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Article 148

RICH OIL SHALE FROM NORTHERN ALASKA

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Abstract.—Samples of oil shale of Jurassic(?) age from the foothills along the north edge of the Brooks Range assay 26–146 gallons of oil per ton of rock. The oil yield is greater than that of the Green River Formation, but owing to insufficient information the economic potential of the oil shale cannot be determined.

Samples of an organic shale of Jurassic(?) age, which crops out in the foothills along the north edge of the Brooks Range (fig. 148.1), assay 26–146 gallons of oil per ton of rock, several times more than assays of the minable beds of oil shale in the Green River Formation in the Rocky Mountain region. This Alaskan oil shale may be a significant resource, but more stratigraphic and structural information will be required for its assessment.

The oil shale seems to have been utilized for fuel in prehistoric times. Abnormal distribution of float, especially near old trailways and encampments, indicates that the Eskimos who lived in the interior before 1900 collected and transported the rock. It was probably carried for fuel. This is suggested by their identifica- of the material as wood in the times before the arrival of the white man (Stoney, 1900, p. 69).

Material inferred to have been oil shale was observed on several early expeditions to northern Alaska, and oil shale was specifically identified along later geologic traverses. Dr. John Simpson, surgeon aboard the H.M.S. *Plover* wintering at Point Barrow during 1852 to 1854, noted that "there is strewed along the beach a quantity of coal, . . . bituminous enough to make an excellent fire for cooking. It is of the sort called candle-coal, and some of the pieces are sound enough to be carved by the natives into lip ornaments" (Collinson, 1875, p. 125). On his overland trek in 1886 Lt. Howard found a substance on the middle Etivluk River "called wood by the natives; it was hard, brittle, light brown in color, very light in weight and burned readily, giving out quantities of gas" (Stoney, 1900, p. 69). Specimens collected from the mouth of the Kukpuk River in 1904 that Collier (1906, p. 45) described as cannel coal were more likely to have been fragments of oil shale, for such fragments have been found on gravel bars upstream by the present writer. Smith (Smith and Mertie, 1930, p. 282–286) collected and identified oil shale from bedrock along the Kivalina River and from float along the Etivluk River in the 1920's. The material was composed chiefly of megaspores. He speculated that the rock occurred at the base of the geosynclinal sedimentary deposits of Mesozoic age in northern Alaska and might be the source of the petroleum shows in the region.

Geologic mapping of Naval Petroleum Reserve No. 4 (1948–53) indicated that oil shale similar to that from the Green River Formation occurs in the Tiglukpuk Formation (Jurassic) (W. W. Patton, Jr., written communication, 1959) and in rock units that appear to be correlative with the Tiglukpuk. Highly organic shales also occur in the Shublik Formation (Triassic) and in the Lisburne Group locally (Missis-

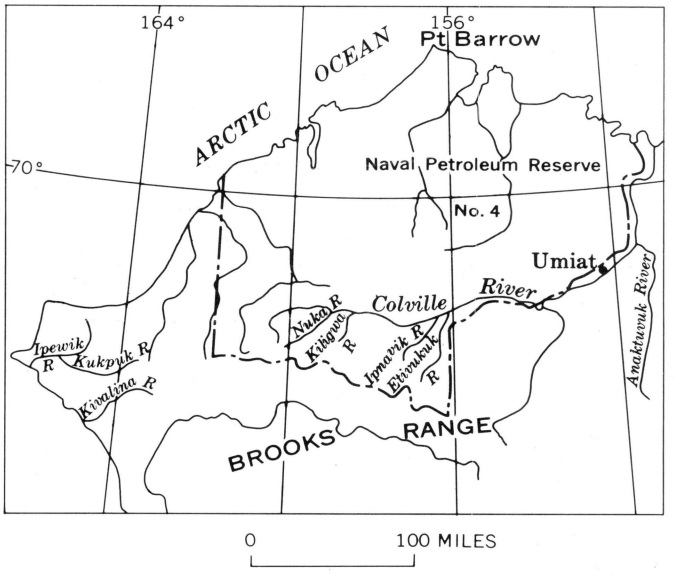

FIGURE 148.1.—Index map of northern Alaska.

ART. 148 *IN* U.S. GEOL. SURVEY PROF. PAPER 475-D, PAGES D131–D133. 1964.

other consists of oil shale and chert lying between ill-defined stratigraphic units of Permian and Jurassic age and the Okpikruak Formation (lowermost Cretaceous).[1] Oil-stained sandstone crops out near exposures of oil shale in the second succession on the Kiligwa River.

FIGURE 148.2.—Location of oil-shale samples (x), other exposures of oil shale (o), and outcrops of oil-stained sandstone (s) on the middle Kiligwa River (from rectified twinplex photo GS TAL 18–104L).

The oil shale has not been given special attention during current mapping because of the structural complexity and an apparent lack of appreciable thickness. However, samples of organic shale from the Nuka-Etivluk Rivers region were analyzed recently as part of a general compilation of oil-shale data (D. Duncan and V. Swanson, oral communication, 1962). Assayed yields of 26–146 gallons/ton of the Jurassic(?) samples are high in comparison with yields of the Green River Formation, in which reserves are computed in terms of 15 and 25 gallons/ton yields, with a maximum yield of 60–90 gallons/ton (Cashion, 1957, p. 135).

Stratigraphic descriptions of the samples, location of outcrops, and Fischer analyses are given in the accompanying table.

