

PUBLIC DATA FILE 88-6d

Alaska Division of Geological and Geophysical Surveys

PRELIMINARY DETAILED STRATIGRAPHIC SECTIONS
OF THE CARBONIFEROUS LISBURNE GROUP,
CENTRAL SHUBLIK TO THE NORTHERN FRANKLIN MOUNTAINS, NORTHEASTERN ALASKA

By

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February 1988

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This report summarizes the results of field work conducted during the summer of 1987 on the stratigraphy and sedimentology of the Carboniferous Lisburne Group in the central Shublik and northern Franklin Mountains, northeastern Alaska. This study was part of a cooperative research program of the University of Alaska-Fairbanks and the Alaska Division of Geological and Geophysical Surveys, and represents one of the integrated geologic research projects involving the structure and stratigraphy in the Arctic National Wildlife Range.

OBJECTIVES OF THE PROJECT

The purpose of this study was to examine the Lisburne Group across its depositional strike along a north-south transect from the Shublik to the northern Franklin Mountains (Figures 1,2). A total of three composite sections were measured by Jacob's staff method and described in detail. Sections 87A - C (#10, Figures 1,2), representing a complete section of the Lisburne Group, were measured in the central Shublik Mountains. Another complete section, composed of sections 87D - E (# 11 Figures 1,2) was measured in a creek bed and along a ridge in the "Fourth Range". An incomplete composite section, represented by sections 87F - G (#12, Figures 1,2), was measured along a spur ridge in the Plunge Creek area. A talus slope covers most of the Alapah Formation, however, the uppermost 43 meters of the Alapah along with the entire Wahoo Formation is exposed in the Plunge Creek area section. A tentative correlation diagram for the three composite sections is shown in Figure 3. Detailed geologic maps and stratigraphic columns of the measured sections are given in Appendices 1 and 2.

Numerous samples were collected from each of these sections for petrography

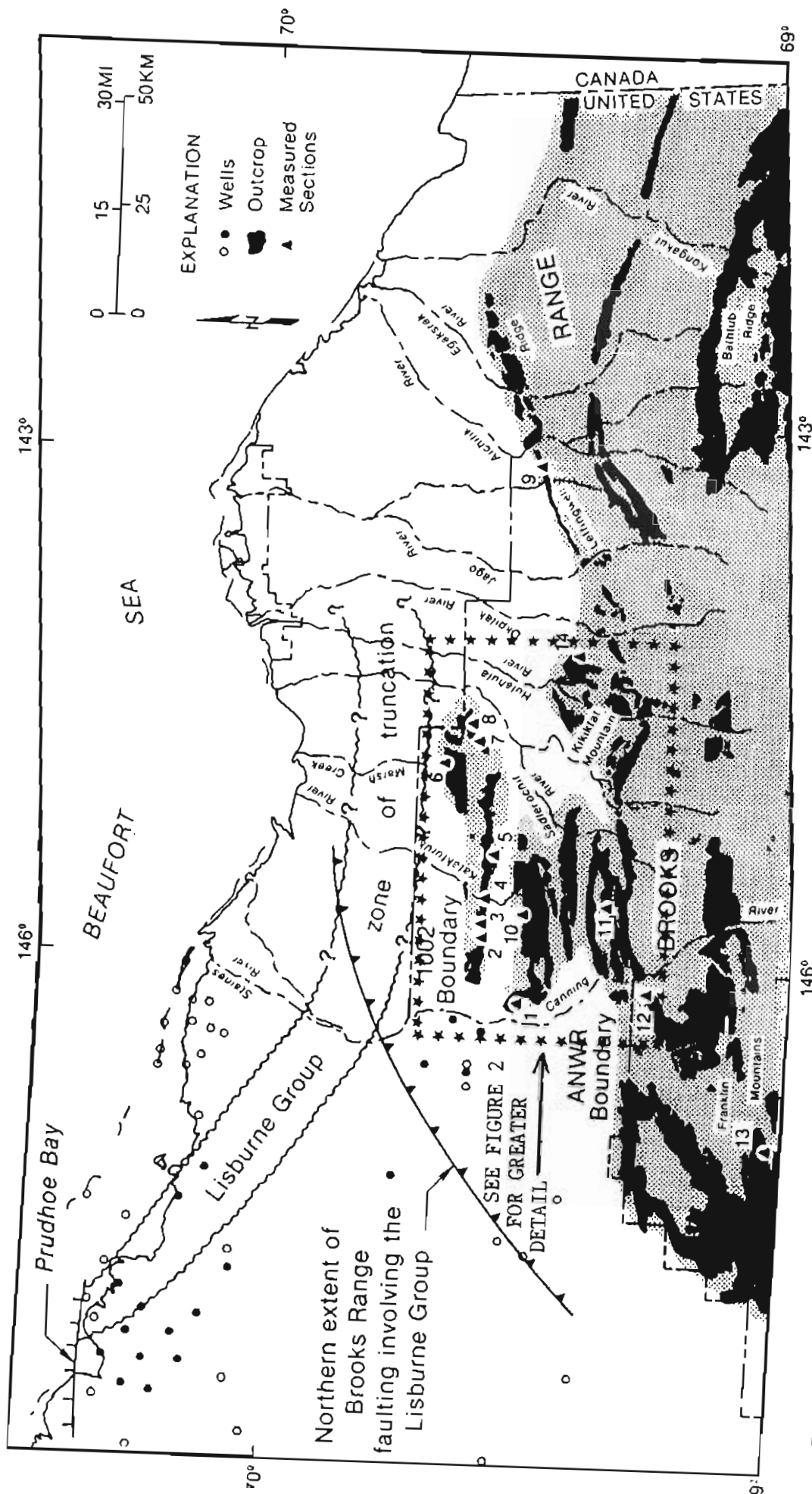
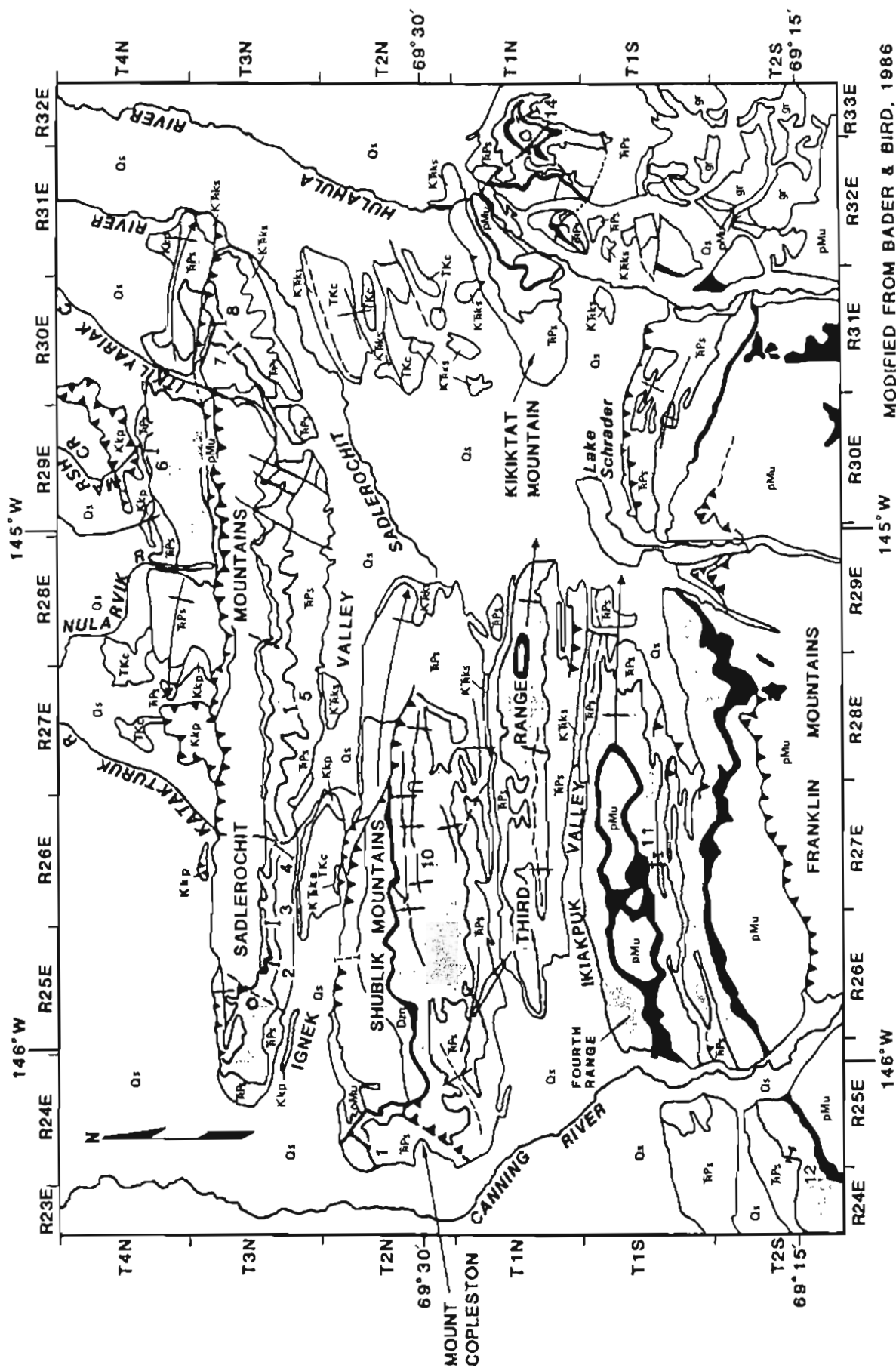


FIGURE 1. Black shaded areas represent Lisburne Group outcrops. Composite section 10 made up of 87A, 87B and 87C. Composite section 11 made up of 87D, 87E. Composite section 12 made up of 87F and 87G.



GEOLOGY OF THE NORTHWESTERN ARCTIC NATIONAL WILDLIFE REFUGE

FIGURE 2. Black shaded areas represent Endicott Group outcrops. Gray shaded areas represent Lisburne Group rocks. Composite section 10 equals 87A + 87B + 87C. Composite section 11 equals 87D + 87E. Composite section 12 equals 87F + 87G.

**LISBURNE GROUP - TENTATIVE STRATIGRAPHIC CORRELATION DIAGRAM
CANNING RIVER TRANSECT**

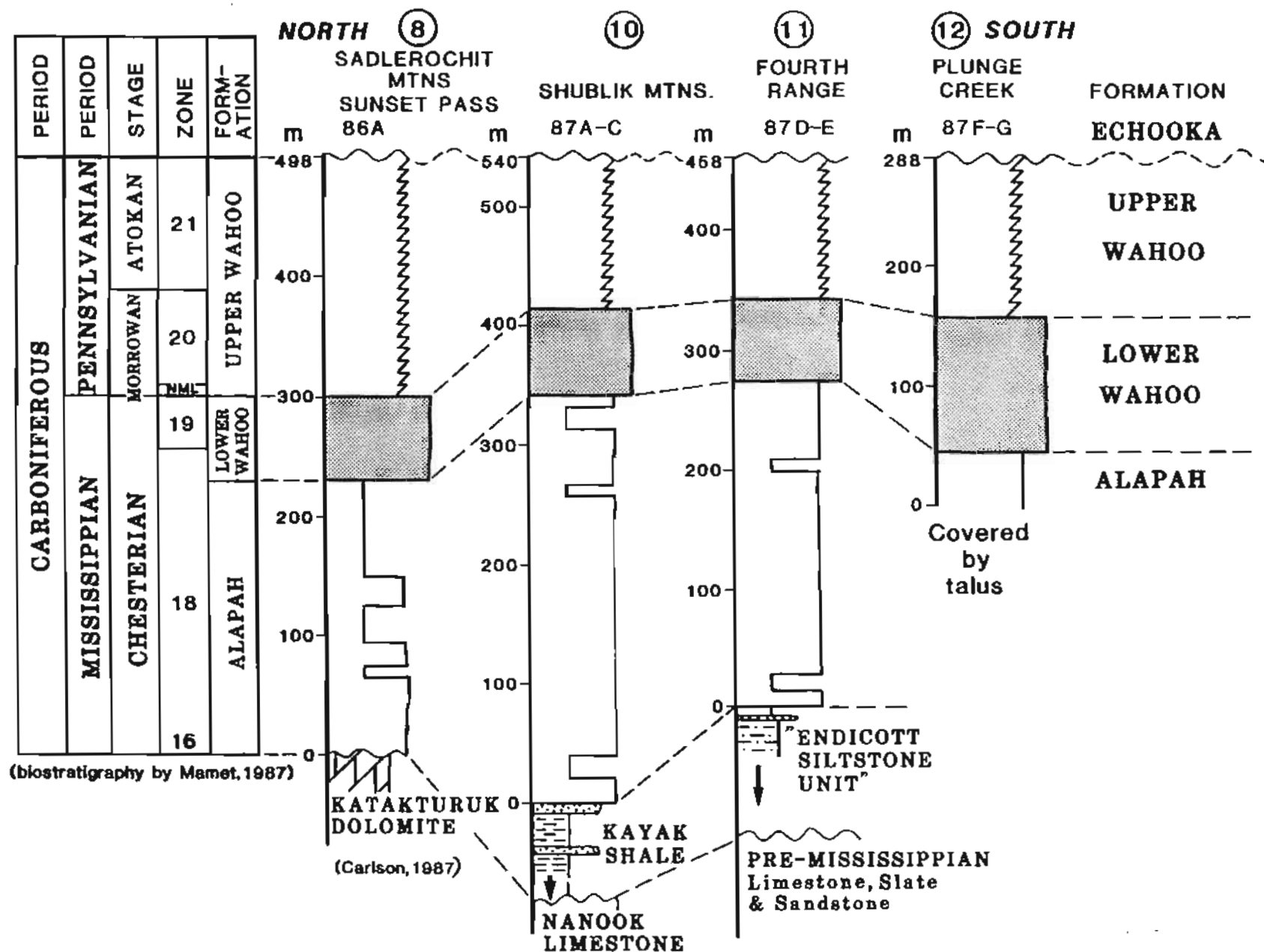


FIGURE 3

and biostratigraphy in order to determine carbonate microfacies, document lithologic cycles, and interpret depositional environments. The sampling interval varied for the different lithologic units. Sampling in the Pennsylvanian upper Wahoo Formation was at 0.5 meter intervals in order to document small-scale shallowing-upward cycles. The cliff-forming Mississippian lower Wahoo Formation had less lithologic variability, and was therefore sampled at 2.0 meter intervals. The Alapah Formation was sampled at a minimum of 5.0 meter intervals within the central Shublik Mountains and the "Fourth Range", and at a minimum of 3.0 meter intervals for the incomplete Alapah section of the Plunge Creek area.

