0	Missing?
1,886.0	1,888.5	Rubble: Slightly greenish gray mudstone with very abundant dark gray dense to coarsely crystalline streaks, stringers, and blebs. Very irregular large broken chunks.
1,888.5	1,913.0	Missing
1,913.0	1,914.1	Trona (?): Dark brownish gray, dense fine-grained crystalline texture. Massive; core eroded to coarse irregular boxworks in some zones; some chalky white coatings. Sample of trona from 1,913.4 feet: X-ray-- northupite, quartz, shortite, trona.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,914.1	1,914.4	Missing?
1,914.4	1,915.4	Nahcolite (?): Brownish black. Coarse platy radiating crystals. Papery boxworks on outside core surfaces. Sample of nahcolite from 1,914.7 feet: X-ray-- trona, northupite, wegscheiderite.
1,915.4	1,916.0	Oil shale: Black to dark grayish brown. Faintly laminated in upper part to very faintly streaked in lower part. Slightly irregular thick parting. Some disseminated crystals and crystalline streaks. Thin dense brown silty tuff (?) stringer at top.
1,916.0	1,923.7	Marlstone: Olive gray and olive green. Massive to faintly streaked. Irregular thick parting. Very abundant coarse disseminated crystals; dense fine-grained banded and laminated crystalline rock at 1,918.4 - 1,919.3. Some papery limonite-stained boxworks at 1,919.4 - 1,920.1. (1,919.3 - 1,919.4 missing?)
1,923.7	1,927.7	Marlstone: Olive green to gray green, dolomitic. Massive with some faint laminae and bands. Fairly regular to irregular thick to medium parting. Abundant disseminated crystals and some thin to fine crystalline streaks and layers. Sample of gray-green marlstone with some crystals from 1,925.5 feet: X-ray-- dolomite, quartz, illite, feldspar, pyrite.
1,927.7	1,929.3	Marlstone (oil shale?): Olive green and olive gray, dolomitic. Faintly banded. Irregular thick parting. Abundant crystals and crystalline streaks.
1,929.3	1,930.6	Marlstone (oil shale?): Olive gray. Faintly banded and laminated. Fairly regular thick parting. Very abundant moderately coarse to fine disseminated crystals.
1,930.6	1,933.0	Marlstone (oil shale?): Medium to dark greenish gray, dolomitic. Faintly streaked. Fairly regular to irregular thick to medium parting. Abundant disseminated crystals and crystalline blebs and streaks. Sample of dark greenish-gray marlstone with small crystalline blebs from 1,932.4 feet: X-ray-- dolomite, quartz, shortite, northupite, illite, feldspar, pyrite.
1,933.0	1,937.5	Marlstone: Medium and some dark olive green to greenish gray. Massive with occasional faint laminae and streaks. Irregular to fairly regular thick parting. Very abundant crystals.
1,937.5	1,938.9	Marlstone: Medium to light greenish gray and olive gray. Massive to faintly laminated. Irregular thick parting. Very abundant disseminated crystals in upper part grading to irregular crystalline laminae and bands in lower part. Sample of crystalline band with sparse interstitial marlstone from 1,938.8 feet: X-ray-- shortite, northupite, quartz, feldspar.
1,938.9	1,957.2	Marlstone: Dark slightly olive and brownish gray. Massive to faintly streaked. Irregular thick parting. Very abundant disseminated crystals grading to massive crystalline rock. (1,944.5 - 1,954.9 missing.)

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LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,957.2	1,957.6	Marlstone: Buff, massive. Abundant dense dark gray crystalline blebs and streaks.
1,957.6	1,959.2	Marlstone: Medium to light brownish-gray crystalline layers (like 1,938.8) grading to dark slightly greenish-gray marlstone with very abundant disseminated crystals. Irregular thick parting.
1,959.2	1,960.2	Trona and marlstone: Coarsely crystalline pale grayish-brown trona with thick irregular bands of marlstone as above and below. Small-diameter eroded core in trona bands; some chalky coatings.
1,960.2	1,960.5	Missing?
1,960.5	1,965.5	Oil shale (?) and marlstone: Dark brownish-gray oil shale (?) in upper part grading to medium greenish-gray marlstone in lower part. Faintly streaked. Irregular thick to some medium parting. <u>Very</u> abundant dark dense coarsely crystalline blebs and streaks. Sample of dark olive-gray oil shale with very abundant coarse crystal blebs from 1,961.8 feet: X-ray-- northupite, shortite, quartz.
1,965.5	1,970.5	Marlstone: Dark to medium greenish gray. Mottled with dark dense crystalline blebs and streaks as above. Irregular thick to some medium parting.
1,970.5	1,973.4	Marlstone (oil shale?): Dark to medium olive gray and greenish gray. Irregularly laminated with <u>very</u> abundant coarse crystals as above. Irregular thick to some thin parting.
1,973.4	1,975.0	Marlstone: As above and below with some irregular brownish-gray to buff fine-grained crystalline bands.
1,975.0	1,977.0	Marlstone: Dark slightly olive and greenish gray. Very abundant coarse crystalline blebs, streaks, and layers. Irregular thick parting.
1,977.0	1,978.7	Marlstone and mudstone: Dark to medium-light slightly greenish gray. Mottled and streaked with very abundant coarse crystals.
1,978.7	1,979.7	Marlstone: Medium to some light olive gray. Faint irregular laminae and bands. Fairly regular to irregular thick to rare thin parting. Very abundant disseminated crystals and crystalline layers.
1,979.7	1,981.1	Marlstone and mudstone: Like 1,977.0 - 1,978.7.
