

Table 1.--Location and description of samples of oil shale from central Brooks Range, northern Alaska

(Location, description of outcrops and stratigraphic assignment by I. L. Tailleux. Mesoscopic description of lithology of sample based on observations by J. M. Schopf and H. A. Tourtelot. Petrographic and mineralogic data by H. A. Tourtelot)

Locality Number	Location	Description of outcrops and stratigraphic assignment	Sample description	Petrographic and mineralogic data
11	Howard Pass Quadrangle, 68°42'25" N., 158°27'45" W. Killiga River; high bank, west side, 1.3 mi. below junction of Rolling Pin Creek. (Same locality as assay No. 4, p. D132, Tailleux, 1964.)	South end of high bank shows the following with dipping units from south to north: (1) talus of fine-grained greenish-gray, soft, non-stratified wacke with spherical (cannonball) calcareous concretions, 10 ft.; (2) oil shale, weathered dark-gray, crumpled, and contains several thin zones of clay shale, 5 ft.; (3) sheared shale weathered to clay, 10 ft.; (4) clay shale, rusty- and gray-colored, interlayered with clay, 5 ft. and (5) clay shale, weathered red, 50 ft. Strongly deformed mudstone, varicolored chert, and dark brownish-gray, thinly laminated limestone also are exposed along bank. Tentatively considered part of a concretion-bearing wacke assemblage of presumably Late Jurassic or Earliest Cretaceous age. Sample 6AAT207A from 1-ft layer at top of oil shale zone. Sample 6AAT207B from 1-ft layer in lower part of oil shale zone.	6AAT207A.--Shale, black, weathered papery. Fracture surface has satiny luster similar to attrital coal. Bedding is smoothly undulating on scale of 2-4 inches. Contains abundant pyrite in lenses 1/2 x 2 mm. Minute gypsum crystals coat weathered bedding planes. Occure plant fragments and prints of fish scales are present. 6AAT207B.--Shale, black, weathered papery. Is similar to 6AAT207A, but contains more iron oxides on weathered joints and bedding planes. Contains a few concretions of calcite.	6AAT207A.--Chiefly composed of closely packed red organic material with fibrous aspect as viewed in thin sections, the scattered luster. Cell structure was preserved. Minor amounts of quartz occur in lenses with the pyrite. X-ray analyzer shows less than 10 percent clay that consists mainly of illite with lesser amounts of kaolinite and mixed-layer illite-montmorillonite. 6AAT207B.--Organic fibers are brown-red and seemingly more altered in comparison with those in 6AAT207A. The calcite concretions consist of phosphatic fish bones and coprolites surrounded by and partly replaced by calcite. Quartz and pyrite are more abundant than in 6AAT207A. Contains about 25 percent clay by X-ray analysis made up of illite, kaolinite, and mixed-layer illite-montmorillonite. The clay is not evident in thin sections.
13	Howard Pass Quadrangle, 68°39'50" N., 158°27'45" W. High bank at edge of terrace on east side of Killiga River about 2 mi. above junction of Rolling Pin Creek. (Approximately same locality as assay No. 3, p. D132, Tailleux, 1964.)	Bank consists of outcrop and talus chiefly of varicolored chert. A zone about 5 ft thick of black, papery to bookish weathering oil shale is partly exposed at and below the lip of the southern end of the bank. Rubble traces about 100 yards to the east consist of similar oil shale associated with chert and light greenish-gray weathering wacke. Other outcrops of oil shale were observed on adjoining bluffs in 1951. The association of varicolored cherts and concretion-bearing wacke suggests correlation with the same sequence as at locality 11. Sample 6AAT208 from 5-ft oil shale zone.	6AAT208.--Shale, black, weathered papery. Fracture surface is fairly lustrous; rock verges on lignite coal. Bedding is undulatory on scale of inches.	6AAT208.--Closely packed red organic material with fibrous aspect make up the rock and account for its fissility. Bedding distorted on small scale from slumping or adjustment to compaction. Pyrite not observed and other visible minerals very sparse.
14	Howard Pass Quadrangle, 68°40'05" N., 157°33'45" W. South of Monument Ridge, 1 1/2 mi. east of Outwavy Creek. Outbank on south end of curved hill on north side of small tributary to Outwavy Creek. (Same locality as assay No. 2, p. D132, Tailleux, 1964.)	Talus and outcrops of northwest-dipping rocks indicate more than 20 ft of mafic igneous rock structurally above more than 50 ft of red chert and cherty mudstone. A 1-ft bed of tasmantite projects through chert talus. These rocks are mapped as part of an unnamed cherty unit stratigraphically between the Opikruk Formation (Early Cretaceous) and the Lisburne Group (Mississippian) with mafic sills. The assemblage is the same as that present at locality 12 (Assay No. 1, p. D132, Tailleux, 1964) and is extensively overthrust in the region. Sample 6AAT209A from upper half of tasmantite bed. Sample 6AAT209B from lower half of tasmantite bed.	6AAT209A.