This study will address four specific questions regarding how different aspects of the Lisburne Group carbonates are affected in a north-south transition:

1. What are the vertical and lateral relationships within the Lisburne Group?
2. What were the depositional environments across the depositional strike of the Lisburne Group platform?
3. What is the diagenetic history of the Lisburne Group rocks, and specifically, how has diagenesis affected the porosity and permeability of potential reservoir rocks?
4. What are the ages of the Lisburne Group rocks and the underlying and overlying bounding units? Can biostratigraphy or cyclic stratigraphy be used as a means of correlating similar shallowing-upward cycles across the carbonate platform?

ACCOMPLISHMENTS OF THE PROJECT

The preliminary results of the field study are presented below. The units are discussed in stratigraphic order, with the oldest unit appearing first. Comparisons are drawn based on field observations of the individual units within the central Shublik and northern Franklin Mountains.

ENDICOTT GROUP

The Endicott Group is represented by the Kayak Shale Formation in the section measured in the central Shublik Mountains. It is composed of mostly black, fissile shale in the lower part and grades upward to include thin-medium bedded sandy limestones in the upper part. The boundary between the Kayak Shale and the Alapah Formation is conformable and gradational. Petrographic analysis will be required to allow for a more precise definition of this gradational boundary. The thickness of the exposed Kayak Shale, including the sandy limestone beds, is estimated to be about 200 feet at the measured section area.

In the "Fourth Range", the Endicott Group is represented by the "unnamed siltstone unit" (Bader and Bird, 1986). Detachment folding is common in the lower part of the unit and progressively dies out upsection. The lithology consists of red-brown, coarse-grained sandstones alternating with siltstone beds. Channelized conglomerate beds occur locally within the lower-middle part of the unit. The upper part of the unit is composed of black siltstone and silty shale interbedded with black, sandy(?) argillaceous limestones. Within the uppermost limestone bed of the Endicott "siltstone unit", colonial corals were observed. The boundary with the overlying Alapah Formation is conformable and is easily distinguished by the first appearance of buff/light-gray weathered limestone above the uppermost occurrence of black shale.

LISBURN GROUP

The Carboniferous Lisburne Group is divided up into the Alapah and Wahoo Formations (Brosge, et al., 1962). The Wahoo Formation can be further subdivided into upper and lower mappable units.

ALAPAH FORMATION

The lower Alapah in the central Shublik Mountain area contains several intervals of thick-bedded/massive, light/medium-gray, peloidal-oolitic grainstone intervals. The grainstones may have formed as shallow-marine shoals which extended from the Shublik Mountains south to the "Fourth Range". Less grainstone occurs farther to the south in the "Fourth Range" suggesting a slightly deeper water environment. Cyclicity is evident in the lower Alapah Formation, but will have to be examined in more detail petrographically in order to understand its nature and origin.

The upper Alapah is composed dominantly of dark-gray/black peloidal mudstones which are indicative of a restrictive (lagoonal?) depositional environment. Also associated with the upper Alapah Formation are dolomitic intervals, algal laminations, calcite replacement nodules, and collapse breccias formed in intertidal-supratidal environments.

Whereas Carlson (1986) and Imm (1986) were able to subdivide the Alapah Formation into a lower cliff-forming unit and an upper dark-colored slope-forming unit in the Sadlerochit and northwestern Shublik Mountains, recognition of these map units were not readily apparent within my study areas. The difference could be related to a decrease in the amount of cliff-forming grainstones towards the south.

Notable variations in the Alapah Formation occur within the central Shublik Mountains and "Fourth Range" (Figure 3). The greater thickness in

the central Shublik Mountain section may indicate increased sedimentation rates and/or subsidence rates in this area. Age control and petrographic data will allow me to better understand the cause of these thickness variations.

WAHOO FORMATION

Lower Wahoo Unit

The lower Wahoo forms a distinct mappable cliff-forming unit above the Alapah Formation. In all three measured sections, the unit was composed of primarily thick-bedded, light/medium-gray, crinoid-bryozoan packstone. The depositional environment of the lower Wahoo was an open-marine setting with good water circulation.

Of the three measured sections, the Plunge Creek area section has the thickest lower Wahoo unit and suggests that the unit is thickening to the south (Figure 3). Increased subsidence and sedimentation rates in the deeper portions of a south-facing ramp may be responsible for this thickening trend towards the south. Age control on the upper boundary is especially needed to understand this thickness variation, because the boundary was not as easily recognized at Plunge Creek in comparison to the sections farther to the north.

Upper Wahoo Unit

The boundary between the lower and upper Wahoo units in the field was defined on the basis of the first appearance of a yellow weathering dolomite bed. Dolomite beds are common in the upper Wahoo giving it a yellow weathering appearance useful for mapping purposes. The upper part of the unit is characterized by ledge and slope topography which results from

numerous shallowing-upward sequences. This ledge and slope topography is best seen on weathered ridge tops, and is more difficult to recognize in fresher exposures such as those along steep drainages (Appendix 1, section 87E).

Oolitic grainstones are common in the upper Wahoo Formation of the central Shublik Mountains and are indicative of a shoaling environment. The oolitic grainstone facies becomes drastically reduced farther to the south in the "Fourth Range" and Plunge Creek areas. An increase in the amount of crinoids and bryozoans within these two areas to the south suggests more open-marine and less agitated depositional environments. Collectively, these observations seem to indicate that the east-west trending ooid grainstone belt pinched out toward the south.

Several fissile shale intervals were noted in the upper Wahoo Formation in the central Shublik Mountains and "Fourth Range". The shale intervals are important because they are used as a means of correlation on the electric logs for the wells in the Lisburne Field at Prudhoe Bay. Microfacies analysis of the shales and associated lithologies may help to determine if the shale represents terrigenous sediments mantling the carbonate platform during a relative sea water lowstand, or alternatively, a condensed transgressive shale that accumulated before carbonate sedimentation became re-established following the drowning.

Carlson (1987) has identified approximately thirty shallowing-upward cycles within the Pennsylvanian upper Wahoo unit in the eastern Sadlerochit Mountains (Figure 4). An important part of my research will be to determine if these cycles can be correlated with those in my measured sections, and

WAHOO FORMATION CORRELATION DIAGRAM FOR EASTERN SADLEROCHIT MTNS.

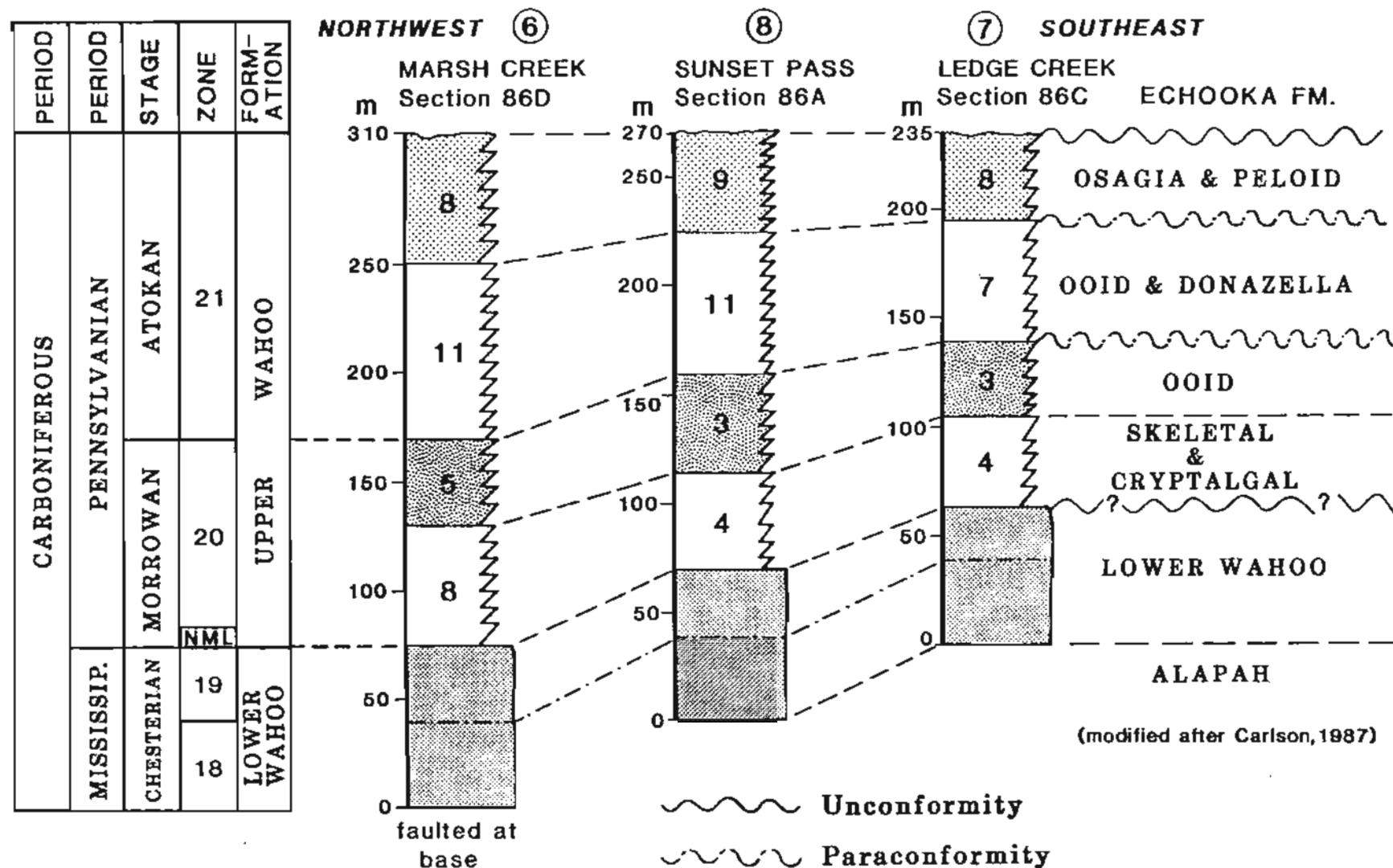


FIGURE 4.

how they relate to paleogeography farther to the south.

ECHOOKA FORMATION

The Echooka Formation unconformably overlies the upper Wahoo unit and is composed of red-brown weathering, medium/coarse-grained, quartzitic sandstone. The contact in the three measured section intervals was not well-exposed, however, the contact was observed approximately 6 miles to the west of the central Shublik Mountain measured section on the ridge top just south of Nanook Creek. Here the Echooka consisted of a dark-green weathered, glauconitic sandstone. The upper Wahoo Limestone beneath the unconformity had numerous solution pits, and locally, a possible terra rosa soil was evident.

Channeling of the Echooka in the western Sadlerochit and Shublik Mountains as reported by Imm (1986) was not observed at the three measured sections or at the contact location. This could account for the greater thicknesses of the upper Wahoo unit measured at these locations in comparison to the upper Wahoo farther to the northwest.

CONTINUING STUDIES

Detailed petrographic study will allow me to develop a better understanding of lithologic cycles within the Lisburne Group. Approximately 1000 samples were collected during the field season and are currently being processed for thin section preparation. The rock types noted on the stratigraphic columns (Appendix 2) are tentative field calls, and will be refined during the petrographic study. Dr. Bernard Mamet, of the University of Montreal, has

offered to do biostratigraphy (forams and algae) on my samples and will provide age control. Conodont samples collected at major unit boundaries will be processed and will be examined by Anita Harris, of the U.S. Geological Survey, Reston, who will provide both age control and conodont alteration indices. Well-constrained age dates, coupled with a greater understanding of the lateral and vertical lithologic succession in the study areas, will allow for a more precise definition of the Lisburne Group depositional environments across the carbonate platform.