1,981.1	1,981.3	Missing
1,981.3	1,985.6	Trona and some halite: Grayish brown to nearly colorless, coarsely crystalline. Very eroded discontinuous core pieces. Irregular 2-inch greenish-gray mudstone band at about 1,982.2. Rare fine spongy boxworks.
1,985.6	1,985.9	Missing?
1,985.9	1,987.7	Marlstone: Dark to medium slightly olive and greenish gray. Faint streaked bedding; some very wavy. Irregular thick parting. Very abundant dark coarse crystals--some very platy. Dense gray crystalline band at 1,986.5 - 1,986.6. Sample of dark marlstone with coarse platy crystals from 1,987.3 feet: X-ray-- northupite, shortite, feldspar, quartz.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
1,987.7	1,990.0	Marlstone: Greenish gray. Mottled with dark coarse crystals.
1,990.0	1,992.6	Marlstone: Greenish gray marlstone with crystals as above grading to thick dense fine-grained brownish-gray crystalline layers.
1,992.6	1,996.8	Trona: Very pale to some medium grayish brown, coarsely crystalline. Some thick marlstone stringers near top and in lower 1 1/2 feet. Moderately eroded core; some chalky white coatings.
1,996.8	1,997.0	Missing?
1,997.0	2,000.3	Oil shale (?): Dark slightly olive and brownish gray. Very abundant coarse crystals. Irregular thick parting.
2,000.3	2,006.0	Marlstone: Light olive gray to some buff. Faintly streaked to massive. Irregular to fairly regular thick parting. Abundant dark coarse crystals.
2,006.0	2,009.0	Marlstone: Light to medium olive gray. Massive to faintly streaked and laminated. Fairly regular to irregular thick parting. Very abundant dark coarse to medium-fine disseminated crystals.
2,009.0	2,013.3	Marlstone and mudstone: Light to some medium olive gray and some gray buff, dolomitic. Faint laminae and streaked bedding accentuated by abundant dark crystals commonly concentrated in fine to thin layers. Fairly regular to irregular thick parting. Sample of light olive-gray mudstone with sparse crystals from 2,010.3 feet: X-ray-- Na and K feldspars, illite.
2,013.3	2,016.15	Marlstone (oil shale?): Medium to rare dark olive gray, dolomitic. Faint streaked bedding and some disrupted laminae. Irregular to fairly regular thick to rare medium parting. Abundant coarse to fine crystalline streaks, stringers, and blebs.
2,016.15	2,016.5	Tuff: White to pale green, earthy to silty. Faintly speckled and streaked. Abundant fine dense light to medium gray blebs in green zone at 2,016.3 - 2,016.4 Sample of white to buff tuff from 2,016.2 feet: X-ray-- K and Na feldspars, halite. Sample of pale green tuff with gray blebs from 2,016.4 feet: X-ray-- K and Na feldspars, northupite, shortite.
2,016.5	2,017.6	Oil shale: Dark to medium olive gray and brownish gray. Faint streaked bedding. Irregular thick to medium parting. Abundant coarse to fine crystals.
2,017.6	2,018.8	Oil shale: Medium and some dark to rare light olive gray. Faintly streaked to massive. Fairly regular to irregular thick parting. Abundant disseminated crystals.
2,018.8	2,023.8	Marlstone: Like 2,000.3 - 2,009.0.
2,023.8	2,025.6	Trona (?) and marlstone: Medium-dark greenish-gray trona with abundant dark gray disseminated crystals. Coarsely crystalline to dense pale to dark grayish-brown trona bands with some greenish patches at 2,023.8 - 2,024.1, 2,024.3 - 2,025.0, and 2,025.2 - 2,025.4. Sample of dark fine-grained trona (?) from 2,024.4 feet: X-ray-- nahcolite, shortite, northupite, quartz, feldspar.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
2,025.6	2,027.5	Trona: Dark to medium grayish brown; dense fine-grained crystalline texture, very coarse crystals in upper 0.2 foot. Slightly eroded; abundant chalky coatings.
2,027.5	2,029.2	Trona (??) and oil shale: Irregular bands of brown fine to coarse crystalline trona (?) grading to dark olive-gray and brownish-gray oil shale with abundant coarse disseminated crystals. Irregular thick parting. Some chalky coatings. Sample of coarse brown trona from 2,028.5 feet: X-ray-- trona, nahcolite, northupite, shortite.
2,029.2	2,031.0	Oil shale: Brownish black to dark brownish gray. Faint streaked bedding and crystal-disrupted laminae. Irregular to fairly regular thick parting. Very abundant moderately coarse to fine-grained dark crystalline streaks, stringers, and blebs. Sample of black oil shale with very abundant dark crystals from 2,029.5 feet: X-ray-- shortite, northupite, quartz, feldspar, illite.
2,031.0	2,034.9	Marlstone: Medium and rare light greenish gray to olive gray. Massive to irregularly laminated and banded. Irregular thick parting. Very abundant coarse crystals--some becoming concentrated in irregular layers in lower part. Very thin buff tuff at 2,033.1.
2,034.9	2,037.4	Trona: Medium to pale brown, fine to very coarse crystals. Few thin to thick greenish-gray marlstone layers with disseminated crystals in upper part. Common slight white coatings.
2,037.4	2,038.5	Oil shale: Brownish black to dark brownish and olive gray. Faint distorted streaked bedding. Irregular to fairly regular thick parting. Very abundant dark crystalline blebs and streaks (like 2,029.5).
