Bedrock Geologic Map of the southern Brooks Range, Alaska, and accompanying Conodont Data

By Alison B. Till, Julie A. Dumoulin, Anita G. Harris, Thomas E. Moore, Heather A. Bleick, and Benjamin R. Siwiec

Open-File Report 2008–1149

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
DIRK KEMPTHORNE, Secretary

U.S. Geological Survey
Mark D. Myers, Director

U.S. Geological Survey, Reston, Virginia 2008

For product and ordering information:
World Wide Web: *http://www.usgs.gov/pubprod*
Telephone: 1-888-ASK-USGS

For more information on the USGS—the Federal source for science about the Earth, its natural and living resources, natural hazards, and the environment:
World Wide Web: *http://www.usgs.gov*
Telephone: 1-888-ASK-USGS

Suggested citation:
Till, A.B., Dumoulin, J.A., Harris, A.G., Moore, T.E., Bleick, H.A., and Siwiec, B.R., 2008, Bedrock geologic map of the southern Brooks Range, Alaska, and accompanying conodont data: U.S. Geological Survey Open-File Report 2008-1149, 88 p., 2 sheets, sheet 1-scale 1:500,000, sheet 2-scale 1:600,000.

Available on-line at:
http://pubs.usgs.gov/of/2008/1149/

Cover photograph:
Looking south toward the upper Ipnelivik River drainage, eastern Ambler River quadrangle (photograph taken by Alison B. Till).

Contents

Tables

Sheet 1 (oversized 28 x 58 inches)

Sheet 2 (oversized 16 x 49 inches)

Bedrock Geologic Map of the southern Brooks Range, Alaska, and accompanying Conodont Data

By Alison B. Till, Julie A. Dumoulin, Anita G. Harris, Thomas E. Moore, Heather A. Bleick, and Benjamin R. Siwiec

INTRODUCTION

This 1:500,000-scale map depicts the bedrock geology of the southern Brooks Range, which spans northern Alaska from west to east. The map encompasses all of the Baird Mountains, Ambler River, Survey Pass, Wiseman, and Chandalar 1:250,000 quadrangles, and parts of the Christian, Selawik, Shungnak, Bettles, and Beaver quadrangles (Sheet 1: Figure 1, Figure 2). A summary of conodont data collected from the area is presented in an appendix and includes a significant amount of previously unpublished material.

The southern part of the Brooks Range has tree- and shrub-covered lowlands and tundra-covered and rocky uplands. Over much of the area, ridgelines reach about 4,000 feet. In the central part of the map area, in the Survey Pass quadrangle and parts of the Wiseman quadrangle, ridgelines exceed 6,000 feet and peaks exceed 7,000 feet. The tallest peak in the map area is Mt. Igikpak, 8,510 feet, in the central Survey Pass quadrangle.

Sources of data

This is the first synthesis of the bedrock geology of the southern Brooks Range at a scale greater than 1:1,000,000. The geologic map was compiled from published maps and papers and unpublished mapping by the authors. Published geologic maps that were used are mostly 1:250,000 in scale and based on field observations made between 1951 and 1986. Results from detailed studies (including Ph.D. theses) and unpublished mapping generally represent work done between 1986 and 1998. All known paleontologic and geochronologic data, published and unpublished, were used to limit the age of rock units. Symbols on the correlation chart (Sheet 1) are representative of the age control available for the geologic units.

The degree of detail in available geologic mapping and associated data vary significantly within the map area. Where detailed mapping is available (for example, along the Dalton Highway and around the Nanielik antiform; Sheet 2), we have taken care to reproduce it at the scale of this map and to extend the units defined in detailed mapping to less well-known parts of the range. In other areas, where 1:250,000-scale geologic mapping is all that is available, we have had to interpret some relationships in order to produce a regionally coherent map.

The geologic map and related supplemental information are presented in an oversized sheet, this text, three tables, and the appendix. The appendix includes an explanatory text and two tables.

The geologic map, correlation chart, sources of data, and list of map units are shown on Sheet 1. Sheet 2 shows geographic names referenced in the text, tectonic subdivisions of the map area, and selected metamorphic data. Metamorphic data were compiled from thin section collections of the authors and archived collections of U.S. Geological Survey geologists. A larger number of thin sections are available from the Schist belt (defined below) than in other parts of the range; however, where there are spatial gaps in metamorphic symbols shown in the Schist belt, thin-section data are lacking. Thin section coverage in the Central belt (defined below) is most dense around the Dalton Highway and the Nanielik antiform, and contains many significant gaps elsewhere.

Geochronologic data in Tables 1 and 2 were compiled from the literature and in rare cases from the authors' files. Analytical results ("dates") that were shown by researchers to have geologic meaning ("ages") are included in the tables, while complex results (e.g, $^{40}Ar/^{39}Ar$ age spectra lacking clear plateaus) were excluded. In a few cases, results that do not meet these criteria are included; statements in the "comments" column of the table indicate when and why this was done. In most cases, the "preferred age" listed in the table was taken directly from the published source. If none was given, the plateau age was used. We have not shown whether dates were interpreted as cooling or crystallization ages.

Table 3 shows the distribution of units by 1:250,000-scale quadrangle, and is intended as an augmentation of geographic information provided in the unit descriptions.

The text for Appendix 1 discusses sources and distribution of conodont data and geologic implications of the data. Table A-1 lists the conodont data by 1:250,000 quadrangle. Table A-2 summarizes the temperature ranges thought to correspond to color alteration indices of conodonts.

Geologic time-scale age boundaries used are those of Gradstein and Ogg (2005).

Subdivisions of the map area

The map area encompasses part of the Brooks Range orogen, a contractional mountain belt with a foreland basin on its north side (Sheet 1, Figure 2). The rocks in the southern part of the range, shown in this map, include the oldest rocks in the range and those most deeply buried during the orogenic episode. As is the case with rocks on the northern, more shallowly buried part of the range, there is evidence that southern Brooks Range rocks were deformed in several pulses spanning Mesozoic and Cenozoic time (Chistiansen and Snee, 1994; Till and Snee, 1995; Blythe and others, 1998; Gottschalk and Snee, 1998; Vogl and others, 2002). Metamorphic events were associated with these pulses, and include two distinct blueschist-facies events, an albite-epidote amphibolite-facies event, one or more greenschist-facies events, and a pumpellyite-actinolite facies event (Till and others, 1988; Little and others, 1994; Till and Snee, 1995; Gottschalk and Snee, 1998; Vogl, 2003). The full extent and exact timing of several of these events is not known. Generally speaking, rocks of the southern Brooks Range vary from penetratively to weakly deformed and from multiply to weakly metamorphosed.

Researchers have subdivided the orogen into fault-bounded packages to facilitate stratigraphic and tectonic descriptions and analyses. These packages have been called allochthons, terranes, subterranes, and belts. In the northern, more shallowly buried part of the Brooks Range, most workers recognize several deformational packages of rocks characterized by their distinctive stratigraphic sequences (e.g. Moore and others, 1994). Some of these deformational packages can be traced 100's of kilometers along the range from east to west. Deformational packages in the southern Brooks Range have been defined on the basis of combined lithologic and metamorphic characteristics (e.g., Moore and others, 1994; Gottschalk and others, 1998). Till and others (1988) proposed that shared Mesozoic metamorphic and deformational characteristics, rather than lithologic or stratigraphic features, would be more useful for recognizing fundamental tectonic components in the southern part of orogen. We follow the philosophy of Till and others (1988) for major belts in the map area. However, along the southernmost flank of the range, commonly used lithotectonic subdivisions are used (e.g., Angayucham terrane, Phyllite belt). Tectonic subdivisions used here are illustrated on Sheet 2 and outlined below.

Northern thrust assemblages – Two areas along the northern boundary of the map area are underlain by rocks that retain primary sedimentary or igneous features and show weakly developed foliations or no foliations at all. Deformation of these rocks occurred under brittle conditions and is characterized by folds of bedding, cleavage, and brittle fault surfaces (see domains 1-3 of Handschy, 1998). More than half of these rocks have thermal indices (e.g., conodont color alteration indices, or CAIs) indicating that maximum burial temperatures did not exceed approximately 350°C (CAI is 4.5-5 or lower; Tables A-1, A-2). The remainder of the rocks have CAIs of 5. In the northwest corner of the map, thrust assemblages include sequences defined by Karl and others (1989b), and in the central map area they contain rocks typically included in the Endicott Mountains allochthon (Moore and others, 1994). Some of the units included in the Northern thrust assemblages also occur to the south in the Central belt, where they typically show evidence of deeper burial (foliations, recrystallization) than correlative rocks to the north.

Doonerak antiform – The Doonerak antiform is cored by lower Paleozoic rocks and a thin sequence of Carboniferous through Triassic sedimentary rocks considered correlative to pre-Mississippian basement that underlies the North Slope. The structural antiform formed during the Tertiary (O'Sullivan and others, 1997; Julian and Oldow, 1998; Seidensticker and Oldow, 1998) and as a result the lower Paleozoic rocks are deformed. Clasts in some siliciclastic rocks are flattened and finer-grained rocks are phyllitic. Volcaniclastic rocks retain original features (such as pumice lapilli) that were statically overprinted by lower greenschist-facies mineral assemblages (Julian and Oldow, 1998). Thrust surfaces within the antiform are characterized by truncation of bedding and cleavage and abrupt lithologic transitions, suggesting that they formed under brittle conditions, in contrast to deformational features in the Central belt. Conodont CAIs from rocks within the antiform are variable and include values significantly lower than those typical of the Central belt.

Central belt – Inhomogeneous deformation, ductile deformation, and evidence for metamorphism are characteristics of the Central belt. Unlike the structurally coherent Schist belt, the Central belt is cut by numerous faults, many of them related to Cretaceous (and possibly Tertiary) shortening. Many fault surfaces are zones of distributed shear, meters to decameters thick, in which primary features were completely transposed. Within thrust sheets, foliations incompletely overprint primary sedimentary or igneous features at some localities, and are better developed in fine-grained metasedimentary rocks. As a result, relict Proterozoic amphibolite-facies metamorphic assemblages and Paleozoic igneous and sedimentary features are locally preserved despite evidence for regional Mesozoic metamorphic events (Till and others, 1988; Till, 1989). Metamorphic minerals are well developed along ductile shear zones and many rocks in the belt display some type of foliation. CAIs are 5 or higher (Table A-1).

Many of the rocks in the Central belt appear to have been metamorphosed at low to moderate greenschist facies. However, the number, regional extent, and relative timing of metamorphic events in the Central belt is unknown. Blueschist-facies metamorphism is well documented in the western Central belt at the Nanielik antiform, and occurred about 120 Ma (Till and Snee, 1995). Fine-grained blue amphibole (crossite), presumably formed during the same event, is recognized in mafic dikes in the central Baird Mountains quadrangle (see Sheet 2). Petrographic and petrologic study is insufficient to show how far to the east of the Nanielik antiform the blueschist metamorphism may have extended. Patrick (1995) documented high-pressure phengitic white mica in metagranitic rocks of the Central belt as far east as the Arrigetch-Igikpak thermal high. Subsequent thermobarometric research in the Arrigetch-Igikpak thermal high has not yielded evidence of an Early Cretaceous high-pressure/low temperature metamorphic event (Vogl, 2003). Kyanite, documented in metamorphosed quartz-rich conglomerates in the Survey Pass quadrangle, may or may not be related to a regional high-pressure event (Nelson and Grybeck, 1980; Vogl, 2003; the description of unit Mc includes an explanation for interpreting the kyanites as metamorphic rather than detrital). The few $^{40}Ar/^{39}Ar$ mica analyses available from low-grade metamorphic rocks in the Central belt east of the Nanielik antiform yielded plateau and isochron ages ranging from 111 to 116.5 Ma (Table 2).

Some units of the Endicott Group or of the Endicott Mountains allochthon (Tailleur and others, 1967; Moore and others, 1994) occur in both the Central belt and the Northern thrust assemblages (e.g. Dhf, Dn, MDk). Central belt occurrences of these rocks generally have foliations and signs of recrystallization that are lacking where they occur to the north. However, the fact that these units can be identified in both belts indicates that the structural dislocation between the northern Central belt and parts of the Northern thrust assemblages is not profound. This is consistent with outcrop-scale structural analysis across the boundary in the vicinity of the Dalton Highway by Handschy (1998), who considered variations in structural style to represent a strain gradient rather than a sharp structural boundary. Moore and others (1997b) interpreted much of the Central belt near the Dalton Highway to comprise the stratigraphically lower and tectonically hindward part of the Endicott Mountains allochthon.

Schist belt – The Schist belt is restricted to rocks that together underwent blueschist-facies metamorphism during the Jurassic. Penetrative metamorphic fabrics, complete metamorphic recrystallization, and structural coherence are characteristics of the belt. Primary igneous and sedimentary features are absent in almost all of the belt (see unit descriptions for exceptions), and foliations are well-developed. Fabrics documented in the schist belt are consistent throughout the belt from west to east, a distance of 610 km. The earliest metamorphic episode recorded in the Schist belt is a high-pressure/low temperature event. The lithologic compositions that produce diagnostic blueschist-facies assemblages are, of course, restricted, but glaucophane, pseudomorphs after glaucophane, and pseudomorphs after lawsonite are documented along the length of the belt and shown on Sheet 2. The blueschist-facies minerals formed in metabasites, metapelites, and calcareous schists. The P-T path recorded in these rocks traversed both lawsonite- and epidote-blueschist facies conditions (Till and others, 1988; Little and others, 1994; Gottschalk, 1998). One occurrence of eclogite and one of jadeite (Sheet 2) probably represent locations with compositionally unusual rocks (Gilbert and others, 1977; Gottschalk, 1998). Many lithologies contain assemblages that are stable at both blueschist and greenschist facies conditions, and in outcrop, most rocks appear to be greenschist facies in grade. However, fine diamond-shaped chlorite and albite pseudomorphs after glaucophane are preserved in the dominant foliation in many areas. This indicates that penetrative deformation did not accompany greenschist-facies recrystallization in those areas, or the pseudomorphs presumably would have been destroyed. In these rocks, greenschist-facies recrystallization was static or the associated deformation was inhomogeneous. Little and others (1994) documented a penetrative greenschist-facies fabric along the southern boundary of the schist belt in the

Wiseman quadrangle, but even they report the presence of glaucophane pseudomorphs within their study area. Further work is needed to document the nature and extent of greenschist-facies fabrics within the Schist belt.

Although direct dating of peak blueschist-facies conditions is notoriously difficult, the best available isotopic data suggest that high-pressure metamorphism of the Schist belt occurred during the Jurassic (Christiansen and Snee, 1994; Gottschalk and Snee, 1998). A white mica $^{40}Ar/^{39}Ar$ analysis that yielded plateau and isochron dates of 171.4 ± 0.4 and 167.9 ± 0.6 Ma and no evidence for excess or lost argon is cited by Christiansen and Snee (1994) as evidence that metamorphism occurred during the Middle Jurassic. More complex $^{40}Ar/^{39}Ar$ analyses of white micas presented by Gottschalk and Snee (1998) were interpreted as evidence that peak blueschist-facies metamorphism occurred before 142 Ma. A white mica isochron date of 144 Ma from schists of the Ruby terrane, thought to have formed in a correlative blueschist-facies episode, was interpreted as a minimum age of high pressure metamorphism (Roeske and others, 1995). The high P/low T metamorphism of the Schist belt (and Ruby terrane) records subduction and underplating of continental crust during the Jurassic. Analysis of detrital zircons from Brookian orogenic sediments yielded ages ranging from approximately 175 to 140 Ma; the zircons are thought to have originated in a Middle to Late Jurassic volcanic arc that collided with a continental margin (Miller and others, 2007; Moore and others, 2007). The Schist belt represents the subducted leading edge of that margin.

Many white mica samples from the Schist belt have yielded Cretaceous $^{40}Ar/^{39}Ar$ dates, generally ranging from 135 to 110 Ma (e.g., Christiansen and Snee, 1994; Blythe and others, 1998; Gottschalk and Snee, 1998). There is no clear geographic pattern to the distribution of dates, and the dated micas have not been related to rock fabrics that overprint the blueschist facies fabric. These dates are challenging to interpret because they could have formed as the blueschists cooled from peak metamorphic conditions through the argon closure temperature for white mica, or during a post-blueschist metamorphic event that occurred at temperatures lower than the closure temperature for white mica (e.g., Gottschalk and Snee, 1998).

The Schist and Central belts are interleaved along their common boundary in some areas (Sheet 2). Abrupt changes in metamorphic textures, evidence for brittle fault structures, and lithologic characteristics were used to distinguish rocks from the two belts; multiple phases of deformation, ranging from ductile to brittle, characterize this contact (Till and Moore, 1991).

The southern margin of the Schist belt is overprinted by secondary structures thought to be related to exhumation of the belt (Box, 1987; Gottschalk and Oldow, 1988; Gottschalk, 1990; Little and others, 1994; Vogl and others, 2002). Box (1987) recognized a ductile fabric in the Cosmos Hills that involved Upper Cretaceous conglomerates and suggested the fabric formed in an extensional setting. A detailed kinematic study of later fabrics in the southern part of the Schist belt was done by Little and others (1994) and Law and others (1994); they describe mylonitic fabrics with a dominantly top-to-the-south sense of shear. Mica from this fabric has not been dated. White mica from schist in the core of the Cosmos Hills yielded disturbed $^{40}Ar/^{39}Ar$ spectra with isochron and preferred dates ranging from 127 to 94 Ma (Christiansen and Snee, 1994). Most of the dates were younger than 103 Ma; the least disturbed sample was collected the greatest distance structurally below the extensional fault. A preferred age of 103 Ma was reported for that sample and the extensional event by Christiansen and Snee (1994). Blythe and others (1998) suggested that a 113 Ma $^{40}Ar/^{39}Ar$ white mica date from the Phyllite belt represented the age of the extensional event. The age of the event and the degree to which rocks in the core of the Schist belt recrystallized and deformed during exhumation is not clear.

CAIs from carbonate rocks in the Schist belt are 5 or higher.

Arrigetch-Igikpak thermal high – A metamorphic culmination in the central Survey Pass quadrangle contains rocks that reached albite-epidote-amphibolite facies conditions during the mid-Cretaceous (Patrick and others, 1994; Dinklage, 1998; Toro and others, 2002). Metamorphic conditions were 560-600°C and 8-9 kb and peaked around 105-103 Ma (Vogl and others, 2002; Vogl, 2003). Rocks along strike to the east and west are lower in metamorphic grade. Along the southern boundary of the culmination, the higher-grade assemblages overprint blueschist-facies assemblages of the Schist belt (Patrick and others, 1994; Dinklage, 1998). The transition between the Schist and Central belts, characterized by a fault or set of faults east and west of the thermal high, was apparently overprinted by the mid-Cretaceous metamorphic event; no faults have been recognized along the southern boundary of the thermal culmination. The northeastern boundary of the culmination is a Tertiary normal fault (Vogl and others, 2002); the western boundary is a fault that also may be relatively young (Toro and others, 2002).

Phyllite belt – The Phyllite belt is recognized along the length of the southern Brooks Range and sits between the Schist belt and Angayucham terrane. The belt contains some extensive exposures of sedimentary rocks with relict primary features, especially at its eastern end in the Christian quadrangle. However, the fabric in much of the belt is tectonic. Tectonic mélange is recognized along the southern boundary of the belt from the Baird Mountains quadrangle to the Wiseman quadrangle; the mélange is thickest in the west and thins to the east, where it is too thin to map at 1:250,000 scale. Metabasite bodies within the mélange contain both greenschist and blueschist-facies metamorphic assemblages, and CAIs of contained carbonate rocks range from 3 to 7 (approximately 150°C to at least 490°C), suggesting that the mélange formed by a process that entrained rocks with different histories.

The northern boundary of the Phyllite belt is difficult to recognize in the field. It is thought to be structurally gradational, involving dynamic recrystallization of Schist belt rocks and adjacent Phyllite belt rocks during exhumation of the Schist belt (Moore and others, 1997b; Blythe and others, 1998). $^{40}Ar/^{39}Ar$ analyses of white mica from the northern boundary of the Phyllite belt yielded ages of 113.3 ± 0.5 Ma (Blythe and others, 1998) and 124 ± 1 Ma (Gottschalk and Snee, 1998). The southern part of the Phyllite belt cooled through apatite closure (roughly 100°C) at about 60 Ma (Blythe and others, 1998).

Mosquito terrane – Two small fault-bounded bodies of amphibolite-facies rocks in the northeastern Bettles and southwestern Chandalar quadrangles comprise the Mosquito terrane; the fault-bounded bodies are surrounded by rocks of lower metamorphic grades. The amphibolites, pelites, and orthogneisses display moderate fabrics that intensify to mylonitic fabrics along bounding faults; deformation occurred during the Tertiary (Roeske and others, 2003). Metamorphic grade, fabric intensity, and timing of metamorphism differentiate these from the few other amphibolite-facies rocks in the map area. The eastern body is the "Mosquito terrane" of Jones and others (1988).

Cosmos Hills sequence – A fault-bounded sequence of dolostone, metalimestone, and marble in the Cosmos Hills sits above schists correlated with the Schist belt (Hitzman and others, 1986; Christiansen and Snee, 1994) and below rocks of the Phyllite belt and Angayucham terrane. The carbonate rock sequence does not show the penetrative deformation typical of Schist belt rocks and has yielded conodont faunas more readily than carbonate rocks from the Schist belt. Because of these characteristics, the carbonate sequence may have more affinity with the Phyllite belt than with the Schist belt; in particular, the sequence may have a derivation and tectonic history similar to carbonate rocks in unit P̶zpc of the Phyllite belt.

Angayucham terrane – The Angayucham terrane consists of a series of metamorphically, geochemically, and age-distinct fault-imbricated packages of mafic rocks, sedimentary rocks, and serpentinite (Pallister and others, 1989). In general, metamorphic grade is low (prehnite-pumpellyite, low greenschist), primary features are preserved, and faults formed at brittle conditions. In a few localities greenschist-facies mafic rocks are strongly foliated. CAI values are generally low (2-3), but some samples have yielded CAIs up to 6 or 7.

Yukon-Koyukuk basin sedimentary rocks – These Cretaceous sedimentary rocks are part of the large basin south of the Brooks Range. They are metamorphosed and deformed in the vicinity of the Cosmos Hills and Angayucham Mountains (Pallister and Carlson, 1988; Box, 1987). Elsewhere, they are folded and faulted but unmetamorphosed (Dusel-Bacon and others, 1989).

Tertiary deformation

Although the major pulse of contractional deformation occurred during the Mesozoic in the central Brooks Range, $^{40}Ar/^{39}Ar$ and fission-track studies show several pulses of Tertiary deformation also affected the area, synchronous with young deformation in the northeast Brooks Range (O'Sullivan and others, 1997; Blythe and others, 1998; Toro and others, 2002; Vogl and others, 2002). In some cases, faults with Tertiary offset have been pinpointed. These include the faults bounding the Doonerak antiform (O'Sullivan and others, 1998) and the Takahula fault northwest of the Arrigetch-Igikpak thermal high (Vogl and others, 2002, Toro and others, 2002). An Eocene $^{40}Ar/^{39}Ar$ cooling age in amphibolite-facies rocks of the Mosquito terrane indicates that faults separating the terrane from adjacent unmetamorphosed rocks are likely Tertiary in age (Roeske and others, 2003). Faults active during the Tertiary are shown in magenta on Sheet 2.

Stratigraphic issues

Research on metacarbonate rocks in the Central belt within the last 20 years has revealed that Late Proterozoic and lower Paleozoic sequences can be defined despite metamorphic and deformational overprints. Metacarbonate rocks of Middle Devonian and older age (map units OƐc, DOc, DOb, and likely parts of P̶zm) exposed in the Central belt once may have been part of a single carbonate platform that was dismembered by later tectonic events (Dumoulin and Harris, 1994; Dumoulin and others, 2002). Deep-water Silurian strata (map unit Spl) may have accumulated along the margin of this platform or in an intraplatform basin (Dumoulin and others, 2002). Middle-Upper Devonian intercalated carbonate and siliciclastic strata (map units Dl, Dmu) locally overlie the carbonate platform succession; the contact is generally faulted but may originally have been depositional. Siliciclastic rocks of the Upper Devonian-Lower Mississippian Endicott Group (map unit Dhf and younger strata) depositionally overlie these mixed carbonate and siliciclastic strata. Thus, map units Dl and Dmu represent facies that are transitional in time and space between lower Paleozoic carbonate rocks to the south and the fluviodeltaic depositional system of the Endicott Group to the north.

Carbonate rocks in the Central belt are variously recrystallized; sedimentary structures, depositional textures, and faunal features are locally well preserved, especially in dolostones and carbonaceous strata. Conodont color alteration indices (CAIs) for virtually all samples from the Central belt are ≥5 and indicate temperatures of at least 300°C (Rejebian and others, 1987).

Tailleur and others (1967) proposed the name Baird Group for Central belt metacarbonate rocks similar to those present in the western Baird Mountains, where exposures are considered most typical. They included in this group their newly named Eli Limestone, as well as the Kugururok Formation of Sable and Dutro (1961), and the Skajit Limestone of Schrader (1902), Smith and Mertie (1930) and Brosgé (1960). Metacarbonate rocks throughout much of the Brooks Range were later included in the Baird Group by some authors (e.g., Brosgé and Tailleur, 1971), but we follow Dumoulin and Harris (1994) and restrict the Baird Group to strata in the west-central part of the Baird Mountains quadrangle (our map unit DOb). We retain the name Eli Limestone for rocks in the northwestern part of the Baird Mountains quadrangle (part of our map unit MDer), but do not include these less metamorphosed rocks in the Baird Group. We also exclude from the Baird Group the unmetamorphosed carbonate rocks of the Kugururok Formation, whose type section is in the Misheguk Mountain quadrangle, ~90 km north of the Baird Mountains. Lastly, we do not use the name Skajit Limestone on this map. The Skajit in its type area along the John River in the Wiseman quadrangle (Brosgé, 1960) consists of marble with few relict sedimentary or biogenic structures. These marbles differ from metacarbonate rocks we call Baird Group, which retain numerous relict primary features. We include marbles in the John River area in our map unit Pzm.

We have chosen to show a large number of Mississippian units on the map, many of which cover relatively small areas. These units do not in all cases contain a unique set of subunits – some subunits, such as the Kekiktuk Conglomerate (Brosgé and others, 1962) or rocks interpreted to be the Kekiktuk, are included in several. We have done this in order (a) to group paleontologically and sedimentologically better characterized exposures (e.g., Mkkl, Mkl, Ml) separately from the less well characterized exposures (e.g. Mu, Mc); (b) to show localities that contain few lithologies (Mc) rather than many (Mkkl, Mu), and (c) to retain observations and interpretations shown on the source maps.

The relations of Mississippian and younger stratigraphic sequences to sequences of older rocks exposed in the Central belt are critical to understanding both the stratigraphic framework of the Paleozoic in northern Alaska and the nature of Mesozoic deformation in the Brooks Range. Of particular interest are quartz-rich conglomerates, commonly interpreted to be the Mississippian Kekiktuk Conglomerate, and the nature of their basal contact with subjacent, older rocks. In the eastern Ambler River quadrangle, the basal contact was interpreted as a major unconformity by Mayfield and Tailleur (1978), who considered the relationship key to reconstruction of stratigraphic relations between upper Paleozoic and older rocks of the Brooks Range. Subsequent workers considered the contact to be a fault (or ductile shear zone), based on the presence of isoclinal folds and mylonitic foliations in the conglomerate and associated metasedimentary rocks (Till and others, 1988; Toro, 1998). Toro (1998) considered the conglomerate to be Devonian, not Mississippian. This example illustrates the fact that both the degree of deformation in the Central belt and challenges in distinguishing among conglomerate units complicate recognition of key stratigraphic relations in the Central belt. The Kanayut Conglomerate, some of which is definitively Devonian (Bowsher and Dutro, 1957) and the Mississippian Kekiktuk Conglomerate are not easily distinguished based upon lithologic characteristics, and rarely contain fossils. In areas less deformed than the Central belt, which are generally outside of this map area, the two units are typically recognized on the basis of their stratigraphic context. Finally, another set of conglomerates is known in the Central belt, and many of them are poorly characterized. On this map, these conglomerates are part of unit Dmu (Devonian metasedimentary and lesser metaigneous rocks).