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APPENDIX 1


GEOLOGIC MAPS SHOWING LOCATION OF MEASURED SECTIONS


MAP UNITS AND SYMBOLS FOR GEOLOGIC MAPS

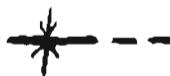
- P R s** - Sadlerochit Group, undifferentiated (Permian-Triassic)
 Ivishak Formation (Triassic)
 Echooka Formation (Permian)
- P e** - Echooka Formation (Permian)
- MPw** - Wahoo Limestone Formation, undifferentiated (Mississippian-Pennsylvanian)
- Pwu** - upper Wahoo Limestone Formation (Pennsylvanian)
- Mwl** - lower Wahoo Limestone Formation (Mississippian)
- Ma** - Alapah Limestone Formation (Mississippian)
- Ms** - unnamed siltstone unit, Endicott Group (Mississippian)
- Mk** - Kayak Shale (Mississippian)
- DZn** - Nanook Limestone (Devonian-Cambrian or Late Proterozoic)
- pMu** - sedimentary and metamorphic rocks, undifferentiated (pre-Mississippian)



 Contact - solid where well-exposed; dashed where approximated; dot-dashed where uncertain; queried where unknown.



 Thrust fault - sawteeth on upper plate; solid where well exposed; dashed where approximated.


 Axial trace of an anticline - solid where well-exposed; dashed where approximated.


 Axial trace of an overturned anticline - solid where well-exposed; dashed where approximated.


 Axial trace of a syncline - solid where well-exposed; dashed where approximated.


 Axial trace of an overturned syncline - solid where well-exposed; dashed where approximated.


 Strike and dip of beds


 Measured section traverse

87A-G Measured section designations (summer of 1987)

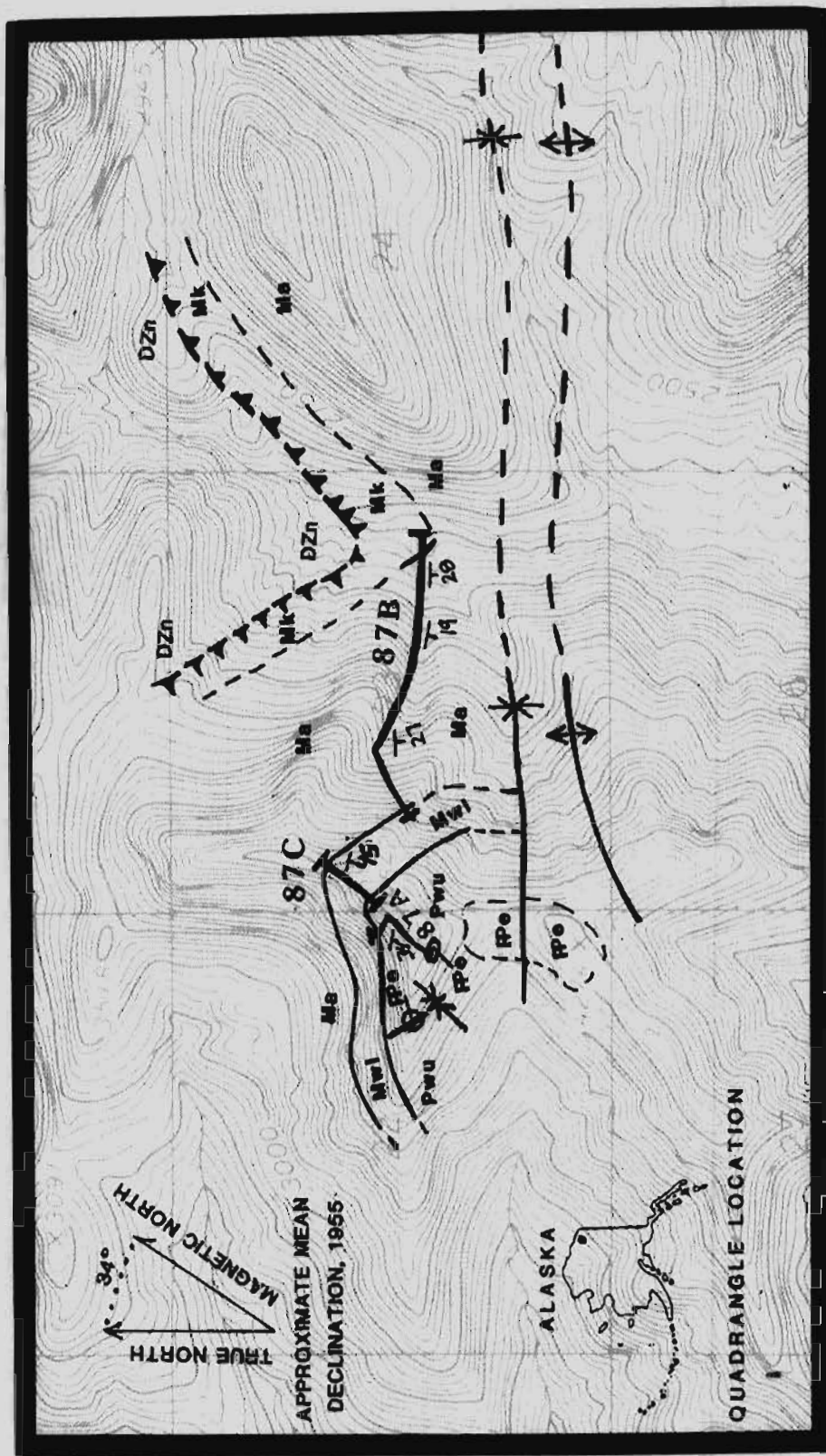
68A-1 Measured section designation (Armstrong et al., 1970)

COORDINATES OF MEASURED SECTIONS

Mt. Michelson Quadrangle

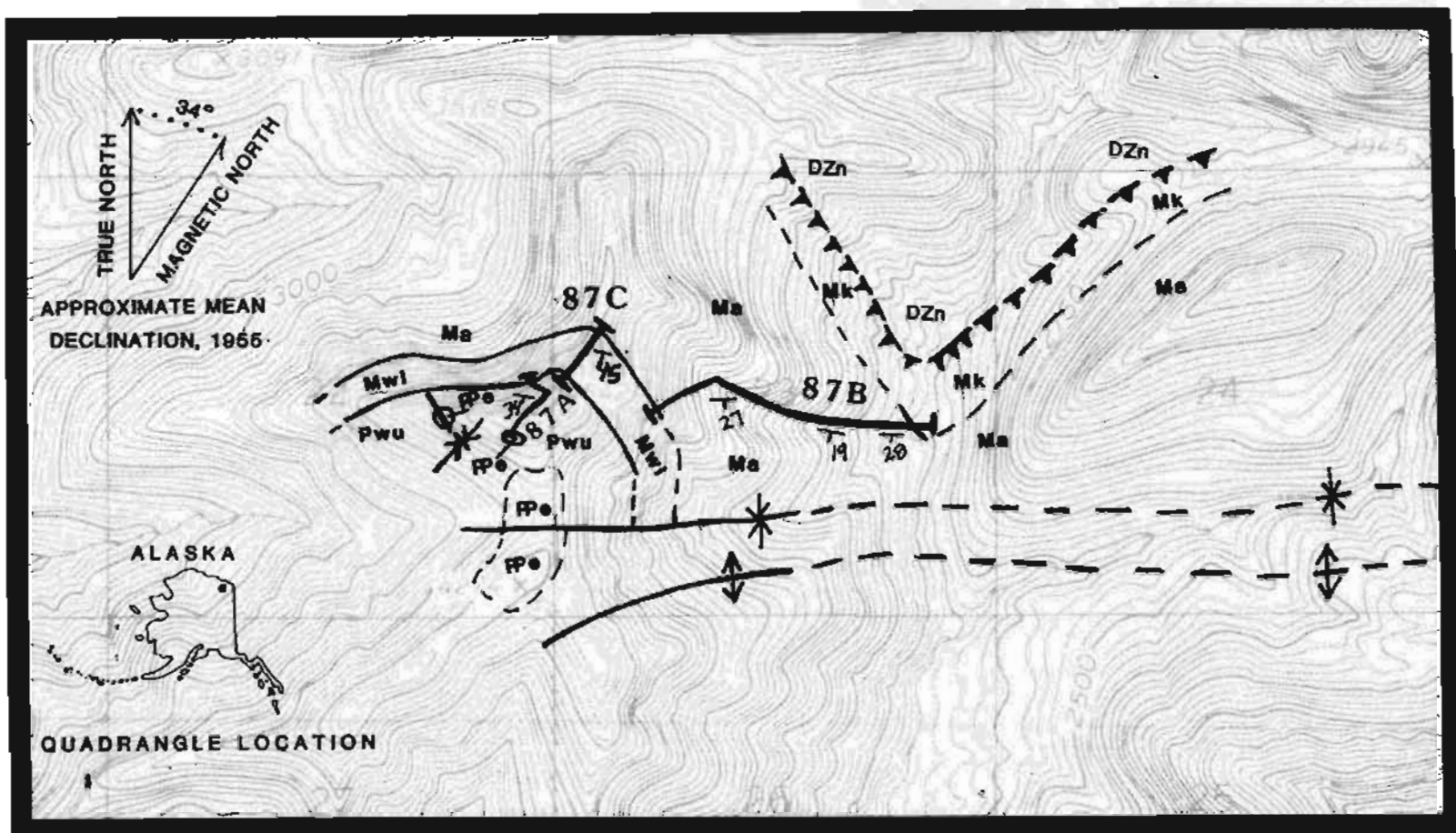
<u>MEASURED SECTION</u>	<u>TOWNSHIP</u>	<u>RANGE</u>	<u>SECTION</u>
87A	2North	26East	22East
87B	2North	26East	23East-West
87C	2North	26East	23Northwest
87D	1South	27East	17SE, 20NE
87E	1South	27East	16SW, 21NW
87F	2South	25East	19South
87G	2South	25East	19Southeast
68A-1*	1South	27East	15S, 22S

* see Armstrong et al., 1970 for description of section



GEOLOGIC MAP OF THE LISBURNE GROUP IN PART OF THE MT. MICHELSON C-3 QUADRANGLE, CENTRAL SHUBLIK MOUNTAINS, NORTHEASTERN ALASKA

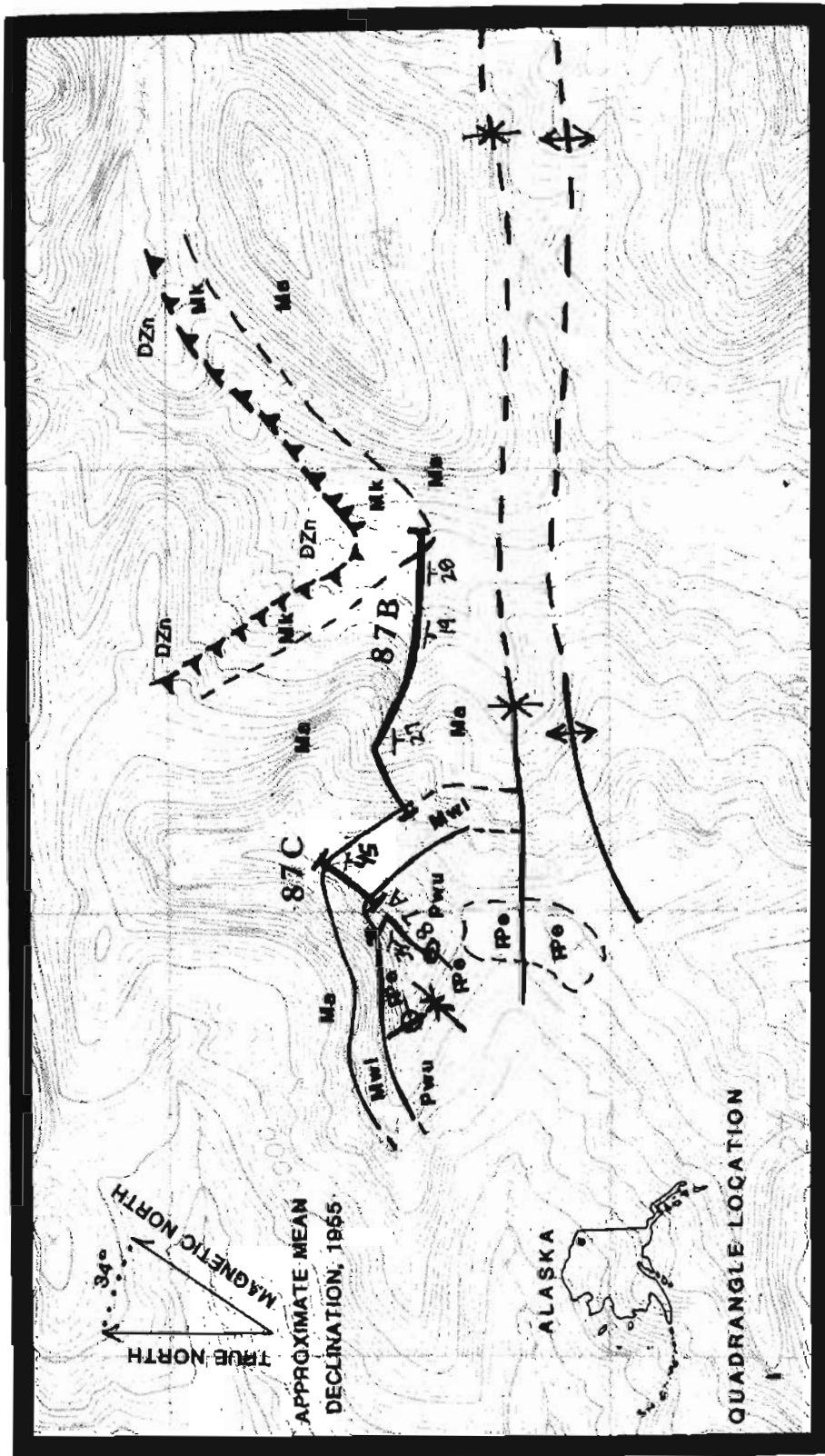
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GEOLOGIC MAP OF THE LISBURNE GROUP IN PART OF THE MT. MICHELSON C-3 QUADRANGLE, CENTRAL SHUBLIK MOUNTAINS, NORTHEASTERN ALASKA

