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by

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INTRODUCTORY DISCUSSION

To refine the stratigraphy of the Otuk Formation and ultimately determine its petroleum source rock potential, 11 columnar sections of the Otuk Formation (sheets 3-13) were measured and described along the north-central front of the Brooks Range fold-thrust belt during June and July 1983. Prior to this study, only a few sections of Otuk had been measured in the north-central Brooks Range, mainly as the result of reconnaissance investigations of Naval Petroleum Reserve No. 4 (now National Petroleum Reserve in Alaska) by the U.S. Geological Survey in the 1940s and 1950s. (Chapman and others, 1964; Patton and Tailleur, 1964).

The 11 columnar sections outcrop within the principal belt of Otuk exposures, a narrow, east-west-trending band along the front of the central and western Brooks Range. The sections span an area 270 km in length within the Killik River, Chandler Lake, and western Philip Smith Mountains quadrangles and, except for the Atigun Gorge locality, are accessible by helicopter only. (See sheet 1 for general location of columnar sections; see sheets 3-13 for specific locations.) To simplify stratigraphic correlations, all the columnar sections were measured on the Endicott Mountains allochthon, the lowest of the major allochthons composing the northern part of the Brooks Range fold-thrust belt.

The Otuk Formation comprises 80-120 m of thinly and rhythmically interbedded black, organic-rich shale, chert, and siliceous limestone. Mull and others (1982) have subdivided the Otuk Formation into four members: (1) black, organic-rich shale and minor gray-weathering limestone of the Lower and Middle Triassic shale member; (2) black to gray-green chert and interbedded black, calcareous shale of the Middle and Upper Triassic chert member; (3) tan-weathering siliceous limestone and interbedded black to green-gray shale of the Upper Triassic limestone member; and (4) black, organic-rich shale of the Jurassic Blankenship Member. During this study, a fifth member, thin siltstone of the Upper Triassic Karen Creek Member, was recognized at the eastern end of the north-central Brooks Range in a stratigraphic position between the limestone member and the Blankenship Member. (See sheet 2.)

Both the limestone and chert members of the Otuk Formation are highly fossiliferous, containing coquinoid layers of Middle and Late Triassic pectinacid bivalves. Additionally, ammonites, conodonts, foraminifera, and radiolarians have been recovered from the formation. The faunal assemblage ranges from Early Triassic (late Dienerian-early Smithian or earlier Early Triassic) to Middle Jurassic (Bajocian). (See sheet 2 for characteristic microfossils and megafossils.)

The Otuk Formation is disconformably underlain by variegated mudstones of the Permian Siksikpuk Formation. Together the Otuk and Siksikpuk Formations form the Etivluk Group of Mull and others (1982). The Otuk is disconformably overlain by the Lower Cretaceous (lower Neocomian) coquinoid limestone and shale unit. Contacts within the Otuk are conformable, with the exception of a disconformity beneath the Blankenship Member. Rocks of the Otuk were originally assigned to analogous strata of the Triassic Shublik Formation of the northeastern Brooks Range but were renamed by Mull and others (1982) due mainly to the absence of siliceous lithologies in the Shublik. The Otuk Formation is time correlative with the Ivishak and Shublik Formations, the Karen Creek Sandstone, and the lower Kingak Shale of the northeastern Brooks Range. Coeval strata of the northeastern Brooks Range are about five times as thick as the Otuk Formation and have a greater clastic component (sheet 14).

The Otuk Formation was deposited mainly below wave base in middle and outer neritic to inner bathyal environments, based on the formation's faunal assemblage, sedimentary structures, and fine-grained, unwinnowed lithologies. Characteristically thin, laterally continuous beds of the Otuk reflect low clastic input on a stable substrate. Lithofacies trends in the Otuk, including an

eastward decrease in chert, coupled with the relatively proximal nature of coeval Triassic rocks to the north and northeast, indicate that the Triassic shelf shallowed to the north and east. The Otuk Formation, therefore, is a condensed, deeper water equivalent of the Ivishak and Shublik Formations, the Karen Creek Sandstone, and the Kingak Shale. (See sheet 14.)

An average total organic carbon value (TOC) for the Otuk Formation of 2.77 weight percent (sheet 2), well above accepted TOC values for source rock, and a dominant amorphous kerogen component suggest that the Otuk Formation may be a source of liquid hydrocarbons. Pyrolysis (T_{max}), vitrinite reflectance (R_o), thermal alteration (TAI), and conodont color alteration (CAI) indices show that thermal maturity of the Otuk Formation increases from immature in the west at Otuk Creek to overmature in the east at Cobblestone Creek. Thermal maturity also increases from north to south toward the Brooks Range mountain front.

Details of this study are presented in Bodnar (1984a), including hydrocarbon source rock analyses of 48 Otuk samples and a list of fossils found in the Otuk Formation and adjacent strata, and are summarized in Bodnar (1989). Preliminary results of this study were presented by Bodnar (1984b).

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