2,038.5	2,043.0	Marlstone: Medium to light greenish gray. Speckled, streaked, and laminated with abundant dark gray crystals. Fairly regular to irregular thick to some medium parting. (2,040.5 - 2,040.6 missing?)
2,043.0	2,044.0	Trona and marlstone: Medium to pale brown coarsely crystalline trona; gray-green marlstone at 2,043.6 - 2,043.9. Some fine green blebby crystalline streaks and small fibrous radiating masses in marlstone. Sample of marlstone with small green radiating crystal masses from 2,043.8 feet: X-ray-- northupite, shortite.
2,044.0	2,045.2	Trona: White to pale grayish brown, coarsely crystalline. Eroded core; chalky white coating on outside core surfaces.
2,045.2	2,046.0	Missing?
2,046.0	2,049.0	Trona and halite: Medium and some dark grayish brown to nearly colorless and transparent. Fine to very coarse crystals. Some very eroded core. Few fine shaly stringers near bottom.
2,049.0	2,049.1	Marlstone: Light brownish gray to buff. Streaked and speckled with fine dark slightly greenish crystals.
2,049.1	2,049.6	Nahcolite (?): Coarse radiating dark to pale grayish-brown crystals. Fibrous green crystals at top (like 2,043.8).

Illustration No. SBR-4751P Sheet 46 of 57

## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
2,049.6	2,049.7	Trona (?): Medium to pale grayish-brown, moderately coarse to fine crystals. Sharp slightly wavy contact with oil shale below.
2,049.7	2,050.0	Oil shale: Medium to dark grayish brown, dolomitic. Faint slightly irregular laminae and thin bands. Abundant dark disseminated crystals.
2,050.0	2,051.1	Oil shale: Dark grayish brown to brownish black. Faint streaked bedding. Irregular thick parting. Very abundant moderately coarse disseminated crystals. Thin brown slightly silty stringer at 2,050.8.
2,051.1	2,054.5	Marlstone and mudstone: Medium to light greenish gray. Streaked and speckled with very abundant dark gray dense crystals. Irregular to fairly regular thick parting. (2,053.0 - 2,053.3 missing?) Sample of dark dense crystalline streaks and blebs with some light greenish-gray mudstone from 2,052.6 feet: X-ray-- north-upite, shortite, feldspar.
2,054.4	2,055.8	Marlstone and mudstone: Medium to light olive gray and brownish gray. Faint distorted streaks and laminae. Irregular to regular thick to some thin parting. Abundant dark dense crystalline streaks and blebs.
2,055.8	2,061.9	Trona: Dark to very pale brown and brownish gray, mostly very coarse crystals. Mottled, variegated, and streaked. Some buff marlstone stringers in lower part.
2,061.9	2,063.6	Oil shale: Light to medium olive gray and some dark brownish gray to brownish black. Faint distorted streaked bedding to indistinct gradational banding. Irregular to fairly regular thick parting. Abundant dark disseminated crystals.
2,063.6	2,064.6	Oil shale: Dark brownish gray to brownish black. Massive to faint distorted streaked bedding. Very abundant dark disseminated crystals.
2,064.6	2,065.6	Oil shale: Dark brownish gray to medium olive gray. Faint streaked bedding. Irregular thick parting. Abundant disseminated crystals. Thin dense gray sparry band at 2,064.95.
2,065.6	2,078.0	Mudstone: Medium to light greenish gray and some olive gray. Speckled and streaked with dark gray crystals. Some coarse greenish-yellow shortite crystals at 2,073.8 - 2,074.0. A 1-inch brownish-black crystalline band at 2,074.6 underlain by a 1/2-inch gray-white biotitic tuff stringer. (2,072.6 - 2,072.8 missing?)
2,078.0	2,079.2	Oil shale: Olive green and olive gray. Faint streaked bedding. Irregular thick parting. Abundant disseminated crystals.
2,079.2	2,081.2	Oil shale: Dark brownish gray to some brownish black. Faint streaked bedding. Irregular thick parting. Very abundant disseminated crystals. Sample of dark brownish-gray oil shale with disseminated crystals from 2,079.9 feet: X-ray-- Na feldspar, shortite, northupite, pyrite, illite.
2,081.2	2,087.0	Marlstone and mudstone: Medium to light olive gray and rare buff. Speckled, streaked, and laminated with dark dense crystals. Irregular to some regular thick parting. Some medium to dark brownish-gray oil shale near top.

Illustration No. SBR-4751P Sheet 47 of 57

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
2,087.0	2,091.0	Trona: Pale to medium grayish brown, fine to rare coarse crystals. Some chalky coatings. (2,088.1 - 2,088.3 missing)
2,091.0	2,094.0	Trona: As above with some interbedded greenish-gray shaly marlstone with yellowish-green shortite crystals. (2,091.9 - 2,092.1 missing?)
2,094.0	2,096.3	Trona: As above with a large dark very coarsely crystalline radiating nahcolite (?) mass at 2,094.2 - 2,094.8 and a small mass at 2,095.9 - 2,096.0.
2,096.3	2,097.3	Marlstone and oil shale: Greenish gray in upper part becoming dark brownish gray to black in lower part. Faint streaked bedding and some very fine laminae. Some shortite and loughlinitite blebs. A 2-inch dark coarse radiating nahcolite mass near top. Irregular thin to thick parting. Sample of coarsely crystalline nahcolite (?) from 2,096.4 feet: X-ray-- trona.
2,097.3	2,098.5	Trona: Medium to light grayish brown and brownish gray, dense very fine crystalline texture. Faintly layered. Some chalky coatings; slightly eroded. Sample of light grayish-brown fine-grained trona from 2,097.7 feet: X-ray-- trona.