By Paul D. Gruzlovic

February 1988



Base map by USGS, 1955

SCALE 1 : 25,000

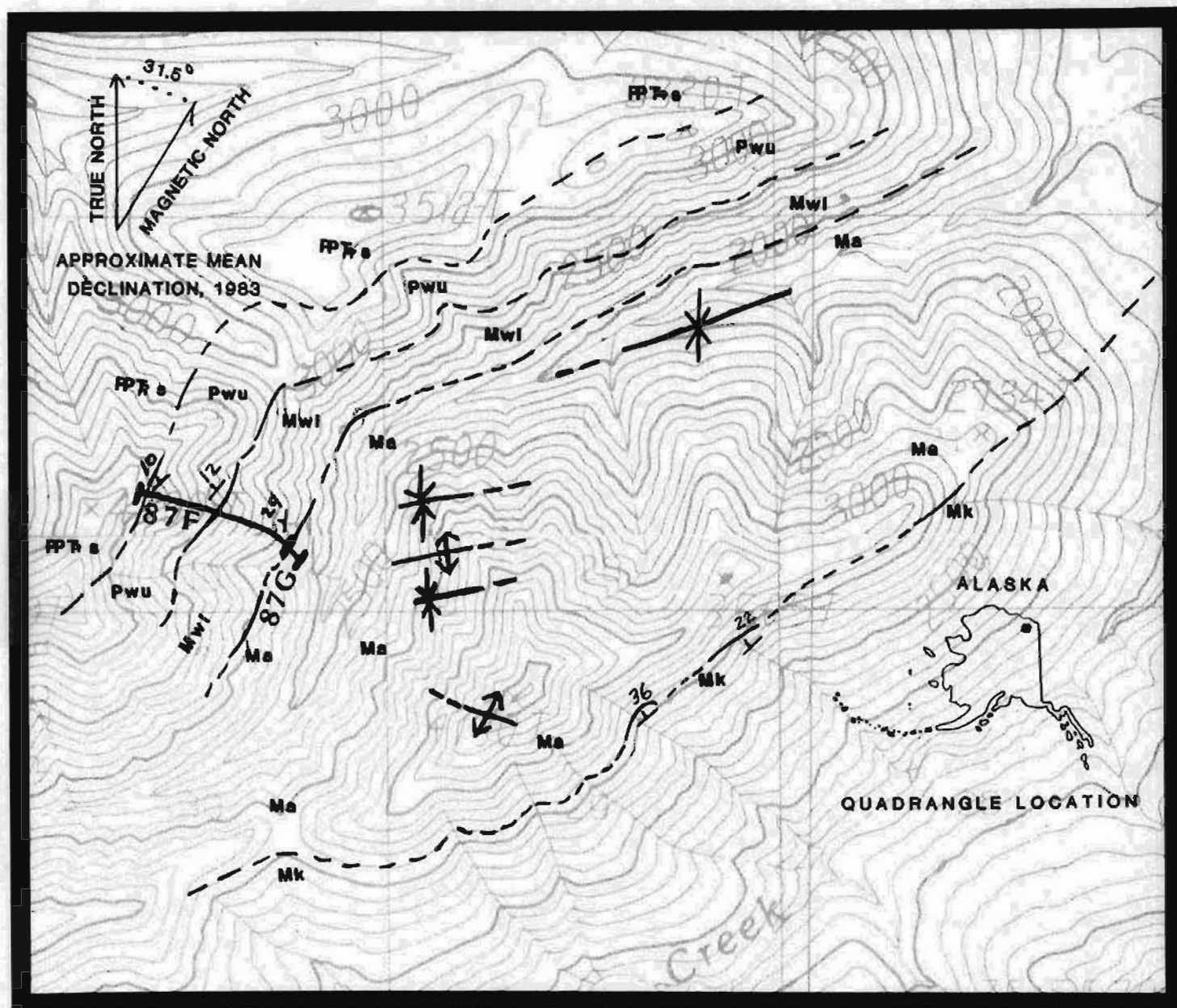


CONTOUR INTERVAL 50 FEET

GEOLOGIC MAP OF THE LISBURNE GROUP IN PART OF THE MT. MICHELSON C-3 QUADRANGLE, CENTRAL SHUBLIK MOUNTAINS, NORTHEASTERN ALASKA

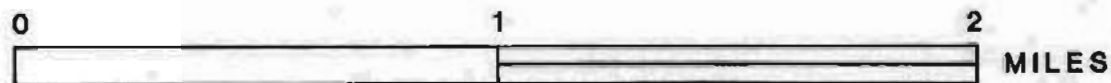
By Paul D. Gruzlovic

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Base map by USGS, 1983

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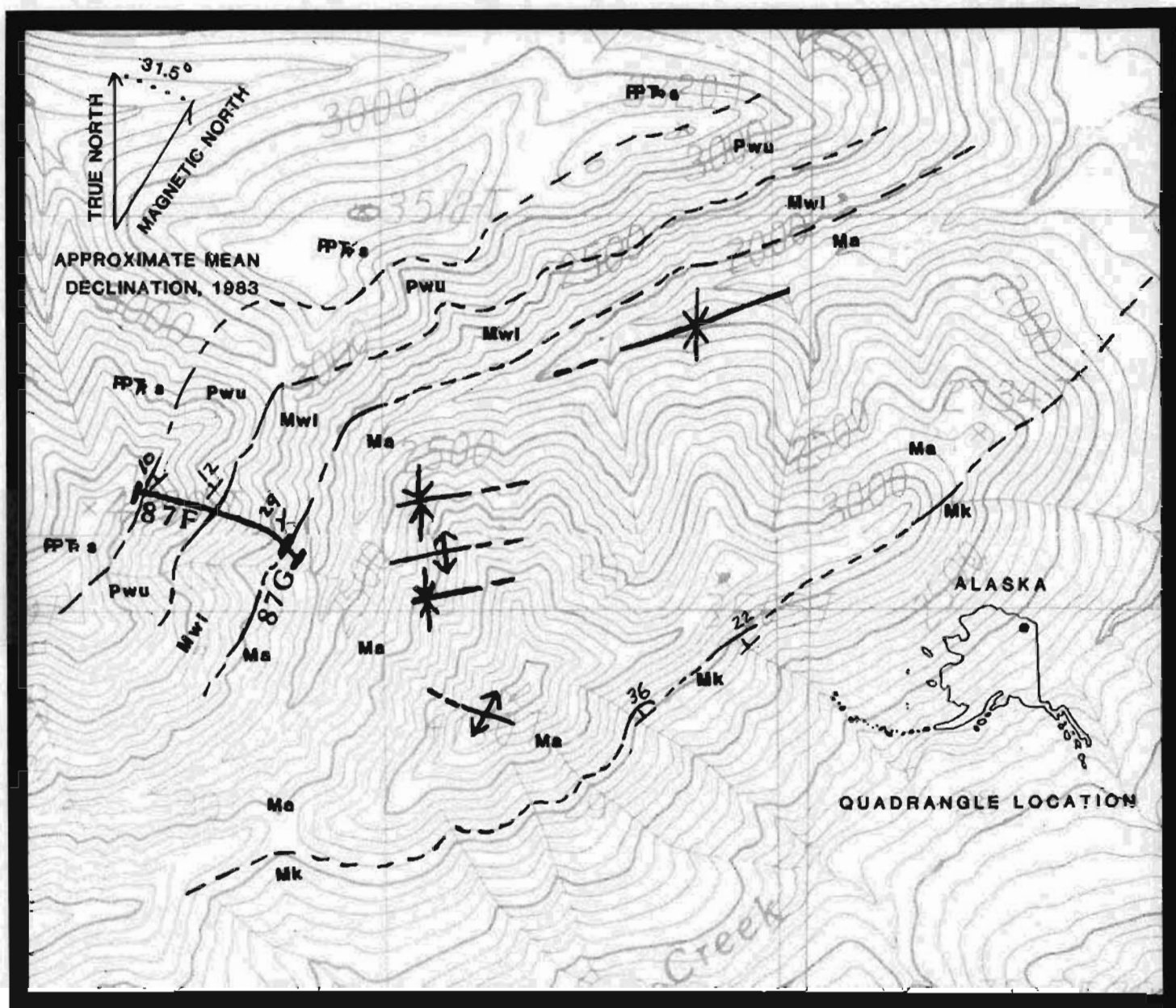


CONTOUR INTERVAL 100 FEET

GEOLOGIC MAP OF THE LISBURNE GROUP IN PART OF THE MT. MICHELSON A-4 & B-4 QUADRANGLES, PLUNGE CREEK AREA, NORTHEASTERN ALASKA

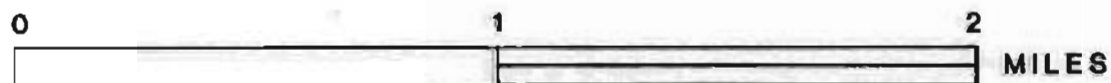
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Base map by USGS, 1983

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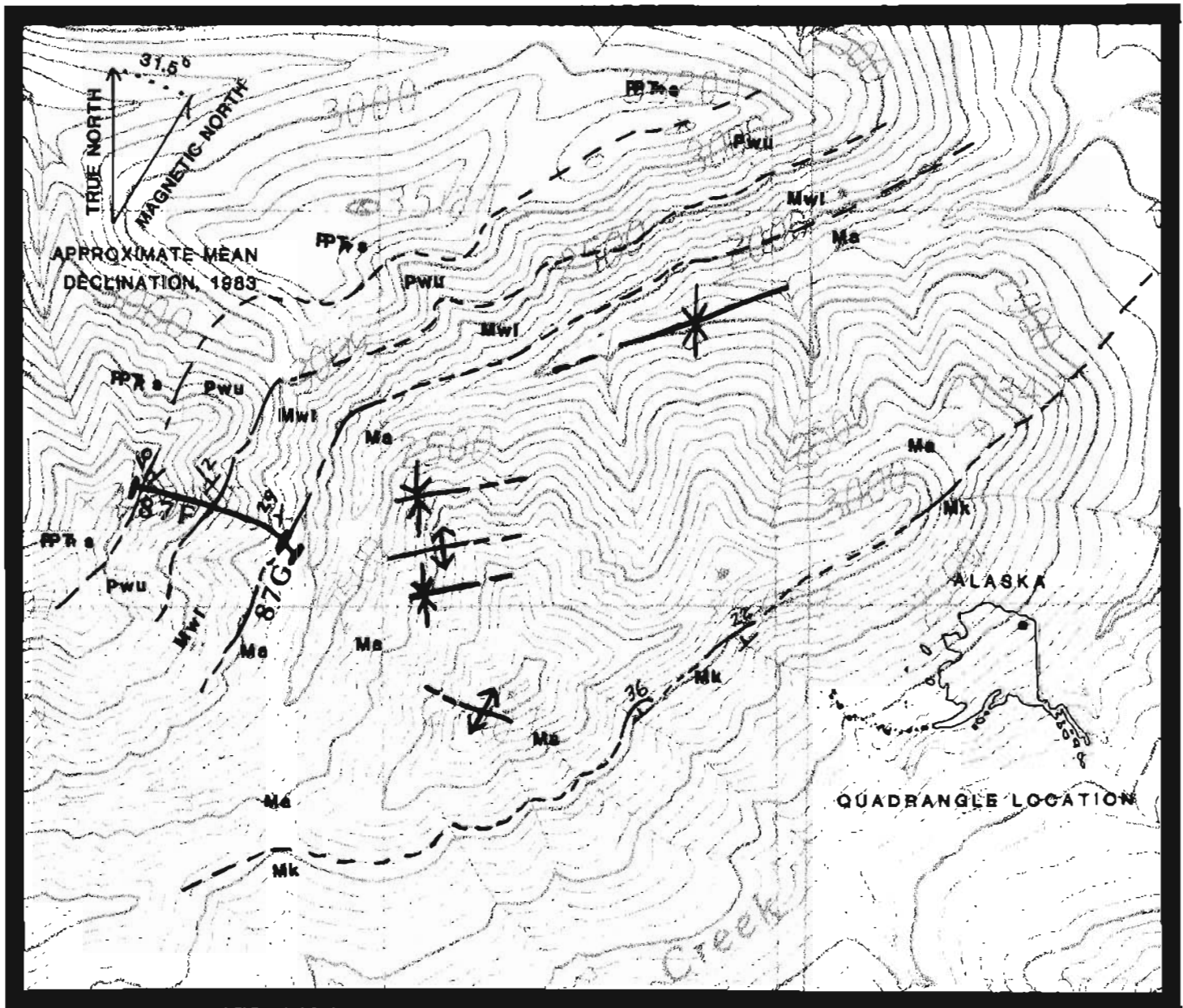