--Tasmantite, an organic-rich rock made up almost entirely of sporelike disseminules of <u>Tasmantites</u> . The rock is brownish-gray with tawny nodulelike luster on fracture surfaces. It is very tough and hard to break. This and other tasmantite samples from Alaska yield much more oil by distillation than any samples reported from Tasmantia. 6AAT209B.--Tasmantite, dark gray, with a bluish cast. Is more fissile than 6AAT209A and fractures are irregularly spotted with iron stained gypsum. Contains lenses 1/2 x 1/2 inches of lighter colored quartz-rich material.	6AAT209A.--Rock is a solid mass of compacted sporelike disseminules botanically identified with <u>Tasmantites</u> , a problematic type of planktonic alga. The compressed disseminules are discoidal, about 400 microns in diameter. The sporelike bodies appear grayish yellow in reflected light but a few are brownish red. The organic matter composing them is anisotropic throughout (strain anisotropic), independent of the individual sporelike bodies. No clay is evident. Quartz fills a few partly compacted sporelike bodies and several are filled with barite. Tiny twinned plagioclase grains appear to be interstitial to the disseminules. Material of this kind was described by White (1929, p. 841-848) 6AAT209B.--Quartz-rich lenses include partly compacted disseminules of <u>Tasmantites</u> lined with fibrous quartz, evidently deposited before much if any compression had taken place. Remaining cavities were subsequently filled with finely crystalline spherulitic quartz. Barite fills some of the disseminules. Relatively low oil yield (88 gal. per ton) may reflect relative abundance of quartz or other mineral matter.
16	Howard Pass Quadrangle, 68°41'30" N., 157°17'40" W. Oula Creek just north of edge of hilly terrain, low outbank west side of stream. (Same locality as assay No. 5, p. D132, Tailleux, 1964.)	The middle part of the cut exposes strongly-sheared dark-colored gray-weathering shale that contains gouge layers, zones of hard, ferruginous and cherty layers, flaky, organic-rich shale, and blocks of tasmantite. At the north end of the cut is a block of contorted varicolored chert and float of the Shublik Formation (Triassic); at the south end of the cut is mudstone comparable to that in the Fortress Mountain Formation (Early Cretaceous). Rocks included in more than one assemblage probably have been mixed tectonically here and originally the tasmantite was likely to have been part of the assemblage present at localities 12 and 14. Sample 6AAT210 from apparently detached block 1 ft thick near creek level in north third of the cut.	6AAT210.--Tasmantite, bluish gray with tawny weathered surfaces. Contains both lenses and numerous scattered silica-filled <u>Tasmantites</u> disseminules.	6AAT210.--Similar to both 6AAT209A and B, but contains minute semiopaque stringers of iron oxide. No clay minerals evident. Relatively low oil yield (75 gal. per ton) may reflect presence of mineral matter, or local metamorphic changes.
19	Howard Pass Quadrangle, 68°37'40" N., 156°42'00" W. South side of Lisburne Ridge, 2.8 mi. east of Hardway Creek; low outbank on south side of northwest-flowing stream. (Same locality as assay No. 6, p. D132, Tailleux, 1964.)	Section of south-dipping rocks along low outbank shows from top: (1) clay, weathered red, more than 15 ft; (2) black, woody-appearing organic shale that weathers silvery gray in layers 0.2-0.8 ft thick separated by 0.1-0.3-ft layers of black flinty chert, 15 ft; 3-ft thick zone of platy, calcareous oil shale with laminae of prismatic calcite (crushed <u>Inoceramus</u> shells) and abundant belemnites near middle; (3) platy oil shale, weathered brown, very finely stratified, 5 ft; (4) organic-rich shale, black, interbedded with black chert and dark-colored cherty calcilitite; contains pelecypod cf. <u>Otapiria</u> and <u>Inoceramus lucifer</u> (R. W. Inlay, written communication, 1964), more than 15 ft thick; (5) poorly exposed interval similar to overlying unit, less than 50 ft; and (6) poorly exposed calcilitite of the Shublik Formation. Most of this section is lithogenetically like the underlying Shublik Formation and it has been included with the Shublik at the few places it has been recognized previously. However, the apparently undisturbed association of oil shale with chert and lutitic rocks bearing a fauna younger (Early Jurassic, R. W. Inlay, written communications, 1964, 1965) than that of the Shublik indicates a hitherto unrecognized supra-Shublik stratigraphic unit. Sample 6AAT205B from unit 3 above. Sample 6AAT205C from 3-ft oil shale zone in unit 2 above.	6AAT205B.