

PALEONTOLOGICAL INVENTORY OF THE KURUPA LAKE AREA, GATES OF
THE ARCTIC NATIONAL PARK, BROOKS RANGE, ALASKA

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INTRODUCTION

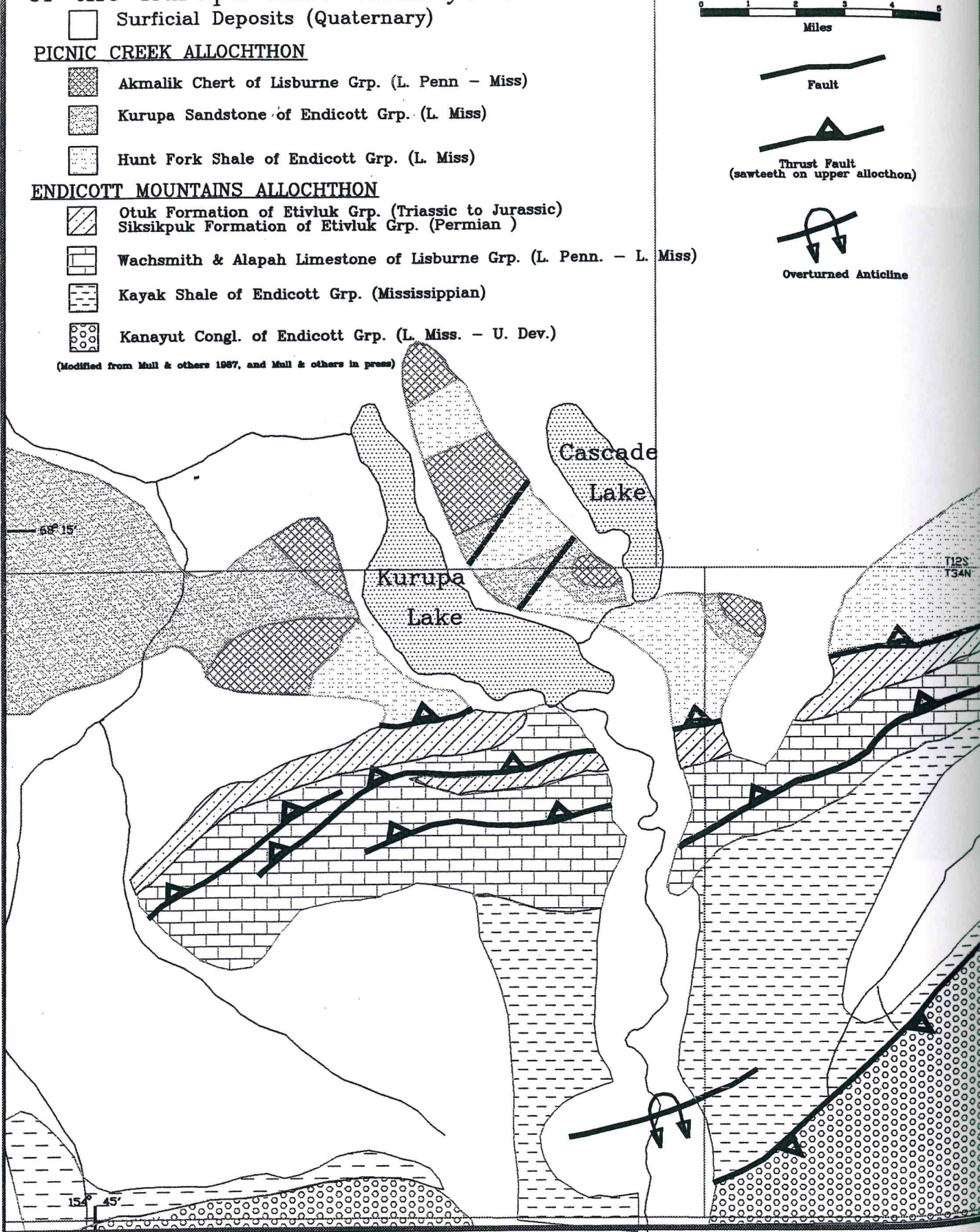
The two authors made a seven-day long field investigation and evaluation of fossil-bearing rocks of the Kurupa Lake area, Killik River B-3 quadrangle (scale 1:63,360), which is situated in the Gates of the Arctic National Park. The field work was conducted between the dates of August 3-August 10, 1996. Weather permitted field studies to be carried out on five of our seven days at Kurupa Lake; unfortunately, examination of rock exposures in the field area was precluded for two days due to snow fall. Our base camp was situated at the southeastern end of Kurupa Lake, several hundred yards upstream from the mouth of an unnamed stream which drains Cascade Lake and flows southwest into Kurupa Lake (Fig. 1). Two major thrust-faulted packages of rocks (overthrust faults represent breaks in the earth's surface where compressive forces bring one sheet or block of crustal material over and above adjacent crust) are exposed in the Kurupa Lake area (see Mull and others, 1987 and 1996, for details). These two faulted packages are both thought to have been displaced great distances, estimates varying from 30 to 300 miles, from



Figure 1. View to southwest of southeast end of Kurupa Lake. Our campsite with tents are clearly visible along unnamed stream. Prominent limestone cliffs in background on opposite side of lake consist of Lisburne Group carbonates primarily of Mississippian (early Carboniferous) age.

Figure 2 (facing page). Index map of Kurupa Lake showing the two major thrust-faulted structural units [Endicott Mountains and Picnic Creek allochthons]. Map modified from Mull and others (1987 and 1996).