CONTOUR INTERVAL 100 FEET

GEOLOGIC MAP OF THE LISBURNE GROUP IN PART OF THE MT. MICHELSON A-4 & B-4 QUADRANGLES, PLUNGE CREEK AREA, NORTHEASTERN ALASKA

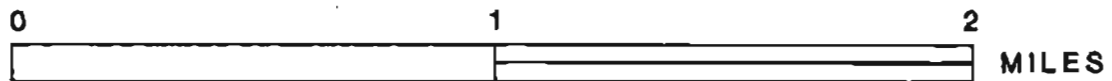
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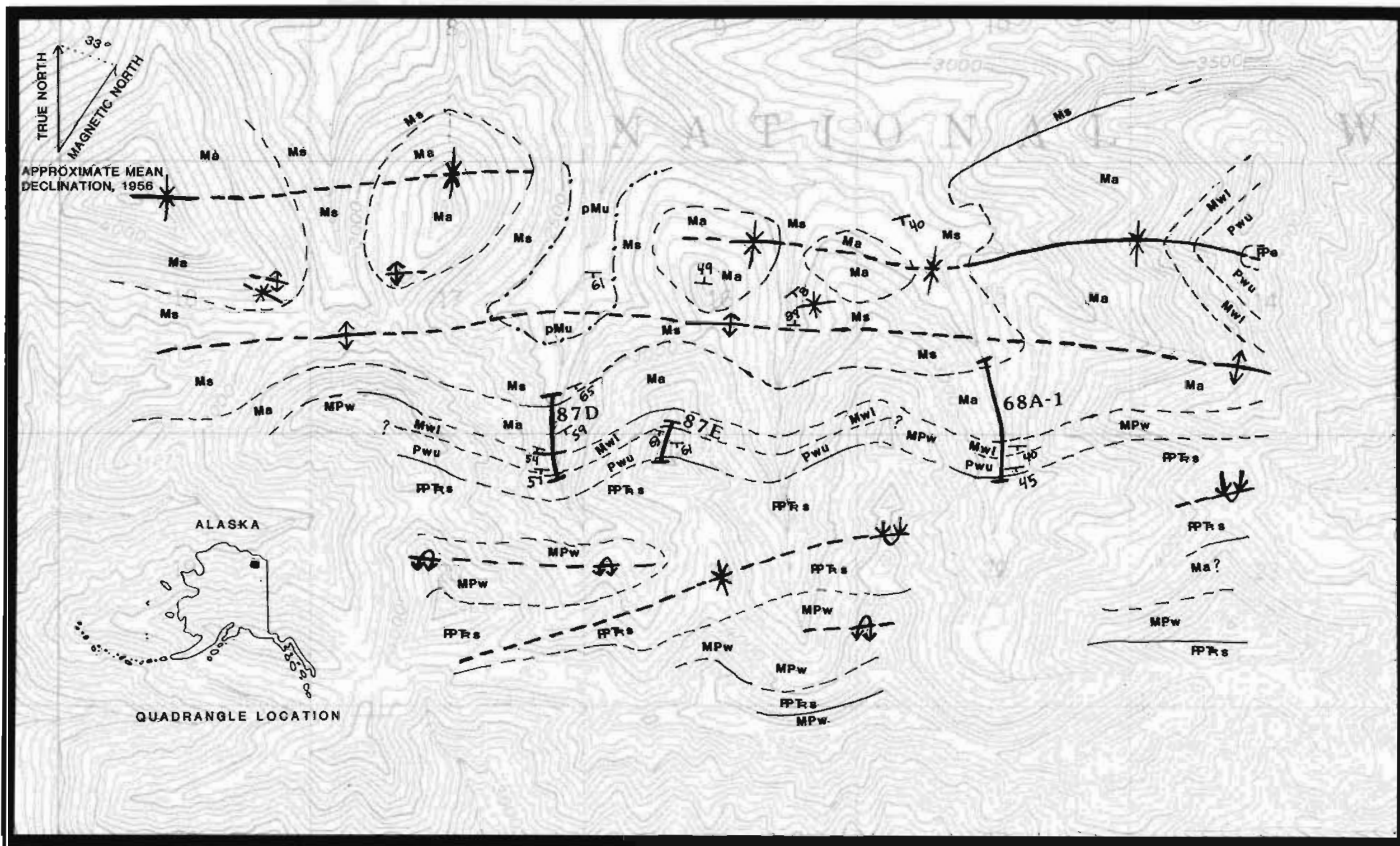


CONTOUR INTERVAL 100 FEET

GEOLOGIC MAP OF THE LISBURNE GROUP IN PART OF THE MT. MICHELSON A-4 & B-4 QUADRANGLES, PLUNGE CREEK AREA, NORTHEASTERN ALASKA

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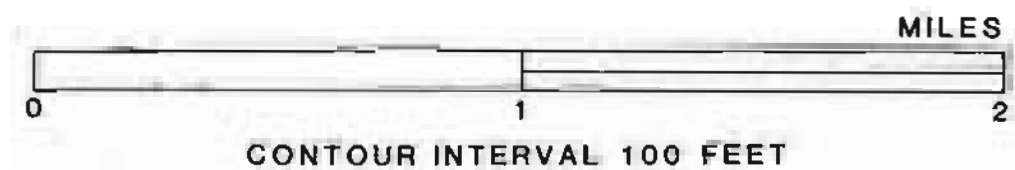


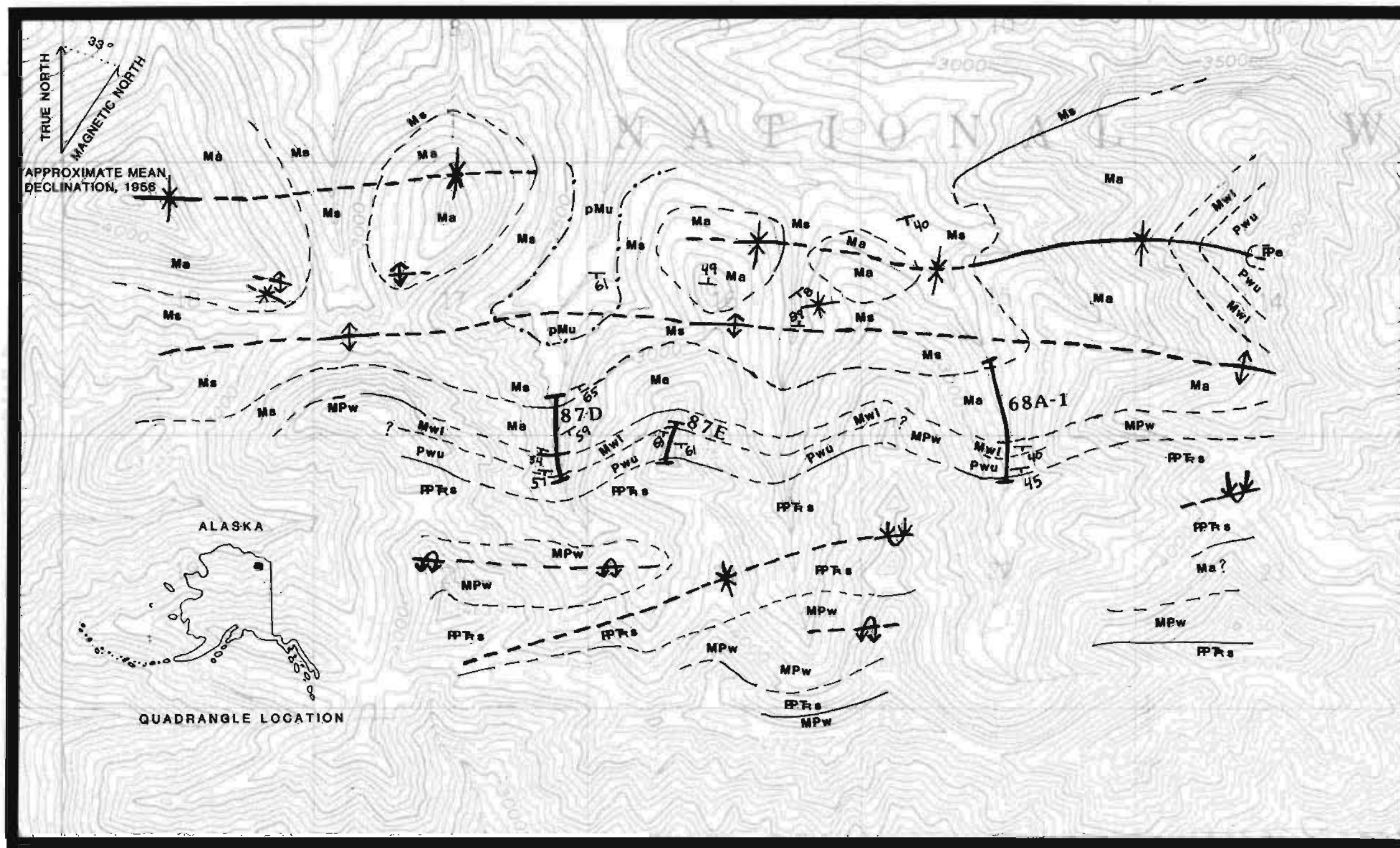
**GEOLOGIC MAP OF THE LISBURNE GROUP IN PART OF THE
MT. MICHELSON B-3 QUADRANGLE, FOURTH RANGE,
NORTHEASTERN ALASKA**

By Paul D. Gruzlovic

February 1988

SCALE 1 : 25,000





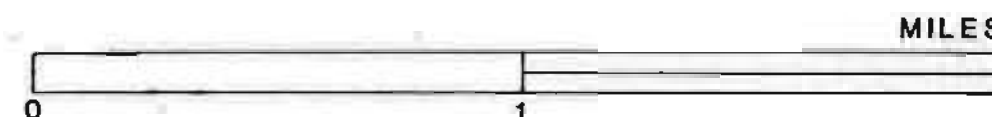
**GEOLOGIC MAP OF THE LISBURNE GROUP IN PART OF THE
MT. MICHELSON B-3 QUADRANGLE, FOURTH RANGE,
NORTHEASTERN ALASKA**

Base map by USGS, 1956

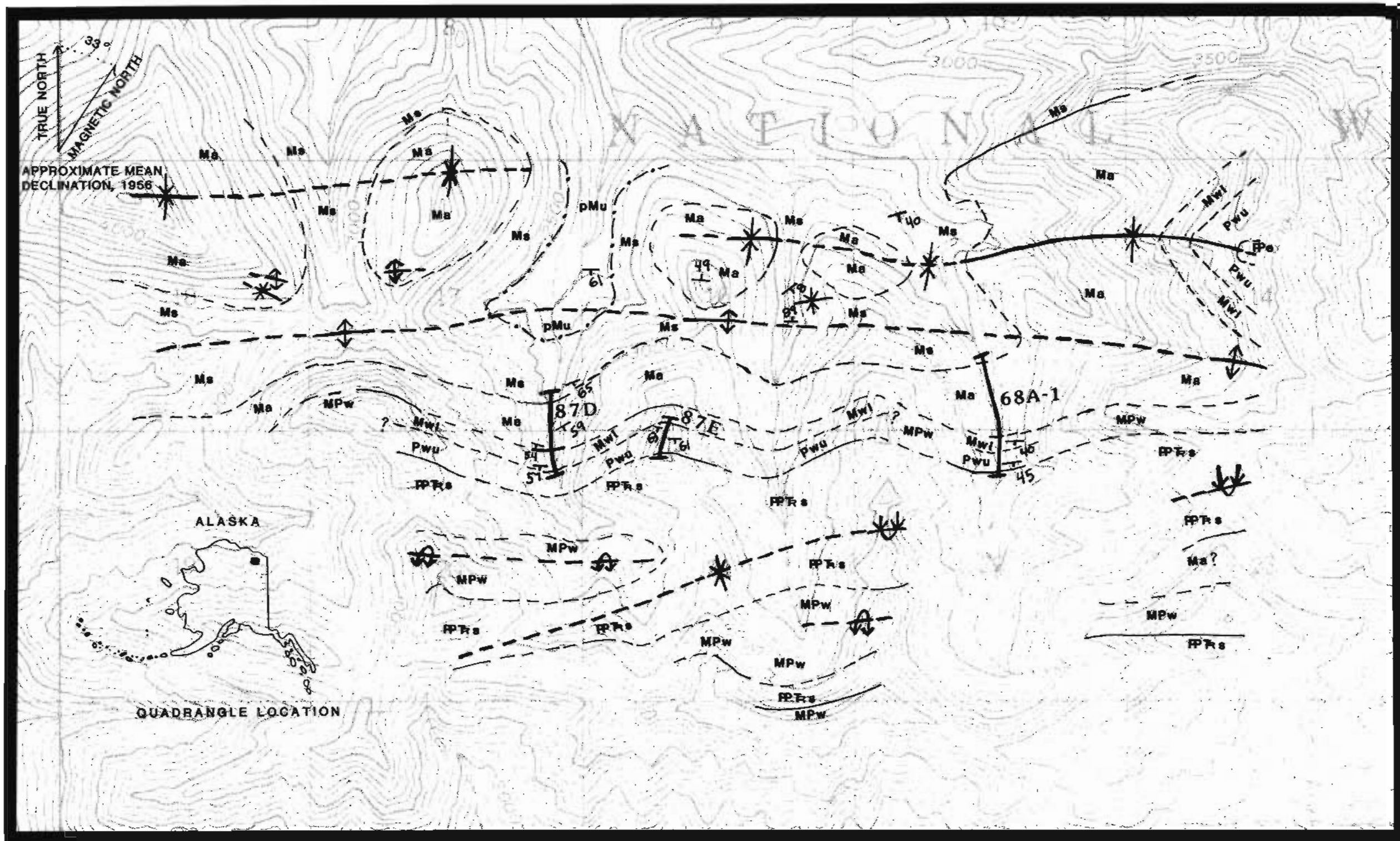
SCALE 1 : 25,000

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CONTOUR INTERVAL 100 FEET



**GEOLOGIC MAP OF THE LISBURNE GROUP IN PART OF THE
MT. MICHELSON B-3 QUADRANGLE, FOURTH RANGE,
NORTHEASTERN ALASKA**

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APPENDIX 2


Detailed Stratigraphic Sections

SYMBOLS AND ABBREVIATIONS FOR STRATIGRAPHIC SECTIONS


ROCK TYPES

M - Mudstone
W - Wackestone
P - Packstone
G - Grainstone
B - Boundstone
D - Dolomite
S - Shale