--Shale, dark gray, with gypsum and iron and manganese oxides on weathered bedding planes. Is very hard and forms large platy blocks. Laminated with half-millimeter layers of organic-rich shale alternating with calcite. 6AAT205C.--Shale, black, weathered papery to platy in 1-m laminae. Weathered bedding planes dusted with iron and manganese oxides. Contains concretions as large as 15 mm in diameter of calcite and fish bones.	6AAT205B.--Ground mass consists of red organic material with fibrous aspect containing some calcite grains, alternating with layers and stringers of finely crystalline calcite. The calcite distorts the bedding of the organic fibers. Barite found by X-ray but not seen in thin section. Fragments of fish bones and scales and minute coprolites are fairly abundant. Oil yield reflects dilution with calcite. 6AAT205C.--Organic matter similar to that in 6AAT205B. Some of the thin plates contain no carbonate, but the few units about 15 mm thick contain both calcite and dolomite in lamina and grains that distort bedding of organic material. Fish remains abundant, but concretions of dolomite and barite surrounding fish bones and phosphatic coprolites account for most of the FeO in the chemical analysis (table 3). Barite also occurs as isolated crystals in the shale. Contains about 25 percent clay by X-ray analysis but clay not evident in thin section.
21	Killik River Quadrangle, 68°31'30" N., 155°28'30" W. Middle Fork of Opikruk River about 0.2 mi. below junction of Okanugun Creek. North part of outbank at end of craggy spur on east side.	Poorly exposed unit consists of deformed mudstone with thin zones of clay and black organic-rich shale that is iron-stained. Adjacent part of outbank consists of rubble of highly green-stained concretion-bearing wacke. A block of arenaceous limestone exposed directly to the north in 1949 had been covered by a mud slump then seen in 1964. This sequence is somewhat similar to that at locality 11. Sample 6AAT215 from organic-rich shale.	6AAT215.--Claystone, shaly, black. Breaks into irregular pieces rather than flakes. Is slightly iron stained.	6AAT215.--In this section available. X-ray analysis indicates about 2 percent barite. The clay fraction (55 percent) consists of about 40 percent mixed-layer clay and 60 percent illite.
25	Chandler Lake Quadrangle, 68°27'30" N., 150°55'30" W. Welcome Creek, 1 mi. below junction of Erratic Creek; east bank at edge of terrace.	Outcrops show steeply-dipping contorted varicolored chert. A bed of oil shale 1 ft thick projects through talus near the middle of the bank, and apparently is within a zone of shale about 50 ft thick. These rocks have been considered part of the Tiplukuk Formation (Patton and Tailleux, 1964, p. 459-460) but direct evidence of their position within mid-Cretaceous to post-Triassic stratigraphic interval is lacking. The association of oil shale and chert resembles that at locality 13, 175 miles to the west. Sample 6AAT206 from exposed oil shale bed.	6AAT206.--Shale or lignite concretion coal, black. Bedding is apparent on weathered surface and fresh fractures are moderately lustrous with finely laminated appearance.	6AAT206.--Consists of highly layered opaque black organic matter with scattered angular quartz grains. No fibrous organic material evident. X-ray analysis shows barite but it is not evident in thin sections.
27	Chandler Lake Quadrangle, approximately 68°31' N., 150°25' W. Cobblestone Creek about 2 mi. below junction of Peregrine Creek. Banks along east wall where canyon cuts a series of ridges; exact location undetermined for lack of visibility.	Poor exposures of a north-dipping sequence beneath the Fortress Mountain Formation of Cretaceous age show about 25 ft of organic-rich and ferruginous shale below clay shale with <u>Buchia</u> and <u>Equid</u> limestone and above organic-rich beds similar to the supra-Shublik unit of locality 19. Sample 6AAT201D-1 from 1-ft bed of sheared shale in upper part of unit. Sample 6AAT201D-2 from more platy, harder shale in lower part of unit.	6AAT201D-1.--Shale, black, flaky. Sample consists of small flakes. 6AAT201D-2.--Shale, black, flaky. Inefficient sample for oil analysis. Loss about 10 percent about 25 percent (table 3) consists of low oil content similar to that of 6AAT201D-1.	6AAT201D-1.--In this section available. X-ray analysis shows about 11 percent barite, 3 percent pyrite and a trace of gypsum as well as quartz and clay. The clay fraction (50 percent) consists of illite and mixed-layer illite-montmorillonite in about equal amounts. 6AAT201D-2.--In this section available. X-ray analysis shows about 2 percent barite, 5 percent pyrite, and 5 percent gypsum as well as quartz and clay. The clay fraction (60 percent) consists of illite and mixed-layer illite-montmorillonite in about equal amounts.

REFERENCES

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