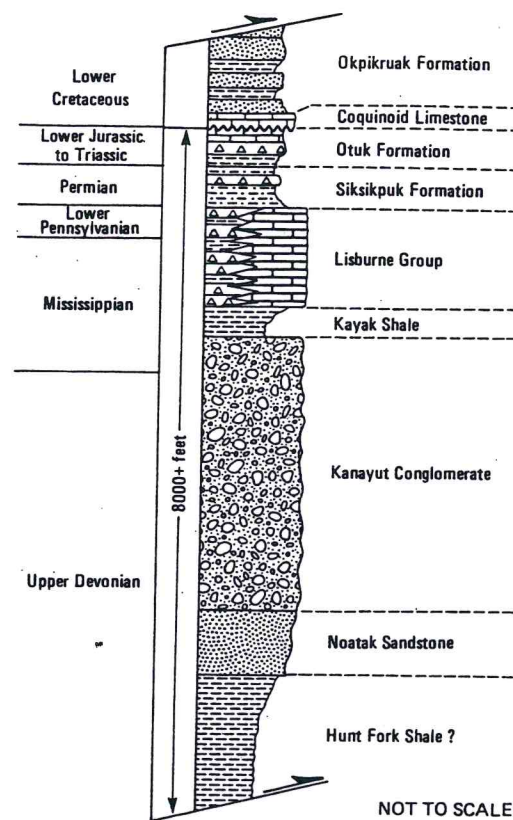
Figure 2. The Geology and Paleontology of the Kurupa Lake Vicinity (Blodgett & Brease 1997)



their original source areas to the south. These packages of rock have been referred to as the Endicott Mountains allochthon and picnic Creek allochthon (an allochthon is a fancy name for a far-traveled thrust-faulted block). The latter allochthon, or overthrust package, is exposed to the north, and structurally overlies the former (see index map, Fig. 2). Although both packages of rock are roughly equivalent in age and presumably once continuous, significant differences can be recognized in the succession of rock types within each package, suggesting some major, long-distance shortening or "telescoping" between these structural units. Two generalized stratigraphic columns showing the lithologic character of each allochthon is given in Figure 3. Appendix I at the end of this report consists of a photocopy of the Killik River B-3 quadrangle showing the location of our fossil collections, as well as traverses made during the study. Photocopies of most of the pertinent references cited in the text are provided in Appendix II.

ENDICOTT MOUNTAINS ALLOCHTHON

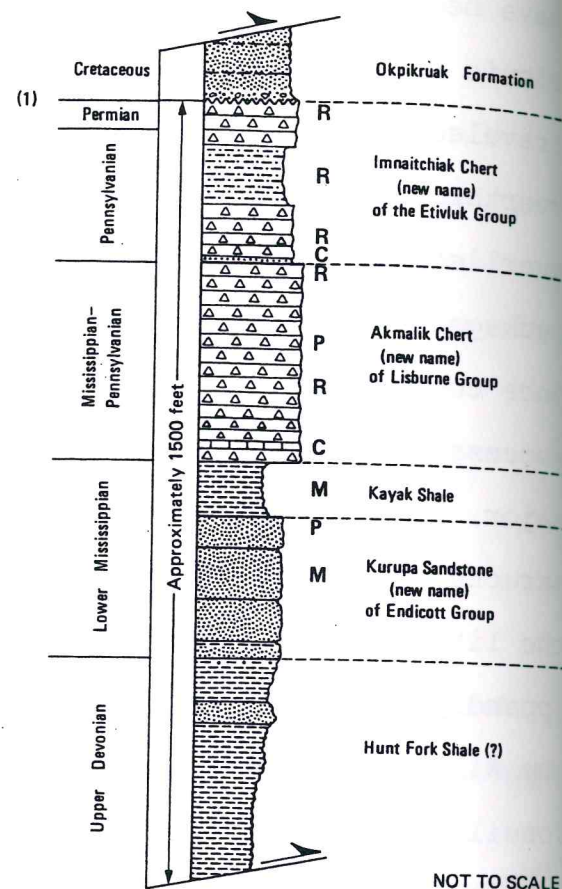
Endicott Group.-- The lowest stratigraphic package exposed in the Endicott Mountains allochthon consists of Late Devonian to Early Mississippian age siliceous clastic rocks (these include conglomerates, sandstones, siltstones, and shale) known as the Endicott Group. In ascending order, the Endicott Group consists of the Hunt Fork Shale, Noatak Sandstone, Kanayut Conglomerate, and Kayak Shale. None of these units mapped within the Endicott



EXPLANATION

Conglomerate	Shale
Sandstone	Limestone
Siltstone	Chert

Generalized stratigraphic column of Endicott Mountains allochthon.



EXPLANATION

Sandstone	R Radiolarians
Siltstone	C Conodonts
Shale	M Megafossils
Bedded Chert	P Plants
Limestone	

Generalized stratigraphic column of Picnic Creek allochthon.

Figure 3. Two generalized stratigraphic columns which show the lithologic character of the Endicott Mountains and Picnic Creek allochthons (from Mull and others, 1987, figs. 2 and 3).

Mountain allochthon were visited by us, due to the distance which separated their exposures from our base camp at the southeast end of Kurupa Lake.

Noatak Sandstone (of the Endicott Group).-- The Noatak Sandstone is not exposed in the vicinity of Kurupa Lake, although exposures of the formation are noted further to the south in the northern part of the Brooks Range. Late Devonian (early Famennian) age megafossils (mostly brachiopods) and microfossils (conodonts) were reported (Dutro and others, 1994) from an exposure of the Noatak Sandstone to the southwest of the Kurupa Lake area, in the Killik River A-5 quadrangle. Brachiopods illustrated in this paper include the following forms: *Crinisarina* sp., *Eoparaphorhynchus* cf. *E. walcotti* (Merriam), *Eoparaphorhynchus* cf. *E. maclareni* Sartenaer, *Cyrtospirifer* cf. *C. portae* Merriam, and *Cyrtospirifer* cf. *C. monticola* (Haynes).