WEATHERING PROFILE

 Covered
Poor exposure
Good exposure
Excellent exposure








BEDDING

 Very thin bedded (< 5cm)
Thin bedded (5 - 20cm)
Medium bedded (20 - 50cm)
Thick bedded (50 - 150cm)
Massive (> 150cm)





SEDIMENTARY STRUCTURES

 - Plane parallel laminae
 - Wavy laminae
 - Low-angle cross-laminae
 - Scour
 - Rip-up clasts
 - Burrow

GRAIN TYPES

★ - Crinoid
Y - Bryozoan (undifferentiated)
- Bryozoan (fenestrate)
 - Brachiopod
 - Solitary coral
 - Colonial coral
 - Bivalve
 - Gastropod
? - Bioclasts (undifferentiated)
 - Ooid (single coat)
 - Ooid (multiple coat)
• - Peloid

DIAGENETIC FEATURES

● - Nodular chert
 - Lensoidal chert
 - Calcite replacement nodules
d - Dolomitic
p - Pyritic
s - Silicified skeletal grains
 - Styolitic
 - Fractures

Units

Ms - Mississippian Endicott Siltstone
Mk - Mississippian Kayak Shale
Ma - Mississippian Alapah Limestone
Mwl - Mississippian Lower Wahoo Limestone
Pwu - Pennsylvanian Upper Wahoo Limestone
Pe - Permian Echooka

OTHER

! - Abundant
() - Minor
? - Questionable
wx - weathered

LISBURNE GROUP SECTION 87 C

1 of 2

Central Shublik Mountains, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN	WAHOO LIMESTONE	Mw1	51						
			48			★ Y		P	-Medium-gray, gray-white wx chert
			45	(●)	≡	★ (●)		P	-Buff/light-gray wx
			42			★ Y?		P	-Argillaceous
			39	(●)		★		P	-Medium-gray/brown
			36		≡	★ Y?		P-G	-Dark-gray/black
			33	●		★ Y?		P	-Black chert
			30	p		★ Y		P	-Medium-gray
			27	d		★ Y		W	-Dark-gray/black
			24		≡	★ Y		P	-Light-gray
			21	s		★ Y		W-P	-Yellow-brown/gray
			18			★ Y?		W	-Dark-gray/black, black tubular chert
			15			★ Y?		P	-Medium-gray
			12			★ Y?		P	-Gray-brown, coarsening up
			9	d?		★ Y.		P	-Light-gray wx
ALAPAH		Ma	6		≡			P-G	-Brown-gray wx
			3					P-G	-Medium-gray
			0					P-G	-Yellow-brown/gray mottled weathering
								W	-Black chert wx white around edges

LISBURNE GROUP SECTION 87 C

2 of 2

Central Shublik Mountains, NE Alaska

AGE			FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN			WAHOO LIMESTONE	Pwu	87							
					84		★ Y				P-G	-Medium-gray
					81	d ●	★ #				P	-Dark-brown wx chert
					78	d ●	★ #				P	-Brown-gray
					75		★ #				W-P	-Orange/yellow wx, dolomitic
					72		★ Y				P	-Medium-gray, <u>Spirifer?</u> brachs
					69	d p	★ ?				P	-Coarse-grained, brittle
					66	d p	★ #				W-P	-Fine-grained
					63	p?	★ ⊙				W-P	-Orange/light-gray wx
					60	(●)	★ #				G	-Light-gray
MISSISSIPPIAN			WAHOO LIMESTONE	Mw1	57		★ ?				P	-Medium-gray
					54	●	★ Y				P	-Medium-gray
					51		★ (#)				P	-Coarse-grained, brittle
							★ !#				P	-Medium-gray/orange splotchy wx
							★ Y				P	-Medium-gray
											P	-Medium-gray, gray-white wx chert

LISBURNE GROUP SECTION 87 A

1 of 8

Central Shublik Mountains, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO Limestone	Pwu	17			• Y		P	-Light-gray, fine-grained
			16	d		★ Y		P-G	-Light-gray/light-brown, muddier and dolomitic at top
			15						
			14	d	~	★ # (M)		W	-Light-gray/yellow-brown, crinoid calyxes
			13	s					
			12	d		# ★		B	-Yellow-brown wx
			11			★ Y		G	-Gray/white wx
			10						
			9			★		P-G	-Gray/white wx, one brach shell (<u>Spirifer</u> ?) near top
			8	d	~	# ★ ?		W	-Medium-brown/yellow-brown wx
			7	d	~	# ★		W	-Yellow-brown wx
			6	d	~	# ★		W	-Argillaceous
			5						
			4	(●)		★ ?		G	-Light-gray, black chert
			3	d		# ★		W-P	-Yellow-brown wx
			2		≡	★		G	-Medium-gray
			1			★		P	
MISS.		MwL	0	p		? #		M-W	-Dark-gray
			0	p		★ #		P-G	-Medium-gray, light-gray wx

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Central Shublik Mountains, NE Alaska

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AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	34				○! ★		G	-Light-gray, brittle
			33				○! ★ (Y)		P-G	-Yellow-gray
			32	d			○! ★ Y		P-G	-Light-gray
			31		(●)					
			30							
			29	d ●!			! #?		W	-Black chert
			28	d ●			! #		W	-Yellow-brown
			27	d ●			! # Y?		W-P	-Argillaceous, red chert
			26	d			Y?		W	-Light-brown, fine-grained
			25	d?			○?		W	-Argillaceous
			24	d ●			! #		P-G	-Light-gray/orange brown splotchy wx
			23	d			! #		B	-Light-brown
			22				! #		W	-Medium-gray, argillaceous
			21				! # (★)		W	-Orange wx, argillaceous, red chert
			20				! #		W	-Argillaceous
			19	d			★		P	-Black chert
			18				! #		B	-Yellow-brown wx
			17	d			●? (#)		P-G	-Medium-gray/light brown, dolomitic towards the top
							★		P	-Light-gray, fine-grained

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Central Shublik Mountains, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	51	d		★ (Y) (M)		P	-Spirifer? mold
			50			★ (Y)		P	-Medium-gray
			49	d		##!		W	-Yellow-brown wx, argillaceous
			48	(●)		# ★ (Y)		P	-Light-gray/brown mottled weathering
			47	d		★ (Y)		P-G	-Medium-gray
			46			★ Y		P	-Brown-gray
			45			★ Y		P	-Fine-grained
			44	p		★ ! (Y)		P-G	-Light-gray
			43				X		
			42			○		G	-Light-gray with orange specs
			41			(2)		M	-Medium-brown, argillaceous
			40		~	○ !		P-G	-Medium-gray/brown
			39						
			38			★ , (Y)		P-G	-Medium-gray
			37			○ ★		P-G	-Light-gray, fine grained
			36			○ ! ★		G	-Light-gray, coarse-grained, very brittle
			35						
			34						

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Central Shublik Mountains, NE Alaska

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AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	68				○!★Y		P-G	-Light-gray
			67							
			66			≡	#★		D	-Medium-brown soil (possible covered shale horizon?) -Yellow-orange wx
			65	s			○!★Y		P-G	-Coarsening upwards
			64							
			63	p						
			62						P	-Medium-gray/light brown
			61	p		≡	Y★			
			60							
			59							
			58				#?		D S	-Medium-gray, yellow-orange wx -Medium-gray/olive, fissle
			57							
			56			≡	Y★?		P	-Dark-gray
			55				(☺)			
			54							
			53	d			○		P	-Yellow-gray mottled wx, slightly dolomitic
			52			≡	○!★		G	-Gray-white wx, medium-grained
			51							

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Central Shublik Mountains, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	85						
			84			○ ?		G	-Medium-gray
			83		≡	★ ?		P-G	-Finning upward
			82						
			81	d		# ?		P	-Light-gray, yellow-brown wx
			80			○ ★ ?		G	-Medium-gray
			79			★ ?		P	-Medium-gray, fining upward
			78		└				
			77			○		G	-Medium-gray
			76						
			75						
			74	d?	≈	# ★		W-P	-Medium-gray with yellow wavy (dolomitic?) banded intervals
			73			# ★		D	-Yellow-orange wx
			72	d	≡	# ★		W-P	-Brown soil, covered shale?
			71	d s!		#		W	-Yellow-brown wx
			70			○ ★		G	-Medium-gray
			69		≡	○ ★		P-G	-Light-gray, fine-grained
			68			○ ! ★ Y		P-G	-Light-gray

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Central Shublik Mountains, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	102			○★Y		P	-Medium-gray
			101	p	≡	○★		P-G	-Medium-gray, three 5-15cm yellow wx dolomite intervals
			100	d		○★#		D	-Orange-yellow wx
			99		≡	○★?		P-G	-Brown-gray
			98	s		★Y/θ		P-G	-Medium-gray, fine-grained
			97						
			96		≡	!•?		P-G	-Dark-gray, medium-gray wx
			95						
			94						
			93		≡	○?		P	-Brown-gray, layered
			92						
			91		≡	★?		W-P	-Yellow-gray/medium-gray wx
			90	d		#?		D	-Olive-green, yellow-orange wx
			89			#★		G	-Light-gray, coarse-grained
			88			○★!		W	-Yellow-brown wx
			87	d	≡?	#?		G	-Medium-gray
			86			○?			
			85						

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Central Shublik Mountains, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	119				★ !6!		P	-Dark-gray
			118				○!		G	-Gray/white
			117	s			⊙! ?		P	-Solitary corals up to 15cm
			116	d			• ?		P	-Dark-gray, brittle
			115	d		~	Y!		W	-Yellow-brown wx
			114	d? p		{	⊙ ?		P	-Dark-gray/black
			113	d p			• (⊙)		W	-Yellow-brown wx
			112				⊙		G	-Light-gray, black chert
			111				★			-Yellow soil and rubble cover
			110	p			•		P	-Medium-gray/orange wx
			109				★		P	-Dark-gray
			108				★		P-G	-Medium-gray, fine-grained
			107	d			★		P	-Dark-gray/black
			106				★		G	-Light-gray
			105				★		P	-Medium-gray
			104				★		P	-Brown-gray
			103				★		W	-Brittle, dolomitic
			102				★		G	-Light-gray
							★		P	-Layered
							★		P	-Fine-grained, black chert
							★		P-G	-Medium-gray, coarse-grained
							★		P	-Brown-gray

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Central Shublik Mountains, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	PERMIAN								
	Wahoo Limestone	ECHOOKA							
		P _{Wu}							
		P _e							
			129						
			128						-Red/brown wx, rubble pile
			127			★ ⊕ ?		P	-Medium-gray
			126			⊕ ★		P	-Brittle outcrop
			125			⊕ ?		P-G	-Fine-grained
			124			2 ⊕ ?		P	-Dark-gray, black chert
			123			⊕		P-G	-Medium-gray, fining upward
			122			Y ⊕ ⊕ (⊕)		P	-Medium-gray
			121			?		P	-Dark-gray
			120			★ ⊕ ⊕		P	-Medium-gray
			119			⊕ ? Y ⊕ ! ⊕ ! ⊕ ! ⊕		P	-Brittle
								P	-Highly fossiliferous

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Central Shublik Mountains, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN	ALAPAH LIMESTONE	Ma	85						
			80						
			75						
			70	- d ~		##! ★		W	-Gray-brown
			65			★ Y		P	-Medium-gray
			60			.		M	-Black, brown-gray wx
			55			Y ★		W	-Dark gray, vuggy
			50			Y ?		W	-Dark-gray/black
			45		≡	Y★(oo)		W-P	-Dark-gray, colonial coral at 46.5
			40						-Light-gray sandy limestone with black chippy wx shale at base
			35						
			30						
			25						
			20						
			15						
			10		≡				-Dark-gray..sandy limestone, red-brown wx, fine-grained
			5						-Mostly black chippy wx shale with minor hematite? stained sandy limestone
			0						