UNIT DESCRIPTIONS

ANGAYUCHAM TERRANE, SERPENTINITE, & YUKON-KOYUKUK BASIN

Ks - Conglomerate, sandstone, and shale (Cretaceous) -- Conglomerate and finer grained sedimentary rocks exposed along the southern map boundary. The unit varies in character from massive, poorly stratified rocks rich in mafic intrusive and extrusive clasts at the base of the unit to well-sorted sedimentary rocks rich in quartz and metagraywacke clasts at the top. It contains sparse plant fossils that range in age from late Early Cretaceous to Late Cretaceous; south of the western map area it contains an ash-fall tuff that yielded a K/Ar age of 86 Ma and marine mollusks of Early Cretaceous (?) age (Patton and others, 2005). In the northeastern Shungnak and parts of the Ambler and Hughes quadrangles, the unit is deformed and regionally metamorphosed to low metamorphic grades (prehnite-pumpellyite to low greenschist-facies; Dusel-Bacon and others, 1989). Where deformed, rocks are strongly foliated and clasts have flattening ratios of 10:1 (Pallister and Carlson, 1988). In the Cosmos Hills, Box (1987) measured NE-trending stretching lineations and kinematic indicators suggesting top to the southwest movement during deformation of the metasedimentary rocks. Clast compositions record successive unroofing of the Angayucham terrane (JDab), followed by the Schist belt and the correlative schist of the Ruby terrane (Nilsen, 1989; unit PzPsr on this map). Equivalent to Kqc and Kmc of Patton and others (2005)

Kvg – Volcanic lithic sandstone and mudstone (Cretaceous) -- Fine-grained to conglomeratic sandstone and fine-grained laminated mudstone exposed along the south-central boundary of the map. Mudstone is locally tuffaceous. Clasts are predominantly intermediate and mafic volcanic and intrusive rocks and chert with subordinate amounts of quartz, metamorphic, and granitic clasts. Metamorphic detritus increases in abundance in the upper part of the unit. Graywacke is more common than mudstone; the unit is thought to represent middle and outer submarine fan deposits (Patton and others, 2005). Late Early Cretaceous (Albian) marine mollusks are present in the map area and in adjacent areas. Equivalent to Kvg of Patton and others (2005) and part of unit Ks of Pallister and Carlson (1988)

JDab - Mafic metavolcanic and metaintrusive rocks, metachert, metalimestone, and amphibolite of the Angayucham terrane (Early Jurassic through Devonian) -- Metamorphosed pillow basalt, hyaloclastic breccia, basaltic tuff, diabase, microgabbro, radiolarian and tuffaceous chert, minor metalimestone, and rare mafic schist in an imbricate package exposed along the southern boundary of the map area. The package varies significantly in breadth (north-south) along its exposure length; the area of broadest exposure is 8 km across (Pallister and others, 1989). Basalt and diabase predominate. Metachert occurs in both depositional (bedded and interpillow) and fault contact with metabasalt and metatuff; chert, basaltic tuff, and cherty tuff are present in sequences up to 60 m thick (Pallister and Carlson, 1988). Typically, metamorphic minerals partially overprint primary igneous and sedimentary textures in the metabasalts and metagabbros, but some foliated and lineated metabasalts occur in the western Ambler River quadrangle (A.B. Till, unpublished data) and in the Angayucham Mountains. Mineral assemblages indicate the unit experienced prehnite-pumpellyite- to greenschist-facies metamorphism, with some exceptions. Barker and others (1988) reported albite-epidote-amphibolite-facies assemblages in metabasalt. A sliver of mafic schist in the Angayucham

Mountains retains relict hornblende and garnet from an amphibolite-facies metamorphic assemblage, contains a foliation-forming greenschist-facies assemblage, and is cut by prehnite-bearing veins (Pallister and Carlson, 1988).

The basalts are tholeiitic, and fall into "within-plate" fields on trace element discrimination diagrams; LREE elements are enriched relative to chondrites in some basalts and gabbros, but show little to no enrichment in other rocks (Barker and others, 1988; Pallister and others, 1989). Based on these characteristics, the mafic rocks are thought to have been parts of oceanic plateaus or islands. In the Angayucham Mountains, where the unit has been mapped in detail, Hitzman and others (1982) and Pallister and Carlson (1988) recognized that several distinct subunits can be distinguished within the package, although the subunits are lithlogically similar and each is internally imbricated. Pallister and Carlson (1988) initially distinguished three subunits on the basis of slight variations in metamorphic minerals and minor element chemistry, but the packages also can be distinguished by age. Jurassic radiolarians were collected from the southernmost subunit and Triassic radiolarians from the central subunit. Along the northern boundary of the central subunit and in the northern subunit, Triassic, Mississippian, and Devonian radiolarians and conodonts were collected from fault-bounded lenses of chert and carbonate rock.

Devonian, Mississippian, Triassic, and Jurassic radiolarians, conodonts, and megafossils have been collected from chert, cherty tuff, metalimestone layers, interpillow sediments, and fault slivers of carbonate rocks and chert (Pallister and Carlson, 1988; Jones and others, 1988). Conodonts of Late Silurian to Early Devonian age (Table A-1, Ambler River quadrangle) are the oldest fossils collected from the unit, and Early Jurassic radiolarians are the youngest (Pallister and Carlson, 1988; Jones and others, 1988). Pennsylvanian-Permian, Permian, and Early Permian radiolarians were collected near the southeast corner of the Wiseman quadrangle (Jones and others, 1988). At two localities, Early Mississippian conodonts have been collected from the same localities that also have yielded distinctly younger micro- and megafossils. At Twelvemile Mountain (Sheet 2), in the southeast Wiseman quadrangle, tightly dated late Early Mississippian (middle Osagean) conodonts, and Mississippian and Mississippian to Early Pennsylvanian radiolarians were collected from carbonate and chert lenses. Bird (1977) identified Pennsylvanian(?) foraminifers from the same locality and noted that the rocks are lithologically similar to those of the Lisburne Group, a unit widely distributed to the north (in the Northern thrust assemblages). At Heart Mountain (Sheet 2), in the southwest Wiseman quadrangle, both Early Mississippian conodonts and Permian foraminifers, bryozoans, and brachiopods were identified (Table A-1; Patton and Miller, 1973). These contrasting ages could reflect structural juxtaposition of rocks of different ages, reworking of older fossils into younger strata, or problems in correlating age ranges of different fossil groups. The thermal indices of conodont collections in this unit are commonly high (CAI=5), though some are low (CAI=2-3).

The Angayucham terrane is thought to comprise parts of a collapsed ocean basin that were emplaced in a high structural position during the Brooks Range orogeny. Metabasalts of the terrane along the southern flank of the Brooks Range, the "Narvak panel" of Patton and Box (1989) are typically correlated with basalts of the "Copter Peak allochthon", which are exposed in the crest of the range (Moore and others, 1994), also in a high structural position. The Maiyumerak sequence (MzDm), in the northwest corner of the map area, contains similar lithologies, but includes basalts with island-arc chemical affinities, unlike metabasalts along the southern or crestal parts of the range (Karl, 1992); we do not consider MzDm part of the

Angayucham terrane. The Angayucham terrane is thought to be correlative with the Tozitna terrane and possibly the Innoko terrane in central Alaska (Patton and others, 1994)

MzPzs - **Serpentinite** (Mesozoic? and Paleozoic?) -- Greenish-gray, yellowish-green, olive green or greenish-black serpentinite, minor basaltic rocks, harzburgite tectonite, and nephrite jade exposed in the southern Ambler River and adjacent Shungnak quadrangles. In the Cosmos Hills, fault-bounded serpentinite bodies up to 130 meters thick and 8 kilometers long sit structurally above Paleozoic and older metasedimentary rocks of the Schist belt and below metabasalts of the Angayucham terrane (JDab) and Cretaceous metasedimentary rocks (Ks) (Hitzman and others, 1982; Loney and Himmelberg, 1985). In the Jade Mountains, in the southwestern Ambler River quadrangle, serpentinite is mixed with subordinate basaltic rocks, dunite, peridotite, and nephrite jade (Mayfield and Tailleur, 1978), and is located adjacent to a thick sequence of basalts of the Angayucham terrane (JDab). Nephrite jade is found as boulders in stream bottoms in several locations in the area and in outcrop in the Jade Mountains (Loney and Himmelberg, 1985). Equivalent to CzMzsp of Hitzman and others (1982) and Ju of Mayfield and Tailleur (1978)

MOSQUITO TERRANE

DPm - **Metamorphic rocks** (Devonian through Proterozoic?) -- Pelitic schist, metabasite, minor felsic orthogneiss and meta-ultramafic rock exposed in two small areas along the Kobuk fault zone in the northeastern Bettles and southwestern Chandalar quadrangles. The rocks exhibit amphibolite-facies metamorphic assemblages. Foliations are locally mylonitic, with well-developed stretching lineations; white mica yielded a ^{40}Ar/^{39}Ar cooling age of 54.8 ± 1.3 Ma (Roeske and others, 2003). Microscopic kinematic indicators from the eastern body, which corresponds to the Mosquito terrane of Jones and others (1988), suggest the formation of ductile fabrics in a high-strain dextral slip system (Roeske and others, 2003). Age and affinity of the protolith rocks are unknown

PHYLLITE BELT

KJm - **Melange** (Cretaceous and Jurassic) -- Tectonic assemblage of meter to kilometer-scale fault slivers of pillow basalt, mafic schist, metagabbro, metalimestone, metachert, metamorphosed lithic sandstone, phyllite, and rare serpentinite exposed in low hills in the south central and southwestern part of the map area. Metamorphic grade varies from slice to slice and ranges from pumpellyite to greenschist facies; relict igneous clinopyroxene is present in some metagabbros. One sliver of mafic schist on the Baird Mountains/Ambler River quadrangle boundary contains abundant blue amphibole, probably crossite (S.M. Karl, unpublished data). The age of the unit is based on the likely time of fault juxtaposition of the tectonic slivers. Metachert yielded Mississippian radiolarians; metalimestone bodies near the contact between this unit and the adjacent Angayucham terrane (JDab) yielded Middle and Late Devonian and Ordovician conodonts (Pallister and Carlson, 1988; Table A-1, Ambler River, Hughes, and Survey Pass quadrangles). Pallister and Carlson (1988) suggested that the unit is derived from the adjacent units to the south (JDab) and north (Pzpg), and that contacts with those units are structurally gradational. Some of the carbonate rocks are too old to have been derived from

JDab, and may have affinities with units some distance to the north. In the Wiseman quadrangle, the contact between the Angayucham terrane and the phyllite and graywacke unit (Pzpg) is a zone of anastomosing faults that involves a broad variety of lithologies and matrix-supported mélange (Moore and others, 1997b; Gottschalk and others, 1998), and probably an eastward extension of KJm. Equivalent to "KJm" of Patton and others (2005), "KJm" of Pallister and Carlson (1988), "MzPzm" of Karl and others (1989b) and part of the Slate Creek terrane of Moore and others (1997b)

Dps – Lithic sandstone and shale (Devonian) -- Dominantly gray-green lithic sandstone, lesser brown quartz sandstone, and black shale and silty shale exposed in the western Christian quadrangle (Brosgé and Reiser, 2000). Sandstones are fine- to medium-grained and thin- to medium-bedded. Black shale forms up to 50 percent of the unit and occurs in layers up to 15 meters thick. The unit may be 1200 meters thick. Localities east of the map area yielded Late Devonian plant fossils and spores that are of Middle or Late Devonian and probable Early Devonian age (Brosgé and Reiser, 2000). May be correlative to parts of unit Pzpg. Area with overlay pattern is schistose, due to crystallization of micas at low metamorphic grade, and contains quartz veins. Schistose varieties are equivalent to units "Dmw" and "Dpm" of Brosgé and Reiser (2000). Dps is part of the Venetie terrane of Brosgé and Reiser (2000), and was included in the Slate Creek subterrane by Moore and others (1994)

Pzpg – Phyllite and graywacke (Paleozoic?) -- Dark-gray to black phyllite and brown-weathering lithic sandstone, sandstone, and mudstone exposed along the southern boundary of the schist belt. The unit varies in breadth along strike. In the Wiseman and Chandalar quadrangles, two subunits are recognized (undifferentiated on our map): a northern dark, fine-grained phyllite or phyllonite, and a southern metamorphosed lithic sandstone-rich unit. The two subunits are difficult to distinguish in the field. The northern unit is lithologically homogeneous, locally well foliated, and locally contains small bodies of mafic schist similar in composition to those in the underlying Schist belt (Dsq; Moore and others, 1997b; Gottschalk and others, 1998). Little and others (1994) reported a strain gradient within the subunit that increases towards the underlying Schist belt; parts of the subunit may be a phyllonite tectonically derived from underlying quartz-mica schist in the Schist belt (Moore and others, 1997b). This subunit is equivalent to the "phyllite belt" of Gottschalk and others (1998). Rocks in the southern subunit retain relict sedimentary features that may reflect contrasting depositional settings. Sedimentary structures, such as Bouma sequences, have been recognized and are thought to indicate deep-water turbidite fan deposition (Murphy and Patton, 1988); others, such as hummocky cross-stratification and oscillation ripple marks, were seen elsewhere and are indicators of shallow-water deposition (Gottshalk and others, 1998). Palynofloras from sandstones with shallow-water structures are Early Devonian (Gottschalk, 1998). The southern subunit is equivalent to the metagraywacke belt of Gottschalk and others (1998); the unit overall is equivalent to "metagraywacke and phyllite" of Dillon and others (1986), Slate Creek subterrane of Moore and others (1994) and the combined Pzpa and Pzg units of Patton and others (2005)

Pzpc - Carbonate rocks of phyllite belt (Paleozoic) -- Fault-bounded blocks of marble, metalimestone, and dolostone that crop out in southwestern Ambler River quadrangle. Carbonate rocks are locally intercalated with black phyllite, black metaquartzite, and metachert, contain megafossils (corals, brachiopods, crinoid debris), and yield conodonts that indicate a range of middle Paleozoic ages; most precise ages are Late Silurian-early Early Devonian, Middle Devonian (Givetian), and Early Mississippian (Alaska Paleontological Database; Table A-1, Ambler River and Hughes quadrangles). Corals of Devonian and possible Silurian age are reported from the Jade Mountains (Patton and others, 1968; Oliver and others, 1975). The fault-bounded blocks may have affinity with carbonate rocks some distance to the north (Central belt). Pzpc includes parts of map units DSba, Ml?, and Pzl of Mayfield and Tailleur (1978)

COSMOS HILLS SEQUENCE

DSc - Carbonate rocks of Cosmos Hills (Devonian and Silurian) -- Thin-bedded to massive dolostone, metalimestone, and marble, locally graphitic or phyllitic, exposed in fault slices in the Cosmos Hills, Shungnak and Ambler River quadrangles. The unit includes minor thin, micaceous layers interpreted as airfall tuffs, and some buff to reddish gray dolostones thought to be of hydrothermal origin (Hitzman and others, 1982). Some intervals are fossiliferous and may represent biohermal build-ups. Brachiopods, corals, gastropods, and crinoids of Middle Devonian age were reported by Hitzman and others (1982); Early(?) and Middle Devonian tabulate and rugose corals and stromatoporoids were documented by Patton and others (1968), Fritts (1970), and Oliver and others (1975). Conodonts indicate the presence of Upper Silurian and Lower Devonian (lower Emsian) strata (A. Harris, unpublished fossil report, 1991; Table A-1, Ambler River quadrangle). This unit hosts the copper-rich Ruby Creek (or "Bornite") and associated stratabound sulfide deposits (Hitzman, 1986). Lithofacies in DSc are in part similar to those of older part of unit Pzpc; the Cosmos Hills carbonate rocks may have shared structural history with units in the Phyllite belt. Hitzman and others (1982) interpreted the lower contact of the unit as conformable with the underlying schist, but considered the upper contact a fault. DSc includes parts of map units DSba, Ml?, and Pzl of Mayfield and Tailleur (1978); it is equivalent to map units Dbm and Dbd (Bornite marble) of Hitzman and others (1982)

SCHIST BELT

Dsq - Quartz-mica schist (Devonian) -- Gray, dark-gray, or brownish-gray weathering, dominantly pelitic or semipelitic schist that constitutes the major lithologic unit of the Schist belt. Outcrops vary from blocky and resistant (quartz-rich varieties) to platy and less resistant (mica-rich varieties), as the abundance of quartz versus mica and albite varies at centimeter to meter scales. Scattered lenses of mafic schist, calcareous schist, albite-mica schist, graphitic metaquartzite and marble up to 10's of meters thick are typical of the unit but volumetrically minor. Mafic lenses may be massive or schistose. In the Wiseman area, rare lenses of ultramafic rocks are up to 10's of meters thick.

The dominant foliation is defined by parallel millimeter- to meter-scale variations in quartz versus mica or albite, or discontinuous layers and lens-shaped quartz segregations (Gottschalk, 1990; Little and others, 1994; Till, unpublished data). Foliation is weakly formed in mica-poor layers, and better formed but varied in character in more micaceous lithologies. Evidence for multiple foliation surfaces, such as intrafolial isoclinal folds, are common in outcrop. Sheath folds and more open, asymmetrical folds are also present. Clots of polycrystalline quartz give a knotty appearance in some structurally complex outcrops. Thin, laterally extensive centimeter-scale quartz and mica segregations give some outcrops a banded appearance. Very strongly foliated outcrops typically display fine, millimeter-scale planar laminations of mica and quartz. At map scales, the dominant foliation is typically broadly arched or folded around axes that are subparallel to the east-west trend of the Schist belt. Gottschalk (1990), Little and others (1994), Law and others (1994), and Dinklage (1998) contain detailed structural descriptions of this and associated Schist belt units.

No fossils have been collected from the quartz-mica schist but protolith age can be partially bracketed by the ages of detrital zircons separated from the unit. Twenty-seven detrital zircons separated from micaceous metaquartzite varied from spherical, with pitted surfaces, to slightly abraded euhedral grains (Moore and others, 1997a). The rounded populations (n=16) yielded $^{207}Pb/^{206}Pb$ ages that suggest source terranes for the protolith of the quartz-mica schist included Archean and Proterozoic rocks. The euhedral grains (n=11) gave concordant ages of 370-360 Ma, indicating a Late Devonian maximum age for at least part of the protolith package. One Middle Devonian granitic orthogneiss body (unit Dg) is present within the quartz-mica schist unit in the Chandalar quadrangle. Geologic mapping is of insufficient detail to show whether there was an original intrusive relationship between Dg and Dsq, or if the orthogneiss was folded in with Dsq during penetrative Mesozoic deformation. It is not clear, therefore, whether or not the age of the orthogneiss bears directly on the age of the protolith of the quartz-mica schist.

The quartz-mica schist shared its early deformational and metamorphic history with other units of the Schist belt (DⱣsc, Da, Dg); see the introduction for a discussion of that history. Common metamorphic minerals in pelitic schists include quartz, muscovite, chlorite, plagioclase, chloritoid, and accessory sphene, tourmaline, rutile, opaque, graphite, and calcite. Some pelitic schists contain garnet, and many contain glaucophane or pseudomorphs of chlorite and albite after glaucophane. Metabasites typically contain a combination of actinolite, albite, epidote, garnet, chlorite, sphene, and quartz; many contain glaucophane or pseudomorphs after glaucophane. Rectangular inclusions of zoisite plus paragonite in garnet or other minerals are likely pseudomorphs after lawsonite. This unit may be a lithologic and metamorphic correlative to a pelitic subunit of the Nome Group, Seward Peninsula, which has also yielded detrital zircons as young as Late Devonian (Till and others, 2006).

Hitzman and others (1982, 1986) divided this lithologic package into the Anirak and Mauneluk schists. The "banded and knotty schist" of Dillon (1989) and Koyukuk schist of Gottschalk (1987) are dominantly pelitic schists that belong to this package. This unit is equivalent to the "quartz mica schist" and "siliceous schist of the Kallarichuk Hills" of Karl and others (1989b), "undifferentiated quartz-mica schist" and "massive quartz-mica schist" of Mayfield and Tailleur (1978), "quartz-muscovite schist" of Nelson and Grybeck (1980), "schist" of Dillon and others (1986), "Marion Creek schist" of Moore and others (1997a,b), and "quartz-mica schist" of Brosgé and Reiser (1964). The protolith was considered by Brosgé and Reiser (1964) to be the Devonian Hunt Fork Shale

Da - Ambler sequence (Devonian) -- Interlayered white- to medium-gray-weathering metarhyolite, dark-green-weathering metabasite, pale-gray-weathering marble, and brown- to dark-gray-weathering calcareous, pelitic and carbonaceous schist exposed in two areas in the Schist belt. The unit occurs as large lenses interfolded with units Dsq and DⱣsc. "Metarhyolite porphyries" with megacrysts of feldspar up to 5 cm across and quartz eyes up to 1 cm across are typical of the unit (Hitzman and others, 1986). "Aphanitic metarhyolite" layers and lenses are characteristic and show rare flow banding, breccia textures, and possible welded shard textures (Hitzman and others, 1986). Metabasites occur as pods and lenses; exposures in the Ambler River quadrangle retain remnant pillow structures (Hitzman and others, 1986). Near the Ambler River – Survey Pass quadrangle boundary, where it has been studied in the most detail, the unit is thought to be 700-1,850 meters thick (Hitzman and others, 1986); there, massive sulfide deposits of the Ambler mining district are associated with the metarhyolites, including the world-class Arctic deposit (Schmidt, 1986).

Most U-Pb zircon ages from metarhyolite layers in the Ambler sequence range from 378-386 Ma; the sample from the Arctic deposit yielded a bimodal igneous zircon population with ages about 378 and 405 Ma (McClelland and others, 2006; Raterman and others, 2006). The significance of the older population of zircons is not understood. The Ambler metarhyolites are, based on these ages, Middle to Late Devonian.

Few fossils are known in the Ambler sequence. One conodont collection from the Wiseman quadrangle is Devonian (Table A-1). Megafossil collections have been reported but are not now considered definitive. In an abstract, Smith and others (1978) reported that poorly preserved favositid corals, crinoid columnals, bryozoans, and ichnofossils were found at a locality in the Ambler district, and assigned the rocks a tentative Middle Devonian to Early Mississippian age. The faunal assemblage was examined by two researchers. G.D. Webster (written commun. to I.L. Tailleur, 1977) indicated a Devonian age for the corals, and considered crinoid columnals to be of probable Middle Devonian and possible Devonian or Mississippian age. William A. Oliver, Jr. (written commun. to I.L. Tailleur, 1977) suggested that the solitary corals indicate a post-Middle Ordovician age and that possible thamnoporoid corals suggested a Silurian-Devonian age. Both paleontologists have reconsidered their findings (written communications to A. Till, 1992), and neither now suggest a Middle Devonian to Early Mississippian age for the assemblage. Therefore, the age reported in Smith and others (1978) and derivative publications (e.g., Hitzman and others, 1982; 1986) can not be supported by megafossil collections. However, Devonian conodonts have been recovered from the sequence (Table A-1, Wiseman quadrangle), and given the radiometric ages cited above, the unit is at least in part Devonian.

The presence of marble within the unit and relict pillow structure in metabasite indicate that deposition was submarine. Hitzman and others (1986) thought the Ambler sequence originated as a compositionally bimodal volcanic association erupted on a rifted continental margin.

The Ambler sequence has a shared structural and metamorphic history with the other lithologic packages in the Schist belt (Hitzman and others, 1986); see the introduction for discussion of that history. One sample of metafelsite from the Ambler sequence was included in a suite analyzed for feldspar and phengite thermobarometry, and yielded a temperature of 376°C and pressure of 10.3 kb, thought to represent conditions of high-pressure metamorphism of the Schist belt (Patrick, 1995). Relict primary volcanic textures in some of the metarhyolite porphyries in the sequence are thought to have been preserved as a result of low fluid-rock ratios and limited element mobility during metamorphism, rather than an indication that the sequence escaped metamorphism and deformation (Schmidt, 1986).

Equivalent to "metamafic igneous rocks", "megacrystic felsic schist", and "felsic schist" of Mayfield and Tailleur (1978); "mafic volcanic rocks" and "felsic schist" of Nelson and Grybeck (1980); and "Ambler metavolcanic rocks" of Dillon and others (1986)

Pzbq - Black quartzite (Paleozoic?) -- Black-weathering, fine- to medium-grained black metaquartzite exposed along the contact between units Dsq and DPsc near the boundary between the Baird Mountains and Ambler River quadrangle. Locally may contain small amounts of mica and show segregation of quartz and graphite in layers parallel to foliation. Equivalent to Pzbq of Mayfield and Tailleur (1978)

Pzsm - Marble of the Schist belt (Paleozoic) -- Metacarbonate rocks form an elongate belt in the central Ambler River quadrangle and are the only mappable occurrence of massive carbonate strata in the Schist belt. The unit surrounds the Redstone pluton (Sheet 2) and includes a variety of rock types (J. Dumoulin, unpublished field notes, 1986). White, gray, and black, fine- to coarse-crystalline marble predominates; these rocks are commonly color laminated on a millimeter to centimeter scale, contain local interlayers and lenses of graphitic schist and dolostone, and are undated. Medium-dark-gray, fine-crystalline, medium-bedded metalimestone with relict corals, stromatoporoids, spines, and echinoderm debris yielded conodonts of Early (middle Emsian)-Middle Devonian age (Table A-1, Ambler River quadrangle). Other undated lithologies (all sampled for, but barren of conodonts) include medium-light-gray dolostone with fine, wispy laminae; dark cherty metalimestone intercalated with quartzite; and dark gray to black, locally sooty metalimestone and marble. Local garnet-epidote skarn in marble adjacent to granite (Dg) indicates intrusive relation between pluton and some parts of Pzsm, but other Pzsm lithologies, including the Devonian metalimestone, may be in fault contact with the skarn-bearing marbles (J. Dumoulin, unpublished field notes, 1986)

Pzsg - Mafic schist (Paleozoic) -- Green and greenish-gray, schistose to massive, irregularly-shaped bodies and lenses of metamorphosed mafic rocks in units Dsq and DPsc large enough to show at the scale of the map occur in the Survey Pass and Chandalar quadrangles. Relict pillow structure is reported in the central Survey Pass quadrangle and adjacent to unit Dg in the Chandalar quadrangle (Nelson and Grybeck, 1980; Brosgé and Reiser, 1964). Rocks of the unit are typically composed of albite, chlorite, actinolite, epidote, quartz, calcite, and sphene, though exposures in the central Chandalar quadrangle adjacent to unit Dg contain hornblende, garnet, and biotite. Equivalent to unit "Dgs" and parts of unit "Dgh" of Brosgé and Reiser (1964), parts of "Dv" of Nelson and Grybeck (1980), and parts of the "Nugget Creek greenschist" of Moore and others (1997b)

DPsc - Calcareous schist (Devonian through Proterozoic) -- Light-gray-, brown- and locally orange-weathering, lithologically heterogeneous mix of marble and carbonate-rich, quartz-rich, and mafic schist derived from metasedimentary and metaigneous protoliths; one of two major units that extend along the length of the Schist belt. Within the unit, lithologies are interlayered at scales varying from millimeters to 10's of meters; along the length of the belt, the dominant lithologies vary. Metabasite, metadiorite, and chlorite-albite schists are characteristic, but vary greatly in abundance along the strike length of the unit. Calcareous schist, albitic schist, marble, and metaquartzite (massive, mica-poor varieties of pelitic schist) are commonly interlayered; pelitic interlayers and pelitic components in calcareous schists are also typical. Calcite marble comprises up to 40% of the unit locally, but generally forms less than 25% of the unit overall. Where marble is present, layers, lenses, and boudins of light-gray-weathering coarsely crystalline, pure calcite marble meters to 10's of meters thick form bare, steep slopes and ledges. Rare dolostone occurs as lenses up to several meters thick. Graphitic varieties of carbonate rocks (marble and dolostone), quartz-rich schists, and albite-rich schists are typical of the unit, as are chloritic varieties of marble, dolostone, and metaquartzite. Metaconglomerates that contain quartz or carbonate clasts are volumetrically minor but are found at several localities. It is likely that the calcareous schist unit is composed of several lithologic packages, the depositional relationships of which are unknown.