2,098.5	2,099.4	Nahcolite (?) and oil shale: Mosaic of very coarsely crystalline dark grayish-brown to black nahcolite and broken stringers of dark brownish-gray to black oil shale.
2,099.4	2,100.6	Oil shale and marlstone: Dark olive brown to medium-light greenish gray. Faint very fine discontinuous laminae near top; faint distorted streaked bedding in other part. Irregular thick parting. Some coarsely crystalline shortite stringers and streaks. Dark oil shale with very abundant fibrous loughlinitite streaks and blebs at 2,100.2 - 2,100.5. Sample of oil shale with loughlinitite and shortite from 2,100.2 - 2,100.5 feet: X-ray-- loughlinitite, shortite, feldspar.
2,100.6	2,105.0	Marlstone: Gray green, dolomitic. Faint streaked bedding. Irregular to fairly regular thick to rare thin parting. Abundant disseminated shortite, becoming coarse and yellowish green in lower part. Coarsely crystalline grayish-brown to brown trona (?) at 2,104.3 - 2,104.6.
2,105.0	2,111.8	Trona (?): Grayish brown to pale green, fine to some coarse crystals. Faintly variegated. Some gray-green marlstone with shortite in upper part. Slightly eroded; some chalky coatings. Very coarse dark nahcolite (?) nodule at 2,107.4 - 2,107.6. (2,108.1 - 2,108.3 missing?) Sample of pale green fine-grained trona (?) from 2,109.5 feet: X-ray-- trona.
2,111.8	2,114.7	Marlstone: Olive green, dolomitic to slightly calcareous. Very faint streaked bedding. Irregular thick to some thin parting; hackly fracture. Moderately abundant shortite crystals.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
2,114.7	2,117.0	Oil shale: Olive green to olive gray. Faint distorted streaked bedding and disrupted laminae. Irregular thick parting. Abundant coarse shortite crystals. Some fibrous loughlinite in lower part.
2,117.0	2,127.9	Marlstone and mudstone: Medium to some light gray green, some olive green in upper part. Faint streaked bedding and some laminae. Fairly regular to irregular thick to thin parting; irregular slight to coarse hackly fracture. Abundant shortite crystals and some thin to fine crystalline layers. Coarsely crystalline pale grayish-brown to transparent trona (?) at 2,123.0 - 2,123.7. (2,122.0 - 2,122.3 missing?) Sample of gray-green mudstone from 2,121.2 feet: dolomite, feldspar, illite, pyrite.
2,127.9	2,128.1	Missing?
2,128.1	2,136.8	Trona (?) and nahcolite (?): Greenish gray to medium and rare dark grayish brown, fine to some very coarse crystals. Faintly variegated. Abundant interbedded gray-green mudstone as above in upper part becoming sparse in lower part. Slightly eroded; rare chalky coatings. Sample of very coarse dark brown trona (?) from 2,135.6 feet: X-ray-- trona.
2,136.8	2,139.0	Trona: Very pale to medium grayish brown, fine to rare coarse crystals, massive. Rare chalky coatings.
2,139.0	2,141.2	Trona (and nahcolite?): Pale to dark grayish brown, fine to very coarse crystals. Some interbedded gray-green mudstone.
2,141.2	2,150.0	Trona: Medium to pale grayish brown, fine grained, massive. Common chalky coatings. Some very fine-grained greenish-gray bands from 2,145.0 to 2,148.0. (2,142.7 - 2,142.8 missing?)
2,150.0	2,152.8	Trona: Medium brownish gray to dark brown, fine crystalline, becoming coarse near bottom. Massive; few green marlstone stringers near bottom.
2,152.8	2,153.9	Oil shale: Medium to rare dark olive gray. Faint streaked bedding and crystal-disrupted laminae. Irregular thick parting. Abundant coarse platy crystals.
2,153.9	2,154.7	Oil shale: Dark and rare medium brownish gray to black. Faint to moderately distinct laminae and crystal-disrupted laminae. Irregular thick parting. Very abundant coarse platy nahcolite (?) crystals (erosion of crystals forms irregular papery boxworks on outside of core). Sample of dark oil shale with nahcolite from 2,154.2 feet: X-ray-- trona, dolomite, feldspar, illite.
2,154.7	2,155.8	Oil shale: Olive gray to olive green, dolomitic. Faint streaked bedding to slightly irregular laminae. Slightly irregular to irregular thick to medium parting. Fine to 1/2-inch braided high angle fractures filled with coarse colorless nahcolite from 2,154.8 to 2,155.5. Some disseminated crystals and crystalline streaks.
2,155.8	2,158.0	Marlstone: Olive gray to greenish gray, dolomitic to moderately calcareous. Faintly streaked to massive. Irregular thick to thin parting. Some coarse shortite crystals. Abundant silky loughlinite streaks at 2,156.0 - 2,156.4.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
2,158.0	2,161.9	Marlstone and mudstone: Medium to light greenish gray, slightly to moderately calcareous. Faintly streaked to laminated and banded. Irregular to fairly regular thick to medium parting. Some coarse shortite crystals. Silty-textured limestone (?) laminae, thin bands, and streaks becoming abundant in lower part.
2,161.9	2,164.1	Trona and some mudstone: Greenish-gray mudstone with coarse colorless to greenish and brownish crystal masses and thick massive fine-grained bands. Moderately eroded core.
2,164.1	2,164.2	Missing?
2,164.2	2,176.9	Trona: As above with rare mudstone. Becoming mostly medium to pale grayish-brown fine to coarse crystalline trona in lower part.