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Central Shublik Mountains, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN	ALAPAH LIMESTONE	Ma	170			• ?		G	-Medium-gray
			165			• ? 0?		D	-Light-brown, yellow-brown wx
			160	d		• ?		P	-Light-gray/brown
			155			•		W-P	-Dark-gray
			150			• (0)?		P-G	-Light-gray/brown mottled wx
			145			• ?		W-P	-Dark-gray/black, burrow structure at 149.8
			140			• ?		P	-Dark-gray, orange-brown wx chert
			135			• ? (0)		P	-Dark-gray, fine-grained
			130			★ (0)?		P-G	-Dark-gray
			125			• (★) ?		P-G	-Fine-grained, black chert
			120			• ?		G	-Medium-gray
			115			•		W-P	-Dark-gray
			110			• Y		G	-Medium-gray, light-brown wx chert
			105	(0)		•		M-W	-Dark-gray/black
			100			★		P-G	-Medium-gray
			95			(?)			
			90	(0)		• ? (★)			
			85						

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Central Shublik Mountains, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN	ALAPAH LIMESTONE	Ma	255			★ Y ⊙		G	-Light-gray, coarse-grained
			250			★		P-G	-Light-gray
			245	●	≡	★ #		P-G	-Medium-gray
			240			★ (C)		W-P	-Dark-gray/black
			235			★ # (C)		P-G	-Light-gray, medium-gray
			230	≡	≡	# ★		P	-Medium-gray/brown
			225			★ ⊙		P-G	-Dark-gray/brown
			220			★		D	-Yellow-brown wx
			215	●		●		G	-Medium-gray
			210	d ●		★ Y (C)		P-G	-Dark-gray, slightly dolomitic
			205	d p	(≡)	★ Y		P	-Medium-gray, red-orange wx chert
			200						
			195	d		● ★ Y		P	-Dark-gray, light-brown wx
			190	● !		●		W	-Dark-gray/black, fine-grained
			185			●		P-G	-Medium-gray, light-gray wx
			180	d	≡	★ ! Y		P	-Dark-gray, yellow-brown wx
			175	(●)		● ?		P-G	-Medium-gray, black chert (top)
			170			● ?		P	-Fissile

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Central Shublik Mountains, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN	ALAPAH LIMESTONE	Ma	340						
			335	0		• ?		M-W	-Dark-gray/olive-green
			330	0		• ?		M	-Black, black chert, calcite replacement nodules to 15cm
			325	0	~	•		M	-Black
			320	0 ! (0)		• (E)		M	-Black, colonial coral at 321.0
			315			•		M W	-Dark-gray/black
			310	s		★ ?		P	-Medium-gray
			305						
			300						
			295		~	• ?		W	-Dark-gray
			290			• ★		W-P	-Fine-grained, black chert
			285			•		P	-Medium-gray
			280		~	• ?		W-P	-Medium-gray, fine-grained
			275			•			
			270	p				P	-Medium-gray, gray-white wx
			265			Y ★		P	-Brown-gray, coarse-grained
			260	p		★ ?		P-G	-Medium-gray, brittle
			255			★ Y 0 ?		G	-Light-gray, coarse-grained

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Central Shublik Mountains, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN	ALAPAH LIMESTONE	Ma	390						
			385						
			380						
			375						
			370						
	WAHOO LIMESTONE	PwL	390						
			385						
			380						
			375						
			370						
			365						
			360						
			355						
			350	d		?		W	-Light-gray/brown mottled weathering
			345			•		M-W	-Dark-gray, brown
			340			•		W	-Dark-gray

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Fourth Range, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN	ALAPAH LIMESTONE	Ma	85	●		?		W	-Dark-gray
			80			? ★		P	-Medium-gray
			75	●		?		M	-Black
			70			? ★		M-W	-Fine-grained, black chert
			65			★		M	
			60			?		W-P	-Medium-gray
			55	d		★		P-G	-Light-gray, coarsening up
			50			?		M-W	-Dark-gray/black
			45			?		M-W	-Black, light-brown wx
			40	d		?		P	-Medium-gray, buff/yellow wx
			35			?		M-W	-Dark-gray, burrow at 46.0
			30			?		B	
			25	d		?		W-P	-Condensed
			20			★		M	-Black
			15			(?)		W	-Medium-gray, dolomitic at top
			10			(?)		W	-Dark-gray, fine-grained
			5			(?)		M-W	-Black, buff wx
			0			?		M	-Dark-gray/black sandy argillaceous limestone interbedded with black siltstone and silty shale

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Fourth Range, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN	ALAPAH LIMESTONE	Ma	170	d		Y!		W-P	-Light-brown/orange wx
			165			?		M-W	-Argillaceous
				d		Y		W-P	-Coarse-grained
			160			★		W	-Dark-gray
						★?		P	-Light-brown/gray wx
			155			★		P-G	-Medium-gray
						○?			
			150			★		W-P	-Dark-gray, light-brown wx
						Y			
			145			○		P-G	-Light-brown/buff wx
						★			
			140			★		P	-Buff wx, medium-grained
						Y?			
			135			•		W-P	-Dark-gray
						•			
			130			★		P	-Medium-gray, fine-grained
						?		W	-Argillaceous
			125			?			
						•		P	-Black chert at top of unit
			120			★		P-G	-Gray-brown
						★		W-P	-Medium-gray
			115	d?		•		W	-Dark-gray
						?		P	-Light-gray, very fine-grained
			110			•		W	-Fine-grained
						?		W-P	-Medium-gray
			105			?		P	-Medium-gray, medium-grained
						?			
			100			•			
						?			
			95			?			
						?			
			90			★			
						(Y)			
			85						

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Fourth Range, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN	ALAPAH LIMESTONE	Na	255			★ Y		W-P	-Dark-gray
			250			⊖ ★ (SS)		P-G	-Medium-gray
			245					M-W	-Black, light-gray wx
			240					W	-Dark-gray/black, fine-grained
			235		~	2 (★)		W-P	-Black lams on buff wx rock
			230		~	★ 2		W	-Dark-gray
			225			Y (★)		P	-Finning-upward
			220					W	-Dark-gray/black, argillaceous in lower part
			215						
			210						
			205		~	★ #		W-P	-Light-gray/brown wx
			200		~	★ # 2		W-P	-Medium/dark gray, condensed
			195		~	★ ! 2		M-W	
			190		~	?		W	-Buff/yellow wx
			185		~	• ?			
			180		~	• ?		M-W	-Dark-gray
			175		~	★ ⊙		W-P	-Black
			170			★ (★)		M-W	-Light-gray, coarse-grained
						★ #		W-P	-Light-brown/yellow
						★ #		P-G	-Yellow-brown wx,
						• (Y) (★)		W-P	-Light-brown wx chert
						2 •		P	-Medium gray/brown

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Fourth Range, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN	WAHOO Limestone	Mw1	318			★ ?		P	-Dark-gray/brown
			315			★ Y?		P-G	-Medium-gray
			312			★ (Y)			
			309	d		★ ?		W-P	-Light-brown/yellow wx chert
			306			★ Y?		G	-Light-gray, medium-gray
			303			★ Y?		P	-Medium-gray
			300			• ?		W	-White wx, possibly recrystallized?
			297		~	★ ?		P	-Light-gray
			294			(?)		M-W	-Black chert
			291	(•)		★ ? #		W-P	-Yellow-gray wx
			288	!		★ #		W	-Dark-gray/black
			285			★ Y.		W-P	-Dark-gray, yellow-orange wx chert
			280	d		• (★)		W	-Light-gray/yellow wx
			275	(•)		★ Y.		G M	-Medium/dark-gray, condensed
			270			★ (Y)		W-P	-Dark-gray
			265		~	?		M	-Black
			260		~	?		B	-Possible collapse breccia at 268.5?
			255		~	• (★)		W	
	ALAPAH Limestone	Ma				# ★		W-P	-Medium-gray

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Fourth Range, NE Alaska

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AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN		Pvu	369			★ #?		P	-Brown-gray, coarse-grained
			366			★ Y?		G	-Light-gray
			363			★ Y		P	-Medium-gray, coarse-grained
			360						
MISSISSIPPIAN	WAHOO LIMESTONE	MwL	357	d		★ #		P	-Brown-gray
			354	d		★ #!		P	-Yellow/dark-brown wx
			351			★ Y		P	-Coarse-grained
			348			★ !Y		P-G	-Light-gray with yellow splotchy wx
			345			★ !Y		P-G	-Medium-gray, yellow-brown wx chert
			342			Y! ★		P	-Brown-gray, fine-grained
			339	p		★ ⊙		P	-Medium-gray
			336	p		• ?		P-G	-Light to medium-gray
			333	p d		★ !Y		W-P	-Dark-gray
			330			★ ?		P-G	-Medium-gray with yellow splotchy wx, pyritic
			327	d p		★ ⊙		P	-Gray-brown variegated wx
			324			★ #?		G	-Light-gray
			321	(●)		★ Y		W-P	-Brown-gray
			318			★ #		P-G	-Medium-gray
						★ #		P	-Medium-brown wx

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Fourth Range, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	372							
			369	- d?			★		W-P	-Light-gray/yellow wx

LISBURNE GROUP SECTION 87 E

Fourth Range, NE Alaska

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AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN ?	PENNSYLVANIAN	WAHOO LIMESTONE	14			★ ? •		P	-Coarsening upward
			13	p d				W	-Yellow-gray, brittle weathering
			12		~	#			
			11			★ ! ?		P	-Medium-gray
			10	s		★ ☞		P	-Chert nodules wx white
			9						
			8	s		⊖ ★		G	-Light-gray
			7						
			6	d	(?)	# ? •		W-P	-Medium-gray
			5	d	~ !	# (?)		B	-Black chert
			4			# ! ★		W-P	-Fine-grained
			3	d	~	# ★ ?		W-P	-Light-gray/yellow wx
			2			★ ⊖ ?		G	-Light-gray, tubular black chert
			1	d		# ★		W-P	-Light-gray/yellow mottled wx
			0	s		★ ⊖ ?		G	-Medium-gray

LISBURNE GROUP SECTION 87 E

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Fourth Range, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	31				★ ?		P-G	-Medium-gray, medium-grained
			30	d			# ?		W-P	
			29				○ ★ ?		G	-Light gray, smooth outward wx appearance
			28				★ ? Y?		P	-Buff wx, brittle
			27			~	★ ?		W	-Argillaceous
			26				★ ?		P	-Medium-gray
			25				★ ?		G	-Light-gray
			24	s			★ ?		P	-Medium-gray, cliff former
			23		(●)					
			22		● !		★ # ?		W	-Argillaceous
			21		● !		• ?		W	-Black tubular chert
			20				• ?		D	-Orange wx
			19				• ?		W	-Dark-gray
			18		●		• ? ★		D	-Gray-brown, orange wx
			17	d			# ★		W	-Dark-gray, fine-grained
			16				★ ?		W	-Fragmental weathering
			15			~	Y ★		P-G	-Light-gray
			14	d			# ?		P	-Medium-gray, coarse-grained
									W	-Light-gray/yellow wx

LISBURNE GROUP SECTION 87 E

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Fourth Range, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	48	d			★ 2		P	-Gray-brown
			47	-			★ 1 2			
			46	-		≡	• ★ 2		P	-Medium-gray, brittle towards the top
			45	-		≡	• 2		W	-Dark-gray/black, very fine-grained
			44	-		≡	• ★ 2		W-P	-Dark-gray, medium-grained
			43	d p			★ 2		P	-Coarse-grained
			42	d			★ 2			
			41	-			2		P	-Medium-gray, smooth outward wx appearance
			40	d			• (★) 2		P	-Medium-gray with orange specs
			39	d		≡	★ 2		P	-Medium-grained
			38	-			• 2		P	-Medium-gray
			37	-			★ 2		P-G	-Coarse-grained
			36	d			★ 2			
			35	-			★ 2		G	-Light-gray, cliff forming unit
			34	-			★ 2			
			33	-			★ 1 2		P	-Orange-brown/light-gray wx, coarse-grained
			32	d?			★ 2		P-G	-Medium-gray, medium-grained
			31	-		≡	★ 2			

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Fourth Range, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	65			★		W-P	-Dark-gray, coarse-grained
			64			★		P	-Black chert
			63	s		★		P	-Medium-gray/brown
			62	s		★		P	-Medium-gray, coarse-grained
			61	d	~	★		W-P	-Brittle weathering
			60	d		★		P	-Fining upward
			59			•		W	-Dark-gray, fine-grained
			58			•		P	-Medium-gray
			57	d		•		W	-Dark-gray/black
			56			★		P	-Fining upward, dolomitic at the base
			55	d		★		D	-Blocky weathering
			54			★		W-P	-Dark-gray, fine-grained
			53			?		P	-Medium-gray
			52	s		★		P	-Medium-gray, medium-grained
			51			★		P	-Medium-gray
			50			•		W	-Dark-gray
			49	d		★		P	-Gray-brown
			48						