Lisburne Group.-- The Lisburne Group of Carboniferous (Mississippian and Pennsylvanian) age is one of the most distinctive geologic formations recognized throughout the Brooks Range. It consists primarily of carbonate rocks (limestone and dolostone), but also includes more siliceous (cherty) deep-water sedimentary units. The Lisburne is commonly broken into differing subunits (formations) and in the Endicott Mountains allochthon these are an underlying Wachsmuth Limestone and overlying Alapah Limestone. We examined Lisburne exposures

southeast of Kurupa Lake, where long continuous stratigraphic sections of limestone are exposed along north-south oriented drainages. Nearly all identifiable megafossil remains consist of solitary rugose corals (Fig. 4) and abundant crinoid columnals. The limestones of the Lisburne have been buried at moderate to relative deep depths and, hence, exhibit relatively hard induration. Thus, cracking out megafossils such as brachiopods and molluscs is nearly impossible, and studies of these latter groups is not possible in this area. It is recommended that any future paleontologic study of the Lisburne of the Kurupa Lake area place emphasis either on corals or microfossils, such as conodonts, which could be recovered by acid digestion or foraminiferids which could be studied by means of petrographic thin section.

Otuk Formation.-- The Otuk Formation was named by Mull and others (1982) for rocks Triassic-Jurassic age rock rocks formerly included in the Shublik Formation. Together with underlying Siksikpuk Formation of Permian, they both were included by Mull and others in their proposed Etivluk Group. The Otuk Formation contains what was the best-preserved macrofossil material we observed during our study. These were found along the west-facing ridge crest approximately 2.0 miles SE of our base camp consist of a prominent E-W trending band of yellowish-brown siltstone containing abundant monotid bivalves (Fig. 5) belonging to Monotis (Pacimonotis) subcircularis Gabb. This distinctive

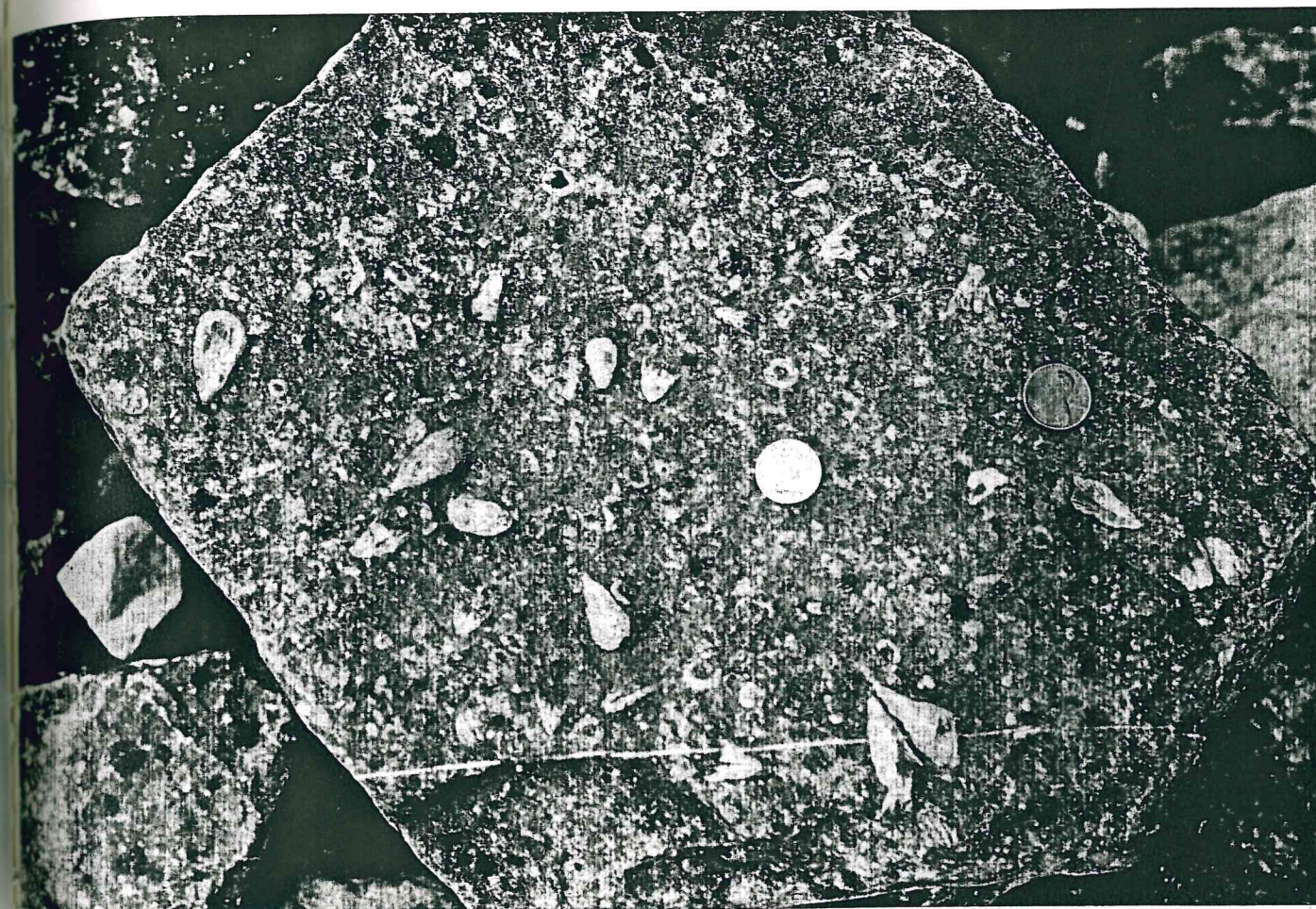


Figure 4. Limestone slab (stream boulder) from Lisburne Group carbonates of the Endicott Mountains allochthon exposed in unnamed creek 2.1 miles ESE of southeast end of Kurupa Lake. This slab contains abundant solitary rugose corals. Penny and dime shown for scale.