Carbonate- and mafic-rich rocks are known in the western and eastern parts of the belt; in these areas, calcite-chlorite-albite schist, chlorite-albite schist, and marble are common, and quartz-rich rocks are uncommon. In the western part of the schist belt, in the Akiak antiform (Sheet 2), these rocks are characterized by abundant albite porphyroblasts and are shown with an overlay of vertical lines. Similar mafic- and carbonate-rich rocks occur near Wiseman. Also present in near Wiseman is a second lithologic subunit, shown with an overlay of crosses. This subunit is dominated by metachert (mm-cm scale laminated quartz-rich rock) and calcareous schist, and contains several types of metaconglomerates. The metachert commonly contains cm-scale lenses and thin, mm-thick layers of spessartine (Mn-rich) garnet and mafic metatuff. Metabasite bodies are associated with the metachert as well (A.B. Till, unpublished data); Immobile trace and rare earth elements in these metabasalts are essentially identical to normal mid-ocean ridge basalts (NMORB; Moore and others, 1997, Figure 8C).

Rarely, textures suggestive of primary sedimentary relationships can be observed in outcrop. In the Wiseman area, light-gray- and orange-weathering, medium-gray platey marble is interlayered at a scale of meters with brown- and orange-weathering calcareous schist and impure marble. The medium-gray marble contains subrounded to subangular clasts of black calcite 0.2-6.0 mm in diameter. The black calcite grains are rich in graphite and make up 5-60% of the layers that contain them. Some clasts show relict internal textures, including ghosts of radiolarians and sponge spicules, bivalves, volcanic textures (replaced by calcite), and fine graphite laminae. The matrix does not contain graphite and is composed of calcite with very small amounts of plagioclase and white mica. In some outcrops, the fine-scale, rhythmic interlayering of this marble with calcareous schist is suggestive of a turbidite protolith. This marble with black calcite "clasts" is found in both subunits of the calcareous schist unit in the Wiseman area.

Marble in the western part of the unit hosts a Late Proterozoic granitic orthogneiss (unit Ꝑg: 705 ± 35 Ma; Karl and Aleinikoff, 1990); at least part of the unit must be Late Proterozoic or older. In the eastern part of the unit, near the village of Wiseman, Silurian to Devonian conodonts were recovered from a dark gray marble containing black calcite "clasts". Early Devonian (Lochkovian) conodonts were recovered from a dark gray fine-grained dolostone lens in the same area (Moore and others, 1997a). In the Baird Mountains quadrangle, conodonts of Middle Ordovician to Middle Devonian and Silurian to Mississippian age have been identified. All but one of the Late Devonian granitic orthogneisses (Dg) within the Schist belt are associated with DꝐsc; this may indicate that the protolith of DꝐsc was host to Late Devonian plutonism. Skarns around orthogneisses in the Chandalar quadrangle occur within the calcareous schist unit (Newberry and others, 1997).

At one locality in the Ambler River quadrangle, undated stromatolites occur near the probable boundary with the Central belt (Hitzman and others, 1982). A dolostone breccia exposed nearby yielded Ordovician to Early Devonian conodonts (Table A-1, Ambler River quadrangle). As the contact has not been mapped well in this area, it is possible that the dolostone breccia and the stromatolites are part of the Central belt. In the western exposure of the calcareous schist unit, at the Akiak antiform, similar stromatolites are part of a fault-bounded lens of the OЄc unit within the calcareous schist; there, they occur as part of a lithologic sequence similar to that found in OЄc (Sheet 2).

Metamorphic assemblages in the calcareous schist unit show that it experienced the same early high-pressure/low-temperature metamorphic and deformational history as the quartz-mica schist (Dsq; Gottschalk, 1990; Little and others, 1994; Dinklage, 1998). Chloritoid, glaucophane, pseudomorphs after glaucophane and pseudomorphs after lawsonite are present in pelitic and mafic layers in the unit (Little and others, 1994; Dinklage, 1998; Till, A., unpublished data). Some calcareous lithologies contain pseudomorphs after glaucophane and lawsonite as well, but more typically consist of calcite, quartz, albite, chlorite, white mica, and ankerite, with lesser garnet, epidote, sphene, and rutile.

The calcareous schist unit is equivalent to the "Kogoluktuk schist" of Hitzman and others (1982, 1986), "calcareous schist and marble of the Kallarichuk Hills" of Karl and others (1989b), parts of the Pzuc, Pzcq, and Pzcs units of Mayfield and Tailleur (1978); parts of the Pzsch, Pzca, DSso and DSsk units of Nelson and Grybeck (1980), the "calcareous schist" unit of Dillon and others (1986), the "Emma Creek schist", "unnamed calcareous schist", "Midnight Dome schist", and parts of the "Nugget Creek greenschist" of Moore and others (1997b), and the "calcareous schist and marble" of Brosgé and Reiser (1964)

ARRIGETCH-IGIKPAK THERMAL HIGH

DЄsm - Schist and marble, undivided (Devonian through Proterozoic?) -- Gray marble, orange dolomitic marble, magnetite-bearing chlorite schist, and pelitic schist exposed in the central Survey Pass quadrangle. Lithologies are interlayered and isoclinally folded, and the unit has a bedded appearance due to layers of resistant marble. Adjacent to the Arrigetch pluton, the unit contains calc-silicate skarn (Nelson and Grybeck, 1980). Mineral assemblages from most of the unit stabilized at albite-epidote-amphibolite facies (Nelson and Grybeck, 1980; Dusel-Bacon and others, 1989; Vogl, 2002); exposures southwest of the major orthogneiss bodies are apparently lower in grade (Nelson and Grybeck, 1980). Albite-epidote-amphibolite facies metamorphism peaked at approximately 105 Ma (Patrick and others, 1994; Vogl and others, 2002). Equivalent to "Pzmsm" and parts of unit "DSsk" of Nelson and Grybeck (1980); equivalent to "Pzqm" and "Pzs" of Toro (1998). May be a metamorphically upgraded equivalent to parts of unit DЄsc

DЄgn - Schist and paragneiss (Devonian to Proterozoic?) -- Pelitic schist, metaquartzite, mafic schist and other lithologies; gneissic textures are particularly common where the unit is adjacent to metaplutonic rocks. Mafic rocks within the unit contain assemblages stable in the albite-epidote-amphibolite facies (Dusel-Bacon and others, 1989; Vogl, 2002); exposures west of the major orthogneiss bodies appear to be lower in grade (Nelson and Grybeck, 1980; Toro, 1998). Metasedimentary rocks contain biotite throughout the unit, and garnet adjacent to the granitic orthogneiss bodies of Dg (Nelson and Grybeck, 1980; Toro, 1998). Equivalent to "Pzsgn" of Nelson and Grybeck (1980), and "Pzqm" and "Pzs" of Toro (1998)

CENTRAL BELT & PART OF NORTHERN THRUST ASSEMBLAGES

Khs - Hammond River shear zone (Cretaceous?) -- Heterogeneous mix of finely laminated, mostly mylonitic lithologies derived in part from adjacent units exposed in the eastern Wiseman and western Chandalar quadrangles. Unit is recessive, poorly exposed, and includes large (up to 0.5 km across) bodies of black quartzite and smaller exposures of quartz-rich schist, metagabbro, dark-brown marble, and relatively undeformed metasandstone and metasiltstone (Moore and others, 1997b; Till, unpublished data). In thin section, minerals are strained and broken. Protolith rocks may range in age from Proterozoic to Paleozoic, but no age control is available. Age of unit is based on likely age of tectonic event that created the shear zone, which encompasses a zone of deformation between the Schist and Central belts. Equivalent to "Hammond River phyllonite" of Moore and others (1997b); westernmost extent of the unit is approximately located

JCs - Sedimentary rocks (Jurassic through Carboniferous) – Sandstone, shale, argillaceous limestone, limestone, dolostone, mudstone, chert and siltstone in north-central Wiseman quadrangle. The unit conformably overlies the Kanayut Conglomerate (Bowsher and Dutro, 1957) of the Endicott Group (Tailleur and others, 1967). JCs consists of the Kayak Shale (Bowsher and Dutro, 1957) of the Endicott Group (Lower Mississippian), the Lisburne Group (Schrader, 1902; Bowsher and Dutro, 1957; Carboniferous), and the Siksikpuk Formation (Patton, 1957; Permian) and Otuk Formation (Mull and others, 1982; Triassic and Jurassic) of the Etivluk Group (Mull and others, 1982). The succession is similar to that of map unit TrCs of the Doonerak antiform, but differs in some aspects; it is part of unit ŦCs of Dillon and others (1986). Dillon and others (1986), Adams (1991, 1994), and Adams and others (1997) provide more information on this succession.

The Carboniferous rocks were described in detail and dated on the basis of foraminifers by Armstrong and Mamet (1978, Till Creek and Tinayguk River sections; see also Dumoulin and others, 1997). The Kayak is dark gray to black shale with subordinate beds of quartzitic sandstone and argillaceous, fossiliferous limestone. The lower part of the Lisburne (Wachsmuth Limestone) gradationally overlies the Kayak and consists of argillaceous limestone overlain by cherty, locally vuggy dolostone; it is mainly Early Mississippian (Osagean) in age and was deposited in an open marine environment. The upper part of the Lisburne (Alapah Limestone) is thinly interbedded black lime mudstone, shale, and chert and contains phosphatic pisolites, cephalopods, sponge spicules, and radiolarians; it is Late Mississippian (Meramecian through late Chesterian) and formed in deeper water slope and starved basin settings. A conodont collection from the upper Lisburne is late Meramecian-early Chesterian and has a CAI of 4-4.5 (Table A-1, Wiseman quadrangle).

Post-Carboniferous strata (Siksikpuk and Otuk formations) were documented by Adams (1991, 1994, Savioyak Creek and Gray Mountain sections; see also Adams and others, 1997). The Lisburne-Siksikpuk contact is sharp and undulatory; the basal Siksikpuk contains phosphate pebbles, trace bioclastic carbonate grains, and Mississippian foraminifers interpreted as reworked from the underlying Lisburne. The Siksikpuk consists, in ascending order, of siltstone with burrows and grazing traces (subunit A), silty shale and shale (subunits B_1, B_2), siliceous shale and radiolarian chert (subunit C), and cherty shale with concretions of carbonate and barite (subunit D). The section is variegated in color throughout and thought to be Permian on the basis of regional correlations; it formed in a storm-influenced shelf setting. The contact with the overlying Otuk is not exposed; elements of all four Otuk members (shale, chert, and limestone informal members, as well as black, organic-rich shale of the Blankenship Member of Mull and others, 1982) are tentatively recognized in this area. Regional correlations suggest an age of Early Triassic through Middle Jurassic and a shelf depositional environment for these rocks. The upper contact of the Otuk is not exposed in the map area

JDk - Rocks of the Kivivik Creek sequence (Jurassic through Devonian) -- Consists, in ascending order, of Devonian marine sedimentary rocks equivalent to unit Dmu, sandstone, conglomerate, and shale of the Endicott Group (Devonian and Mississippian), limestone and tuff (Mississippian), chert and phyllite (Carboniferous), and Etivluk Group (Carboniferous to Jurassic), exposed in the northwestern Baird Mountains quadrangle. All unit contacts within this succession are gradational. The sequence also includes limited exposures of less stratigraphically well-defined shale (Devonian) and limestone (Devonian and (or) Mississippian). The sequence contains several units shown separately on this map elsewhere in the west-central Baird Mountains quadrangle; structural complexity and small scale of exposures precludes delineating them on this section of the map. As a group, the units were combined into the Kivivik sequence by Karl and others (1989b).

The Devonian marine sedimentary rocks include green, gray, and maroon siliceous and calcareous phyllite, and calcareous and quartzose metasiltstone, metasandstone, and metaconglomerate. No dated fossils are in this sequence, but correlative rocks in the west-central Baird Mountains quadrangle, shown as Dmu on this map, contain conodonts of Middle and Late Devonian age (Table A-1, Baird Mountains quadrangle; Karl and others, 1989b). These rocks formed in shallow marine depositional settings and are equivalent to Dmu of this map and the Nakolik River unit ("Dnu") defined by Karl and others (1989b).

The Endicott Group (Tailleur and others, 1967) is made up of Hunt Fork Shale (Chapman and others, 1964), Noatak Sandstone (Smith, 1913; Dutro, 1952; Nilsen and others, 1985), Kanayut Conglomerate (Bowsher and Dutro, 1957), and Kayak Shale (Bowsher and Dutro, 1957). The Hunt Fork is gray to green or black phyllite with intercalated metasiltstone and metasandstone; it is locally intruded by massive mafic sills and dikes and at one locality includes a 30-m-thick section of pillowed(?) mafic flows (Ellersieck, 1985; Karl and others, 1989b). The Hunt Fork contains brachiopods and mollusks of Late Devonian (late Frasnian or early Famennian) age in the west-central Baird Mountains quadrangle (Nakolik sequence of Karl and others, 1989b). The Noatak is commonly cross-bedded quartz metasandstone, metasiltstone, and maroon and green phyllite; it has yielded Late Devonian brachiopods in the west-central Baird Mountains quadrangle, where it is shown on this map as Dn. The Kanayut is cross-bedded quartzite, pebbly quartzite, and metaconglomerate that has produced no dated fossils in the Kivivik Creek sequence. The Kanayut is shown as unit MDk elsewhere on this map. The Kayak is dark gray to black, siliceous or calcareous slate and phyllite, with subordinate intercalated metalimestone, metasiltstone, and metasandstone; it contains Early Mississippian conodonts and foraminifers; it is part of units Mkl, Mkkl, and Mu elsewhere on this map. The Endicott was deposited in a progradational, dominantly marine deltaic system; only the Kanayut formed chiefly in nonmarine (fluvial) settings (Moore and Nilsen, 1984).

The limestone and tuff subunit is orange-, tan-, or light-brown-weathering metalimestone, metatuff, and metavolcaniclastic rocks, and subordinate sills and plugs of intermediate to mafic composition. Metalimestone contains conodonts of early Early Mississippian (Kinderhookian) age. The unit is laterally discontinuous and forms lenses associated with the Kayak; similar volcanic strata occur in the Kayak to the north (e.g., Howard Pass quadrangle; see Mull and others, 1997). The subunit is equivalent to map unit Mlt of Karl and others (1989b).

The chert and phyllite subunit consists of black carbonaceous metachert, siliceous or calcareous phyllite that may have a distinctive silvery blue (phosphatic?) coating on weathered surfaces, and subordinate interlayers of black metalimestone and quartzose metasandstone. Limestone contains conodonts of latest Devonian (late Famennian) through Mississippian age. A low-oxygen slope or basin depositional setting is inferred. The subunit commonly contains abundant iron sulfides; stream sediment and rock samples contain elevated zinc, silver, and other metal values (Karl and others, 1985; Schmidt and Allegro, 1988; and Zayatz and others, 1988). Equivalent to map unit PMc of Karl and others (1989b), this subunit is broken out as Mcp elsewhere on this map and is similar to and likely correlative with the Kuna Formation (Mull and others, 1982) of the Lisburne Group (Schrader, 1902; Bowsher and Dutro, 1957).

The Etivluk Group (undivided) is maroon, red, green, gray, black, and variegated chert and siliceous argillite, minor calcareous siltstone and argillite, and rare maroon or gray limestone lenses. No dated fossils were reported from the Etivluk in this sequence, but it contains radiolarians of Middle Pennsylvanian to Early Permian, Late Triassic (early to middle Carnian and late middle Norian), and Early Jurassic (Hettangian) ages to the west in unit MzDm of this map. The Etivluk formed in a relatively deep marine setting with little input of clastic material. The unit was defined by Mull and others (1982) for rocks in the Howard Pass quadrangle to the north of the map area; the Etivluk in the Baird Mountains quadrangle contains notably more shale in its lower part and more chert in its upper part than do correlative sections in the type area.

Shale (map unit Ds of Karl and others, 1989) is black, sooty, siliceous and calcareous; it contains lenses of chert with rare radiolarian ghosts and fine-grained quartzose and calcareous sandstone that yield brachiopods of Middle-early Late Devonian age. The subunit is coeval with Devonian marine sedimentary rocks at the base of the Kivivik sequence, but the depositional relation between the two units is unknown.

Limestone (map unit MDl of Karl and others, 1989b) is white- to gray-weathering, light- to dark-gray, fine- to medium-crystalline metalimestone and lesser dolostone. It is exposed in small, isolated outcrops that are typically fault bounded and may include rocks correlative with various units including the Nakolik River unit, Kayak Shale, and Lisburne Group.

The overall succession of the Kivivik Creek sequence is similar to that in the west-central Baird Mountains quadrangle, immediately to the east of the sequence (Nakolik River sequence of Karl and others, 1989b). However, outcrop patterns, stratigraphic details, and structural style of the two areas differ. Older rocks (specifically the Baird Group, DOb) are not present in the Kivivik Creek sequence, but are common in the west-central Baird Mountains quadrangle. The Kivivik Creek sequence is complexly deformed along numerous NE-trending faults and folds, while structural grain in the west-central Baird Mountains quadrangle is flat-lying. The Kivivik sequence has been included in the Central belt because rocks are generally foliated and contain minerals consistent with lower greenschist facies metamorphism, and CAIs are uniformly 5-5.5 (Table A-1, Baird Mountains quadrangle)

Mkkl - Kekiktuk Conglomerate(?), Kayak Shale of Endicott Group, and Lisburne Group (Mississippian) -- Quartzite, conglomerate, phyllite, metalimestone, slate, dolostone, marble, and chert. The succession occurs in several fault-bounded exposures in the east-central Ambler River quadrangle. Within the fault-bounded exposures, the intensity of deformation is variable.

Primary sedimentary features are recognizable locally; intrafolial isoclinal folds and stretching lineations strongly overprint primary structures elsewhere. The Kekiktuk(?) is fine- to coarse-grained quartzite and quartz-chert metaconglomerate with interlayers of red, green, and gray phyllite and rare carbonate; clasts are well rounded and as much as 10 cm in diameter. Toro (1998) questioned inclusion of these strata in Kekiktuk Conglomerate of Brosgé and others (1962) and suggested they may instead correlate with Devonian siliciclastic rocks. The nature of the contact between the Kekiktuk(?) and the Kayak Shale (Bowsher and Dutro, 1957) is uncertain; both units are part of the Endicott Group (Tailleur and others, 1967). The Kayak is black slate and phyllite with thin orange-weathering fossiliferous metacarbonate interlayers; it contains echinoderm debris, horn corals, brachiopods, and mollusks, as well as phosphatized bioclasts (including gastropods, ostracodes, bryozoans, and sponge spicules) and Early Mississippian (Kinderhookian) conodonts that indicate a shallow-water, relatively high-energy depositional environment (Table A-1, Ambler River quadrangle; A. Harris, unpublished fossil report, 1994). The Lisburne Group (Schrader, 1902; Bowsher and Dutro, 1957) is thin- to thick-bedded dolostone, metalimestone, and marble with nodules and layers of black chert, brachiopods, echinoderm debris, and corals of Mississippian (probably Meramecian) age (Mayfield and Tailleur, 1978; Toro, 1998). Lisburne conodonts are of Early and Late Mississippian age; restricted age calls include middle Kinderhookian-Osagean, late Meramecian, and latest Chesterian (Table A-1, Ambler River quadrangle; A. Harris, unpublished fossil report, 1994; Toro, 1998). Mull and Tailleur (1977, p. B27) reported that “reddish-brown-weathering quartzose siltstone grading to black phyllitic shale” locally overlies the Lisburne near Shishakshinovik Pass; they considered these rocks to be Sadlerochit Group (Leffingwell, 1919; Detterman and others, 1975) but found no fossils to confirm their interpretation.

The basal contact of the unit was interpreted as a major (angular?) unconformity by Mayfield and Tailleur (1978), and was subsequently considered key to reconstruction of stratigraphic relations between upper Paleozoic and older rocks of the Brooks Range. However, Till and others (1988) and Toro (1998) considered the contact to be structural. Quartz-rich metasedimentary rocks at the contact contain deformed quartz clasts with 10:1 elongation ratios, ribbon quartz, and well-defined stretching lineations, and intrafolial isoclinal folds (Till and others, 1988; Toro, 1998). Deformation is most intense near the contact with the subjacent granitic orthogneiss (Dg). Toro (1998) characterized the contact as a mylonitic shear zone.

Although Mull and Tailleur (1977) correlated the Mkkl succession with parautochthonous rocks in the northeastern Brooks Range, fossil data summarized above indicate that the Kayak and Lisburne in Mkkl are in part older than their parautochthonous equivalents and correlate better with Carboniferous successions of the Endicott Mountains allochthon in the central Brooks Range (e.g., Dumoulin and others, 1997; Dumoulin and Bird, 2002)

Mcp - Carbonaceous chert and siliceous phyllite (Mississippian) -- Black carbonaceous metachert and siliceous phyllite exposed in a small area in the northwestern Baird Mountains quadrangle. Local layers of black carbonaceous metalimestone contain conodonts of Devonian-Mississippian age (Table A-1). The unit likely formed in low-oxygen slope and (or) basin settings. Massive iron sulfide intervals with elevated silver and other metal values were documented by Karl and others (1985), Schmidt and Allegro (1988), and Zayatz and others (1988). Karl and others (1989b) mapped basal depositional contacts with both the Noatak Sandstone and the Kayak Shale. At one locality (Karl and others, 1989b), Mcp is overlain by an outcrop of chert and argillite of the Etivluk Group (Mull and others, 1982) that is too small to show separately at the scale of our map. Mcp is lithologically similar to, and likely correlative with, the Kuna Formation (Mull and others, 1982) of the Lisburne Group (Schrader, 1902; Bowsher and Dutro, 1957). New studies (e.g., Dumoulin and others, 2004) indicate that the Kuna is of Mississippian age and does not extend into the Pennsylvanian; hence, we infer a Mississippian age for Mcp. Rocks directly correlative to Mcp are also present in unit JDk of this map. Mcp is equivalent to map unit PMc of Karl and others (1989b) in the northwestern Baird Mountains quadrangle

Mkl - Kayak Shale of Endicott Group and Lisburne Group (Mississippian) -- Phyllite or slate, siltstone, sandstone, limestone, and chert exposed in two small areas in the northwestern Baird Mountains quadrangle and in a larger discontinuous outcrop belt in the northern Survey Pass quadrangle. In the Baird Mountains quadrangle, one occurrence of the unit is fault-bounded; the other includes map units Mk (Kayak Shale) and Mko (Kogruk Formation of the Lisburne Group) of Karl and others (1989b) and overlies Noatak Sandstone of the Endicott Group. In the Survey Pass quadrangle Mkl includes map units Mk (part) and Ml of Nelson and Grybeck (1980) and overlies the Kanayut Conglomerate of the Endicott Group. In both quadrangles, Kayak Shale (Bowsher and Dutro, 1957) of the Endicott Group (Tailleur and others, 1967) is volumetrically predominant and consists of black phyllite or slate interlayered with brown to orange-weathering fossiliferous siltstone, sandstone, and limestone. Limy layers in the Survey Pass quadrangle contain ostracodes, brachiopods, bryozoans, and echinoderm debris of probable Early Mississippian age, as well as latest Devonian-earliest Mississippian (late Famennian-Kinderhookian) conodonts with CAI values of 4 to 5.5 (Table A-1). The Lisburne Group (Schrader, 1902; Bowsher and Dutro, 1957) is gray limestone to metalimestone with layers and nodules of black and gray chert. It contains locally abundant fossils that include crinoid, bryozoan, and coralline debris, brachiopods, gastropods, and sponge spicules, as well as Late Mississippian endothyrid foraminifers in the Baird Mountains quadrangle (B. Mamet, unpublished fossil report, 1983), and middle Late Mississippian (late Meramecian-early Chesterian) conodonts in the Survey Pass quadrangle (Nelson and Grybeck, 1980). The Shublik Formation (Triassic) and Siksikpuk Formation (Permian), undivided, were reported to overlie the Lisburne Group in two small areas of the north-central and northeastern Survey Pass quadrangle (Nelson and Grybeck, 1980). These authors described the Siksikpuk as black slate and orange-weathering black chert and the Shublik as pink-weathering limestone but presented no age data to confirm the presence of post-Carboniferous strata. These rocks are not differentiated on this map and are included in Mkl

Mc - Quartz-rich conglomerate (Mississippian?) -- Quartz- , chert-, quartzite-, and slate-clast conglomerate with minor thin layers of metasandstone and phyllite exposed in the Ambler River, Survey Pass, and Wiseman quadrangles. Quartz and chert clasts are most common; chert clasts are varicolored. The matrix of the conglomerate is composed of quartz, white mica, and chlorite, and clasts are typically stretched. Phyllite may be gray, green, or red. Rocks included in the unit resemble Kekiktuk Conglomerate of Brosgé and others (1962), and lack any age-diagnostic fossils. Conglomerates in the southeastern Survey Pass and southwestern Ambler River quadrangles are thought to sit in depositional contact with underlying metasedimentary rocks of the Ernie Lake area (PzPem; Nelson and Grybeck, 1980; Dillon and others, 1986). If these contacts are indeed depositional, they record a critical stratigraphic link between upper Paleozoic and older rocks of the Brooks Range. However, a similar relationship in the eastern Ambler

River quadrangle between units Mkkl and Dg was shown to be structural (Till and others, 1988; Toro, 1998), and quartz-rich conglomerates associated with unit PzPem are described as strained (Nelson and Grybeck, 1980; Dillon and others, 1986).

Kyanite has been identified in at least four exposures of the unit in the Survey Pass quadrangle (Plate 2). Nelson and Grybeck (1980) suggested that the kyanite might be detrital, derived from underlying Late Proterozoic schists that also contain kyanite (Plate 2, Dillon and others, 1980). However, Reed and Hemley (1966) identified the mica pyrophyllite in exposures of Kekiktuk Conglomerate in the northeast Brooks Range. Pyrophyllite forms in rocks unusually rich in silica and aluminum at low metamorphic grades, and at temperatures and pressures above 400°C and about 3kb, it reacts to form kyanite (Spear, 1993). Vogl (2003) reported kyanite - pyrophyllite and kyanite - chloritoid assemblages in exposures of Kekiktuk Conglomerate in the central Survey Pass quadrangle. He considered the kyanite to be metamorphic and estimated pressures and temperatures of 300-400°C and pressures between 3 and 6 kb. In rocks rich in Si and Al, kyanite is stable at greenschist facies and moderate pressures; kyanite in conglomerates of this unit may have formed at conditions consistent with the low metamorphic grade of the surrounding rocks. Equivalent to parts of unit Mc of Mayfield and Tailleur (1978), parts of Mke? and Mk? of Nelson and Grybeck (1980), and Dbc of Dillon and others (1986). Unit Mkkl also contains possible exposures of the Kekiktuk Conglomerate

Ml - Carbonate rocks (Mississippian) -- Light- to medium-gray weathering, dark-gray metalimestone and dolostone with locally abundant layers and lenses of black chert, exposed at one locality in the Nanielik antiform, northeastern Baird Mountains quadrangle. The unit contains conodonts of Late Mississippian (latest Meramecian to early Chesterian) age (Karl and others, 1989b) and megafossils, commonly silicified, that include Meramecian-early Chesterian lithostrotionid corals (entries 5682, 5683 in Alaska Paleontological Database) and possible stromatolites. Ml is correlative in age and facies with the Kogruk Formation (Sable and Dutro, 1961) of the Lisburne Group (Schrader, 1902; Bowsher and Dutro, 1957).