2,176.9	2,177.9	Mudstone and trona: Medium and rare dark greenish-gray to olive-gray mudstone. Faint streaked bedding. Irregular thin to thick parting. Some coarse shortite crystals. Pale to dark brownish-gray fine to coarse crystalline trona in lower 0.3 foot.
2,177.9	2,181.3	Oil shale: Dark and some medium brownish gray, mostly black in middle part. Faint distorted streaked bedding to crystal-disrupted laminae (inclined about 20-25° near 2,180.0). Slightly irregular to irregular thick parting. Abundant crystalline blebs and streaks. Some coarse shortite in upper part. Medium to dark coarsely crystalline nahcolite (?) mass with some interstitial oil shale at 2,180.2 - 2,180.6.
2,181.3	2,188.4	Oil shale: Medium to dark brownish gray. Faint commonly distorted streaks and irregular laminae (some slightly inclined). Irregular thick to rare medium parting. Large nahcolite (?) masses from 2,183.3 to 2,185.5, 2,186.5 to 2,187.4 and 2,187.7 to 2,187.9. (2,184.3 - 2,184.5 missing?) Sample of medium to dark brownish-gray oil shale from 2,185.8 feet: X-ray-- dolomite, feldspar, illite, pyrite.
2,188.4	2,192.4	Marlstone: Medium to some light olive green, dolomitic. Faint streaked bedding and rare laminae. Irregular to regular thick to medium parting. Some fine crystals and crystalline streaks. A thin horizontal colorless crystalline seam at 2,192.3. Sample of olive-green marlstone from 2,191.6 feet: X-ray-- dolomite, feldspar, quartz, illite, pyrite. Sample of crystalline seam from 2,192.3 feet: X-ray-- nahcolite.
BOTTOM OF WILKINS PEAK MEMBER TOP OF TIPTON SHALE MEMBER		
2,192.4	2,197.0	Oil shale: Medium to dark brownish gray, dolomitic. Faintly streaked to laminated. Regular to irregular thick parting. Thin crystalline stringer at 2,193.3. Some fine dark pyritic streaks. Sample of brownish-gray oil shale from 2,192.6 feet: X-ray-- dolomite, feldspar, illite.
2,197.0	2,199.0	Oil shale: Medium brownish gray with moderately abundant dark gray pyritic laminae and streaks. Faint very fine regular laminae; becoming irregularly streaked near bottom. Irregular thick parting.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
2,199.0	2,201.0	Oil shale: Brownish gray, some dark brownish gray to rare black in lower part, dolomitic. Faint to moderately distinct slightly distorted (nonparallel) streaked bedding. Irregular to fairly regular thick parting. Some dark gray pyritic streaks in upper part.
2,201.0	2,203.0	Oil shale: Dark brownish gray to black, dolomitic. Faintly laminated. Fairly regular thick parting. Rare dark gray pyritic laminae and streaks. Sample of dark brownish-gray to black oil shale from 2,202.0 feet: X-ray-- dolomite, Na and K feldspars, illite, Mg-siderite, quartz.
2,203.0	2,204.2	Oil shale: Dark brownish gray to some black, dolomitic. Faintly laminated. Irregular thick parting. Tan silty to very fine sandy-textured tuff braided with thin to fine oil-shale stringers at 2,203.1 - 2,203.4; dark brownish-gray slightly oil-stained tuff at 2,203.9 - 2,204.1. Sample of tan tuff with fine oil-shale stringers from 2,203.2 feet: X-ray-- Na feldspar, quartz, analcime, biotite, pyrite.
2,204.2	2,206.2	Oil shale: Medium to dark brownish gray, dolomitic. Moderately distinct to faint streaked bedding. Fairly regular to irregular thick parting. Rare fine to small tan tuff lenses.
2,206.2	2,208.2	Oil shale: Dark brownish gray to black. Faint streaked bedding and some very fine laminae. Irregular thick parting. Few thin dense dark grayish-brown lenses in upper part.
2,208.2	2,209.3	Oil shale: Medium to dark brownish gray and grayish brown, dolomitic. Moderately distinct to faint streaked bedding. Regular to irregular thick parting. Rare small dense dark grayish-brown lenses.
2,209.3	2,210.5	Oil shale: Medium to dark brownish gray and rare black, dolomitic. Moderately distinct to faint streaked bedding; slightly wavy laminae in lower 0.3 foot. Regular to irregular thick parting. Thin dense dark grayish-brown lenses (pinched out layers?) at 2,210.2 and 2,210.5. Sample of thin dense dark grayish-brown lens from 2,210.2 feet: X-ray-- dolomite; trace quartz, analcime, feldspar.
2,210.5	2,212.8	Oil shale: Dark grayish brown to some black. Faint laminae and some streaked bedding. Irregular to fairly regular thick parting. Some dense lenses as above in upper part. A 1-inch dark brownish-gray granular analcime band at 2,212.2.
2,212.8	2,214.8	Oil shale: Black to dark brownish gray, dolomitic. Faintly laminated to very faintly bedded. Regular to irregular thick parting. Sample of black oil shale from 2,213.6 feet: X-ray-- analcime, quartz, dolomite, feldspar, calcite, pyrite, illite.
2,214.8	2,215.0	Missing?
2,215.0	2,216.2	Oil shale: Dark and rare medium grayish brown to some black. Faintly laminated to very faintly bedded. Regular thick parting. A thin slightly wavy dark grayish-brown analcime band at 2,215.4.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
2,216.2	2,219.0	Oil shale: Black to some dark brownish gray. Faintly laminated to very faintly bedded. Irregular to some regular thick parting. Dark brownish-gray silty to sandy-textured tuff with fine light braided to contorted stringers at 2,217.4 - 2,218.0. Sample of tuff from 2,217.5 - 2,217.7 feet: X-ray-- analcime, quartz, Na feldspar.