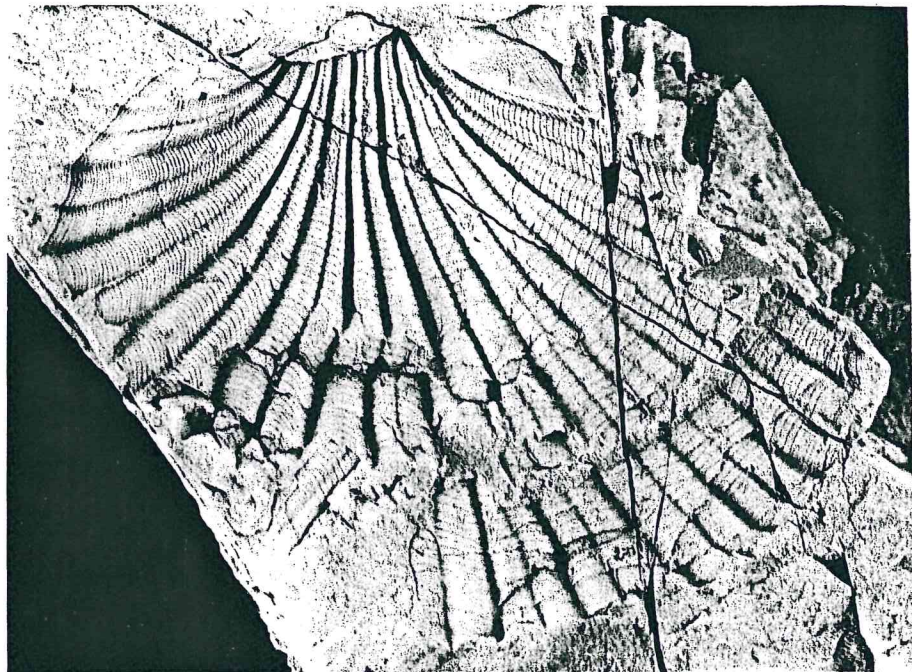


Figure 5. Photograph (x3) of an external mold of the monotid bivalve, Monotis (Pacimonotis) subcircularis Gabb from the Otuk Formation

group of Mesozoic age flat clams are extremely important in dating deep-water, outer-shelf deposits of Triassic age. Genera included in the group are Monotis, Daonella, and Halobia. Excellent general references for the group include Westermann (1973), Silberling (1963, 1985), and Grant-Mackie and Silberling (1990). They are extremely abundant and wide-spread in many regions of the world during Middle and Late Triassic time, and because of their wide distribution, presumably due to a pseudonektonic style of life [the term "pseudonektonic" refers to their life habit of being attached by byssal threads to floating marine algae (or seaweed), allowing them to have great geographic distribution depending upon directions of oceanic currents]. Together with ammonoid cephalopods, this group of bivalves are one of the most highly utilized biologic entities for Triassic biostratigraphy. A review of the systematics and biogeographic distribution of the genus Monotis is provided by Westermann (1973). Because of its prominence of the genus in the Upper Triassic rocks of the circum-Pacific region, it has also been undergone serious later taxonomic studies by Japanese, New Zealand, Russian, as well as North American paleontologists. One of the most recent updates on current thinking on the taxonomy and biogeography of the genus is by Grant-Mackie and Silberling (1990). Numerous specimens on an rock slab identified as Monotis subcircularis Gabb were illustrated by Silberling (1985, Fig. 1i) from the Killik River quadrangle. This species was recently transferred by Grant-Mackie and Silberling (1990) to their new

subgenus Monotis (Pacimonotis).

PICNIC CREEK ALLOCHTHON

Endicott Group.⁴- In the Picnic Creek allochthon, the Endicott Group exposures around Kurupa Lake include the following formations in ascending order: Hunt Fork Shale(?), Kurupa Sandstone, and Kayak Shale. Only two of these units were visited by us (Hunt Fork Shale(?) and Kurupa Sandstone), the Kayak not being exposed in vicinity of our base camp.

Hunt Fork Shale(?).--This formation has been questionably recognized in field mapping by earlier field parties. This unit which forms the lowest recognized formation in the Picnic Creek allochthon consists of "unfossiliferous greenish-gray shale that grades up to dark-gray to black shale interbedded with thin sandstone beds" (Mull and others, 1987, p. 654). The contact with the overlying Kurupa Sandstone is gradational and interfingering. The unit is at least 300 meters thick at Kurupa Lake, and is well exposed in the hill which flanks the southeast shore of the lake. We spent several days on this exposure. Careful examination was made for invertebrate shelly remains (i.e. brachiopods, bivalves), but none were recognized. The sedimentologic character of the rocks in this unit suggest that it was deposited in a relatively deep-water setting, probably in a basinal setting with low oxygen levels which prevented the development of abundant benthonic shelly invertebrate fauna.