Carbonate rocks of Ml are spatially related to metasiliciclastic strata (map unit Dmu of this map, map unit Pzqs of Karl and others, 1989b) that consist of quartz metaconglomerate, metasandstone, and siliceous phyllite. The nature of the contact between the siliciclastic and carbonate rocks is uncertain.

Ml is equivalent to map unit Mc of Till and Snee (1995) and the eastern part of map unit Mko of Karl and others (1989b) in the Baird Mountains quadrangle

Mu - Metasedimentary rocks, undivided (Mississippian) -- Quartz conglomerate, quartzite, metasandstone, phyllite, shale, and metalimestone in the Ambler River, Survey Pass, and Wiseman quadrangles. Includes metasiliciclastic and metacarbonate strata in Ambler River and Survey Pass quadrangles, most with few to no age constraints, assigned to various Mississippian units by Mayfield and Tailleur (1978) and Nelson and Grybeck (1980). In east-central Ambler River quadrangle, consists of undated quartz conglomerate that contains minor interlayers of coarse-grained quartzite and red and green phyllite (map unit Mc of Mayfield and Tailleur, 1978). Clasts are stretched and made of quartz, varicolored chert, quartzite, and gray slate. Here the unit resembles Kekiktuk Conglomerate of Brosgé and others (1962). Along eastern border of Ambler River quadrangle, this unit comprises a depositional succession of, in ascending order, Kekiktuk Conglomerate, Kayak Shale (Bowsher and Dutro, 1957), and Lisburne Group (Schrader, 1902; Bowsher and Dutro, 1957) that consists of map units Mke, Mk, and Ml of

Mayfield and Tailleur (1978); the succession is lithologically like that of our map unit Mkkl (which crops out ~10 km to the south) but has no reported age control. A similar succession, included in this unit, occurs in adjacent west-central Survey Pass quadrangle (map units Mke, Mk, Ml, and Mu of Nelson and Grybeck, 1980). These rocks have produced a few fossils, including crinoids, brachiopods, corals, and foraminifers, of Early and Late Mississippian ages (Brosgé and Pessel, 1977). The Kekiktuk in this area consists of semischistose metasandstone and metaconglomerate with minor interlayers of red, green, and gray phyllite (Nelson and Grybeck, 1980). Coarser layers contain quartz clasts as much as 2 cm in diameter; some intervals are calcareous and (or) feldspathic. Radiating clusters of chloritoid grew across foliation planes in some samples. Mu in all three of these areas is interpreted to depositionally overlie older rocks (units Pzm and Spl of this map) (Mayfield and Tailleur, 1978; Nelson and Grybeck 1980). Mu also occurs along the eastern border of Survey Pass quadrangle, where it consists of rocks tentatively assigned to the Kekiktuk and Kayak (Nelson and Grybeck, 1980) that have yielded no diagnostic fossils, and in a small area near the western border of Wiseman quadrangle, where Lisburne(?) metalimestone contains gastropods, molluscan and echinoderm debris, possible bryozoan, pelecypod, brachiopod, and ostracode fragments, and foraminifers of Mississippian(?) age (J. Dutro and A. Armstrong, unpublished fossil reports, 1980, 1981). Although the exposures in this unit may be correlative to those included in the unit Mkkl, they are relatively poorly characterized sedimentologically and paleontologically

MDk - Kanayut Conglomerate (Lower Mississippian? and Upper Devonian) -- Quartzite, pebbly quartzite, conglomerate, and minor siltstone. MDk is exposed in a few small areas in the northwestern Baird Mountains quadrangle and the northeastern Ambler River quadrangle, and is widely distributed in northern Survey Pass quadrangle. In the northern Wiseman quadrangle, an overlay of crosses indicates an area where the Kanayut has not been differentiated from Noatak Sandstone (Dillon and others, 1986). The Kanayut was defined by Bowsher and Dutro (1957) in the Chandler Lake quadrangle north of map area; its age was modified by Nilsen and Moore (1982) and it is part of the Endicott Group (Tailleur and others, 1967). The Kanayut overlies the Noatak Sandstone; the contact is commonly gradational. Upper contact of MDk is rarely preserved in the map area, but the unit is locally overlain by the Kayak Shale of the Endicott Group in the Survey Pass quadrangle. The Kanayut consists of fine- to medium-grained, thin- to thick-bedded quartzite, pebbly quartzite, and conglomerate, with silty to muddy interlayers and local ironstone concretions. Semischistose and mylonitic textures and mineral assemblages suggesting lower greenschist facies metamorphism were reported mainly from the western part of the map area (Nelson and Grybeck, 1980; Karl and others, 1989b). Fine-grained interlayers variously described as phyllite (Nelson and Grybeck, 1980), argillite (Karl and others, 1989b), and slate (Mayfield and Tailleur, 1978) occur in the Central belt, and shale is found in the Northern thrust assemblages (Dillon and others, 1986; Brosgé and Reiser, 2000). Sedimentary structures are generally well preserved and include graded bedding and planar trough cross-bedding. Meter to decameter-scale thinning- and (or) fining-upward cycles were noted locally (Karl and others, 1989b; Brosgé and Reiser, 2000). Sandstone and conglomerate are well sorted and made mostly of quartz, lesser chert, and minor argillitic lithic grains (in part rip-up clasts). Maximum quartz clast size in conglomerate is 3 cm in the Baird Mountains quadrangle (Karl and others, 1989b). Sandy layers differ from those in the Noatak Sandstone by being generally better sorted and coarser grained and by containing fewer non-chert lithic grains and no plagioclase; some quartz grains have quartz overgrowths interpreted as inherited from preexisting quartzcemented sedimentary rocks (Nelson and Grybeck, 1980). Limy beds in parts of the unit transitional to the Noatak Sandstone contain echinoderm debris, brachiopods, mollusks, cephalopods, and plant fragments. The most definitively dated fossil assemblages of the Kanayut in the map area, presumably from these transitional lithologies, are Late Devonian (Famennian?) in the Survey Pass and Wiseman quadrangles (Nelson and Grybeck, 1980; W. Brosgé, unpublished fossil compilation, 1988). MDk was deposited in fluvial to very shallow marine settings. It also occurs as part of the Kivivik Creek sequence (unit JDk of this map) and the Endicott Group undivided (unit MDe of this map) in the Baird Mountains quadrangle (Karl and others, 1989b).

MDk is equivalent to "MDk" of Karl and others (1989b), "Dk" of Mayfield and Tailleur (1978), "Dk" and "Dkq" of Nelson and Grybeck (1980)

MDe - Endicott Group, undivided (Mississippian and Devonian) -- Shale and sandstone exposed in the northwest Baird Mountains quadrangle. Represents undifferentiated parts of the Endicott Group that are equivalent to the Hunt Fork Shale (unit Dhf), the Noatak Sandstone (unit Dn) and the Mississippian Kayak Shale (part of unit Mkl). Equivalent to "MDe" of Karl and others (1989b)

Dn - Noatak Sandstone (Devonian) -- Metasandstone, metasiltstone, and subordinate phyllite exposed in the northern Baird Mountains, Ambler River, and Survey Pass quadrangles; part of Endicott Group (Tailleur and others, 1967). The unit was established by Smith (1913); Dutro (1952) designated the type section in the Misheguk Mountains quadrangle north of map area (see also Nilsen and others, 1985). Dn is mapped as a separate unit in the north-central Baird Mountains quadrangle (unit Dn of Karl and others, 1989b), northeastern Ambler River quadrangle (unit Dss of Mayfield and Tailleur, 1978), northern Survey Pass quadrangle (unit Dhfs of Nelson and Grybeck, 1980), and northeastern Christian quadrangle (unit Dn of Brosgé and Reiser, 2000). It also occurs as part of the Kivivik Creek sequence (unit JDk of this map) and the Endicott Group undivided (unit MDe of this map) in the Baird Mountains quadrangle (Karl and others, 1989b), and was mapped with the Kanayut Conglomerate (and thus included in unit MDk of this map) in the Wiseman quadrangle (Dillon and others, 1986). Throughout the map area, the Noatak overlies the Hunt Fork Shale and is overlain by the Kanayut Conglomerate (both are part of Endicott Group); both contacts are generally gradational. Dn consists of metasandstone and metasiltstone with subordinate interlayers of green, gray, and maroon phyllite and local ironstone concretions. Semischistose textures and minerals indicative of lower greenschist facies metamorphism occur locally, but original sedimentary structures are commonly preserved. In the Baird Mountains quadrangle, these include meter-thick intervals of planar and trough cross-beds and, near the top of the unit, coarsening-upward cycles of pebbly beds; pebbles are quartz or argillite and as much as 1 cm in diameter (Karl and others, 1989b). Metasandstone is typically calcareous and (or) ferruginous, thin- to medium-bedded, and fine- to medium-grained. The most detailed petrographic descriptions of metasandstone are from the Survey Pass quadrangle, where it consists of poorly to moderately well sorted, angular to subrounded quartz and chert (together generally ~80%), plagioclase feldspar (5 to 15%), fine-grained foliated lithic grains (as much as 20%), and minor amounts of iron oxide, tourmaline, and zircon. Fossils are abundant in some calcareous beds and include brachiopods, echinoderms, gastropods, pelecypods, plant debris, and trace fossils; the most tightly dated assemblages in the map area are Late Devonian, locally Famennian (Brosgé and Pessel, 1977; Nelson and Grybeck, 1980; W. Brosgé, unpublished fossil compilation, 1988; Karl and others, 1989b). Conodonts from a thin limestone layer at the top of the unit in the western Baird Mountains quadrangle are of probable late Famennian age (Table A-1). Deposited in shallow-marine settings

Dhf - Hunt Fork Shale (Late Devonian) -- Dark-gray to black phyllite and lesser gray-green phyllite with thin layers of siliceous or calcareous metasiltstone, lithic wacke, metasandstone, and minor layers of fossiliferous metalimestone exposed along the length of the northern boundary of the map. Locally massive mafic sills and dikes up to 10 m thick are common. One locality of pillow lava was reported in the Baird Mountains quadrangle (Karl and others, 1989b). A basal conglomerate containing clasts of quartz, chert, siltstone, slate, and a few limestone and dolostone pebbles was mapped in Wiseman and Chandalar quadrangles (Dillon and others, 1986; Brosgé and Reiser, 1964). In excess of 300 m thick, the unit depositionally overlies parts of units Dl, Dmu, and Pzm. The Hunt Fork Shale is depositionally overlain by the Noatak Sandstone (Dn) and Kanayut Conglomerate (MDk), and with those units constitutes a major part of the Endicott Group (Tailleur and others, 1967). Originally designated the Hunt Fork Shale by Chapman and others (1964).

Limestone layers contain Late Devonian (late Frasnian to early Famennian) brachiopods, mollusks, and echinoderms (Dillon and others, 1986; Brosgé and Reiser, 1964). Middle to Late Devonian conodonts were collected in the east-central Wiseman quadrangle (Table A-1). In the Phillip Smith quadrangle, north of the map area, conodonts from the limestones are middle to late Frasnian (Late Devonian; Dumoulin and Harris, 1994). A single Middle Devonian conodont collection on Wiseman/Survey Pass quadrangle boundary is unusually old for the unit; the conodonts may be reworked, or may indicate there is an unidentified expanse of Dmu included in the unit. The portion of unit shown with overlay is more strongly foliated and sedimentary structures are less obvious. The "Dietrich River phyllite" and part of the "Dusty Mountain phyllite" of Moore and others (1997b) are included in this more schistose part of the unit. Mafic bodies in the unit (both strongly and weakly foliated parts) contain lower greenschist-facies minerals

Dl - Metalimestone (Devonian) -- Metalimestone and lesser metasandstone, metasiltstone, phyllite, and minor conglomerate exposed in the Baird Mountains, Chandalar, and Christian quadrangles, closely associated with unit Dmu.

In the Baird Mountains quadrangle, Dl consists of generally fossiliferous metalimestone and marble, subordinate quartz-carbonate metasandstone and metasiltstone, and phyllite (Karl and others, 1989b). Carbonate rocks are light to dark gray and fine to coarse grained. Original textures, where preserved, are mainly bioclastic packstone and wackestone; fossils include solitary and colonial corals, stromatoporoids, brachiopods, and pelmatozoan debris. Fossiliferous carbonate strata commonly form mounds several decameters across surrounded by lime mudstone and (or) siliciclastic rocks; some build-ups may have been organic reefs. Metasandstone weathers yellow to orange, is fine to medium grained, and planar to cross-laminated; metasiltstone and phyllite weather purple and are poorly exposed. Siliciclastic intervals are 0.5 to 40 m thick and make up 20 to 40 percent of most sections; coarser intervals likely represent storm and shoal deposits (Dumoulin and Harris, 1994). Conodonts and megafossils indicate an age of late Middle through early Late Devonian (latest Givetian and Frasnian)—younger than the youngest part of the Baird Group (DOb) and coeval with the oldest part of the Endicott Group. The unit grades upward and laterally into map unit Dmu; its basal contact is generally a fault but a depositional contact above DOb is preserved in at least one area (Karl and others, 1989b).

In the Chandalar quadrangle, Dl is composed of pink- and light-brown-weathering, gray and black metalimestone, commonly micaceous and (or) silty, intercalated with calcareous to noncalcareous siltstone, calcareous sandstone, slate, and local purple and green phyllite, greenstone, and basal limestone-pebble conglomerate (Brosgé and Reiser, 1964). Carbonate lithofacies include muddy biohermal buildups and carbonate sand shoals (Dumoulin and Harris, 1994). The unit contains corals, brachiopods, stromatoporoids, mollusks, and conodonts; the most tightly dated collections are early Late Devonian (Frasnian) but some assemblages could be as old as late Middle Devonian (Givetian) (Dumoulin and Harris, 1994).

In the Christian quadrangle, Dl consists of fossiliferous cherty limestone locally present just above the base of the Beaucoup Formation; it contains corals and stromatoporoids of Middle(?) and Late Devonian age (Brosgé and Reiser, 2000). The remainder of the Beaucoup Formation in the Christian quadrangle is included in unit Dmu of this map.

In both the western and eastern parts of the map area, Dl represents a facies transitional in time and space between carbonate platform rocks to the south (DOb, Pzm) and the siliciclastic depositional sequence of the Endicott Group to the north.

Dl includes limestone of Nakolik River (map unit Dnl) of Karl and others (1989b) in the Baird Mountains quadrangle, limestone layers in the Chandalar quadrangle called Dl by Brosgé and Reiser (1964), and limestone layers of the Beaucoup Formation (map unit Dbl) in the northwestern Christian quadrangle (Brosgé and Reiser, 2000). The Beaucoup Formation was defined by Dutro and others (1979). Dumoulin and Harris (1987, 1994), Dillon and others (1987), Table A-1 (Baird Mountains and Chandalar quadrangles), and Alaska Paleontological Database give additional details on lithofacies and fossils of this unit

Dmu - Metasedimentary and lesser metaigneous rocks (Middle and Late Devonian) -- Heterogeneous expanses of calcareous, siliceous, and volcaniclastic metasedimentary rocks, with lesser metaigneous rocks, exposed along the length of the Central belt. Includes interlayered gray, maroon, purple and green siliceous phyllite, brown and black calcareous phyllite; gray-green, green, and purple metasiltstone, orange, brown and black calcareous metasiltstone; gray, green, and brown weathering metasandstone and lithic metasandstone, locally limonitic and calcareous; brown, red, gray, and black metalimestone and marble, locally impure; brown-weathering metaconglomerate with clasts of quartz, chert, metalimestone, marble, and phyllite; and minor, thin, brown-weathering dolostone. In the northwestern Christian quadrangle, mafic intrusive rocks are common in the sedimentary package. In the northeastern Ambler River quadrangle, the unit includes a ~30-m-thick interval of matrix-supported metaconglomerate; the matrix is highly deformed calcareous phyllite with locally abundant silt-sized grains of quartz. Clasts are largely subrounded dolostone, 2 mm to 7 cm in diameter, that contain possible relict bioclasts. Section has some lithologic similarities to carbonate metaconglomerates in the Baird Mountains quadrangle ("Dnu" of Karl and others, 1989b), also included in this unit. A relatively lithologically simple section in the north and northeast Survey Pass quadrangle consisting of light brown, gray, and orange-weathering ferruginous and calcareous mica schist, phyllite, and metasiltstone is shown with a diagonal line overlay. Parts of the unit that contain felsic to intermediate volcanic rocks or sedimentary rocks with abundant volcanic clasts are shown with a vertical line overlay. In the northeast Baird Mountains quadrangle, laminated to massive porphyritic rhyolite plugs, flows, and pyroclastic rocks are closely associated with siliceous and calcareous sedimentary rocks (Karl and others, 1989b). Along the northern part of the boundary between the Wiseman and Chandalar quadrangles, felsic to intermediate porphyries, metavolcaniclastic rocks, and rare massive hypabyssal rocks are associated with purple and green phyllite, lithic, quartz, feldspar metasandstone, and meta-argillite pebble conglomerate (Moore and others, 1997b). Elsewhere, volcanic-clast sandstone and conglomerate, feldspathic volcanic wacke or graywacke, and tuffaceous metalimestone occur with other sedimentary rocks of the unit.

Megafossils and conodonts collected from calcareous black phyllite and metalimestone interlayered with purple and green phyllite in the Snowden Mountain area are Middle and early Late Devonian in age (Dumoulin and Harris, 1994). Middle and Late Devonian conodonts were recovered from the unit in the northwest Wiseman quadrangle (Table A-1). A foliated felsic metavolcaniclastic rock collected in the northwestern Chandalar quadrangle yielded a U-Pb zircon crystallization age of 393 ± 2 Ma (Middle Devonian; Aleinikoff and others, 1993).

This unit includes part of the Beaucoup Formation of Dutro and others (1979) and other rocks that record the transition from early Paleozoic platform carbonate sedimentation to voluminous, widespread clastic sedimentation represented by rocks of the Endicott Group. In the Baird Mountains, unit Dmu (and associated metalimestones of Dl) sits in depositional contact with underlying carbonate rocks of the Baird Group (DOb) (Karl and others, 1989b), and map relations elsewhere suggest that the deposition of rocks contained in Dmu succeeded sedimentation on the carbonate platform represented by units DOb and DOc. Depositional contacts between Dmu (and Dl) and overlying units of the Endicott Group (Hunt Fork Shale: Dhf) are found in the central Baird Mountains, north-central Survey Pass, northwestern Wiseman and northern Chandalar quadrangles.

Equivalent to the "Nutirwik Creek metavolcaniclastic rocks" of Moore and others (1997b); unit "Dnu" and parts of "₽zqs", "₽zr", "₽zbq", "MDe" of Karl and others (1989b); parts of "M̶z₽zfw", "M̶z₽zph", "₽zbq", "₽zl", "₽zmq", "₽zm", and "Dc" of Mayfield and Tailleur (1978); units "Dfc" and "Dc" of Nelson and Grybeck (1980); units "Dbcw", "Dsg", "Dbc", "Dbb", "Dc", and "Dsc" of Dillon and others (1986); unit "Dls" and parts of units "Ds" and "Dsp" of Brosgé and Reiser (1964); and units "Dbsg" and "Dbls" of Brosgé and Reiser (2000)

Spl - **Black phyllite and metalimestone** (Silurian) -- Black siliceous phyllite and metalimestone, metasandstone, metasiltstone, phyllite, and graphitic calcareous schist in the eastern Ambler River and western Survey Pass quadrangles. Conodonts and graptolites indicate Silurian ages for these strata in the Ambler River quadrangle (Dumoulin and Harris, 1988; Table A-1); rocks included in this unit in the Survey Pass quadrangle are undated but contiguous with, and lithologically similar to, Silurian strata in the eastern Ambler River quadrangle.

Sedimentary features and fossil assemblages denote an off-platform and (or) edge of platform setting for these rocks (Dumoulin and Harris, 1988). In western Ambler River quadrangle, the unit consists of black siliceous phyllite with recrystallized radiolarians and interlayers of black metalimestone; it contains early Early Silurian (latest Llandoverian) conodonts and late Early Silurian (late Wenlockian) graptolites. In northeastern Ambler River quadrangle, the unit comprises a succession of interlayered metasandstone, metasiltstone, phyllite, and metalimestone with turbidite features including convolute laminae, flute casts, and graded beds. Metasandstone is made up of quartz, carbonate, feldspar, and chert grains, as well as sedimentary and volcanic lithic clasts. Carbonate interlayers are also gravity deposits, and consist of redeposited shallow-water carbonate detritus; they contain a variety of megafossils such as corals, gastropods, bryozoans, brachiopods, conularids, and orthocone cephalopods, as well as conodonts of late Early to early Late Silurian (Wenlockian to Ludlovian) age. In east-central Ambler River quadrangle, a similar but more carbonate-rich succession of black metalimestone, graphitic calcareous schist, graphitic siliceous phyllite, and lesser impure chert contains probable calcitized radiolarians and conodonts of Wenlockian-Ludlovian and Ludlovian ages. Fossiliferous dolostone in this area (part of Pzm at Blind Pass Mountain) is coeval with, and may represent a platformal source for, the off-platform strata of unit Spl.

Spl includes map units "₽zbs" (part), "Ds", and "Db" (part) of Mayfield and Tailleur (1978) in the Ambler River quadrangle and map unit "MDcp" of Nelson and Grybeck (1980) in western Survey Pass quadrangle.

Off-platform sequences of carbonate turbidites that are at least in part Silurian and thus correlative with this unit include strata on northern and southeastern Seward Peninsula (Till and others, 1986, Ryherd and Paris, 1987). Dominantly siliciclastic basinal sequences that are in part Silurian occur on Cape Lisburne and have been penetrated in exploratory wells on the North Slope (Carter and Laufeld, 1975; Grantz and others, 1983; Moore and others, 1994; Dumoulin, 2001)

DOb - **Baird Group** (Devonian through Ordovician) -- Beige- to orange-weathering, laminated, partly argillaceous to silty metalimestone and light- to dark-gray, flaggy-bedded to massive metalimestone, marble, and dolostone. DOb is part of the Nakolik River sequence of Karl and others (1989b). The Baird Group was established by Tailleur and others (1967), but was restricted by Dumoulin and Harris (1994) to the carbonate succession of the west-central Baird Mountains quadrangle; broadly coeval carbonate strata of the eastern Baird Mountains quadrangle and Middle and Late Devonian carbonate rocks of the Maiyumerak Mountains were excluded. Conodonts constrain the age, depositional settings, and biogeographic affinities of this unit (Karl and others, 1989b; Dumoulin and Harris, 1987, 1994; Table A-1, Baird Mountains quadrangle; Alaska Paleontological Database). Older rocks are exposed mainly in the south and younger strata to the north. Lower and upper contacts of DOb are faults, but the unit was likely depositionally overlain by Dmu originally.

Oldest strata are Early and Middle Ordovician, locally contain reworked Late Cambrian conodonts, and comprise two roughly coeval lithofacies: dolostone with fenestral fabric and evaporite molds that formed in locally restricted, shallow to very shallow water, and bioturbated to laminated, argillaceous to silty metacarbonate rocks with local cross-bedding, ripples, and flame structures that accumulated in somewhat deeper platform settings. Several intervals of dark metalimestone partly equivalent in age and biofacies to the Ordovician basinal section in OꞒc are intercalated with the argillaceous lithofacies. Younger strata include Upper Ordovician and middle Silurian (Wenlockian) metalimestone deposited in middle to outer platform settings and Upper Silurian and Lower and Middle Devonian (Emsian, Eifelian, and possibly Givetian?) shallow-water dolostone and metalimestone with corals and stromatoporoids; the Emsian section includes an interval of calcareous, chloritic metasandstone. DOb hosts several mineral occurrences, including the Omar copper prospect in Devonian (Emsian) dolostone (Folger and Schmidt, 1986; Folger, 1988) and the Powdermilk Pb-Zn-Ag prospect in Ordovician(?) dolostone (Schmidt and Folger, 1986).

DOb includes local occurrences of metabasaltic rocks of unknown age that are especially abundant in western exposures. Outcrop of these rocks is rare; the mafic rocks occur as subcrop or rubble crop in most places. Contacts between the carbonate and mafic rocks are therefore rarely exposed. No unequivocally extrusive features have been documented, although at the locality where they appear to be the thickest (up to about 45-70 meters), vesicular textures were observed. Some of the better exposures are dikes or sills, one-half to two meters thick, with signs of baking in the surrounding sedimentary rocks. Based on our reconnaissance information, the mafic material may be concentrated in the Ordovician part of the unit. These rocks contain fine-grained blue amphibole (crossite) at multiple localities, indicating that the Baird Group has experienced blueschist facies metamorphism.

The unit has similarities in lithofacies and biofacies to parts of OꞒc and DOc, as well as coeval strata of the York Mountains on Seward Peninsula. Conodont assemblages have both Laurentian and Siberian affinities (Dumoulin and Harris, 1994; Dumoulin and others, 2002)

DOc - Younger carbonate rocks of the Nanielik antiform (Middle Devonian through Ordovician) -- Very light- to dark-gray- (locally orange-) weathering, gray to black, commonly massive dolostone and lesser metalimestone and marble exposed in the Nanielik antiform (northeastern Baird Mountains and northwestern Ambler River quadrangles) and in the northwestern Chandalar quadrangle. DOc was first described in the Nanielik antiform (Sheep Creek section of Dumoulin and Harris, 1987) and later recognized to the east (Dumoulin and Harris, 1994). Meter- to decimeter-scale color banding is characteristic of this unit and reflects shallowing-upward peritidal cycles of darker colored, bioturbated, bioclastic and (or) peloidal carbonate strata overlain by light-colored cryptalgal laminite. Recognizable fossils include corals, stromatoporoids, brachiopods, gastropods, bryozoans, pelmatozoan debris, ostracodes, and dasycladacean algae. Corals and conodonts indicate an age of Upper Ordovician through Silurian for most of the unit. Definitively Devonian rocks have not been found in the eastern Baird Mountains quadrangle, but stromatoporoid wacke-packstone of late Early to early Middle Devonian (Emsian-Eifelian) age occurs locally in the Chandalar quadrangle. The unit is generally fault-bounded but a gradational and apparently conformable contact above OꞒc is locally preserved. Sedimentary structures and fossils indicate warm, shallow-water depositional settings that were shallowest and most restricted during Late Ordovician (Richmondian) time. DOc has similarities in lithofacies and biofacies to the younger part of DOb, as well as coeval strata of the York Mountains on Seward Peninsula. Ordovician biotas include some megafossils and microfossils with Siberian affinities and others with Laurentian affinities; Silurian and younger fossil assemblages are chiefly cosmopolitan (Dumoulin and Harris, 1994; Dumoulin and others, 2002).