2,219.0	2,220.0	Oil shale: Dark brownish gray and some black to medium olive gray, dolomitic. Faintly laminated. Irregular thick parting. One-inch dense brown dolomite bands at 2,219.2 and 2,219.8.
2,220.0	2,221.0	Oil shale: Olive gray to some medium and rare dark brownish gray, dolomitic. Faintly laminated. Irregular to fairly regular thick parting. Sample of olive-gray oil shale from 2,220.2 feet: X-ray-- quartz, dolomite, calcite, feldspar, illite, Mg-siderite, pyrite.
2,221.0	2,225.4	Oil shale: Dark brownish gray to black, dolomitic. Faint streaked bedding and some laminae. Fairly regular to irregular thick parting; some regular thin shaly parting in lower part. A 1-inch dense grayish-brown dolomite band at 2,221.2, a 1-inch lens at 2,222.0, and a 2-inch laminated band at 2,223.3 - 2,223.5. Thin distorted dark brownish-gray analcime tuff at 2,223.5 Sample of dense brown dolomite from 2,223.4 feet: X-ray-- dolomite; some quartz, analcime, feldspar.
2,225.4	2,226.5	Oil shale: Dark to medium and rare light brownish gray, dolomitic. Faint to moderately distinct laminae. Fairly regular to irregular thick to some medium parting. A 1-inch dense to silty brown band at top.
2,226.5	2,229.4	Marlstone: Medium to rare light slightly brownish and olive gray, dolomitic. Faintly laminated and streaked to massive. Irregular thick parting. Dense grayish-brown dolomite with fine dark oil-shale stringers in lower 0.2 foot. Sample of slightly olive-gray massive marlstone from 2,228.2 feet: X-ray-- quartz, dolomite, feldspar, illite, analcime, pyrite, Mg-siderite.
2,229.4	2,233.7	Oil shale: Very dark brownish gray to black, dolomitic. Faint laminae and streaked bedding. Irregular to regular thick parting, becoming medium to thin in lower foot. Few thin dense dark grayish-brown dolomite laminae in lower half foot. Sample of dark brownish-gray oil shale with regular thin parting from 2,233.0 feet: X-ray-- quartz, illite, pyrite, calcite, dolomite, analcime.
2,233.7	2,238.8	Oil shale: Dark and rare medium brownish gray to some black, some dark to medium gray, dolomitic to calcareous. Faintly laminated. Regular to irregular thick to rare thin parting. (Core sequence suspect.)

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Laramie Energy Research Center, Laramie, Wyoming

October 17, 1975

LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
2,238.8	2,240.1	Oil shale: Dark brownish gray, calcareous to dolomitic. Very faint very fine laminae. Regular to irregular thick to some medium parting. Medium to dark brown silty to very fine sandy-textured tuff at 2,239.0 - 2,239.3.
2,240.1	2,241.0	Oil shale: Dark to some medium brownish gray. Faint very fine laminae. Regular to irregular thick parting. Tight silty slightly brownish-gray tuff at 2,240.3 - 2,240.5.
2,241.0	2,242.0	Oil shale: Dark brownish gray to black. Faintly laminated. Fairly regular thick to thin parting. A 1/4-inch brown silty tuff at 2,241.9 and a fine white silty laminae at 2,242.0.
2,242.0	2,243.7	Oil shale: Dark and rare medium gray to brownish gray, calcareous to dolomitic. Faint very fine laminae and some streaked bedding. Fairly regular thick to medium parting. A 3/4-inch white moderately coarse-grained analcime lens at 2,242.4 (some black organic material between grains). Sample of analcime lens from 2,242.4 feet: X-ray-- analcime, quartz, calcite.
2,243.7	2,244.7	Oil shale: Dark and rare medium brownish gray to some black, dolomitic to calcareous. Faintly laminated. Regular to irregular thick to thin parting. Gray unctuous shale at 2,244.2 - 2,244.3 (probably out of place).
2,244.7	2,245.8	Oil shale: Dark and some medium grayish brown, calcareous. Faint very fine laminae. Medium to light brownish-gray and rare gray-buff tuff with abundant biotite (and hornblende?) at 2,245.1 - 2,245.5 Sample of tuff from 2,245.4 feet: X-ray-- quartz, analcime, feldspar, biotite.
2,245.8	2,247.8	Oil shale: Dark grayish brown, some black in upper part, moderately to slightly calcareous. Faint very fine laminae and some streaked bedding. Regular to irregular thick to some thin parting. Sample of dark grayish-brown oil shale from 2,246.9 feet: X-ray-- quartz, aragonite, analcime, calcite, feldspar, illite.
2,247.8	2,255.5	Shale (oil shale in part): Medium to some dark slightly olive gray, dolomitic to slightly calcareous. Faintly laminated and streaked to massive. Irregular to regular thick to thin parting; coarse hackly fracture; slightly unctuous. Several thick dense buff dolomite layers in upper part. Gray limy siltstone at 2,253.2 - 2,253.5. Sample of gray shale from 2,251.6 feet: X-ray-- quartz, dolomite, analcime, illite, feldspar, pyrite, Mg-siderite, calcite.