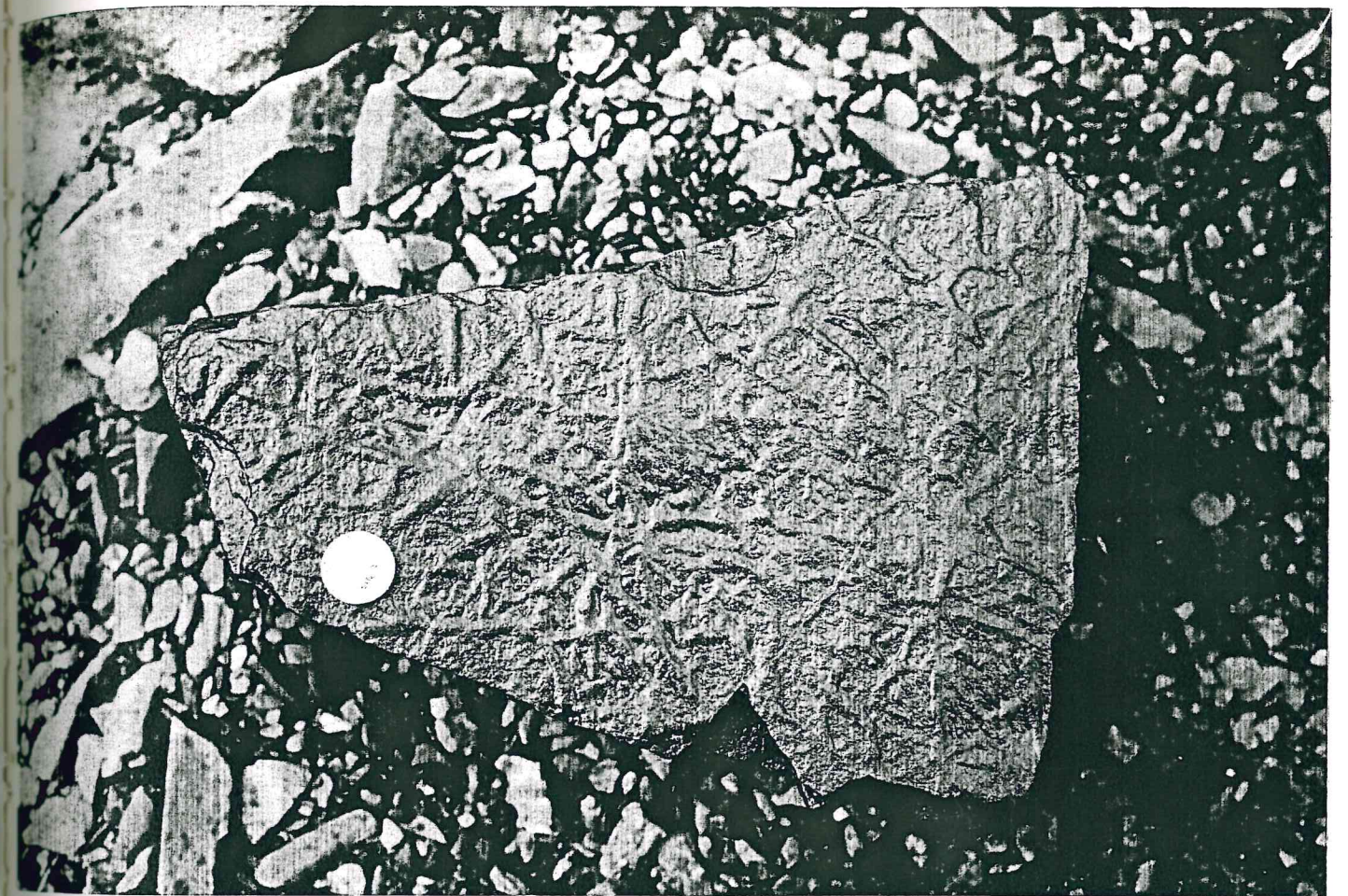


Figure 6. Trace fossils (feeding traces) from finer-grained siltstone/shale beds within Hunt Fork Shale (?). Age is probably Late Devonian. Specimen found in stream gravels at base camp. Dime shown for scale.

However, trace fossils (feeding traces) are moderately abundant in this unit (Figure 6) and a detailed study of their stratigraphic succession could be useful in better determining the paleoenvironmental setting of this unit. The abundance and diversity of feeding trace types suggest that a moderately diverse fauna of non-shelled invertebrates (i.e., worms) were locally developed. Large, woody plant fragments are also infrequently found (Figure 7); these being more common in the sandier beds, which probably represent distal turbidite deposits.

Kurupa Sandstone.-- This unit was named by Mull and others (1987). It consists of well-bedded succession of medium- to coarse-grained sandstone with thin interbeds of shale and siltstone. The type section of formation is located in the Kurupa Hills, situated to the west of Kurupa Lake. Typically, the formation is about 130 feet (39 m) thick. It lies conformably upon the Hunt Fork Shale (?), and represents part of an upward-coarsening succession recognized as having been already well established in the upper part of the underlying formation. Mull and others (1987, p. 656) interpreted much of the unit to consist of amalgamated turbidites. Body plant fossils were recovered from a number of localities in the further east, in the central Killik River quadrangle, and these were described by Spicer and Thomas (1987). Lycopod forms dominate the described flora, which includes taxa previously known only Mississippian age floras of Siberia. On this basis, it was