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Fourth Range, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	82				★ Y		W	-Argillaceous, slightly dolomitic
			81	d					W-P	-Dark-gray
			80				• ?		P	-Light-gray, medium-grained
			79				★		W	
			78	d			##		M-W	-Argillaceous in upper part
			77	d			•		S	-Light-gray/olive
			76	d			★ #		W-P	-Spirifer? brachs
			75	d			★ (Y)		W-P	-Medium-gray
			74	d			##		W	-Yellow-brown wx
			73	d			★ #		W-P	-Medium-gray
			72	d			★ ?		M ^P S	-Chippy wx surface flakes
			71	d			★		W	-Yellow-brown wx
			70				★ #		P	-Medium-gray, stylitic in upper part
			69				★		G	-Light-gray
			68				★ ?		P	-Yellow-gray splotchy wx
			67				★		P-G	-Coarsening upward
			66	s			★		S	-Chippy wx surface flakes
			65				★		W	-Dark-gray, medium-grained
							★		P	-Argillaceous, brittle
							★		P	-Highly fossiliferous
							★		W-P	-Black chert

LISBURNE GROUP SECTION 87 E

Fourth Range, NE Alaska

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AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	99			• ?		P	-Dark-gray, fine-grained
			98			? ★		P	-Medium-gray, medium-grained
			97						
			96			? ★		P	-Medium-gray
			95			• ?			
			94			? ⊙?		P-G	-Light-gray
			93	d	~	#! ★		W	-Yellow-brown wx
			92	s	~	★! ⊙!		P	-Layered towards the top
			91			? ★		W-P	-Dark-gray
			90			? ?		W	-Dark gray, fine-grained
			90			⊙! ?		S	-Light-gray/olive
			89					P	
			88			★ ?		W-P	-Dark-gray/black
			87	d (●)	~	# ★		W	-Yellow-brown wx
			86						
			85						
			84					S	-Chippy wx surface flakes
			83			? •		W-P	-Dark-gray
			82	d		★ Y		W-P	-Argillaceous, slightly dolomitic

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Fourth Range, NE Alaska

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AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PERMIAN	ECHOOKA	Pe	115							-Red-brown wx, quartzitic sandstone
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	114				• 7 ★		P	-Dark-gray, orange wx staining from overlying Echooka
			113				• 7		P	-Dark-gray, fine-grained
			112				• 7		G	-Light-gray
			111				⊙!		W-P	-Dark-gray
			110				• 7		P	-Dark-gray with orange specs
			109	d			★ 7		W-P	-Medium-gray
			108				★ • 7		P-G	-Medium-gray
			107				• 7		P	-Dark-gray, medium-grained
			106				⊙ 7		M-W	-Dark-gray/black
			105				• 7		W	-Spirifer? brachs
			104				(•)		P	-Dark-gray
			103	d			★ •		P-G	-Dark-gray/black
			102				★ 7		W-P	-Dark-gray
			101				• (7)		P	-Dark-gray, fine-grained
			100				• 2			
			99							

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Plunge Creek, Canning River, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN	WAHOO LIMESTONE	Pw1	51			★ ?		W-P	-Dark-gray
			48			★ ! Y		P	-Medium-gray
			45			? ★		P	-Medium-gray, medium-grained
			42			★ ? Y		P	-Black chert wx brown
								P	-Medium-gray
			39			★ ! #!		W-P	-Coarse-grained.
			36			★ (S)?		P-G	-Light-gray
			33	d		★ Y		P	-Light-gray/brown
				d		★ ?		P	-Slightly dolomitic
			30	s		★ ? Y		P	-Fine-grained
								P	-Medium-gray, coarse-grained
			27			★ ! (#)		W-P	-Argillaceous, orange wx chert
								P	-Gray-white, coarse-grained
			24	d		★ Y		P	-Medium-gray
			21			? •		W-P	-Argillaceous
			18	d		★ Y ?		P	-Brown-gray
								P	-Coarse-grained
			15			★ ! ?		G	-Light-gray
				d		★ ? •		P-G	-Light-brown, coarse-grained
			12	d				P	-Gray-brown
				d		? ★		P	-Fining up, dolomitic at top
			9	d		Y ★		P-G	-Gray-brown
						★ ?		P	-Gray-brown, fine-grained
			6					W-P	-Dark-gray
						★ ! Y		P-G	-Light-gray
			3	d		★ ? •		P	-Gray-brown, slightly dolomitic
			0					P	-Medium-gray

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Plunge Creek, Canning River, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
MISSISSIPPIAN	WAHOO LIMESTONE	Pw1	102		● !		★ Y		P	-Dark-gray, black chert
			99				★ #		P	-Medium-gray
			96		● !		★ #?		W-P	-Medium/dark-gray, brown wx chert
			93							
			90				★ Y		P	-Medium-gray
			87	(●)			★ ?		P	-Dark-gray
			84				★ ●		W-P	-Dark-gray
			81				★ ! Y		P	-Coarse-grained
			78							
			75				Y !		W-P	-Muddier towards the top
			72			}	★ ?		P	-Buff wx, coarse-grained
							#?		P	-Medium-gray, fine-grained
			69				★ ?		P-G	-Light-gray
			66	d			★ Y		P	-Light-brown, gray/yellow wx
			63				★ ! ?		P-G	-Grayish-white
			60	d			● ?		W-P	-Argillaceous
			57				★ ! Y		P	-Light-gray, very brittle
			54				★ ! Y		P	-Medium-gray
			51		●					

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Plunge Creek, Canning River, NE Alaska

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AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	124				?		P	-Fine-grained
			123				Y! ★		P-G	-Medium-gray
			122				● ?		M-W	-Dark-gray/black, fine-grained
			121	0			Y! ★		P-G	-Light-gray
			120				★ ? (Y)		P	-Medium-gray, brittle rock
			119				★		P-G	-Light-gray, coarse-grained
			118				Y! ↗		P	-Medium-grained
			117				★ (Y)		P	-Light-gray, coarse-grained, very brittle
			116				##		D	-Yellow-gray wx
			115							
			114							
			113							
MISSISSIPPIAN	WAHOO Ls.	Mw1								SCALE CHANGE FROM 3m TO 1m AT 112.2m
			111				★ ↗		P	-Medium-gray, coarse-grained
			108	s			★ ! ##			
			105	d? ↗		↗	★ # ?		W-P	-Yellow-gray mottled wx
			102				★ ● ?		W-P	-Dark-gray

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Plunge Creek, Canning River, NE Alaska

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AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	141			Y •		P	-Medium-gray, black chert (bedded?) at top of unit
			140	- d p		★ Y			
			139	- d		★ Y?		P-G	-Orange-brown wx chert with vugs
			138	- O		⊙(Y)		M-W	-Black
			137	- l		• ?		W	-Dark-gray/black
			136	- d s		★ ⊙(Y)		P	-Medium-gray
			135			Y! ★		G	-Light-gray
			134	(s)		⊙ ★		G	-Finning-upward
			133	s		★		P	-Coarse-grained
			133	s		★ ⊙(⊙)?		D	-Olive-green wx and fresh
			132	s		★ ! ?		G	-Light-gray, fining upward
			131	s		★ # ★		D	-Olive-green wx and fresh
			130	d		★ ?		P	-Medium-gray
			129			Y! ★ ?		P-G	-Dark-gray/olive
			128						
			127	d?		★ Y		G	-Coarse-grained, blocky wx at base
			126			⊙		G	-Light-gray, fine-grained
			125			Y ★		G	-Coarse-grained
			124			?		P	-Fine-grained

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Plunge Creek, Canning River, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	158				Y?		P	-Dark-gray, fine-grained
			157	d			★ Y		P	-Medium-gray, dolomitic at base
			156	d			★ (Y)		W	-Coarsening upwards
			155				★		P-G	-Medium-gray
			154	d			•? ★		W	-Dark-gray
			153				Y! ★		P	-Medium-gray
			152				★ (Y)		P-G	-Coarse-grained
			151				★		G	-Medium-gray
			150				★			
			149				★		G	-Medium-gray with orange specs
			148				★		G	-Light-gray, medium-grained
			147				★		D	-Olive-green with orange specs
			146				★ Y		P	-Medium-gray, coarse-grained
			145	d! (●)			★		W	-Olive-green/dark-gray
			144	d			Y?		P-G	-Medium-gray, coarse-grained
			143				★ Y			
			142	d!			★		P	-Olive-green/dark-gray
			141				★		P-G	-Coarse-grained, brittle

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Plunge Creek, Canning River, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	175	d!			• ?		W	
			174				★ ⊕		G	-Medium-gray
			173	s		≡	★ !		P-G	-Dark-gray, medium-grained
			172	d! ss		≡	#		W	-Orange/gray splotchy wx
			171	d			# ! ?		W	
			170				★ ?		P-G	-Very coarse-grained, brittle
			169	d		≡	★		P	-Dark-gray
			168							
			167							
			166							
			165							
			164			≡	★		P	-Medium-gray, dolomitic base
			163	d			?		W	-Dark-gray, fine-grained
			162	s		≡	★		P	-Coarsening upwards
			161	d		≡	#		W	
			160				• ?		W-P	-Dark-gray
			159	d			★ Y		P-G	-Medium-gray, coarse-grained
			158				• ?		W-P	-Dark-gray, black chert
							Y ?		P	-Dark-gray, fine-grained

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Plunge Creek, Canning River, NE Alaska

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AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	192				★ ⊕		P-G	-Medium-gray
			191				★ !Y		P-G	-Coarse-grained, very brittle
			190	d		≡	★ Y		G	-Light-gray, fining-upward
			189			≡	★ Y		P	-Dark-gray/olive-green
			188	d!			Y ★		P	-Dark-gray, coarse-grained
			187				★ !Y		P	-Dark-gray, coarse-grained
			186				★ !Y		P-G	-Light-gray
			185							
			184							
			183							
			182				★ ?		P	-Dark-gray, brittle rock
			181	d			★ ⊕ ?		P-G	-Light-gray/orange wx
			180				Y ?		W-P	-Dark-gray/black
			179				★ ?		P-G	-Medium-gray
			178	d			• ? ★		P	-Dark-gray with orange streaks
			177	s			★ (⊕) ?		P	-Coarse-grained
			176	d!			? (▽)		W-P	-Dolomitic at base
			175			≡	• ?		W	-Dark-gray mottled with orange

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Plunge Creek, Canning River, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwtu	209	d		★ ?		P-G	-Medium-gray
			208	d		• ?		W	-Dark-gray
			207			(u)			
			206			★ Y,		P-G	-Coarsening upwards
			205						
			204			⊙ ?		G	-Medium-gray, fine-grained
			203			⊙		P-G	-Fine-grained
			202	d		★ ?		W	-Dark-gray
			201			(⊙)?		G	-Medium-gray
			200			★ ?		D	-Olive-green, fine-grained
			199	s		★ ?		P-G	-Coarse-grained
			198	(●)		★ ?		D	-Olive-green, chert wx orange
			197	s		★ !u		G	-Medium-gray, black chert
			196	s		★ !u		G	-Coarse-grained, brittle
			195	s		★ Y		P-G	-Medium-gray
			194	s		★ ?		D	-Olive-green, chert wx orange
			193			★ ?		P-G	-Medium-gray, black chert
			192			★ ⊙		P	-Dark-gray
						★ ⊙		P-G	-Medium-gray

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Plunge Creek, Canning River, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	226			★ ?		P	-Finning-upward
			225			? ?		G	-Medium-gray, recrystallized?
			224						
			223	d		★ ?		P-G	-Medium-gray/dark-green
			222			★ !		G	-Light-gray, coarse-grained
			221						
			220			Y !		P	-Medium-gray
			219			?		M-W	-Dark-gray/black
			218			★ Y ?		P	-Coarse-grained, brittle
			217			★ Y		P-G	-Medium-gray
			216			★ Y		G	-Fine-grained
			215	d		Y		P	-Medium-gray/light-brown
			214			★ #		P-G	-Coarse-grained, black chert
			214			★ (Y)		G	-Medium-gray, coarse-grained
			213			⊙ !		G	-Light-gray
			212	s		★ !		P	-Dark-gray
			211			(s) ★ Y		M	-Black
			210	p		?		P	-Dark-gray, coarsening upwards
			209			★		G	-Medium-gray

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Plunge Creek, Canning River, NE Alaska

AGE	FORMATION	UNIT	THICKNESS (m)	SAMPLE	DIAGENETIC FEATURES	SEDIMENTARY STRUCTURES	GRAIN TYPE	GRAPHIC COLUMN	ROCK TYPE	DESCRIPTION
PENNSYLVANIAN	WAHOO LIMESTONE	Pwu	243			≡	Y ★ ?		P-G	-Medium-gray
			242	d			Y ★		P	-Gray-brown
			241				Y!		P	-Medium-gray, brittle
			240				Y! ?		P-G	-Medium-gray
			239	s			⊙! ★		W	-Dark-gray/black
			238	d		≡	★! Y		P	-Brittle outcrop
			237				★ Y!		P	-Coarse-grained, dolomitic
			236				Y ?		P-G	-Medium-gray
			235							
			234	d?		≡	# ⊙		W	-Dark-gray/brown
			233				★ Y		P	-Dark-gray
			232				★ Y ?		P-G	-Brittle
			231				?		G	-Medium-gray, possibly recrystallized?
			230			≡	★ ?		P-G	-Coarsening upwards
			229				Y ★		P	-Dark-gray
			228							
			227							
			226	s			★ ?		P	-Medium-grained