2,255.5	2,256.5	Oil shale: Dark brownish gray to some black. Faint laminae and streaked bedding; some very fine distinct tan to buff streaks. Regular to irregular thick to rare thin parting. A 1/2-inch dense brown dolomite band at 2,255.7. Sample of dark oil shale with fine buff streaks from 2,256.4 feet: X-ray-- calcite, quartz, pyrite, analcime.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
2,256.5	2,257.9	Oil shale: Dark to medium brownish gray, some black in lower 0.4 foot, calcareous to dolomitic. Moderately distinct to faint laminae. Regular to irregular thick to medium parting. A 1-inch dense gray limestone band at 2,257.7.
2,257.9	2,259.4	Oil shale: Medium brownish gray, very calcareous. Faint fine to thin laminae. Irregular to regular thick parting. Sample of brownish-gray oil shale from 2,258.7 feet: X-ray-- calcite, quartz, dolomite, analcime.
2,259.4	2,260.4	Oil shale: Dark brownish gray, calcareous. Faintly laminated. Irregular thick to rare thin parting.
2,260.4	2,262.0	Oil shale: Medium and some dark brownish gray, calcareous. Faintly laminated. Regular to irregular thick to medium parting.
2,262.0	2,263.3	Oil shale: Dark brownish and almost neutral gray to some black, calcareous. Faintly laminated. Regular to irregular thick to thin parting.
2,263.3	2,270.0	Oil shale: Medium to some dark and light brownish gray, calcareous. Faint to distinct laminae. Regular to irregular thick to some medium parting. Thin tight light gray silty band at 2,267.0.
2,270.0	2,273.1	Oil shale: Medium to dark brownish gray and some black, calcareous. Faintly laminated. Regular to irregular thick to thin parting. Thin gray silty pyritic band at 2,270.5.
2,273.1	2,277.2	Oil shale: Dark to some medium grayish brown and rare black, calcareous to dolomitic. Faint to some moderately distinct laminae; abundant very fine distinct tan to buff streaks and laminae in some parts. Regular medium to thick parting; some regular shaly to papery parting in lower part. A 1-inch dense blebby gray analcime stringer at 2,276.5
2,277.2	2,278.2	Oil shale: Black to grayish brown, becoming slightly olive near base, dolomitic. Very faint laminae and streaked bedding. Regular to irregular thin to thick parting. Dense brown dolomite bands at 2,277.6 and 2,277.8. Sample of dense brown dolomite band from 2,277.6 feet: X-ray-- dolomite, quartz.
2,278.2	2,282.9	Marlstone and limestone: Very light buff to light and rare medium brownish and olive gray, slightly to moderately calcareous. Faint distorted to disrupted thick to thin stringers and streaks. Irregular thick parting. (2,281.6 - 2,281.8 missing?) Sample of very light buff limestone from 2,280.5 feet: X-ray-- dolomite, quartz, calcite, analcime, feldspar.
2,282.9	2,284.9	Marlstone: Medium to light olive gray, calcareous. Contorted to regular streaked bedding marked by fine buff to gray limestone and siltstone streaks in upper part; faint regular laminae with very fine loop structures below 2,284.2. Fairly regular to irregular thick parting.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
2,284.9	2,286.7	Oil shale: Dark brownish gray to buff, slightly calcareous. Distinct slightly wavy laminae; rare loop structures. Slightly irregular to curved thick to some thin parting. Sample of distinctly laminated oil shale from 2,285.5 feet: X-ray-- dolomite, quartz, analcime, feldspar, illite.
2,286.7	2,288.1	Oil shale: Black to dark and rare medium brownish gray, dolomitic. Faint and rare distinct laminae to very faint streaked bedding. Irregular to regular thick to medium parting.
2,288.1	2,291.1	Oil shale: Medium to light olive gray and brownish gray, some dark in upper and lower part, dolomitic. Faint to some fairly distinct laminae. Irregular to regular thick parting. A 2-inch dense dark brownish-gray dolomite band at 2,288.9. Sample of olive-gray oil shale from 2,290.2 feet: X-ray-- quartz, calcite, dolomite, feldspar, illite.
2,291.1	2,291.7	Oil shale: Dark and rare medium brownish gray to black. Faint streaked bedding. Fairly regular thick parting. A 1 1/2-inch dolomite band at bottom.
2,291.7	2,292.8	Oil shale: Very dark brownish gray to black. Very faint streaked bedding. Fairly regular to irregular thick to thin parting. Sample of black oil shale from 2,292.4 feet: X-ray-- dolomite, quartz, illite, analcime, feldspar.
2,292.8	2,296.0	Oil shale: Dark to some medium brownish gray and black, dolomitic. Faint streaked bedding and some thin to fine laminae. Regular to irregular medium to thick parting. Few dark grayish-brown dolomite bands. A fine vitreous black brittle organic lamina at 2,294.1.
2,296.0	2,304.0	Oil shale: Dark brownish-gray to black, some dark to medium brown in upper half, dolomitic. Faint to some moderately distinct laminae. Regular to irregular thick to medium parting, becoming thin in lower foot.
2,304.0	2,305.0	Oil shale: Medium olive gray, some dark near top, dolomitic. Very faint thin to fine laminae and some streaked bedding. Fairly regular thick parting.
2,305.0	2,305.5	Missing
2,305.5	2,306.8	Oil shale: Medium to dark brownish gray, slightly olive near top, dolomitic. Faint to some moderately distinct streaked bedding. Fairly regular to irregular thick to rare thin parting. Few grayish-brown dolomite lenses and bands.
2,306.8	2,309.3	Oil shale: Dark brownish gray to some black, dolomitic. Faintly laminated to streaked. Regular to irregular thick to medium parting. Some dark grayish-brown dolomite layers and lenses.