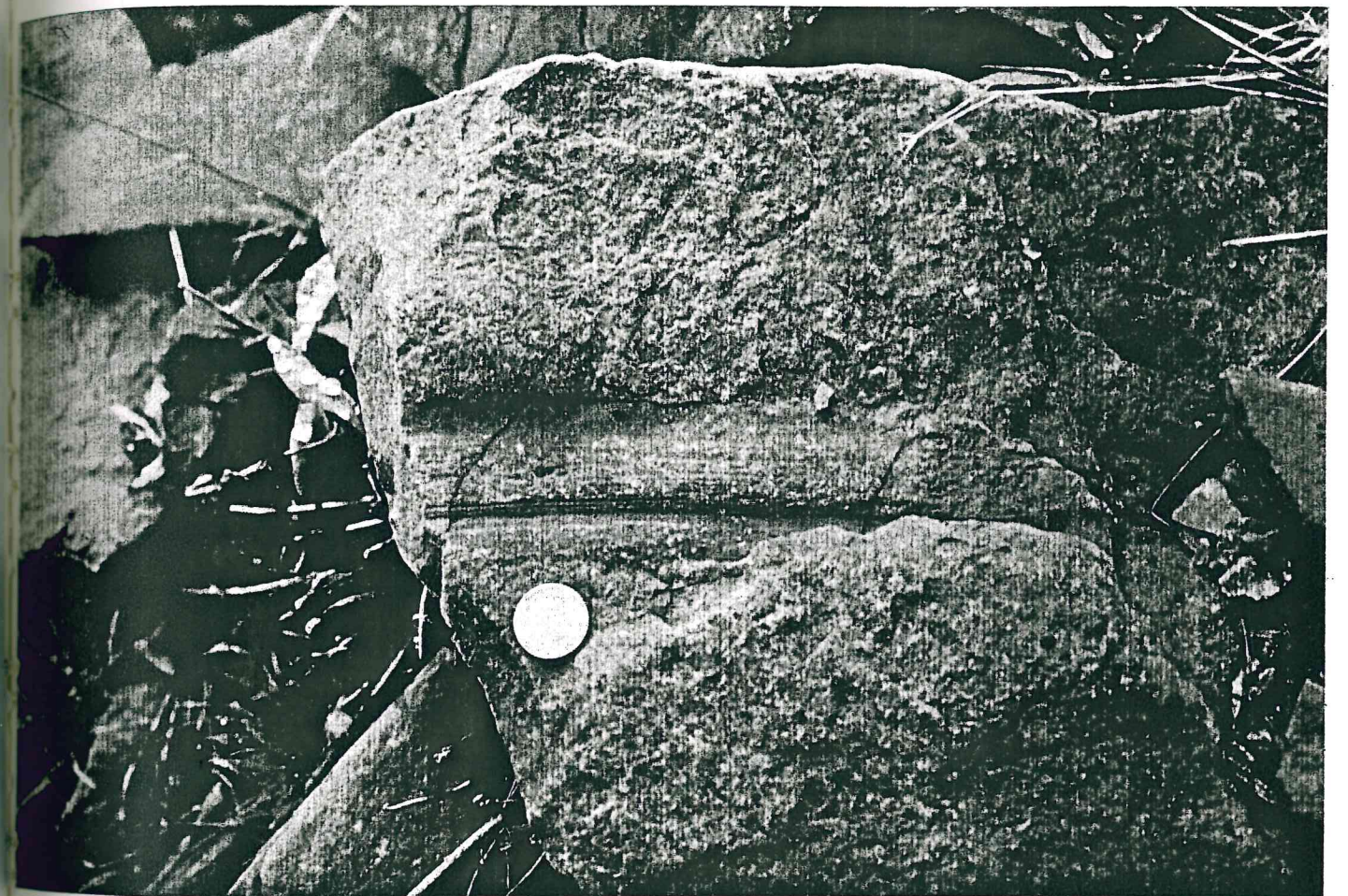


Figure 7. Woody plant stem preserved in medium-grained sandstone slab (probably basal part of a turbidite) in the Hunt Fork Shale (?). Age is probably Late Devonian. Specimen found in stream gravels at base camp. Dime shown for scale.

suggested by these authors that northern Alaska (i.e., the strata comprising the Brooks Range) and Siberia were joined together in Mississippian time. We examined a well exposed sequence of the Kurupa Sandstone situated on the hill east of the southeast end of the Kurupa Lake, but were not able to find any plant fossils in these exposures. Although we found nothing during the day we spent at this exposure, it is indeed possible that a much more detailed and lengthy search may show their presence here too.

Lisburne Group.-- In the Picnic Creek allochthon, the Lisburne Group is represented by deeper-water equivalent cherty rocks, to which the name Akmalik Chert have been applied (Mull and others, 1987).

Akmalik Chert of the Lisburne Group.-- The Akmalik Chert is a sequence of black chert between 230 and 260 feet (75 to 83 m) thick, which overlies the Kurupa Sandstone with an intervening thin interval of Kayak Shale. The latter unit is absent to very poorly exposed near our base camp. Akmalik Chert is considered to be part of the Lisburne Group, however, representing a deep-water lateral equivalent to the shallow-water carbonates that one typically associates with the Lisburne Group (as in the previously discussed Endicott Mountains allochthon). No megafossil remains were observed by us in this unit during our field study. The age of the unit is thought to range from Mississippian to early Pennsylvanian, based primarily on conodont and radiolarian ages. Both microfossil groups could bear further

detailed study in the area, as there appears to be a discrepancy in age dates from these two groups (Mull and others, 1987, p. 659).

CONCLUSIONS

In general, the Paleozoic and Mesozoic age strata exposed in the two major thrust packages exposed in the Kurupa Lake area are not highly fossiliferous. The oldest exposed rock unit (formation) in the area is the Hunt Fork Shale (?), which on the basis of regional correlation is thought to be of Late Devonian age. The unit consists primarily of basinal, deep-water sediments which contain almost no invertebrate shelly fossil remains (i.e., brachiopods, gastropods, corals). Locally, abundant trace fossils representing feeding traces of grazing non-shelled invertebrates are abundant. Scientifically this unit would hold much promise for study of the trace fossil succession throughout the formation, in order to document relative water depth and environmental change upward into the shoaling (shallowing) upward trend observed in our field study. Plant stem fragments are rare, but were observed in sandy interbeds in the Kayak; these intervals are thought to represent turbidite deposits which have transported sand sediment downslope into a deeper water setting.