Additional study of the oil shale will be required to assess its potential. In the author's experience, shale along the Kiligwa River offers the most promise. Known exposures of oil shale along this river are shown on figure 148.2.

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Smith, P. S., and Mertie, J. B., Jr., 1930, Geology and mineral resources of northwestern Alaska: U.S. Geol. Survey Bull. 815, 351 p.

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[1] R. A. Scott (written communication, 1964) palynologically examined seven oil-shale samples and found that they contained only planktonic forms (chiefly dinoflagellates and hystrichosphaerids) and presumably reworked pollen of Permian or Early Triassic age. He inferred that the samples were of post-Triassic age and possibly were deposited far enough from shore to exclude contemporaneous pollen.

sippian) but lack the massive woody aspect of the Jurassic(?) shale (see accompanying table). The oil shale is known to crop out sporadically from the Ipewik River on the west to the Anaktuvuk River on the east, a distance of more than 300 miles. Owing to its low density and toughness, the shale is distributed widely as float and as outsized clasts in coarse-grained younger rocks.

Exposures of oil-shale strata are sparse and incomplete, and most show strong deformation. Thickness and other stratigraphic details, therefore, are difficult to determine. Oil shale apparently is present in at least two distinct stratigraphic successions. One consists of oil shale and chert near the base of the Tiglukpuk Formation, which overlies the Shublik and Siksikpuk (Permian) Formations and the Lisburne Group; the

Analyses and descriptions of organic shale samples

[Specific gravity determined by author; Fischer analyses by J. Budinsky]

Stratigraphic unit	Laboratory No. and (field No.)	Location [1] (coordinates)	Specific gravity	Fischer analyses					
				Oil (gal/ton)	Water (gal/ton)	Oil (percent)	Water (percent)	Gas, plus loss (percent)	Ash at 900°C (percent)
1. Jurassic(?)	160 127 (51ATr220)	Mid part of Kiligwa River (68°41′50″ N., 158°28′00″ W.)	1. 22	146	6. 3	53. 7	2. 6	8. 9	30. 0
2. Jurassic(?)	160 134 (50AKt261)	East of mid part of Kuna River (68°40′05″ N., 157°32′15″ W.)	1. 27	144	17. 7	60. 6	7. 4	13. 7	23. 1
3. Jurassic(?)	160 129 (51AKt67)	Mid part of Kiligwa River (68°39′45″ N., 158°28′10″ W.)	1. 20	52. 6	25. 2	19. 7	10. 7	18. 7	12. 7
4. Jurassic(?)	160 128 (51ATr228)	Mid part of Kiligwa River (68°42′25″ N., 158°27′45″ W.)	1. 51	40. 9	12. 9	17. 1	5. 3	8. 0	26. 0
5. Tiglukpuk Formation	160 133 (50AKt237)	West of mid part of Ipnavik River (68°41′30″ N., 157°17′40″ W.)	1. 61	48. 8	14. 9	20. 3	6. 3	6. 1	48. 1
6. Tiglukpuk Formation	160 132 (50ATr60)	West of mid part of Etivluk River (68°37′40″ N., 156°43′00″ W.)	1. 86	26. 6	9. 8	11. 1	4. 1	6. 0	57. 6
7. Shublik Formation	160 130 (51ATr248)	Mid part of Kiligwa River (68°44′50″ N., 158°24′50″ W.)	1. 90	24. 7	8. 8	8. 2	3. 7	4. 1	59. 2
8. Lisburne Group	160 131 (50AKt106)	East of mid part of Ipnavik River (68°40′05″ N., 156°57′40″ W.)	2. 4	6. 7	3. 4	2. 8	1. 4	1. 8	58. 3

1. Cutbank. Brownish-black woody shale; tough, compact, incipient very thin plates with conchoidal, resinous transverse fracture; weathers pale brown; thinly interbedded with varicolored chert; within 70 feet of unconformable basal contact of Okpikruak Formation on south flank of anticline.
2. Float along small stream. Dark-yellowish-brown woody shale; tough, compact; resinous, irregular fracture; crenulated varicolored chert and Okpikruak Formation nearby.
3. Cutbank. Grayish-black papery to woody shale; platy, weakly exfoliated; 12 feet thick; overlies moderately dipping, faulted, varicolored chert. Oil shale and oil-stained sandstone exposed in adjacent cutbanks.
4. Cutbank. Black organic shale; compact with incipient parting; dull with very fine resinous layers; grayish-yellow bloom; 20-foot thickness exposed, subordinate chert; associated with strongly deformed varicolored chert, shale, sandstone, and very finely stratified limestone.
5. Rubble bank. Grayish-black organic shale; compact, very fine, platy partings, dull luster; associated with chert. Apparently crenulated with underlying Shublik Formation and overlying Fortress Mountain Formation. Float of asphaltum also in rubble.
6. Outcrop. Dark brownish-gray papery shale; calcareous; belemnites; weathers light gray and pale brown; 15 feet of 2–3 inch layers, subordinate thin dark chert beds; overlies crenulated Shublik Formation.
7. Cutbank. Brownish-black papery shale; calcareous; abundant *Halobia* (pectenoid mollusk) imprints; 2–4-inch beds with interbeds of dark, very fine limestone and black chert.
8. Rubble. Grayish-brownish-black, platy shale; calcareous; associated with thin platy, brittle, very dark gray limestone.

[1] From 1:63,360 manuscript maps for Howard Pass quadrangle, Alaskan Topographic Series.