2,309.3	2,310.2	Tuff and oil shale: Medium to light brown and brownish-gray silty tuff interbedded with thin to fine black oil-shale laminae (some slightly wavy). Regular to irregular thick parting. Sample of brown tuff from 2,309.8 feet: X-ray-- dolomite, some quartz.

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## LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
2,310.2	2,311.6	Oil shale: Black to very dark brownish gray. Very faintly bedded. Irregular to regular thick to thin parting. Grayish-brown silty tuff band at 2,310.8 - 2,311.0.
2,311.6	2,312.3	Tuff and oil shale: Tan to brownish-gray silty to marly tuff laminated and streaked with black to dark grayish-brown oil shale. Regular thick parting. A thin zone of abundant vitreous black organic streaks at 2,312.0.
2,312.3	2,315.2	Oil shale: Dark slightly brownish gray, dolomitic to slightly calcareous. Very faintly bedded. Regular to irregular thick to shaly parting; hackly fracture in some parts. Some thin vermiform grayish-brown marlstone stringers. Sample of dark brownish-gray shale from 2,313.2 feet; X-ray-- quartz, dolomite, calcite, illite, pyrite, feldspar, montmorillonite.
2,315.2	2,317.5	Oil shale: Dark brownish gray, dolomitic. Very faintly bedded to laminated. Regular thick to some thin parting. Dense to very fine blebby-textured gray mudstone with some interfingered oil shale in lower 0.6 foot. Sample of gray mudstone from 2,317.4 feet: X-ray-- dolomite, calcite, quartz, montmorillonite, pyrite, analcime.
2,317.5	2,319.5	Oil shale: Black to dark slightly brownish gray, calcareous. Very faintly bedded with occasional regular laminae. Regular to irregular thick to some thin parting.
2,319.5	2,322.6	Oil shale: Dark brownish gray and some black, dolomitic. Faint laminae and streaked bedding. Regular to irregular thick to thin parting. Few brown dolomite laminae and bands. A thin zone of fine soft unctuous gray to white streaks and vermiform stringers at 2,321.3. Sample of soft unctuous gray to white material from 2,321.3 feet: X-ray-- montmorillonite; some quartz, kaolin.
2,322.6	2,324.1	Oil shale: Black to dark gray, calcareous. Faint very fine regular laminae and streaked bedding. Fairly regular thick to medium parting. Sample of dark gray oil shale from 2,323.7 feet: X-ray-- calcite, quartz, dolomite, pyrite, illite.
2,324.1	2,325.5	Marlstone (oil shale?): Medium and some dark slightly brownish gray, dense, calcareous. Very faintly laminated to massive. Irregular to regular thick parting. Sample of marlstone from 2,325.2 feet: X-ray-- calcite, quartz, dolomite, pyrite.
2,325.5	2,328.7	Oil shale: Dark to some medium brownish gray, some black in upper part. Faintly laminated. Regular to irregular thick to thin parting. Few brown dolomite layers in upper part.
2,328.7	2,328.8	Missing?
2,328.8	2,330.6	Marlstone: Like 2,324.1 - 2,325.5; some oil shale at top and bottom.

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LITHOLOGIC DESCRIPTION OF SAMPLES SUBMITTED FOR ASSAY

Core samples from Union Pacific Railroad Company's El Paso 44-3

From	To	Description
2,330.6	2,331.7	Oil shale: Dark to rare medium brownish gray and black, calcareous. Very faint to rare distinct laminae. Fairly regular thick to thin parting. Some snail shell fragments in lower inch. Sample of dark brownish-gray oil shale from 2,331.3 feet: X-ray-- quartz, dolomite, calcite, illite, pyrite, feldspar.
2,331.7	2,332.8	Limestone: Medium to dark gray and brownish gray. Irregularly streaked with clam and snail shell fragments (not Goniobasis). Irregular thick parting. Sample of brownish-gray limestone from 2,332.3 feet: X-ray-- calcite, dolomite, pyrite.
BOTTOM OF TIPTON SHALE MEMBER OF GREEN RIVER FORMATION		
TOP OF WASATCH FORMATION		
2,332.8	2,334.0	Mudstone: Greenish gray, massive. Irregular thin to thick parting. Sample of mudstone from 2,333.5 feet: X-ray-- quartz, illite, feldspar.
2,334.0	2,339.9	Mudstone: Medium to rare light gray, slightly calcareous. Massive to faintly variegated. Irregular thick parting.
2,339.9	2,343.7	Siltstone: Light gray, calcareous, massive. Regular to irregular thick parting. Becoming variegated with slightly greenish-gray mudstone in lower part.
2,343.7	2,345.4	Sandstone: Light gray, calcareous, very fine grained. Faint irregular (non parallel) streaked bedding. Irregular thick parting.
2,345.4	2,347.5	Siltstone: Light gray becoming medium slightly greenish gray near bottom, calcareous. Faint slightly non parallel streaked bedding. Irregular thick parting.
2,347.5	2,351.0	Mudstone: Olive gray to greenish gray, slightly calcareous. Massive to faintly streaked. Very irregular medium to thick parting.
2,351.0	2,354.5	Siltstone and mudstone: Light slightly greenish gray, slightly to moderately calcareous, massive. Irregular thick parting.
2,354.5	2,357.0	Mudstone and siltstone: Medium to light greenish gray, slightly calcareous. Massive; rare buff mottling. Irregular thick parting.
2,357.0	2,359.5	Siltstone: Light gray, slightly to moderately calcareous, massive. Irregular thick parting.
Bottom of core		