The immediately overlying Kurupa Sandstone (of early Mississippian) age, whose type section is situated to the west of the Kurupa Lake area, has yielded well-preserved body plant fossils of strongly Siberian affinities in other areas east of

Kurupa Lake. We did not observe any plant fossils in the Kurupa Sandstone in the field area during our study, but it is not beyond question that a more detailed, intensive search could reveal their presence here.

The Lisburne Group, primarily of Mississippian age, consists of carbonate rocks (limestone and less abundant dolostone) which contain relatively abundant invertebrate fossils (mostly rugose corals and crinoid columnals). Compared to other areas however, such as Atigun Gorge along the Haul Road, the Kurupa Lake exposures are much more highly indurated and few invertebrate shelly fossil groups like brachiopods or bivalves could be broken out for study. Future study of invertebrate fossils from the Lisburne Group of the Kurupa Lake area would most profit from study of rugose corals or foraminiferids.

The only invertebrate megafossils that we observed in post-Lisburne age rocks were from a distinct coquinoid bed of Late Triassic age within the Otuk Formation (Triassic-Jurassic). This unit contains a distinctive interval of thin-bedded limestone and cherty shale which has abundant monotid bivalves. This group is highly useful for age dating globally, presumably due to the assumed pseudonektonic style of life. Although the shells are well preserved in the field area, few exposures are present, and future workers who wish to investigate the area should carefully peruse areal photographs to delineate potential collecting sites. It is felt that this last unit which would be potentially the most valuable in terms of study of its contained invertebrate

fossil fauna.

Our experience with snow cover of rock exposures for two of seven working days in the early part of August compels us to suggest that geologic investigations should best be planned for late June through July.