DOc includes map unit DOc of Karl and others (1989b) and Till and Snee (1995) in the Baird Mountains quadrangle and the informal Mathews River unit (SOm) of Dumoulin and Harris (1994) and parts of "DSk" of Brosgé and Reiser (1964) in the Chandalar quadrangle. Dumoulin and Harris (1987), Dillon and others (1987, 1988), Table A-1 (Ambler River, Baird Mountains, and Chandalar quadrangles), and the Alaska Paleontological Database provide additional information on lithologies and fossils of this unit

OꞒc - Older carbonate rocks of the Nanielik antiform (Middle Ordovician through Proterozoic?) -- Dolostone, metalimestone, marble and subordinate quartzose metasedimentary rocks, carbonate conglomerate, and metabasite exposed in the in the Nanielik antiform (northeastern Baird Mountains and northwestern Ambler River quadrangles), central Survey Pass quadrangle, and along the Dalton Highway in the Wiseman and Chandalar quadrangles. The unit was first described in the Nanielik antiform (Mt. Angayukaqsraq section of Dumoulin and

Harris, 1987) and later recognized to the east (Dumoulin and Harris, 1994). Older rocks in the unit are orange- to light-gray-weathering, dark- to light-gray dolostone, metalimestone, and marble, with subordinate intervals of quartzose metasedimentary rocks, carbonate cobble conglomerate, and metabasite. Well-preserved tabular to club-shaped stromatolites and coated grains (ooids, oncoids, composite grains, and pisoids) occur locally in dolostones and suggest an intertidal to shallow subtidal depositional setting. Matrix-supported conglomerate forms massive layers as much as 20 m thick and may represent debris flows; clasts are mainly dolostone (locally stromatolitic) and ≤1 m in diameter. Metabasite includes metamorphosed pillow breccia, pillow lava, and mafic pyroclastic rocks that contain blue amphibole in the Baird Mountains quadrangle.

Younger strata consist of three subunits. The older rocks described above grade upward into subunit one, which consists of variously impure metalimestone, marble, and dolostone, with subordinate interlayers of phyllite and calcareous and chloritic schist. Carbonate layers contain locally abundant coated grains; preserved sedimentary structures include grading and parallel and cross-laminae and suggest deposition by turbidity currents. Subunit two is massive marble that grades upward into thin couplets of bioturbated metalimestone and laminated dolostone interpreted as shallowing-upward peritidal cycles. Protoconodonts, chancellorid sclerites, hyolithids, and steinkerns of monoplacophoran mollusks indicate a maximum age of Early Cambrian for the marble; acrotretid brachiopods and agnostid arthropods demonstrate Middle and Late Cambrian ages for the middle and upper parts of the subunit. A condensed Lower and Middle Ordovician section deposited in a shallowing-upward regime makes up the third subunit. Carbonaceous phyllite, with subordinate layers of radiolarian chert and fine-grained metalimestone, grades up into platform-margin carbonate turbidites and then into middle to inner platform bioclastic supportstones; graptolites and conodonts indicate an age of Arenig to Caradoc for this subunit.

The stratigraphic succession of OꝒc is most complete and lithologies are most diverse in the Baird Mountains and western Ambler River quadrangles. There, the close spatial relationship of the unit with Proterozoic metamorphic rocks (Ꝓam) is thought to reflect an original depositional relationship. Conglomerate and metabasite intervals in older rocks and the lower two subunits of younger strata are known only in the Baird Mountains. The presence of OꝒc as a fault-bounded sequence in the Akiak antiform (western Ambler River quadrangle) is documented in Dumoulin (1988) and Dumoulin (unpublished field notes, 1986, 1987). Older rocks in unit OꝒc may correlate with parts of DꝒsc in the schist belt (Dumoulin, 1988) and the Katakturuk Dolomite (Dutro, 1970; Blodgett and others, 1986) in the northeastern Brooks Range. The Cambrian subunit is partly equivalent to Middle Cambrian phyllite and metalimestone that crop out northwest of Snowden Mountain (here included in Pzm; Snowden Mountain unit of Dumoulin and Harris, 1994). Ordovician strata are roughly coeval with the older part of DOb, but formed in a deeper water setting. Fossils in OꝒc are mainly cosmopolitan, but include some Siberian and Laurentian forms (Dumoulin and Harris, 1994; Dumoulin and others, 2002). Exposures that contain the Ordovician part of the section only are shown on the map with a vertical line overlay.

OꝒc includes map units PzꝒcb and O€c of Karl and others (1989b) and €Ꝓvc, €Ꝓic, €c, and Opc of Till and Snee (1995) in the Baird Mountains quadrangle, part of map unit DSsk of Mayfield and Tailleur (1978) in the western Ambler River quadrangle, map unit Om of Toro (1998) in the central Survey Pass quadrangle, and informal units PzꝒd and Os (Snowden Creek unit) of Dumoulin and Harris (1994) in the Wiseman and Chandalar quadrangles (Snowden

Mountain area). Additional data on lithofacies and biotas of this unit are found in Carter and Tailleur (1984), Dumoulin and Harris (1987), Table A-1 (Ambler River, Baird Mountains, Chandalar, and Survey Pass quadrangles), and the Alaska Paleontological Database

Pzbs - Black metasedimentary rocks (Paleozoic) -- Dark-gray to black phyllite and calcareous phyllite with dark-gray to orange-weathering marble and dolostone layers up to 50 m thick are exposed in the northeastern Survey Pass and northwestern Wiseman quadrangles. In the Wiseman quadrangle, the unit is thought to be depositionally overlain by unit Dmu. Brachiopods from a marble lens near the Wiseman-Survey Pass boundary yielded a Middle Devonian or Frasnian age (W.P. Brosgé, written commun., 1988). Based on this very limited data, Pzbs may overlap the age of upper parts of units DOb and Doc and/or it may be a facies equivalent of the older parts of Dmu. Equivalent to "MDcp" of Nelson and Grybeck (1980), and "Dbs" of Dillon and others (1986)

Pzm - Marble (Paleozoic) -- White to gray (less commonly black), fine to coarsely crystalline, massive to platy marble and subordinate metalimestone and dolostone occurs discontinuously in all quadrangles within the map area. Pzm includes two sets of carbonate rocks: marbles with no relict sedimentary features and poor age control, and carbonate rocks too poorly studied to in clude in other units. The one exception to this generalization is a Cambrian sequence of rocks in the northwestern Chandalar quadrangle too small to show as a separate unit.

Pzm locally contains abundant disseminated quartz or mica grains, and (or) interlayers of schist, quartzite, or phyllite. In some areas, these strata contain no relict sedimentary textures and few or no fossils; elsewhere, relict sedimentary structures and fossils occur, but rocks have not been studied in sufficient detail to allow assignment to carbonate units such as DOc. Thoroughly recrystallized parts of this unit may be equivalents of units such as OЄc, DOc, DOb, and (or) Dl that have lost their distinctive lithologic and faunal features through metamorphism and (or) deformation. Existing fossil data and regional relationships suggest that most Pzm is Cambrian through Mississippian in age.

Pzm occurs in the southwestern, central, and northeastern parts of the Baird Mountains quadrangle. Most outcrops contain no fossils or relict sedimentary features, but a belt in the central part of the quadrangle (marble of Klery Creek, Pzkm, of Karl and others, 1989b) is in part of Devonian and Mississippian age. This marble contains subordinate interlayers of quartz-chlorite schist, mica schist, and black carbonaceous quartzite, and has produced Late Silurian-Early Devonian conodonts, silicified two-hole crinoid columnals of late Early-early Middle Devonian (late Emsian-Eifelian) age, and earliest Mississippian (very early Kinderhookian) conodonts.

Pzm is abundant and widely distributed in the Ambler River quadrangle but has in general been little studied. It contains conodonts of Early Mississippian age in the northwestern part of the quadrangle. Lithofacies data and conodont collections from the east-central area around Blind Pass Mountain indicate a carbonate succession with some features of both DOb and DOc. Bioclastic supportstones contain conodonts of late Early-earliest Middle Ordovician age and acrotretid brachiopods of possible Early Ordovician age; these strata correlate with older platform facies of DOb. Upper Ordovician dolostones, however, have lithofacies and conodont faunas that closely resemble those of the basal parts of DOc. The Blind Pass Mountain succession also includes dark-gray to black Silurian dolostone that contains peloids, possible stromatoporoids, pelmatozoan and other bioclastic debris, and conodonts of Wenlockian-

Ludlovian and late Ludlovian ages that are typical of warm, probably very shallow water settings (Table A-1, Ambler River quadrangle; J. Dumoulin, unpublished field notes, 1986, 1987). These strata are coeval with, and may represent a platformal source for, the off-platform strata of unit Spl that crops out in this area.

Few lithofacies or fossil data are available from Pzm east of the Ambler River quadrangle. Most of these outcrops have been little studied, but only one of more than 20 small samples taken from Pzm in the Survey Pass quadrangle contained conodonts (Alaska Paleontological Database). In the northwestern Chandalar quadrangle, Pzm includes a section of phyllite and metalimestone deposited in an outer shelf or slope setting that contains trilobites of early Middle Cambrian age and Siberian affinities (Snowden Mountain unit of Dumoulin and Harris, 1994). Late Ordovician conodonts occur in a sample of Pzm from the Christian quadrangle (Table A-1)

Pzw - Metasedimentary rocks (Paleozoic) -- Weakly to moderately metamorphosed metasandstone, meta-argillite, phyllite, conglomerate, and rare marble exposed in two belts that straddle the northern part of the Wiseman/Chandalar quadangle boundary. The northern belt is composed of metasandstone and argillite; in its eastern part, metasandstone contains abundant detrital white mica that yielded a Late Ordovician $^{40}Ar/^{39}Ar$ cooling age (Moore and others, 1997b). The northern belt is equivalent to the Trembley Creek phyllite of Moore and others (1997b), and "Rocks of Whiteface Mountain" of Dillon and others (1986). The southern belt (shown with overlay) is composed of phyllite, metasandstone with volcanic clasts, argillite, sandstone, pebble conglomerate and rare marble. A bryozoan- and coral-rich marble in the southern belt yielded late Middle to Late Devonian conodonts (Table A-1, Wiseman quadrangle), suggesting that at least part of the southern belt may be equivalent to or correlate with Dmu. The southern belt is equivalent to the "unnamed metagraywacke and metaconglomerate" of Moore and others (1997b). Stratigraphic relations of both belts unknown

Pzp - Phyllite (Paleozoic?) -- Phyllite, fine-grained schist, and phyllonite of the Central belt that underlie areas of poor exposure in the northeastern Baird Mountains quadrangle, western Ambler River quadrangle, and northwestern Chandalar quadrangle. Locally contains minor lenses of metalimestone and metaconglomerate. Equivalent to parts of Pzqs of Karl and others (1989b), parts of uqm of Mayfield and Tailleur (1978), and Dusty Mountain phyllite of Moore and others (1997b)

Pzj - Metasedimentary rocks of Jesse Mountain (Paleozoic) -- Generally fine grained, phyllitic to schistose, gray-weathering meta-argillite, black-weathering metaquartzite, marble, and brown weathering impure marble, exposed in a single area in the eastern Wiseman and western Chandalar quadrangles. Carbonate rocks include some dolomitic varieties. Lithologic layering is locally isoclinally folded, and foliation crosses layering in some outcrops. Oldow and others (1998) collected pre-Devonian conodont forms from carbonate rocks in the lower part of the unit. They also collected poorly preserved brachiopods, thought to be post-Early Ordovician, and coral fragments from the lowest part of the unit. Equivalent to the Jesse Mountain phyllite of Moore and others (1997b), thrust nappe N6 of Oldow and others (1998), and part of "black slate, phyllite, and limestone" of Dillon and others (1986)

Pzb - Black phyllite and siliceous phyllite (Paleozoic?) -- Gray to dark-gray carbonaceous phyllite, locally silica rich, exposed in the Central belt in the western Ambler River quadrangle. Equivalent to parts of Pzbs of Mayfield and Tailleur (1978)

PzPem - Metamorphic rocks of the Ernie Lake area (Paleozoic and Proterozoic) -- Coarse crystalline marble, orange dolomitic marble, quartz-mica schist, metaquartzite, calcareous schist, graphitic metaquartzite, and metabasite exposed in the eastern Survey Pass and western Wiseman quadrangles. Marble is the most common lithology; other lithologies are more common in the eastern part of the unit (Wiseman quadrangle), are locally gneissic, and are interlayered with the marbles. These non-marble lithologies correspond to the banded schist ("Pb") of Dillon and others (1986) and include interlayered quartz-mica schist, metaquartzite, calcareous schist, graphitic phyllite, and metabasite. Bodies of granitic gneiss of unit Pg that occur within this unit yielded U-Pb zircon ages of 971 ± 5 Ma (Late Proterozoic) and intruded marble (McClelland and others, 2006). The marble and possibly other parts of the unit are therefore older than 971 Ma, and are the oldest known rocks in the Brooks Range.

The western part of the unit (Survey Pass quadrangle) consists predominantly of marble, mapped as "Skajit Limestone" (DSsk) and "Orange dolomitic marble" (DSso) by Nelson and Grybeck (1980). No Proterozoic orthogneisses (Pg) are known. Some of the marbles in the southeastern Survey Pass quadrangle may indeed be Paleozoic.

Dillon and others (1980) and Nelson and Grybeck (1980) reported kyanite from metasedimentary rocks in this unit, but metamorphic grade and history of these rocks are not documented

PzPcm - Metasedimentary and metavolcanic rocks, undivided (Paleozoic and Proterozoic?) -- Heterogeneous assemblage of interlayered calcareous, mafic, and siliceous rocks exposed in the central Baird Mountains, Ambler River, and Wiseman quadrangles. Includes black quartzite, meta-argillite, and marble; white quartzite; green, buff, and black phyllite and calcareous phyllite; orange-weathering dolostone, orange weathering chloritic marble, chloritic dolomitic marble, gray marble, medium- and dark-green mafic metavolcanic rocks; pale green and orange calcareous schist, and gray-green pelitic schist. Age control is limited to one locality in the Baird Mountains quadrangle, which yielded early Middle Ordovician conodonts (Karl and others, 1989b). The faunal assemblage and lithology of the host rock are similar to the Ordovician part of unit OPc. Karl and others (1989b) suggested that the part of this unit exposed in the Baird Mountains quadrangle represents a basin that sat between the carbonate platforms on which units DOb and DOc were deposited. Equivalent to the "metasedimentary and metavolcanic rocks of Tukpahlearik Creek" of Karl and others (1989b), parts of "Pzcs", "Pzmq", "Pzi", "mi", and "Pzm" of Mayfield and Tailleur (1978), parts of "DSso", "DSsk" and "Pzclq" of Nelson and Grybeck (1980), and parts of "Dc", "Dbb"?, "Dm", "Dbs", and "DSk" of Dillon and others (1986)

PzPm - Mafic schist (Paleozoic? and Proterozoic?) -- Dark green-weathering foliated mafic schist exposed in one area on the boundary between the Ambler River and Survey Pass quadrangles. Composed of green to blue-green amphibole, albite, epidote, quartz, and biotite. Grain size is variable. Epidote occurs in the matrix of the rock and as multicrystalline ovoids, some with relict garnet grains in their centers. Epidote ovoids are probably pseudomorphs after garnet. Amphibole is aligned in the foliation and biotite crosses it. Equivalent to part of Pzgg of Nelson and Grybeck (1980). May be equivalent to the part of unit Pam that underwent albite-epidote-amphibolite-facies metamorphism; biotite crystallization in this unit is late (Cretaceous?) and not developed in Ꝑam

ꝐzꝐqs - Quartz-rich metasedimentary rocks (Paleozoic and Proterozoic?) -- Relatively homogeneous assemblage dominated by light greenish-gray fine-grained schist, typically accompanied by minor layers of metaconglomerate, marble, and calcareous schist. Exposed in the southern Central belt in the western Survey Pass quadrangle and straddling the Wiseman/Chandalar quadrangle boundary. In the eastern exposure of the unit, the schist has a laminated appearance and contains a marble that yielded a conodont of Ordovician to Triassic age (Moore and others, 1997b; Table A-1, Chandalar quadrangle). Equivalent to "Ꝑzclq" and parts of "DSsk" and "DSso" of Nelson and Grybeck (1980) and the "Vi Creek schist" of Moore and others (1997b)

ꝐzꝐb - Metasedimentary rocks of Bluecloud Mountain (Paleozoic and Proterozoic?) -- Light-, medium-, and dark-gray phyllite, dark-gray to black metaquartzite, dark-gray and grayish-brown calcareous phyllite, and reddish-brown-weathering impure marble exposed in fault-bounded lenses along the Schist belt-Central belt contact in the Wiseman quadrangle. Lithologic layering is visible in outcrop where it crosses foliation; locally, lithologic layering is transposed by foliation, which is defined by fine-grained mica. In thin section, lithologic layering and relict clasts are recognizable; metamorphic minerals include white mica, chlorite, stilpnomelane (?), and very fine-grained garnet or albite. No protolith age control is available; the protolith may have been a sequence of turbidites. Equivalent to "Hunt Fork schist" of Brosgé and Reiser (1964) and Bluecloud Mountain schist of Moore and others (1997b) who described it as mafic schist

Ꝑam - Metamorphic rocks of Mt. Angayukaqsraq (Proterozoic) -- Amphibolite, metaquartzite, calcareous schist, metapelite, and a few small bodies of metagranite and metagabbro, exposed in the northeastern Baird Mountains quadrangle around Mt. Angayukaqsraq and in the northeastern Ambler River quadrangle. Lithologies are interlayered on a scale of centimeters to meters, with pelite layers generally thicker than a meter and other lithologies in layers up to tens of meters thick (Till, 1989). Outcrops vary from massive to stepped, depending on the scale of interlayering. Amphibolite is dark-gray to black weathering, massive, and dotted with pink garnets up to 1.5 cm in diameter. Hornblende, plagioclase, sphene and quartz constitute the rest of the rock. Metaquartzite forms tan-, green-, and gray-weathering layers interlayered on a millimeter to centimeter scale with tan- and brown-weathering calcareous schist. The metaquartzite contains ≤15% white mica, biotite, garnet and calcite; the calcareous schist is composed of quartz, epidote, plagioclase, hornblende, calcite, and garnet. Metapelitic rocks, commonly containing biotite and garnet, form light-green, well-layered outcrops rich in white mica, typically interlayered with metaquartzite on a scale of centimeters. Mineral assemblages record amphibolite-facies conditions (Till, 1989). Light-gray to tan-weathering metagranite and cream to brownish-green metagabbro occur as small bodies up to 100 m across that are volumetrically minor (Till, 1989; Karl and others, 1989a). U-Pb zircon ages from the granite indicate that it crystallized around 750 Ma (Karl and others, 1989a). White mica from a metapelite yielded a Late Proterozoic metamorphic age (680 Ma; Till and Snee, 1995). In the Baird Mountains quadrangle, some of the amphibolite-facies rocks were overprinted by an albite-epidote-amphibolite-facies event; these rocks are shown on the map with a dashed overlay. Mafic outcrops in these areas are massive dark-blue to dark-bluish-green with small knots of olive-colored epidote after garnet. Dolostone and marble occur along shear zones within the albite-epidote amphibolite facies rocks. Both the amphibolite facies and albite-epidote amphibolite facies rocks experienced a blueschist facies overprint detectable only in thin section (Till and others, 1988; Till and Snee, 1995). The blueschist-facies event yielded a $^{40}Ar/^{39}Ar$ age of 120 Ma (Till and Snee, 1995). Equivalent to unit "Psv" of Karl and others (1989) and parts of unit "mi" of Mayfield and Tailleur (1978)

NORTHERN THRUST ASSEMBLAGES

MzDm - Igneous and sedimentary rocks of the Maiyumerak Mountains (Mesozoic? through Devonian) -- Basalt, limestone, and two belts of mélange exposed in the northwesternmost part of the map area. Four northeast-southwest trending belts defined by Karl and others (1989b) and revised in Karl (1992) include, from east to west: matrix supported mélange with meter- to decameter-size blocks of pillow basalt, dolostone, marble, phyllite, argillite, quartz wacke, and gabbro; the Kugururok Limestone (Sable and Dutro, 1961), which is Middle to Late Devonian based on conodont and megafossil ages (Karl and others, 1989b), and contains sandstone layers, volcanic lithic grains, and feldspar grains; a thick section of massive to pillowed basalt with minor andesite, dacite, tuff, and volcanic breccia, thought to be Triassic; and a matrix-free mélange with meter to kilometer sized blocks of quartz wacke, argillite, bedded chert, limestone, and volcaniclastic rocks (Karl and others, 1989b; Karl, 1992). Blocks of carbonate rock and chert in the matrix-supported mélange yielded fossils that range in age from Devonian to Jurassic; chert and limestone in the matrix-free mélange yielded Devonian, Mississippian, Pennsylvanian-Permian, Triassic, and Jurassic fossils. Chert and argillite in the matrix-free mélange were originally mapped as Etivluk Group by Karl and others (1989b), but later reassigned by Karl (1992)

MDer - Eli River sequence (Mississippian and Devonian) -- Dolostone, limestone, argillaceous or sandy limestone, sandstone, and limestone and dolostone with chert that make up the Eli River sequence of Karl and others (1989b). MDer consists of unnamed Middle Devonian carbonate rocks (here excluded from the Baird Group of Tailleur and others, 1967), Eli Limestone of Tailleur and others, 1967 (also excluded from the Baird Group), and Utukok and Kogruk Formations (Sable and Dutro, 1961) of Lisburne Group (Schrader, 1902; Bowsher and Dutro, 1957); all contacts within this succession appear conformable.

Unnamed lowest unit is light- to medium-gray-weathering, medium- to dark-gray dolostone and lesser limestone. Lithofacies include laminated mudstone with fenestral fabric, sheet and desiccation cracks, and evaporite laths; stromatoporoid wackestone; and peloidal grainstone. Conodonts indicate an age of Eifelian-Givetian (Middle Devonian). Base of the unit is not exposed. Eli Limestone is yellow-brown to orange weathering, medium- to dark-gray, fine- to coarse-grained, commonly argillaceous limestone and lesser dolostone; beds are planar to irregular and bioturbated and rock types range from lime mudstone to bioclastic packstone. Conodonts denote an age of late Middle or early Late to late Late Devonian (late Givetian or Frasnian to Famennian); it also contains brachiopods of Late Devonian (possibly mid-Famennian) age (entries 8494-96 in Alaska Paleontological Database). Utukok is gray to brown limestone, sandy limestone, quartzose to calcareous sandstone, and subordinate siltstone and shale. Carbonate lithofacies include bioclastic wackestone, packstone, and grainstone; bioclasts are mainly pelmatozoan, brachiopod, bryozoan, and coral fragments, foraminifers, and algae.

Age is Early Mississippian (Kinderhookian through middle Osagean) based on conodonts. Kogruk is light- to medium-gray-weathering, medium- to dark-gray, fine- to coarse-grained limestone and dolostone with locally abundant layers and nodules of black, gray, and white chert. Lithofacies include bioclastic wackestone and, in the upper part of the unit, spiculitic limestone. Conodonts, corals, and brachiopods indicate an age of late Early-Late Mississippian (late Osagean to late Meramecian-early Chesterian; see entries 5079-84 in Alaska Paleontological Database for details of coral identification and age). The top of the Kogruk is not exposed in the map area, but to the west, the Etivluk Group conformably overlies the Kogruk.

The MDer succession was deposited in a range of shallow-water, inner to middle shelf environments; the shallowest and most restricted depositional regimes prevailed during the late Middle Devonian. Strata are locally recrystallized, but conodont CAI values are generally 4 to 4.5 (Karl and others, 1989b), indicating temperatures of at least 190°-250° C (Table A-2; Watts and others, 1994). MDer is part of a sequence exposed extensively outside this map area, where is it called the Eli River sequence (Mayfield and others, 1988) or the "Eli River plate" (Young, 2004) of the Kelly River allochthon. Middle Devonian carbonate rocks correlate at least in part with youngest part of Baird Group; the Kogruk Formation correlates with unit "Ml" and parts of units "Mkl", "Mkkl", and "Mu". MDer is equivalent to the Maiyumerak sequence of Dumoulin and Harris (1992), who described in detail the lithofacies and biotas of these rocks

DOONERAK ANTIFORM

ŦCs - Sedimentary rocks (Triassic through Carboniferous) -- Quartzite, phyllite, siltstone, conglomerate, shale, sandstone, limestone, argillaceous limestone, dolomitic limestone, and cherty dolostone. The unit occurs in the Mount Doonerak area in northeastern Wiseman and northwestern Chandalar quadrangles, where it has been interpreted (Dillon and others, 1986) to unconformably overlie lower Paleozoic rocks (map unit S€vs). ŦCs consists of the Kekiktuk Conglomerate (Brosgé and others, 1962) and Kayak Shale (Bowsher and Dutro, 1957) of the Endicott Group (Tailleur and others, 1967; Mississippian), the Lisburne Group (Schrader, 1902; Bowsher and Dutro, 1957; Carboniferous), the Echooka Formation (Keller and others, 1961) of the Sadlerochit Group (Leffingwell, 1919; Detterman and others, 1975; Triassic and Permian), and the Shublik Formation (Leffingwell, 1919) and Karen Creek Sandstone (Detterman and others, 1975; Triassic). The succession is similar to that of map unit JCs but differs in some aspects; it is part of unit ŦCs of Dillon and others (1986). Dutro and others (1976), Dillon and others (1986), Mull and others (1987), Adams (1991, 1994), and Adams and others (1997) provide additional data on these strata.

The Kekiktuk is discontinuously present and consists of quartzite and minor pebble conglomerate with interlayers of phyllite, siltstone, and felsic volcaniclastic rocks and a basal conglomerate (Dillon and others, 1986; Mull and others, 1987). Coarser beds display horizontal and trough cross-stratification and small- to large-scale channels; conglomerate clasts are mainly chert and quartz but locally include green to dark-gray phyllite. These rocks were included in the basal sandstone member of the Kayak by Armstrong and others (1976) but noted by these authors to strongly resemble the Kekiktuk of the northeastern Brooks Range. The Kayak and Lisburne (Mount Doonerak composite section) were discussed by Armstrong and others (1976), Armstrong and Mamet (1978), and Dumoulin and others (1997). The Kayak is black shale with interbeds of sandstone and siltstone near the base and limestone (crinoidal packstone) near the top. It contains conodonts and foraminifers of Early Mississippian (Kinderhookian and Osagean) age. Basal and upper contacts of the Kayak are gradational. The Lisburne is composed of three formations. The Wachsmuth Limestone is argillaceous limestone and cherty dolostone of Osagean age, formed in an open marine setting. The Alapah Limestone is dark, argillaceous, coralline limestone (foreslope deposits?) overlain by light-gray, locally dolomitic limestone (shoal and open platform strata) of Late Mississippian age. The Wahoo Limestone is fossiliferous limestone of Pennsylvanian (mainly Morrowan) age that accumulated at least partly as a lag concentrate on a drowned carbonate platform.

Post-Carboniferous stratigraphy was detailed by Adams (1991, 1994, Amawk Creek and Bombardment Creek sections) and summarized in Mull and others (1987) and Adams and others (1997). The lower contact of the Echooka is sharp and undulatory and locally coated with several centimeters of red clay; basal beds contain probable phosphatic pebbles. The Echooka consists in ascending order of siltstone, sandstone, and silty dolostone (subunit A), light to dark gray silty shale with subordinate carbonate interbeds (subunit B_1), and dark gray to black cherty shale with barite nodules (subunit D). The formation contains abundant burrows and trace fossils, as well as brachiopods that indicate an early Early Permian (Wolfcampian) age for the lower part of subunit B_1. Regional correlations suggest that the upper part of the Echooka in the Doonerak area is late Early to Late Permian (Leonardian to Guadalupian). The Echooka is overlain (disconformably?) by black, calcareous, sooty shale with phosphatic nodules and argillaceous gray to black limestone assigned to the Shublik Formation; this unit has produced pelecypods of Middle and (or) Late Triassic age, as well as Late Triassic conodonts (Dutro and others, 1976; Mull and others, 1987; Adams, 1991; Table A-1, Wiseman quadrangle). The Shublik is gradationally overlain by a thin interval of dark-gray to black siltstone and very fine grained sandstone correlated with the Karen Creek Sandstone by Mull (1982) and Mull and others (1987). The upper contact of the Karen Creek is not exposed in the map area. CAI values of conodonts from ŦCs mostly range from 4.5 to 6, but may be as low as 3 to 4 locally (Table A-1, Wiseman quadrangle).

Various workers (e.g., Dutro and others, 1976; Mull, 1982; Mull and others, 1987; Adams and others, 1997) have suggested that the general stratigraphy of TrCs is more like that of coeval parautochthonous rocks in the northeastern Brooks Range (outside of this map area) than that of equivalent strata in the central part of the range that have been assigned to the Endicott Mountains allochthon (EMA; Moore and others, 1994). TrCs does differ from JCs, the nearest coeval strata in the EMA; the most notable contrast is the presence of somewhat deeper water facies in parts of both the Carboniferous and Permian successions in JCs. However, Lisburne Group facies in ŦCs are generally similar to coeval rocks exposed to the northeast in the central Chandler Lake quadrangle (Dumoulin and others, 1997)

SЄvs - Volcanic and sedimentary rocks (Silurian through Cambrian) -- Volcanic rocks, volcaniclastic rocks, and clastic sedimentary rocks exposed in the core of the Doonerak antiform, northeastern Wiseman quadrangle. The unit can be divided into at least two lithologic sequences, one dominated by volcanic rocks, the other by sedimentary rocks (Dillon and others, 1986; Moore and others, 1994; Julian and Oldow, 1998). The thick volcanic sequence includes flows and pyroclastic rocks with island-arc chemical affinities (Julian and Oldow, 1998). Sedimentary rocks include phyllite, slate, sandstone, fine-grained conglomerate, and lenses of limestone, including carbonate conglomerate. Middle Cambrian microfossils, brachiopods and trilobites, Ordovician conodonts, and Silurian graptolites and conodonts have been recovered from the sedimentary rocks (Dutro and others, 1984; Repetski and others, 1987). Cambrian fossils have Siberian affinities (Dutro and others, 1984). K-Ar and Ar-Ar ages from five dikes yielded two sets of ages (Dutro and others, 1976). Three samples yielded Devonian ages (373-388 ± 11-17 Ma); two samples yielded older ages, both with large errors. The older sample with the more potassic hornblende and better radiogenic yield is Ordovician (478 ± 20 Ma), and was collected from the volcanic sequence (Dutro and others, 1976). Equal to units S€b and O€v of Dillon and others, (1986) and the Apoon assemblage of Julian and Oldow (1998)

RUBY TERRANE

₽zPbs - **Biotite schist** (Paleozoic and Proterozoic?) -- Quartz-albite-oligoclase-biotite schist with staurolite and andalusite exposed in the southeastern Chandalar quadrangle, adjacent to rocks of the Schist belt. Age of metamorphism not known

₽zPsr - **Ruby schist** (Paleozoic and Proterozoic?) -- Biotite-bearing pelitic schist with subordinate metaquartzite, exposed in the southern Chandalar quadrangle. May have crystallized at upper greenschist or amphibolite facies (Dusel-Bacon and others, 1989). Equivalent to schists of the Ruby geanticline, south of the map area, where the earliest documented metamorphic episode occurred under blueschist-facies conditions (Sheet 1, Figure 2; Patton and others, 1994). The Ruby blueschist episode was similar in grade, deformational style, and timing to the blueschist-facies metamorphism recorded in the Schist belt (Roeske and others, 1995)

IGNEOUS AND METAPLUTONIC ROCKS

QTb - **Basalt** (Quaternary? or Tertiary?) -- Flat-lying, vesicular olivine basalt flows exposed in the southeastern part of the Chandalar quadrangle. Thought to be about 300 meters thick (Brosgé and Reiser, 1964)

Kg - **Granitic rocks** (Cretaceous) -- Granite, quartz monzonite, and granodiorite of the northern Ruby terrane, exposed along the southern boundary of the Chandalar quadrangle (Brosgé and Reiser, 1964). K-Ar dates range from 103 ± 6 to 110 ± 6 (Blum and others, 1987)

Km - **Migmatite** (Cretaceous) -- Intermixed granitic rocks, biotite schist, and hornblende hornfels; pyroxene hornfels and granitic dikes, associated with Cretaceous granitic rocks, all exposed in the northern Ruby terrane along the southern margin of the Chandalar quadrangle (Brosgé and Reiser, 1964)

Dg - **Granitic orthogneiss** (Devonian) -- Tan- to gray-weathering, equigranular to porphyroblastic, fine- to coarse-grained metagranitic bodies ranging in size from less than a kilometer to over 20 km across, found in both the Schist and Central belts. Generally granitic in composition and made up of quartz, K-feldspar, albite, muscovite, and biotite. In the Chandalar quadrangle, the Horace Mountain pluton is dioritic to granodioritic in composition, and contains hornblende. Chlorite, sericite, Fe-Ti oxides, epidote minerals, and calcite are also present in many of the plutons. Remnants of intrusive contact relations are locally preserved. Exposures of skarn have been mapped at the contacts and within the orthogneiss bodies. Skarns at the contacts of some of the plutons are mineralized (Sn or Cu; Newberry and others, 1997).

The first isotopic dates on the plutons were done by the K-Ar method and yielded middle Cretaceous ages (Turner and others, 1979). A Devonian U-Pb zircon age for a group of metaplutonic bodies in the southern and northeastern Brooks Range was determined assuming the bodies were comagmatic (Dillon and others, 1980). More precise U-Pb zircon dates on individual orthogneiss bodies are Middle Devonian (390-396 Ma; Aleinikoff and others, 1993). Toro and others (2002) give a preferred age of 375-395 Ma for orthogneiss at Mt. Igikpak in the central Survey Pass quadrangle. Neodymium isotopic data indicate an ancient crustal component in the magmas that formed the Devonian orthogneisses (Nelson and others, 1993). Strontium isotope compositions are unrealistically low for some of the orthogneiss samples, indicating that the Rb – Sr systems in these rocks have been disturbed and do not provide useful petrogenetic information (Nelson and others, 1993). Metafelsite in unit Dmu and the Kiwalik Mountain orthogneiss, Seward Peninsula, are similar in age to the more precisely dated granitic orthogneisses in this unit (Aleinikoff and others, 1993; Till and others, 1986; Till and others, 2006).

Thermobarometric analysis of phengite and feldspars in eight separate bodies of granitic orthogneiss in the Schist belt yielded temperatures ranging from 372 to 427°C and pressures of 7 to 11.3 kb, thought to represent conditions of Jurassic high-pressure metamorphism (Patrick, 1995). These samples all had secondary populations of phengite that yielded lower pressure estimates and are thought to have crystallized during exhumation of the belt. Five samples from granitic orthogneiss in the Central belt were collected from three major bodies in the eastern Ambler River and central Survey Pass quadrangles and yielded temperatures ranging from 327 to 416°C and pressures of 3 to 8.9 kb (Patrick, 1995)

PzᵽG - Granitic rocks (Paleozoic and Proterozoic?) -- Pale gray-green, massive to gneissic granitic to dioritic orthogneiss exposed in the Schist belt in the southern Baird Mountains quadrangle. This body was one of several metagranitic rocks from the Schist belt analyzed to evaluate the temperature and pressure conditions of Jurassic metamorphism. Results of phengite and feldspar thermobarometry on a sample from this body yielded 432°C, 10.2 kb (Patrick, 1995). No direct age control; may be correlative with Ᵽg

Ᵽg - Granitic orthogneiss (Proterozoic) -- Metagranitic rocks of several Proterozoic ages exposed in southern Baird Mountains and western Wiseman quadrangles. In the Schist belt in the Baird Mountains quadrangle, a light-gray, medium- to fine-grained, foliated to gneissic metamorphosed granite sits within an exposure of unit DP_sc (Karl and Aleinikoff, 1990). The orthogneiss contains cm-sized albite porphyroblasts, pink K-feldspar, quartz, biotite, chlorite, sericite, magnetite, calcite, sphene, and zircon. Karl and Aleinikoff (1990) reported a U-Pb zircon age of 705 ± 35 Ma. In the Central belt, two bodies of Proterozoic metagranitic rocks span the boundary of the Survey Pass and Wiseman quadrangles. The Ernie Lake pluton yielded an age of 971 ± 5 Ma (McClelland and others, 2006); the nearby Sixtymile River orthogneiss yielded discordant zircons likely of a similar age (Dillon and others, 1980). Granodiorite at Mt. Angayukaqsraq, in the northeastern Baird Mountains quadrangle, yielded a U-Pb zircon age of 750 ± 6 Ma (Karl and others, 1989a); the granodiorite and related granitic rocks are too small to show on the map and were included in unit Ᵽam

SURFICIAL DEPOSITS

Qs - Surficial sedimentary deposits, undivided (Quaternary) -- Frost-rived rubble on slopes and broad low ridges; glacially deposited sand, gravel, and boulders; fluvial gravel and sand; terrace deposits; wetlands

ACKNOWLEDGMENTS

This map represents the sweat, persistence, and insight invested over many years by many geologists. Its strengths reflect the strengths of those individuals. One individual in particular, however, laid the framework for much of the map, and proved to have excellent geologic instincts -- William P. Brosgé. We are indebted to him.

Thanks to Dwight Bradley and in particular Cynthia Dusel-Bacon for thorough, thoughtful reviews. The patient, competent work of Keith Labay and Ric Wilson is deeply appreciated.

LIST OF REFERENCES

Adams, K.E., 1991, Permian sedimentation in the northcentral Brooks Range, Alaska: Implications for tectonic reconstructions: Fairbanks, Alaska, University of Alaska, M.S. thesis, 122 p.

Adams, K.E., 1994, Columnar sections and lithostratigraphic correlation of the Permian Siksikpuk and Echooka Formations, northcentral Brooks Range, northern Alaska: Alaska Division of Geological and Geophysical Surveys Public-Data File 94-95.

Adams, K.E., Mull, C.G., and Crowder, R.K., 1997, Permian deposition in the north central Brooks Range, Alaska: Constraints for tectonic reconstructions: Journal of Geophysical Research, v. 102, p. 20, 727-20, 748.

Alaska Paleontological database at http://www.alaskafossil.org/.

Aleinikoff, J.N., Moore, T.E., Walter, M., and Nokleberg, W.J., 1993, U-Pb ages of zircon, monazite, and sphene from Devonian metagranites and metafelsites, central Brooks Range, Alaska, *in* Dusel-Bacon, C., and Till, A.B., eds., Geologic studies in Alaska by the U.S. Geological Survey in 1992: Boulder, Colorado, U.S. Geological Survey Bulletin 2068, p. 59-70.

Armstrong, A.K., and Mamet, B.L., 1978, Microfacies of the Carboniferous Lisburne Group, Endicott Mountains, arctic Alaska, *in* Stelck, C.R. and Chatterton, B.D.E., eds., Western and arctic Canadian biostratigraphy: Geological Association of Canada Special Paper 18, p. 333-394.

Armstrong, A.K., Mamet, B.L., Brosgé, W.P., and Reiser, H.N., 1976, Carboniferous section and unconformity at Mount Doonerak, Brooks Range, northern Alaska: American Association of Petroleum Geology Bulletin, v. 60, p. 962-972.

Barker, F., Jones, D.L., Budahn, J.R., and Coney, P.J., 1988, Ocean plateau-seamount origin of basaltic rocks, Angayucham Terrane, central Alaska: Journal of Geology, v. 96, p. 368-374.

Bird, K.J., 1977, Late Paleozoic carbonates from the south-central Brooks Range, *in* Blean, K.M., ed., The United States Geological Survey in Alaska; Accomplishments during 1976: U.S. Geological Survey Circular 751-B, p. B19-B20.

Blodgett, R.B., Clough, J.G., Dutro, J.T., Jr., Ormiston, A.R., Palmer, A.R., and Taylor, M.E., 1986, Age revisions for the Nanook Limestone and Katakturuk Dolomite, northeastern Brooks Range, *in* Bartsch-Winkler, S., and Reed, K.M., eds., Geologic studies in Alaska by the U.S. Geological Survey during 1985: U.S. Geological Survey Circular, 978, p. 5-10.

Blum, J.D., Blum, A.E., Davis, T.E., and Dillon, J.T., 1987, Petrology of cogenetic silica-saturated and –oversaturated plutonic rocks in the Ruby geanticline of north-central Alaska: Canadian Journal of Earth Sciences, v. 24, no. 1, p 159-169.

Blythe, A.E., Bird, J.M., and Omar, G.I., 1998, Constraints on the cooling history of the central Brooks Range, Alaska, from fission-track and $^{40}Ar/^{39}Ar$ analyses, *in* Oldow, J.S., and Avé Lallemant, H.G., eds., Architecture of the central Brooks Range fold and thrust belt, arctic Alaska: Boulder, Colorado, Geological Society of America Special Paper 324, p. 163-177.

Boak, J.L., Turner, D.L., Henry, D.J., Moore, T.E., and Wallace, W.K., 1987, Petrology and K/Ar dates of the Misheguk igneous sequence; an allochthonous mafic and ultramafic complex, and its metamorphic aureole, western Brooks Range, Alaska, *in* Tailleur, I.L., and Weimer, P., eds., Alaskan North Slope Geology: Field trip guidebook – Pacific Section, Society of Economic Paleontologists and Mineralogists, v. 50, p. 737-745.

Bowsher, A.L., and J.T. Dutro, Jr., 1957, The Paleozoic section in the Shainin Lake area, central Brooks Range, Alaska: U.S. Geological Survey Professional Paper 303-A, 39 p.

Box, S.E., 1987, Late Cretaceous or younger SW-directed extensional faulting: Cosmos Hills, Brooks Range, Alaska: Geological Society of America Abstracts with Programs, v. 19, no. 6, p. 361.

Brosgé, W.P., 1960, Metasedimentary rocks in the south-central Brooks Range, Alaska, *in* Short papers in the geological sciences; Geological Survey Research 1960: U.S. Geological Survey Professional Paper, 400-B, p. B351-B352.

Brosgé, W.P., Dutro, J.T., Jr., Mangus, M.D., and Reiser, H.N., 1962, Paleozoic sequence in eastern Brooks Range, Alaska: American Association of Petroleum Geologists Bulletin, v. 46, no. 12, p. 2174-2198.

Brosgé, W.P., and Pessel, G.H., 1977, Preliminary bedrock geologic map, Wiseman and eastern Survey Pass quadrangles: U.S. geological Survey Open-File report #479, scale 1:250,000.

Brosgé, W.P., and Reiser, H.N., 1964, Geological map and section of the Chandalar quadrangle, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-375, scale 1:250,000.

Brosgé, W.P., and Reiser, H.N., 1971, Preliminary bedrock geologic map, Wiseman and eastern Survey Pass quadrangles, Alaska: U.S. Geological Survey Open-File Map OF 71-56, 2 sheets, 1:250,000.

Brosgé, W.P., and Reiser, H.N., 2000, Geological map of the Christian quadrangle, Alaska: U.S. Geological Survey Open-File Report 00-192, scale 1:250,000.

Brosgé, W.P., and Tailleur, I.L., 1971, Northern Alaska petroleum province; Future petroleum provinces of the United States; their geology and potential, Volume 1: American Association of Petroleum Geologists Memoir, 15, p. 68-99.

Brosgé, W.P., Reiser, H.N., Dutro, J.T., Jr., Detterman, R.L., and Tailleur, I.L. 2001, Geological map of the Arctic quadrangle, Alaska: U.S. Geological Survey Geologic Investigations Series I-2673, scale 1:250,000.

Carter, C., and Laufeld, S., 1975, Ordovician and Silurian fossils in well cores from the North Slope of Alaska: American Association of Petroleum Geologists Bulletin, v. 59, p. 457-464.

Carter, C., and Tailleur, I.L., 1984, Ordovician graptolites from the Baird Mountains, western Brooks Range, Alaska: Journal of Paleontology, v. 58, p. 40-57.

Chapman, R.M., Detterman, R.L., and Marvin, D.M., 1964, Geology of the Killik-Etivluk Rivers region, Alaska, *in* Exploration of Naval Petroleum Reserve No. 4 and adjacent areas, northern Alaska, 1944-53; Part 3, Areal geology: U.S. Geological Survey Professional Paper, 303-F, p. F325-F407, incl. geologic map, scale 1:125,000.

Christiansen, P.P., and Snee, L.W., 1994, Structure, metamorphism, and geochronology of the Cosmos Hills and Ruby ridge, Brooks Range schist belt, Alaska: Tectonics, v. 13, p. 191-213.

Detterman, R.L., Reiser, H.N., Brosgé, W.P., and Dutro, J.T., Jr., 1975, Post-Carboniferous stratigraphy, northeastern Alaska: U.S. Geological Survey Professional Paper, 886, 46 p.

Dillon, J.T., 1989, Structure and stratigraphy of the southern Brooks Range and northern Koyukuk basin near the Dalton Highway, *in* Mull, C.G., and Adams, K.E., eds., Dalton Highway, Yukon River to Prudhoe Bay, Alaska, Bedrock geology of the eastern Koyukuk basin, central Brooks Range and east-central Arctic Slope: Alaska Division of Geological And Geophysical Surveys Guidebook 7, v. 1, p. 157-187.

Dillon, J.T., Brosgé, W.P., and Dutro, J.T., Jr., 1986, Generalized geologic map of the Wiseman Quadrangle, Alaska: U.S. Geological Survey Open-File Report OF 86-219, 1 sheet, scale 1:250,000.

Dillon, J.T., Harris, A.G., and Dutro, J.T., Jr., 1987, Preliminary description and correlation of lower Paleozoic fossil-bearing strata in the Snowden Mountain area of the south-central Brooks Range, Alaska, *in* Tailleur, I. L., and Weimer, Paul, eds., Alaskan North Slope geology: Bakersfield, California, Pacific Section, Society of Economic Paleontologists and Mineralogists, book 50, p. 337-345.

Dillon, J.T., Harris, A.G., Dutro, J.T., Jr., Solie, D. N., Blum, J. D., Jones, D. L., and Howell, D. G., 1988, Geologic map and section of the Chandalar D-6 and parts of the Chandalar C-6 and Wiseman C-1 and D-1 quadrangles, Alaska: Alaska Division of Geological & Geophysical Surveys Report of Investigations 88-5, 1 sheet, scale 1:63,360.

Dillon, J.T., Pessel, G.H., Chen, J.H., and Veach, N.C., 1980, Middle Paleozoic magmatism and orogenesis in the Brooks Range, Alaska: Geology, v. 8, p. 338-343.

Dinklage, W.S., 1998, Extension of a convergent orogen: Structural evolution of the high-pressure/low-temperature Schist Belt, Brooks Range, Alaska: [Ph.D. thesis] Santa Barbara, Calif., University of California, 255 p.

Dover, J.H., Tailleur, I.L., and Dumoulin, J.A., 2004, Geologic and fossil locality maps of the west-central part of the Howard Pass quadrangle and part of the adjacent Misheguk Mountain quadrangle, western Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-2413, 2 sheets with 25 p. of explanatory text, scale 1:100,000.

Dumoulin, J.A., 1988, Stromatolite- and coated-grain-bearing carbonate rocks of the western Brooks Range, *in* U.S. Geological Survey Circular 1016, Geologic Studies during 1987, p. 31-34.

Dumoulin, J.A., 2001, Lithologies of the basement complex (Devonian and older) in the National Petroleum Reserve - Alaska, *in* Houseknecht, D.W. (ed.), NPRA Core Workshop; Petroleum Plays and Systems in the National Petroleum Reserve - Alaska, Society for Sedimentary Geology (SEPM) Core Workshop no. 21, p. 201-214.

Dumoulin, J.A., and Bird, K. J., 2002, Lithofacies and stratigraphy of the Lisburne and Etivluk Groups in the Lisburne 1 well and adjacent outcrops, central Brooks Range, Alaska [abs.]: American Association of Petroleum Geologists Program and Abstracts, Pacific Section, p. 71.

Dumoulin, J.A., and Harris, A.G., 1987, Lower Paleozoic carbonate rocks of the Baird Mountains quadrangle, western Brooks Range, Alaska, *in* Tailleur, I.L. and Weimer, Paul, eds., Alaskan North Slope Geology: Bakersfield, Calif., Pacific Section Society for Sedimentary geology (SEPM) and Alaska Geological Society, v. 1, p. 311-336.

Dumoulin, J.A., and Harris, A.G., 1988, Off-platform Silurian sequences in the Ambler River quadrangle, *in* U.S. Geological Survey Circular 1016, Geologic Studies during 1987, p. 35-38.

Dumoulin, J.A., and Harris, A.G., 1992, Devonian-Mississippian carbonate sequence in the Maiyumerak Mountains, western Brooks Range, Alaska: U.S. Geological Survey Open-File Report 92-3, 83 p.

Dumoulin, J.A., and Harris, A.G., 1994, Depositional framework and regional correlation of pre-Carboniferous metacarbonate rocks of the Snowden Mountain area, central Brooks Range, northern Alaska: U.S. Geological Survey Professional Paper 1545, 74 p.

Dumoulin, J.A., Harris, A.G., Gagiev, M., Bradley, D.C., and Repetski, J.E., 2002, Lithostratigraphic, conodont, and other faunal links between lower Paleozoic strata in northern and central Alaska and northeastern Russia, *in* Miller, E.L., Grantz, A., and Klemperer, S.L., eds., Tectonic Evolution of the Bering Shelf-Chukchi Sea-Arctic Margin and Adjacent Landmasses: Boulder, Colorado, Geological Society of America Special Paper 360, p. 291-312.

Dumoulin, J.A., Harris, A.G., Blome, C.D., and Young, L.E., 2004, Depositional settings, correlation, and age of Carboniferous rocks in the western Brooks Range, Alaska: Economic Geology, v. 99, p. 1355-1384.

Dumoulin, J.A., Harris, A.G., Blome, C.D., and Young, L.E., 2006, Conodont and radiolarian data from the De Long Mountains quadrangle and adjacent areas: U.S. Geological Survey Open-File Report 2006-1068.

Dumoulin, J.A., Watts, K.F., and Harris, A.G., 1997, Stratigraphic contrasts and tectonic relationships between Carboniferous successions in the Trans-Alaska Crustal Transect corridor and adjacent areas, northern Alaska: Journal of Geophysical Research, v. 102, p. 20, 709-20, 726.

Dumoulin, J.A., Harris, A.G., Gagiev, Mussa, Bradley, D.C., and Repetski, J.E., 2002, Lithostratigraphic, conodont, and other faunal links between lower Paleozoic strata in northern and central Alaska and northeastern Russia, *in* Miller, E.L., Grantz, A., and Klemperer, S.L., eds., Tectonic Evolution of the Bering Shelf-Chukchi Sea-Arctic Margin and Adjacent Landmasses: Boulder, Colorado, GSA Special Paper 360, p. 291-312.

Dumoulin, J.A., Harris, A.G., Blome, C.D., and Young, L.E., 2006, Conodont and radiolarian data from the De Long Mountains quadrangle and adjacent areas: U.S. Geological Survey Open-File Report 2006-1068.

Dusel-Bacon, C., Brosgé, W.P., Till, A.B., Doyle, E.O., Mayfield, C.F., Reiser, H.N., and Miller, T.P., 1989, Distribution, facies, ages, and proposed tectonic associations of regionally metamorphosed rocks in northern Alaska: U.S. Geological Survey Professional Paper 1497-A, p. A1-A44, 2 sheets, scale 1:1,000,000.

Dutro, J.T., Jr., 1952, Stratigraphy and paleontology of the Noatak and associated formations, Brooks Range, Alaska; Geologic Investigations, Naval Petroleum Reserve No. 4: U.S. Geological Survey Alaska Special Report, no. 33, 154 p.

Dutro, J.T., Jr., 1970, Pre-Carboniferous carbonate rocks, northeastern Alaska, *in* Adkison, W.L., and Brosgé, M.M., eds., Proceedings of the geological seminar on the North Slope of Alaska: American Association of Petroleum Geologists, Pacific Section, p. M1-M8.

Dutro, J.T., Jr., Brosgé, W.P., Lanphere, M.A., and Reiser, H.N., 1976, Geologic significance of Doonerak structural high, central Brooks Range, Alaska: American Association of Petroleum Geologists Bulletin, v. 60, p. 952-961.

Dutro, J.T., Jr., Brosgé, W.P., Reiser, H.N., and Detterman, R.L., 1979, Beaucoup Formation, a new Upper Devonian stratigraphic unit in the central Brooks Range, Alaska, *in* Sohl, N.F., and Wright, W.B., Changes in stratigraphic nomenclature by the U.S. Geological Survey, 1978: U.S. Geological Survey Bulletin 1482-A, p. A62-A69.

Dutro, J.T., Jr., Palmer, A.R., Repetski, J.E., and Brosgé, W.P., 1984, Middle Cambrian fossils from the Doonerak Anticlinorium, central Brooks Range, Alaska: Journal of Paleontology, V. 58, p. 1364-1371.

Ellersieck, I., 1985, Tectonic shortening of the upper crust in the western Brooks Range, Alaska: structure of the northwestern Baird Mountains: Berkley, Calif., University of California, M.S. thesis, 121 p.

Epstein, A.G., Epstein, J.B., and Harris, L.D., 1977, Conodont color alteration-an index to organic metamorphism: U.S. Geological Survey Professional Paper 995, p. 27.

Folger, P.F., 1988, The geology and mineralization at the Omar copper prospect, Baird Mountains quadrangle, Alaska: MS thesis, University of Montana, 152 p.

Folger, P.F., and Schmidt, J.M., 1986, Geology of the carbonate-hosted Omar prospect, Baird Mountains, Alaska: Economic Geology, v. 81, p. 1690-1695.

Fortey, R.A., Harper, D.A.T., Ingham, J.K., Owen, A.W., and Rushton, A.W.A., 1995, A revision of Ordovician series and stages from the historical type area: Geological Magazine, v. 132, no. 1, p. 15-30.

Fritts, C.E., 1970, Geology and geochemistry of the Cosmos Hills, Ambler River and Shungnak Quadrangles, Alaska: Alaska Division of Mines and Geology Geologic Report 39, 69 p.

Gilbert, W.G., Wiltse, M.A., Carden, J.R., Forbes, R.B., and Hackett, S.W., 1977, Geology of Ruby Ridge, Southwest Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Geologic Report 58, 16 p.

Gottschalk, R.R., Jr., 1987, Structural and petrologic evolution of the southern Brooks Range near Wiseman, Alaska: Houston, Texas, Rice University, Ph.D. dissertation, 263 p.

Gottschalk, R.R., 1990, Structural Evolution of the schist belt, south-central Brooks Range fold and thrust belt, Alaska: Journal of Structural Geology, v. 12, no. 4, p. 453-469.

Gottschalk, R.R., 1998, Petrology of eclogite and associated high-pressure metamorphic rocks, south-central Brooks Range, Alaska, in Oldow, J.S., and Avé Lallemant, H.G., eds., Architecture of the Central Brooks Range Fold and Thrust Belt, Arctic Alaska: Boulder, Colorado, Geological Survey of America Special Paper 324, p.141-162.

Gottschalk, R.R., and Oldow, J.S., 1988, Low-angle normal faults in the south-central Brooks Range fold and thrust belt, Alaska: Geology, v. 16, p. 395-399.

Gottschalk, R.R., and Snee, L.W., 1998, Tectonothermal evolution of metamorphic rocks in the south-central Brooks Range, Alaska; constraints from 40Ar/39Ar geochronology, in Oldow, J.S., and Ave Lallemant, H.G., eds., Architecture of the central Brooks Range fold and thrust belt, Arctic Alaska: Boulder, Colorado, Geological Survey of America Special Paper 324, p. 225-251.