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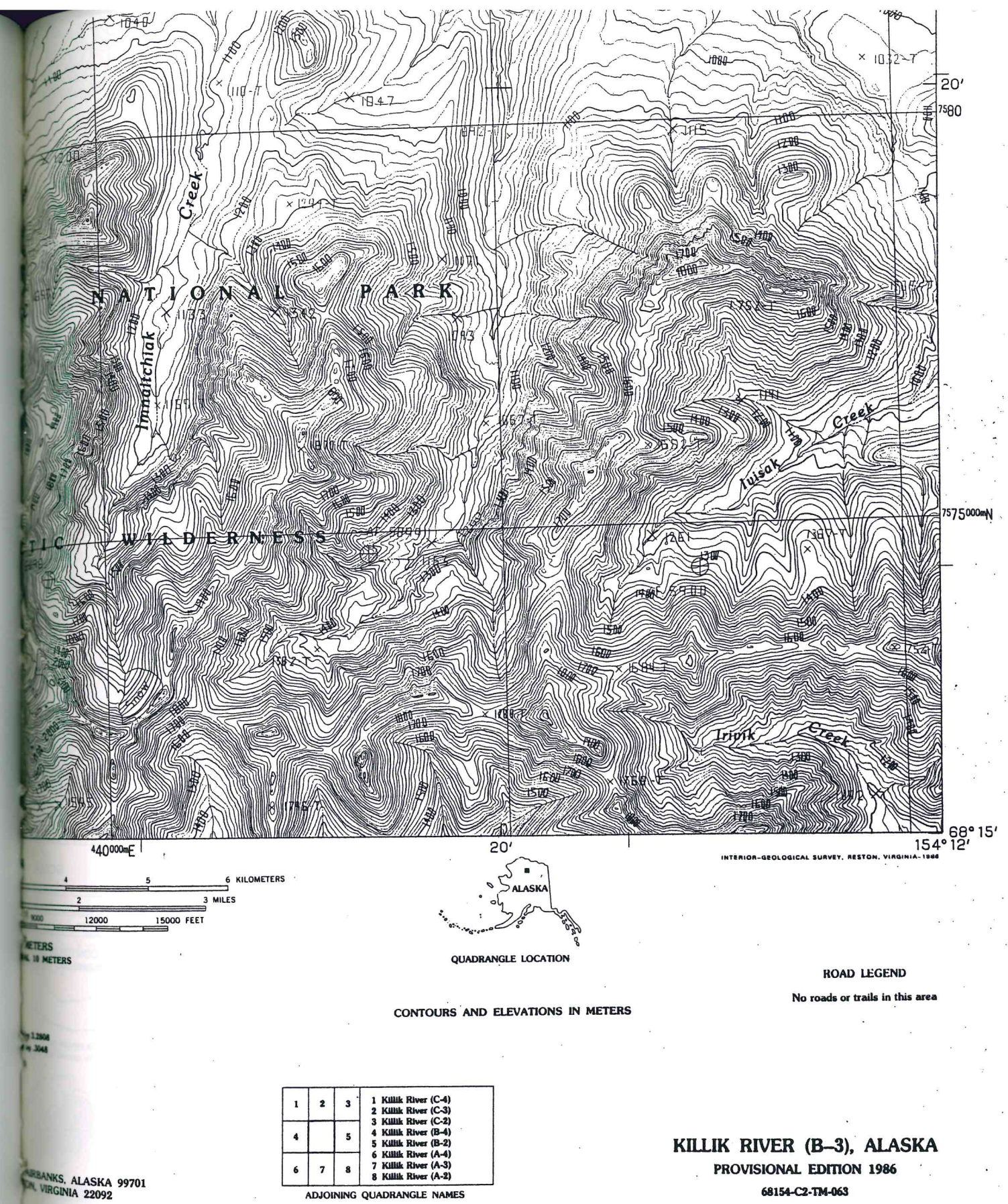
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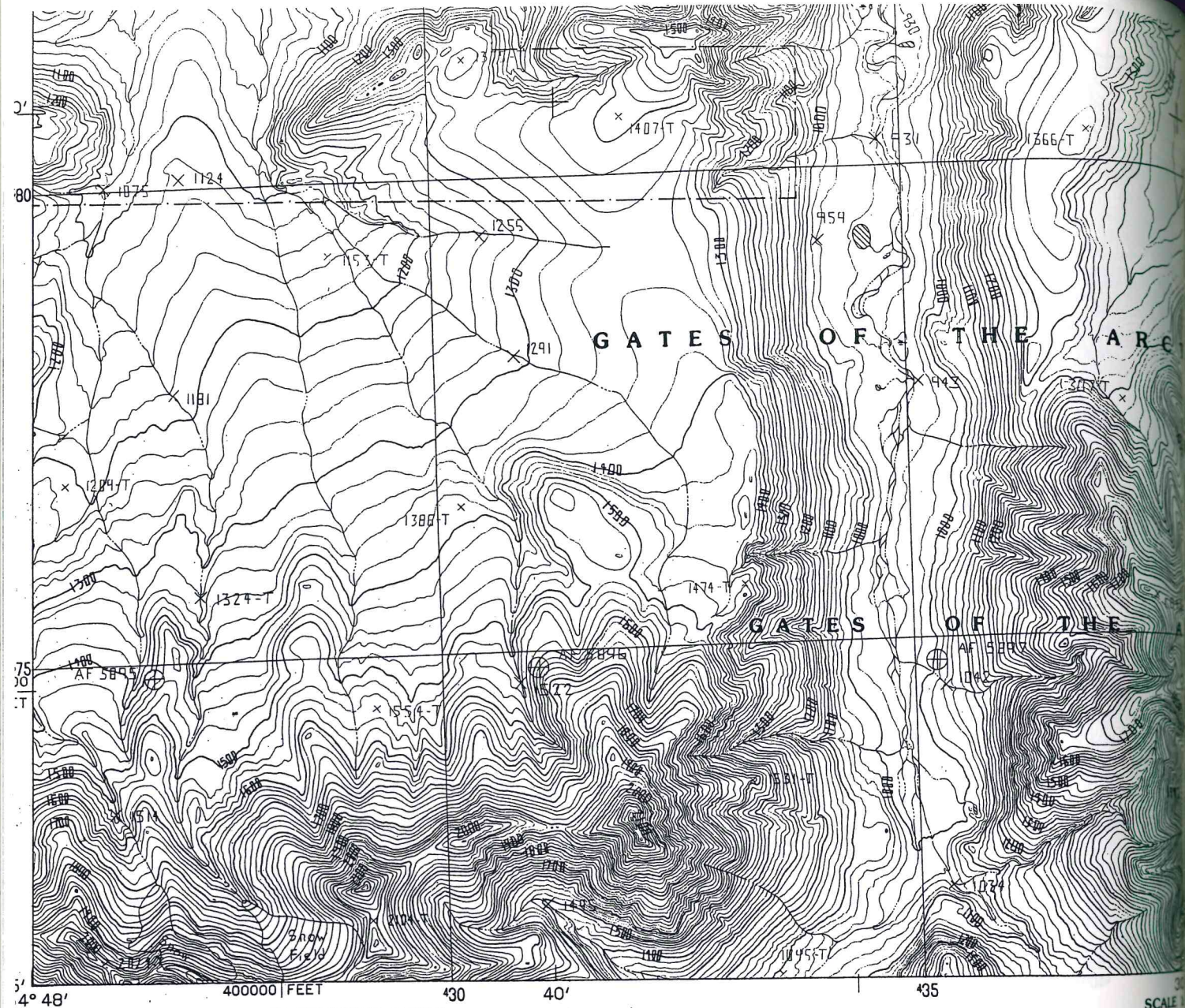
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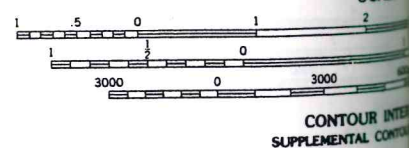
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 CONTROL BY USGS, NOS/NOAA
 COMPILED FROM AERIAL PHOTOGRAPHS TAKEN 1973
 MAP NOT FIELD CHECKED. MAP EDITED 1986
 PROJECTION UNIVERSAL TRANSVERSE MERCATOR
 GRID: 5000-METER UNIVERSAL TRANSVERSE MERCATOR ZONE 5
 20,000-FOOT STATE GRID TICKS ALASKA, ZONE 5
 UTM GRID DECLINATION 1°24' WEST
 1986 MAGNETIC NORTH DECLINATION 25° EAST
 VERTICAL DATUM NATIONAL GEODETIC VERTICAL DATUM OF 1929
 HORIZONTAL DATUM 1927 NORTH AMERICAN DATUM
 To place on the predicted North American Datum of 1983, move the
 projection lines 55 meters north and 122 meters east
 Land lines represent unsurveyed and unmarked locations predeter-
 mined by the Bureau of Land Management, Folios U-10, Umiat
 Meridian and K-1, Kateel River Meridian
 There may be private inholdings within the boundaries of any
 Federal or State Reservations shown on this map
 Federal Reservations boundaries established by the Alaska National
 Interest Lands Conservation Act, PL 96-487, Dec. 2, 1980, are
 shown as compiled by the administering agencies
 All streams and lakes are perennial
 Swamps, as portrayed, indicate only the wetter areas, usually of low
 relief, as interpreted from aerial photographs

PROVISIONAL MAP
 Produced from original
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UP ROOM
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— traverse route
 X — fossil locality