Gottschalk, R.R., Oldow, J.S., and Avé Lallemant, H.G., 1998, Geology and Mesozoic structural history of the south-central Brooks Range, Alaska, in Oldow, J.S., and Ave Lallemant, H.G., eds., Architecture of the central Brooks Range fold and thrust belt, Arctic Alaska: Boulder, Colorado, Geological Survey of America Special Paper 324, p. 195-223.

Gradstein, F.M. and Ogg, J.G., 2005, Time scale: in Selley, R.C., Cocks, L.R.P., and Plimer, I.R., eds., Encyclopedia of geology: Imperial College, London, Elsevier Academic Press, v. 5.

Grantz, A., Tailleur, I.L., and Carter, C., 1983, Tectonic significance of Silurian and Ordovician graptolites, Lisburne Hills, northwest Alaska: Geological Society of America Abstracts with Programs, v. 15, no. 5, p. 274.

Handschy, J.W., 1998, Spatial variation in structural style, Endicott Mountains allochthon, central Brooks Range, Alaska, in Oldow, J.S., and Ave Lallemant, H.G., eds., Architecture of the central Brooks Range fold and thrust belt, Arctic Alaska: Boulder, Colorado, Geological Survey of America Special Paper 324, p. 33-50.

Harris, A.G., Harris, L.D., and Epstein, J.B., 1978, CAI and gas data from Paleozoic rocks in the Appalachian basin: maps for assessing hydrocarbon potential and thermal maturity (conodont color alteration isograds and overburden isopachs): U.S. Geological Survey Miscellaneous Investigations Series Map I-917-B, 4 sheets, scale 1:2,500,000.

Hitzman, M.W., 1986, Geology of the Ruby Creek copper deposit, southwestern Brooks Range, Alaska: Economic Geology and the Bulletin of the Society of Economic Geologists, v. 81, no. 7, p. 1644-1674.

Hitzman, M.W., Proffett, J.M. Jr., Schmidt, J.M., and Smith, T.E., 1986, Geology and mineralization of the Ambler District, northwestern Alaska: Economic Geology and the Bulletin of the Society of Economic Geologist, v. 81, no. 8, p. 1592-1618.

Hitzman, M.W., Smith, T.E., and Proffett, J.M., 1982, Bedrock geology of the Ambler District, southwestern Brooks Range, Alaska: Alaska Division of Geological and Geophysical Surveys Geologic Report 75, 2 sheets, scale 1:125,000.

Jones, D.L., Coney, P.J., Harms, T.A., and Dillon, J.T., 1988, Interpretive geologic map and supporting radiolarian data from the Angayucham Terrane, Coldfoot area, southern Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1993, 1 sheet, scale 1:63,360.

Julian, F.E., and Oldow, J.S, 1998, Structure and lithology of the lower Paleozoic Apoon assemblage, eastern Doonerak window, central Brooks Range, Alaska, *in* Oldow, J.S., and Avé Lallemant, H.G., eds., Architecture of the Central Brooks Range Fold and Thrust Belt, Artic Alaska: Boulder, Colorado, Geological Society of America Special Paper 324, p. 65-80.

Karl, S.M., 1992, Arc and extensional basin geochemical and tectonic affinities for Maiyumerak basalts in the western Brooks Range, in Bradley, D.C., and Ford, A.B., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1990: U.S. Geological Survey Bulletin 1999, p. 141-155.

Karl, S.M., Aleinikoff, J.N., Dickey, C.F., and Dillon, J.T., 1989a, Age and chemical composition of Proterozoic intrusive rocks at Mount Angayukaqsraq, western Brooks Range, Alaska, *in* Dover, J.H., and Galloway, J.P., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1988: U.S. Geological Survey Bulletin 1903, p. 10-19.

Karl, S.M., and Aleinikoff, J.N., 1990, Proterozoic U-Pb zircon age of granite in the Kallarichuk hills, western Brooks Range Alaska: Evidence for Precambrian basement in the schist belt, in Dover, J.H., and Galloway, J.P., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1989: U.S. Geological Survey Bulletin 1946, p. 95-100.

Karl, S. M., Dumoulin, J. A., Ellersieck, Inyo, Harris, A. G., and Schmidt, J. M., 1989b, Preliminary geologic map of the Baird Mountains and part of the Selawik quadrangles, Alaska: U.S. Geological Survey Open-File Report 89-551, 65 p., 1 pl., scale 1:250,000.

Karl, S.M., Schmidt, J.M., and Folger, P.F., 1985, Selected anomalous rock and sediment samples from central and northwestern Baird Mountains quadrangle, in Bartsch-Winkler, S., ed., The United States Geological Survey in Alaska: Accomplishments during 1984: U.S. Geological Survey Circular 967, p. 8-13.

Keller, A.S., Morris, R.H., and Detterman, R.L., 1961, Geology of the Shaviovik and Sagavanirktok Rivers region. Alaska, *in* Exploration of Naval Petroleum Reserve No. 4 and adjacent areas, northern Alaska, 1944-53; Part 3, Areal geology: U.S. Geological Survey Professional Paper, 303-D, p. D169-D222, incl. geologic map, scale 1:125,000.

Law, R.D., Miller, E.L., Little, T.A., and Lee, J., 1994, Extensional origin of ductile fabrics in the Schist Belt, central Brooks Range, Alaska—II. Microstructural and petrofabric evidence: Journal of Structural Geology, v. 16, p. 919-940.

Leffingwell, E. de K., 1919, The Canning River region, northern Alaska: U.S. Geological Survey Professional Paper, 109, 251 p., incl. geologic map, scale 1:250,000.

Little, T.A., Miller, E.L., Lee, J., and Law, R.D., 1994, Extensional origin of ductile fabrics in the Schist Belt, central Brooks Range, Alaska—I. Geologic and structural studies: Journal of Structural Geology, v. 16, p. 899-918.

Loney, R.A. and Himmelberg, G.R., 1985, Ophiolitic ultramafic rocks of the Jade Mountains-Cosmos hills area, southern Brooks Range: Geologic studies in Alaska by the U.S. Geological Survey during 1984: U.S. Geological Survey Circular, 967, p. 13-15.

Mayfield, C.F., 1976, Metamorphism in the southwestern Brooks Range, *in* Cobb, E.H., ed., The United States Geological Survey in Alaska; accomplishments during 1975: U.S. Geological Survey Circular 733, p. 31-32.

Mayfield, C. F., and Tailleur, I. L., 1978, Bedrock geology map of the Ambler River quadrangle, Alaska: U.S. Geological Survey Open-File Map 79-120A, 1 sheet, scale 1:250,000.

Mayfield, C. F., Tailleur, I. L., and Ellersieck, I., 1988, Stratigraphy, structure, and palinspastic synthesis of the western Brooks Range, northwestern Alaska, *in* Gryc, G., ed., Geology and Exploration of the National Petroleum Reserve in Alaska, 1974-1982: U.S. Geological Survey Professional Paper 1399, p. 143-186.

McClelland, W.C., Schmidt, J.M., Till, A.B., 2006, New U-Pb Shrimp ages from Devonian felsic volcanic and Proterozoic plutonic rocks of the southern Brooks Range, Alaska: Geologic Survey of America Abstracts with Programs, v. 38, no. 5, p. 13.

Miller, E.L., Soloviev, A., Gehrels, G., and Wooden, J., 2007, U-Pb and fission track dating of detrital zircon suites from Jura-Cretaceous (J3-K1) syn-orogenic deposits of Chukotka, Russia: implications for Brookian orogenesis in the Arctic: Geological Society of America Abstracts with Programs, v. 39, no. 4, p. 68-69.

Moore, T.E., Aleinikoff, J.N., and Harris, A.G., 1997a, Stratigraphic and structural implications of conodont and detrital zircon U-Pb ages from metamorphic rocks of the Coldfoot terrane, Brooks Range, Alaska: Journal of Geophysical Research, v. 102, no. B9, p. 20,797-20,820.

Moore, T. E., and Nilsen, T. H., 1984, Regional sedimentological variations in the Upper Devonian and Lower Mississippian(?) Kanayut Conglomerate, Brooks Range, Alaska: Sedimentary Geology, v. 38, p. 465-497.

Moore, T.E., Potter, C.J., O'Sullivan, P.B., and Aleinikoff, J.N., 2007, The Brooks Range foreland basin – where is the provenance for Brookian sedimentation?: Geological Society of America Abstracts with Programs, v. 39, no. 4, p. 69.

Moore, T.E., Wallace, W.K., Bird, K.J., Karl, S.M., Mull, C.G., and Dillon, J.T., 1994, The Geology of Northern Alaska, *in* Plafker, G., and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America, The Geology of North America, v. G-1, p. 49-140.

Moore, T. E., Wallace, W. K., Mull, C. G., Adams, K. E., Plafker, G., and Nokleberg, W. J., 1997b, Crustal implications of bedrock geology along the Trans-Alaska Crustal Transect (TACT) in the Brooks Range, northern Alaska: Journal of Geophysical Research, v. 102, p. 20,645-20,684.

Mull, C.G., 1982, Tectonic evolution and structural style of the Brooks Range, Alaska: an illustrated summary, *in* Powers, R.B., ed., Geological studies of the Cordilleran thrust belt: Denver, Colorado, Rocky Mountain Association of Geology, v. 1, p. 1-45.

Mull, C.G., Adams, K.E., and Dillon, J.T., 1987, Stratigraphy and structure of the Doonerak fenster and Endicott Mountains allochthon, central Brooks Range, Alaska, *in* Tailleur, I.L. and Weimer, Paul, eds., Alaskan North Slope Geology: Bakersfield, Calif., Pacific Section Society for Sedimentary Geology (SEPM) and Alaska Geological Society, v. 2, p. 663-679.

Mull, C.G., Harris, A.G., and Carter, J.L., 1997, Lower Mississippian (Kinderhookian) biostratigraphy and lithostratigraphy of the western Endicott Mountains, Brooks Range, Alaska, *in* Dumoulin, J.A., and Gray, J.E., eds., Geological studies in Alaska by the U.S. Geological Survey, 1995: U.S. Geological Survey Professional Paper 1574, p. 221-242.

Mull, C.G., and Tailleur, I.L., 1977, Sadlerochit(?) Group in the Schwatka Mountains, south-central Brooks Range, *in* Blean, K.M., ed., The United States Geological Survey in Alaska: Accomplishments During 1976: U.S. Geological Survey Circular 751-B., p. B27-29.

Mull, C.G., Tailleur, I.L., Mayfield, C.F., Ellersieck, I., Curtis, S., 1982, New upper Paleozoic and Mesozoic stratigraphic units, central and western Brooks Range, Alaska: American Association of Petroleum Geologists Bulletin, v. 66, p. 348-362.

Murphy, J.M., and Patton, W.W. Jr., 1988, geologic setting petrography of the phyllite and metagraywacke thrust panel, North-Central Alaska: Geologic studies in Alaska by the U.S. Geological Survey during 1987: U.S. Geological Survey Circular 1016, p. 104-108.

Nelson S.W., and Grybeck, D., 1980, Geologic map of the Survey Pass quadrangle, Brooks Range, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1176-A, 2 sheets, scale 1:250,000.

Nelson, B.K., Nelson, S.W., and Till, A.B., 1993, Nd- and Sr-isotope evidence for Proterozoic and Paleozoic crustal evolution in the Brooks Range: The Journal of Geology, v. 101, p. 435-450.

Newberry, R.J., Allegro, G.L., Cutler, S.E., Hagen-Levelle, J.H., Adams, D.D., Nicholson, L.C., Weglarz, T.B., Bakke, A.A., Claütice, K.H., Coulter, G.A., Ford, M.J., Myers, G.L., and Szumigala, D.J., 1997, Skarn deposits of Alaska: *in* Goldfarb, R.J., and Miller, L.D., eds., Mineral deposits of Alaska: Economic Geology Monograph 9, p. 355-395

Nilsen, T.H., 1989, Stratigraphy and sedimentology of the Mid-Cretaceous deposits of the Yukon-Koyukuk basin, west central Alaska: Journal of Geophysical Research, v. 94, n. B11, p. 15925-15940.

Nilsen, T.H., and Moore, T.E., 1982, Fluvial-facies model for the Upper Devonian and Lower Mississippian(?) Kanayut Conglomerate, Brooks Range, Alaska, *in* Embry, A.F., and Bankwill, H.R., eds., Arctic geology and geophysics; proceedings of the 3rd international symposium on Arctic geology: Canadian Society of Petroleum Geologists Memoir 8, p. 1-12.

Nilsen, T.H., Brosgé, W.P., and Dutro, J.T., Jr., 1985, New reference section of the Noatak Sandstone, Nimiuktuk River, western Brooks Range, Alaska: U.S. Geological Survey Circular 945, p. 10-13.

O'Sullivan, P.B., Moore, T.E., and Murphy, J.M., 1998, Tertiary uplift of the Mt. Doonerak Antiform, central Brooks Range, Alaska; apatite fission-track evidence from the Trans-Alaska crustal transect, *in* Oldow, J.S., and Avé Lallemant, H.G., eds., Architecture of the central Brooks Range fold and thrust belt, arctic Alaska: Boulder, Colorado, Geological Society of America Special Paper 324, p. 179-193.

O'Sullivan, P.B., Murphy, J.M., and Blythe, A.E., 1997, Late Mesozoic and Cenozoic thermotectonic evolution of the central Brooks Range and adjacent North Slope foreland basin, Alaska: Including fission track results from the Trans-Alaska Crustal Transect (TACT): Journal of Geophysical Research, v. 102, no. B9, p. 20821-20845.

Oldow, J.S., Boler, K.W., Avé Lallemant, H.G., Gottschalk, R.R., Julian, F.E., Seidensticker, and C.M., Phelps, J.C., 1998, Stratigraphy and paleogeographic setting of the eastern Skajit allochthon, central Brooks Range, Artic Alaska, *in* Oldow, J.S., and Avé Lallemant, H.G., eds., Architecture of the central Brooks Range fold and thrust belt, arctic Alaska: Boulder, Colorado, Geological Society of America Special Paper 324, p. 109-125.

Oliver, W.A., Jr., Merriam, C.W., and Churkin, Michael, Jr., 1975, Ordovician, Silurian, and Devonian corals of Alaska: U.S. Geological Survey Professional Paper 823-B, p. 13-44.

Pallister, J.S., Budahn, J.R., and Murchey, B.L., 1989, Pillow basalts of the Angayucham Terrane: Oceanic plateau and island crust accreted to the Brooks Range: Journal of Geophysical Research, v. 94, p. 15901-15923.

Pallister, J.S., and Carlson, C., 1988, Bedrock geologic map of the Angayucham Mountains, Alaska: U.S. Geological Survey Miscellaneous Field Map MF-2024, 1 sheet, scale 1:63,360.

Patrick, B., 1995, High-pressure-low-temperature metamorphism of granitic orthogneiss in the Brooks Range, northern Alaska: Journal of Metamorphic Geology, v. 13, n. 1, p. 111-124.

Patrick, B., Till, A.B., and Dinklage, W.S., 1994, An inverted metamorphic field gradient in the central Brooks Range, Alaska and implications for exhumation of high-pressure/low-temperature metamorphic rocks: Lithos, v. 33, p. 67-93.

Patton, W.W., Jr., 1957, A new upper Paleozoic formation, central Brooks Range, Alaska, *in* Exploration of Naval Petroleum Reserve No. 4 and adjacent areas, northern Alaska, 1944-53; Part 3, Areal geology: U.S. Geological Survey Professional Paper, 303-B, p. B42-B43.

Patton, W.W., Jr., and Box S.E., 1989, Tectonic setting of the Yukon-Koyukuk basin and its borderlands, Western Alaska: Journal of Geophysical Research, v. 94, no. B11, p. 15807-15820.

Patton, W.W., Jr., Box, S.E., Moll-Stalcup, E.J., and Miller, T.P., 1994, Geology of West-Central Alaska, *in* Plafker, G., and Berg, H.C., eds., The Geology of Alaska: Boulder, Colorado, Geological Society of America, The Geology of North America, v. G-1, p. 241-269.

Patton, W.W., Jr., Wilson, F.H., Labay, K.A., and Shew, N., 2005, Digital Data for the Reconnaissance Geologic Map of the Yukon-Koyukuk Basin, Alaska: U.S. Geological Survey Open-File Report 2005-1341, 2 sheets, scale 1:500,000.

Patton, W.W., Jr., and Miller, T.P., 1968, Regional geologic map of the Selawik and southeastern Baird Mountains quadrangles, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-530, 1 sheet, scale 1:250,000.

Patton, W.W., Jr., and Miller, T.P., 1973, Bedrock geologic map of Bettles and southern part of Wiseman quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-492, scale 1:250,000.

Patton, W.W., Jr., Miller, T.P., and Tailleur, I.L., 1968, Regional geologic map of the Shungnak and southern part of the Ambler River quadrangles, Alaska: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-554, 1 sheet, scale 1:250,000.

Patton, W.W., Jr., Stern, T.W., Arth, J.G., and Carlson, C., 1987, New U/Pb ages from granite and granite gneiss in the Ruby geanticline and southern Brooks Range, Alaska: Journal of Geology, v. 95, p. 118-126.

Pessel, G.H., Garland, R.E., Tailleur, I.L., and Eakins, G.R., 1973, Preliminary geologic and mineral evaluation of the Ambler River drainage, Alaska: Alaska Division of Geological & Geophysical Surveys, Alaska Open File Report 27, 7 p., 1 sheet, scale 1:63,360.

Raterman, N.S., McClelland, W.C., and Presnell, R.D., 2006, Geochronology and lithogeochemistry of volcanic rocks of the Ambler District, southern Brooks Range, Alaska [abs.]: Geologic Survey of America Abstracts with Programs, v. 38, no. 5, p. 69.

Reed, B.L., and Hemley, J.J., 1966, Occurrence of Pyrophyllite in the Kekiktuk Conglomerate, Brooks Range, Northeastern Alaska [Abs.]: Geological Survey Research, U.S. Geological Survey Professional Paper 550-C, p. C162-C166.

Rejebian, V.A., Harris, A.G., and Huebner, J.S., 1987, Conodont color and textural alteration: An index to regional metamorphism, contact metamorphism, and hydrothermal alteration: Geological Society of America Bulletin, v. 99, p. 471-479.

Repetski, J. E., Carter, Claire, Harris, A. G., and Dutro, J. T., Jr., 1987, Ordovician and Silurian fossils from the Doonerak anticlinorium, central Brooks Range, Alaska, *in* Hamilton, T. D., and Galloway, J. P., eds., Geologic studies in Alaska by the U. S. Geological Survey during 1986: U. S. Geological Survey Circular 998, p. 40-42.

Roeske, S.M., Dusel-Bacon, C., Aleinikoff, J.N., Snee, L.W., and Lanphere, M.A., 1995, Metamorphic and structural history of continental crust at a Mesozoic collisional margin, the Ruby terrane, central Alaska: Journal of Metamorphic Geology, v. 13, p. 25-40.

Roeske, S.M., Till, A.B., Layer, P.W., and Harms, T.A., 2003, Kobuk fault zone of the southern Brooks Range, Alaska, preserves Paleocene exhumation of amphibolite grade rocks along a dextral strike-slip fault system [abs.]: Geological Society of America Abstracts with Programs, v. 35, no. 6, p. 474.

Ryherd, T.J., and Paris, C.E., 1987, Ordovician through Silurian carbonate base-of-slope apron sequence, northern Seward Peninsula, Alaska [abs.], *in* Tailleur, I.L., and Weimer, Paul, eds., Alaskan North Slope geology: Bakersfield, California, Pacific Section, Society of Economic Paleontologists and Mineralogists, book 50, p. 347-348.

Sable, E.G., and Dutro, J.T., Jr., 1961, New Devonian and Mississippian formations in DeLong Mountains, northern Alaska: American Association of Petroleum Geologists Bulletin, v. 45, no. 5, p. 585-593.

Schmidt, J.M., 1986, Stratigraphic setting and mineralogy of the Arctic volcanogenic massive sulfide prospect, Ambler district, Alaska: Economic Geology and the Bulletin of the Society of Economic Geologists, v. 81, n. 7, p. 1619-1643.

Schmidt, J.M., and Allegro, G.L., 1988, Map showing mineral occurrences and indicators in the Baird Mountains quadrangle, northwestern Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-1992, scale 1:250,000.

Schmidt, J.M., and Folger, P.F., 1986, Pb-Zn-Ag mineralization in Paleozoic dolostones, Powdermilk prospect, Baird Mountains B-4 quadrangle, *in* Bartsch-Winkler, S., and Reed, K.M., eds., Geologic Studies in Alaska by the U.S. Geological Survey during 1985: U.S. Geological Survey Circular 978, p. 19-21.

Schrader, F.C., 1902, Geologic section of the Rocky Mountains in northern Alaska: Geological Society of America Bulletin, v. 13, p. 233-252.

Seidensticker, C.M., and Oldow, J.S., 1998, Structural development and kinematic history of ramp-footwall contraction in the Doonerak multiduplex, central Brooks Range, Arctic Alaska, *in* Oldow, J.S., and Avé Lallemant, H.G., eds., Architecture of the central Brooks Range fold and thrust belt, Arctic Alaska: Boulder, Colorado, Geological Survey of America Special Paper 324, p. 81-108.

Smith, P.S., 1913, The Noatak-Kobuk region, Alaska: U.S. Geological Survey Bulletin 536, 160 p., incl. geologic map, scale 1:500,000.

Smith, P.S., and Mertie, J.B., Jr., 1930, Geology and mineral resources of northwestern Alaska: U.S. Geological Survey Bulletin, 815, 351 p., incl. geologic map, scale 1:500,000.

Smith, T.E., Webster, G.D., Heatwole, D.A., Proffett, J.M., Kelsey, G.L., and Glavinovich, P.S., 1978, Evidence for mid-Paleozoic depositional age of volcanogenic base-metal massive sulfide occurrences and enclosing strata, Ambler district, northwest Alaska [abs.]: Geologic Society of America Abstracts with Programs, v. 10, p. 148.

Spear, F.S., 1993, Metamorphic phase equilibria and pressure-temperature-time paths: Mineralogical Society of America, Monograph, p. 351.

Tailleur, I. L., Brosgé, W. P., and Reiser, H. N., 1967, Palinspastic analysis of Devonian rocks in northwestern Alaska, *in* Oswald, D. H., ed., International Symposium on the Devonian System, v. 2: Calgary, Alberta Society of Petroleum Geologists, p. 1345-1361.

Till, A.B., 1989, Proterozoic Rocks of the Western Brooks Range: Geologic Studies in Alaska by the U.S. Geologic Survey, 1988: U.S. Geological Survey Bulletin 1903, p. 20-25.

Till, A.B., Aleinikoff, J.N., Amato, J.M., and Harris, A.G., 2006, New paleontologic and geochronologic protolith ages for the paleocontinental margin of Arctic Alaska [abs.]: Geologic Survey of America Abstracts with Programs, v. 38, no. 5, p. 13.

Till, A.B., Dumoulin, J. A., Gamble, B. M., Kaufman, D. S., and Carroll, P. I., 1986, Preliminary geologic map and fossil data, Solomon, Bendeleben, and southern Kotzebue quadrangles, Seward Peninsula, Alaska: U.S. Geological Survey Open-File Report 86-276, 74 p., 3 sheets, scale 1:250,000.

Till, A.B., and Moore,T.E., 1991, Tectonic relations of the schist belt, southern Brooks Range, Alaska: Eos, Transactions, American Geophysical Union, v. 72, no. 44, p. 295-296.

Till, A.B., Schmidt, J.M., and Nelson, S.W., 1988, Thrust involvement of metamorphic rocks, southwestern Brooks Range, Alaska: Geology, v. 16, p. 930-933.

Till, A.B., and Snee, L.W., 1995, $^{40}Ar/^{39}Ar$ evidence that deformation of blueschists in continental crust was synchronous with foreland fold and thrust belt deformation, western Brooks Range, Alaska, *in* Patrick, B.E., and Day, H.W., eds., Special issue on Cordilleran high-pressure metamorphic terranes: Journal of Metamorphic Geology, v. 13, p. 41-60.

Toro, J., 1998, Structure and thermochronology of the metamorphic core of the central Brooks Range, Alaska [Ph.D. Thesis]: Palo Alto, Calif., Stanford University. 200 p.

Toro, J., Cole F.E., and Meier, J.M., 1998, $^{40}Ar/^{39}Ar$ ages of detrital minerals in Lower Cretaceous rocks of the Okpikruak Formation; evidence for upper Paleozoic metamorphic rocks in the Koyukuk Arc, *in* Gray, J.E., and Riehle, J.R., eds., Geologic studies in Alaska by the U.S. Geological Survey, 1996: U.S. Geological Survey Professional Paper 1595, p. 169-182.

Toro, J., Gans, P.B., McClelland, W.C., and Dumitru, T.A., 2002, Deformation and exhumation of the Mount Igikpak region, central Brooks Range, Alaska, *in* Miller, E.L., Grantz, A., and Klemperer, S.L., eds., Tectonic evolution of the Bering Shelf-Chukchi Sea-Arctic margin and adjacent landmasses: Boulder, Colorado, Geological Society of America Special Paper 360, p. 111-132.

Turner, D.L., Forbes, R.B., and Dillon, J.T., 1979, K-Ar geochronology of the southwestern Brooks Range, Alaska: Canadian Journal of Earth Sciences, v. 16, p. 1789-1804.

Vogl, J.J., 2002, Late-orogenic backfolding and extension in the Brooks Range collisional orogeny, northern Alaska: Journal of Structural Geology, v. 24, p. 1753-1776.

Vogl, J.J., 2003, Thermal-baric structure and P-T history of the Brooks Range metamorphic core, Alaska: Journal of Metamorphic Geology, v. 21, p. 269-284.

Vogl, J.J., Calvert, A.T., and Gans, P.B., 2002, Mechanisms and timing of exhumation of collision-related metamorphic rocks, southern Brooks Range, Alaska; insights from $^{40}Ar/^{39}Ar$ thermochronology: Tectonics, v. 21, no. 3, 18 p.

Watts, K.F., Harris, A.G., Carlson, R.C., Eckstein, M.K., Gruzlovic, P.D., Imm, T.A., Krumhardt, A.P., Lasota, D.K., Morgan, S.K., Enos, Paul, Goldstein, R., Dumoulin, J.A., and Mamet, B., 1994, Analysis of reservoir heterogeneities due to shallowing-upward cycles in carbonate rocks of the Upper Mississippian and Pennsylvanian Wahoo Limestone of northeastern Alaska, Department of Energy Report, Contract DE-AC22-89BC14471, 433 p.

Wirth, K.R., Bird, A.E., Blythe, A.E., and Harding, D.J., 1993, Age and Evolution of western Brooks Range ophiolites in Alaska: Results from $^{40}Ar/^{39}Ar$ thermochronometry: Tectonics, v. 12, p. 410-432.

Young, L.E., 2004, A geologic framework for mineralization in the western Brooks Range, Alaska: Economic Geology, v. 99, p. 1281-1306.

Zayatz, M.R., Thompson, W.B., Bailey, E.A., Sutley, S.J., Folger, P.F., Karl, S.M., and Schmidt, J.M., 1988, Analytical results and sample locality maps of mineralized and unmineralized rock samples from the Baird Mountains quadrangle, Alaska: U.S. Geological Survey Open-File Report 88-256-A, p. 159, scale 1:250,000.

TABLE 1. Selected U-Pb zircon analyses

[- not reported]

Field number or station	Regional belt or assemblage	Unit	Quadrangle	Locality	Latitude degrees	Latitude decimal minutes	Longitude degrees	Longitude decimal minutes	Mineral dated	Interpreted age (Ma)	Interpreted age error (Ma)	Rock Type	Reference
77Dn74D	Central	Dg	Survey Pass	Arrigetch peak, Devonian plutonic rocks	67	22.500	-154	10.500	zircon	365	15	Epidote-biotite-quartz monzonite orthogneiss	Dillon and others, 1980
77Dn74M	Central	Dg	Survey Pass	Arrigetch peak, Devonian plutonic rocks	67	22.500	-154	10.500	zircon	365	15	Epidote-biotite-quartz monzonite orthogneiss	Dillon and others, 1980
W-1	Central	Pg	Wiseman	Ernie Lake, Proterozoic plutonic rocks	67	24.747	-152	48.669	zircon	971	5	Granitic orthogneiss	McClelland and others, 2006
85Dn24	Central	Fault lense	Baird Mountains	Mount Angayukaqsraq granite	67	44.442	-159	30.000	zircon	750	6	Alkali feldspar granite	Karl and others, 1989
78Md120	Central	Pam	Baird Mountains	Mount Angayukaqsraq granodiorite	67	42.264	-159	25.368	zircon	750	6	Granodiorite	Karl and others, 1989
93-JT-88	Central	Dg	Survey Pass	Mt. Igikpak Area	67	30.100	-154	59.400	zircon	375-395	-	Orthogneiss	Toro and others, 2002
90TM409	Central	Dmu	Wiseman	Nutirwik Creek unit dacite porphyry	67	52.284	-149	43.896	zircon	393	2	Dacite porphyry	Aleinikoff and others, 1993
90TM497	Central	Dmu	Wiseman	Nutirwik Creek unit plagioclase porphyry	67	58.634	-149	30.590	zircon	385	2	Plagioclase porphyry	Aleinikoff and others, 1993
Not reported	Schist	Da	Ambler River	Ambler sequence - Arctic deposit	67	11.252	-156	23.008	zircon	376	3	Metarhyolite	Raterman and others, 2006
Not reported	Schist	Da	Ambler River	Ambler sequence - Arctic deposit	67	11.252	-156	23.008	zircon	376	2	Metarhyolite	Raterman and others, 2006
Not reported	Schist	Da	Ambler River	Ambler sequence - Arctic deposit	67	11.252	-156	23.008	zircon	379	3	Metarhyolite	Raterman and others, 2006
Not reported	Schist	Da	Ambler River	Ambler sequence - Arctic deposit	67	11.252	-156	23.008	zircon	405	3	Metarhyolite	McClelland and others, 2006
Not reported	Schist	Da	Wiseman	Ambler sequence - Sun/Picnic Ck prospect	67	5.202	-155	1.760	zircon	386	2	Metarhyolite	McClelland and others, 2006
Not reported	Schist	Da	Ambler River	Ambler sequence - Tom--Tom prospect	67	8.078	-156	8.721	zircon	381	2	Metarhyolite	McClelland and others, 2006
90ANK012	Schist	Dg	Chandalar	Baby Creek orthogneiss body	67	28.280	-149	0.550	zircon, monazite	381-398	-	Orthogneiss	Aleinikoff and others, 1993
87ATi70A	Schist	Dg	Wiseman	Beaver Creek	67	6.268	-155	18.603	zircon	400	4	Granitic orthogneiss	McClelland, written comm. 2006
SH-1	Schist	Dg	Shunghak	Cosmos Hills - Kogoluktuk	66	58.302	-156	42.919	zircon	386	3	Granitic orthogneiss	McClelland, written comm. 2006
90TM408	Schist	Dg	Chandalar	Geroe Creek orthogneiss body	67	42.030	-148	42.354	zircon, sphene	391 or 393?	1	Hornblende-biotite granite gneiss	Aleinikoff and others, 1993
90TM498	Schist	DPsc	Chandalar	Horace Mountain plutons	67	39.500	-149	11.700	zircon, sphene	393	2	Hornblende-biotite granite gneiss	Aleinikoff and others, 1993
85SK175B	Schist	PzPg	Baird Mountains	Kallarichuk Hills metagranitic body	67	2.094	-160	10.068	zircon	705	35	Alkali feldspar granite	Karl and Aleinikoff, 1990
88TM137	Schist	Dg	Wiseman	Middle Fork Koyukuk River orthogneiss body	67	21.480	-150	9.816	zircon	392	-	Orthogneiss	Aleinikoff and others, 1993
77Dn43	Schist	Dg	Wiseman	Wild River, Devonian plutonic rocks	67	19.350	-151	20.050	zircon	365	15	Garnet-epidote-biotite-quartz monzonite banded orthogneiss	Dillon and others, 1980

TABLE 2. Selected $^{40}Ar/^{39}Ar$ analyses

[* no plateau; - not reported]

Field number or station	Regional belt or assemblage	Unit	Quadrangle	Locality	Latitude degrees	Latitude decimal minutes	Longitude degrees	Longitude decimal minutes	Mineral dated	Preferred age (Ma)	Preferred age error (Ma)	Total fusion age (Ma)	Total fusion age error (Ma)	Plateau age (Ma)	Plateau age error (Ma)	Isochron age (Ma)	Isochron age error (Ma)	Rock Type	Reference	Comments
APK90-111	Arrigetch-Igikpak thermal high	DPsm	Survey Pass	Arrigetch area	67	17.2102	-154	18.8263	Biotite	95.2	0.2	95.1	0.2	95.2	0.2	-	-	Pelitic schist	Till, unpublished data	
APK94-105	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Arrigetch area	67	25.3612	-154	5.3282	Biotite	90.5	0.4	90.5	-	91.0	0.1	90.3	0.4	Granitic orthogneiss	Vogl and others, 2002	Labeled APK90-105 in Table 1: Summary of Argon Thermochronology Data (Vogl and others, 2002); original sample number is APK90-105.
APK90-121	Arrigetch-Igikpak thermal high	DPsm	Survey Pass	Arrigetch area	67	16.6852	-154	21.4280	Hornblende	105.1	1	105.9	0.4	-	-	104.5	0.6	Metabasite	Till, unpublished data	
APK90-119	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Arrigetch area	67	17.1827	-154	22.1319	White mica	95.5	1	95.6	0.2	96.2	0.2	95.5	1	Pelitic schist	Patrick and others, 1994 and A. Till, 2004, written communication	
93-JT-124	Arrigetch-Igikpak thermal high	DPgn	Survey Pass	Mt. Igikpak area	67	29.8265	-154	58.0820	Biotite	102	0.2	101.95	0.20	102.20	0.20	102.51	0.22	Biotite-garnet schist	Toro and others, 2002	
93-JT-142	Arrigetch-Igikpak thermal high	[DPgn]	Survey Pass	Mt. Igikpak area	67	32.0667	-154	58.0667	Biotite	95	0.3	94.85	0.14	94.19	0.15	94.92	0.33	Biotite-garnet schist	Toro and others, 2002	Locality of the sample plots in Q as shown by Toro and others (2002)
93-JT-143	Arrigetch-Igikpak thermal high	DPgn	Survey Pass	Mt. Igikpak area	67	33.1000	-154	59.4000	Biotite	89	0.2	89.18	0.13	89.27	0.13	89.53	0.20	Biotite-garnet schist	Toro and others, 2002	
93-JT-88	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Mt. Igikpak area	67	30.1000	-154	59.4000	Biotite	77	0.3	77.02	0.12	77.26	0.12	77.99	0.31	Orthogneiss	Toro and others, 2002	
94-JT-79	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Mt. Igikpak area	67	25.2000	-155	2.2000	Biotite	85	1	85.12	0.83	84.98	0.83	85.28	0.92	Orthogneiss	Toro and others, 2002	
94-JT-19	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Mt. Igikpak area	67	30.1000	-155	11.4000	Hornblende	96	1.7	94.12	0.91	96.16	0.93	95.47	1.73	Skarn: marble	Toro and others, 2002	
94-JT-33	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Mt. Igikpak area	67	30.0000	-155	5.7000	Hornblende	97	1	98.72	0.95	97.96	0.94	97.61	2.52	Orthogneiss	Toro and others, 1998	
93-JT-96	Arrigetch-Igikpak thermal high	Pzm	Survey Pass	Mt. Igikpak area	67	34.7000	-154	52.8000	White mica	97	0.3	96.21	0.15	97.15	0.14	97.22	0.30	Marble	Toro and others, 2002	
94-JT-79	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Mt. Igikpak area	67	25.2000	-155	2.2000	White mica	84	1	84.59	0.83	84.18	0.82	83.81	1.00	Orthogneiss	Toro and others, 2002	
93-JT-85	Arrigetch-Igikpak thermal high	PzPm	Survey Pass	Mt. Igikpak area	67	31.5000	-154	57.5000	White mica	74	0.4	72.94	0.25	74.29	0.22	74.45	0.40	Quartz muscovite schist	Toro and others, 2002	
AVL94-78	Arrigetch-Igikpak thermal high	DPsm	Survey Pass	Northern Epidote-Amphibolite Zone (Northern Part)	67	26.4721	-154	12.5705	Biotite	89	0.4	89.2	-	89.5	0.1	89.3	0.4	not reported	Vogl and others, 2002	
AVL95-43	Arrigetch-Igikpak thermal high	DPsm	Survey Pass	Northern Epidote-Amphibolite Zone (Northern Part)	67	28.8905	-154	14.8690	Biotite	84.8	0.4	83.6	-	84.8	0.4	85.7	0.4	not reported	Vogl and others, 2002	
AVL95-52	Arrigetch-Igikpak thermal high	DPsm	Survey Pass	Northern Epidote-Amphibolite Zone (Northern Part)	67	23.7994	-154	14.8269	Biotite	94.6	0.2	94.3	-	94.6	0.1	94.6	0.2	Micaceous quartzite	Vogl and others, 2002	
AVL94-100b	Arrigetch-Igikpak thermal high	DPsm	Survey Pass	Northern Epidote-Amphibolite Zone (Northern Part)	67	27.2199	-154	5.4323	Hornblende	152.1	-	152.1	-	*	*	-	-	Metavolcanic	Vogl and others, 2002	
AVL95-96	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Northern Epidote-Amphibolite Zone (Northern Part)	67	25.5310	-154	4.7753	Hornblende	103.9	0.1	104.5	-	102.9	0.1	-	-	Mafic layer in orthogneiss	Vogl and others, 2002	
AVL94-60	Arrigetch-Igikpak thermal high	DPsm	Survey Pass	Northern Epidote-Amphibolite Zone (Northern Part)	67	26.2511	-154	12.0097	White mica	92	0.1	90.8	-	92.0	0.1	-	-	not reported	Vogl and others, 2002	
AVL95-43	Arrigetch-Igikpak thermal high	DPsm	Survey Pass	Northern Epidote-Amphibolite Zone (Northern Part)	67	28.8905	-154	14.8690	White mica	87.6	0.8	91.7	-	87.6	0.8	87.2	0.9	not reported	Vogl and others, 2002	
AVL95-52	Arrigetch-Igikpak thermal high	DPsm	Survey Pass	Northern Epidote-Amphibolite Zone (Northern Part)	67	23.7994	-154	14.8269	White mica	92.8	0.1	92.9	-	92.8	0.1	92.8	0.2	Micaceous quartzite	Vogl and others, 2002	

TABLE 2. Selected $^{40}Ar/^{39}Ar$ analyses–Continued

[* no plateau; - not reported]

Field number or station	Regional belt or assemblage	Unit	Quadrangle	Locality	Latitude degrees	Latitude decimal minutes	Longitude degrees	Longitude decimal minutes	Mineral dated	Preferred age (Ma)	Preferred age error (Ma)	Total fusion age (Ma)	Total fusion age error (Ma)	Plateau age (Ma)	Plateau age error (Ma)	Isochron age (Ma)	Isochron age error (Ma)	Rock Type	Reference	Comments
AVL95-53	Arrigetch-Igikpak thermal high	DPgn	Survey Pass	Northern Epidote-Amphibolite Zone (Southern Part)	67	21.7901	-154	22.0333	White mica	93.1	0.2	93.1	-	93.1	0.2	93.1	0.2	not reported	Vogl and others, 2002	
90ATi-230A	Arrigetch-Igikpak thermal high	DPsc	Survey Pass	Walker Lake area	67	12.8108	-154	23.0978	Biotite	100	0.2	98.2	-	100.0	0.2	100.5	0.4	Biotite-garnet schist	Vogl and others, 2002	
APK90-38	Arrigetch-Igikpak thermal high	DPsc	Survey Pass	Walker Lake area	67	12.3952	-154	21.8862	Biotite	107	0.2	106.3	0.2	106.9	0.2	-	-	Metabasite	Till, unpublished data	
APK91-14	Arrigetch-Igikpak thermal high	DPsm	Survey Pass	Walker Lake area	67	16.6095	-154	20.2849	Biotite	96	0.3	96.21	0.2	96.4	0.2	96.0	0.3	Metapelite	Till, unpublished data	
AVL95-51	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Walker Lake area	67	23.8301	-154	14.1049	Biotite	90	0.2	89.1	-	90.00	0.2	90.0	0.3	Granitic orthogneiss	Vogl and others, 2002	
AVL95-56	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Walker Lake area	67	20.4842	-154	21.0502	Biotite	92.6	0.4	92.6	-	92.6	0.4	92.5	0.4	Granitic orthogneiss	Vogl and others, 2002	
APK90-108	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Walker Lake area	67	16.9600	-154	22.5600	Biotite	95	0.3	94.3	0.3	94.5	0.3	95.0	0.3	Granitic orthogneiss	Till, unpublished data	
APK90-110	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Walker Lake area	67	17.6887	-154	21.6243	Biotite	93.5	0.2	93.1	0.2	93.3	0.1	93.5	0.2	Granitic orthogneiss	Till, unpublished data	
AVL95-56	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Walker Lake area	67	20.4842	-154	21.0502	White mica	92.3	0.1	92.9	-	92.3	0.1	93.7	0.4	Granitic orthogneiss	Vogl and others, 2002	
APK90-108	Arrigetch-Igikpak thermal high	Dg	Survey Pass	Walker Lake area	67	16.9600	-154	22.5600	White mica	97.7	0.4	97.6	0.20	97.6	0.60	97.7	0.40	Granitic orthogneiss	Vogl and others, 2002	
93-JT-113	Central Belt	Dhf	Survey Pass	Mt. Igikpak area	67	40.8677	-154	41.1575	White mica	111	1.2	112.68	1.07	111.58	1.06	111.38	1.21	Graphitic phyllite	Toro and others, 2002	Sample location based on sample locality map (not based on Lat./Long. given in table) from Toro and others (2002)
87ATi55	Central Belt	Ml	Baird Mountains	Nanielik antiform	67	45.8417	-159	15.7522	Fine white mica	120	0.2	124.1	0.3	120.2	0.3	120.1	0.2	Stretched-cobble metaconglomerate rich in quartz and chert clasts	Till and Snee, 1995	
86ATI75PP	Central Belt	OPc	Baird Mountains	Nanielik antiform	67	36.3240	-159	7.9680	White mica	108.2	0.1	108.2	0.3	-	-	108.2	0.1	Calcareous schist	Till and Snee, 1995	
86ATi91A	Central Belt	Pam	Baird Mountains	Nanielik antiform	67	43.1383	-159	27.4372	White mica	680	1	665	2	-	-	-	-	Metapelite	Till and Snee, 1995	76% of ^{39}Ar released yielded ages 673-681±2 ma
AVL94-62	Central Belt	Dhf	Survey Pass	Northern Epidote-Amphibolite Zone (Northern Part)	67	28.1546	-154	10.3781	White mica	90	0.3	89.2	-	89.9	0.2	89.9	0.3	not reported	Vogl and others, 2002	
AVL94-98	Central Belt	Mc	Survey Pass	Northern Greenschist Zone	67	27.8827	-154	3.1209	Biotite	116.5	0.2	115.2	-	116.5	0.2	114.6	0.4	Kekiktuk conglomerate (?)	Vogl and others, 2002	
AVL94-14	Central Belt	Dhf	Survey Pass	Northern Greenschist Zone	67	29.6920	-153	46.8280	White mica	114	1.5	120.8	-	114.8	1.3	113.8	1.5	not reported	Vogl and others, 2002	
59ABe-478	Doonerak antiform	SCvs	Wiseman	Doonerak antiform	67	54.7000	-150	32.6000	Hornblende	520	17	520	17	-	-	-	-	Mafic volcanic rocks: basaltic and andesitic	Dutro and others, 1976	Best available geochronolgy
65ALe-1	Doonerak antiform	SCvs	Wiseman	Doonerak antiform	67	54.7000	-150	32.6000	Hornblende	384	12	384	12	-	-	-	-	Mafic volcanic rocks: basaltic and andesitic	Dutro and others, 1976	Best available geochronolgy
65ALe-6	Doonerak antiform	SCvs	Wiseman	Doonerak antiform	67	54.8000	-150	24.1000	Hornblende	478	20	478	20	-	-	-	-	Mafic volcanic rocks: basaltic and andesitic	Dutro and others, 1976	Best available geochronolgy
65ALe-6a	Doonerak antiform	SCvs	Wiseman	Doonerak antiform	67	54.8000	-150	24.1000	Hornblende	465	14	465	14	-	-	-	-	Mafic volcanic rocks: basaltic and andesitic	Dutro and others, 1976	Best available geochronolgy
88SR129	Mosquito Terrane	DPm	Bettles	South Fork complex	66	56.4007	-150	38.9200	White mica	54.8	1.3	-	-	54.8	1.3	-	-	not reported	Roeske and others, 2003	
7-26-84-5	Phyllite Belt	Pzpg	Wiseman	Phyllite Belt	67	12.7500	-150	4.4160	White mica	124	1	125.8	5	-	-	124	1	Fine-grained quartz-mica schist	Gottschalk and Snee, 1998	
25b-87	Phyllite belt	Pzpg	Wiseman	Phyllite belt	67	13.4293	-150	8.0135	White mica	113.3	0.5	-	-	113.3	0.5	-	-	Schist	Blythe and others, 1998	

TABLE 2. Selected $^{40}Ar/^{39}Ar$ analyses–Continued

[* no plateau; - not reported]

Field number or station	Regional belt or assemblage	Unit	Quadrangle	Locality	Latitude degrees	Latitude decimal minutes	Longitude degrees	Longitude decimal minutes	Mineral dated	Preferred age (Ma)	Preferred age error (Ma)	Total fusion age (Ma)	Total fusion age error (Ma)	Plateau age (Ma)	Plateau age error (Ma)	Isochron age (Ma)	Isochron age error (Ma)	Rock Type	Reference	Comments
CH-128	Schist belt	DPsc	Ambler River	Cosmos Hills	67	0.0398	-156	46.0346	Coarse-grained white mica	130	0.4	127.5	0.4	-	-	126.8	0.5	Metabasite margin	Christiansen and Snee, 1994	
CH-128	Schist belt	DPsc	Ambler River	Cosmos Hills	67	0.0398	-156	46.0346	Fine-grained white mica	127.1	0.5	121.9	0.3	-	-	120.5	0.7	Metabasite margin	Christiansen and Snee, 1994	
CH-104b	Schist belt	Dsq	Shungnak	Cosmos Hills	66	58.1767	-156	47.8253	Fuchsite	99.2	0.3	98.7	0.4	-	-	96.8	1.3	Graphitic phyllite	Christiansen and Snee, 1994	
PCBR-65	Schist belt	Dg	Shungnak	Cosmos Hills	66	58.2037	-156	43.0370	Muscovite	102.7	0.1	103.0	0.3	-	-	101.9	0.4	Granitic orthogneiss	Christiansen and Snee, 1994	
CH-126	Schist belt	DSc	Ambler River	Cosmos Hills	67	0.1403	-156	55.7733	White mica	103	1.2	102.0	0.4	*	*	100.3	1.2	Quartz mylonite	Christiansen and Snee, 1994	
CH-140	Schist belt	Dsq	Ambler River	Cosmos Hills	67	0.8868	-156	53.1613	White mica	103.5	0.3	99.8	0.3	-	-	102.1	0.5	Graphitic phyllite	Christiansen and Snee, 1994	
ELM-34	Schist belt	Dsq	Ambler River	Cosmos Hills	67	2.5460	-157	7.2870	White Mica	94.4	0.9	94.3	0.3	*	*	94.4	0.9	Not given	Christiansen and Snee, 1994	
SBR88-56	Schist belt	[Dsq]	Wiseman	Near Dalton Highway	67	13.6440	-150	11.9160	Barroisite-hornblende	114	1	147	2	115	1	114	1	Metagabbro	Gottschalk and Snee, 1998	
SBR88-51b	Schist belt	Dg	Wiseman	Near Dalton Highway	67	21.5820	-150	9.6360	Biotite	128.5	0.6	128.6	0.4	128.8	0.6	128.5	0.2	Feldspathic schist	Gottschalk and Snee, 1998	
SBR88-51b (rerun)	Schist belt	Dg	Wiseman	Near Dalton Highway	67	21.5820	-150	9.6360	Biotite	129.3	0.4	129.0	0.4	129.3	0.4	129.7	0.2	Feldspathic schist	Gottschalk and Snee, 1998	
SBR88-57	Schist belt	[Dsq]	Wiseman	Near Dalton Highway	67	13.5600	-150	13.5840	White mica	118.3	0.3	116.4	0.3	118.3	0.3	121.0	0.7	Quartz-mica schist	Gottschalk and Snee, 1998	
SBR88-8a	Schist belt	Dsq	Wiseman	Near Dalton Highway	67	14.5860	-151	3.0000	White mica	124.2	0.3	125.7	5	123.3	0.7	124.2	0.3	Quartz-mica schist	Gottschalk and Snee, 1998	
SB51-2a	Schist belt	Da	Ambler River	Ruby Ridge	67	12.9610	-156	38.9150	White mica	130.6	0.4	127.1	0.4	-	-	129.8	1.1	Quatrz-mica schist	Christiansen and Snee, 1994	
SB52-2b	Schist belt	Da	Ambler River	Ruby Ridge	67	13.7677	-156	44.4287	White mica	171.4	0.4	170.1	0.5	171.4	0.4	169.7	0.6	Quatrz-mica schist	Christiansen and Snee, 1994	
SB53-1	Schist belt	Dsq	Ambler River	Ruby Ridge	67	16.8112	-156	42.7133	White mica	123	0.5	125.3	0.3	125.0	0.3	123.6	0.5	Garnet-bearing schist	Christiansen and Snee, 1994	
6-20-84-4	Schist belt	[Dsq]	Wiseman	Schist belt	67	17.0340	-150	8.3340	Hornblende	N/A	N/A	187	6	-	-	188	6	Eclogite (retrograded)	Gottschalk and Snee, 1998	Isochron date determined from all temperature steps; Locality of the sample plots in Q as shown by Gottchalk and Snee (1998)
28-87	Schist belt	Dsq	Wiseman	Schist belt	67	16.8023	-150	7.4770	White mica	124.6	1.8	-	-	124.6	1.8	-	-	Schist	Blythe and others, 1998	Did not have a well-developed plateau
29-87	Schist belt	Dsq	Wiseman	Schist belt	67	19.8505	-150	7.0591	White mica	122.5	1.9	-	-	122.5	1.9	-	-	Schist	Blythe and others, 1998	Did not have a well-developed plateau
31-87	Schist belt	DPsc	Wiseman	Schist belt	67	21.9829	-150	5.6956	White mica	124.8	1.0	-	-	124.8	1.0	-	-	Schist	Blythe and others, 1998	Did not have a well-developed plateau
54-87	Schist belt	Dg	Wiseman	Schist belt	67	20.9008	-150	10.5418	White mica	120.4	2.2	-	-	120.4	2.2	-	-	Granitic orthogneiss	Blythe and others, 1998	Did not have a well-developed plateau
ABR85-17	Schist belt	Dg	Chandalar	Schist belt	67	40.0980	-148	45.4680	White mica	119	1	119.2	0.3	120.7	0.3	119	1	Granitic orthogneiss	Gottschalk and Snee, 1998	
8-4-85-5	Schist belt	DPsc	Wiseman	Skajit Allochthon	67	24.9480	-150	0.4140	White mica	127	2	125.5	0.4	-	-	127	2	Calc-phyllite	Gottschalk and Snee, 1998	
ADE91-88	Schist belt	DPsc	Survey Pass	Walker Lake area	67	15.3183	-154	19.8545	White mica	101.5	0.2	100.11	0.2	101.5	0.2	-	-	Pelitic schist	Till, unpublished data	
SBR88-27	Schist belt	Dg	Wiseman	Wild River Pluton	67	18.9600	-151	20.8500	White mica	110.4	0.3	110.1	0.3	110.4	0.3	110.4	0.2	Granitic orthogneiss	Gottschalk and Snee, 1998	

TABLE 3. Distribution of geologic units by quadrangle

[1 in the unit column indicates the unit has an overlay pattern]

Unit	Baird Mountains	Ambler River	Survey Pass	Wiseman	Chandalar	Christian	Selawik	Shungnak	Hughes	Bettles
Angayucham terrane, Serpentinite, & Yukon-Koyukuk basin										
Ks	X	X	X	X	X	----	X	X	X	X
Kvg	----	----	----	X	----	----	----	X	X	X
JDab	----	X	X	X	X	X	----	X	X	X
Mz₽zs	----	X	----	----	----	----	----	X	----	----
Mosquito terrane										
D₽m	----	----	----	X	X	----	----	----	----	X
Phyllite belt										
KJm	X	X	X	----	----	----	----	X	X	----
Dps	----	----	----	----	----	X	----	----	----	----
Dps[1]	----	----	----	----	X	X	----	----	----	----
₽zpg	X	X	X	X	X	----	----	----	X	----
₽zpc	----	X	----	----	----	----	----	----	----	----
Cosmos Hills sequence										
DSc	----	X	----	----	----	----	----	X	----	----
Schist belt										
Dsq	X	X	X	X	X	X	X	X	----	----
Da	----	X	X	X	----	----	----	----	----	----
₽zbq	X	X	----	----	----	----	----	----	----	----
₽zsm	----	X	----	----	----	----	----	----	----	----
₽zsg	X	X	X	----	X	----	X	----	----	----
D₽sc	X	X	X	X	X	----	X	X	----	----
D₽sc[1]	----	----	X	X	X	----	----	----	----	----
D₽sc[1]	X	X	----	----	----	----	----	----	----	----
Arrigetch-Igikpak thermal high										
D₽sm	----	----	X	----	----	----	----	----	----	----
D₽gn	----	----	X	----	----	----	----	----	----	----
Central belt & part of Northern thrust assemblages										
Khs	----	----	----	X	X	----	----	----	----	----
JCs	----	----	----	X	----	----	----	----	----	----
JDk	X	----	----	----	----	----	----	----	----	----
Mkkl	----	X	----	----	----	----	----	----	----	----
Mcp	X	----	----	----	----	----	----	----	----	----
Mkl	X	----	X	----	----	----	----	----	----	----
Mc	----	X	X	X	----	----	----	----	----	----
Ml	X	----	----	----	----	----	----	----	----	----
Mu	----	X	X	X	----	----	----	----	----	----
MDk	X	X	X	----	----	----	----	----	----	----
MDk[1]	----	----	X	X	----	----	----	----	----	----
MDe	X	----	----	----	----	----	----	----	----	----
Dn	X	X	X	----	----	----	----	----	----	----
Dhf	X	X	X	X	X	----	----	----	----	----
Dhf[1]	X	X	X	X	X	X	----	----	----	----
Dl	X	----	----	----	X	X	----	----	----	----

TABLE 3. Distribution of geologic units by quadrangle–Continued

[[1] in the unit column indicates the unit has an overprint pattern]

Unit	Baird Mountains	Ambler River	Survey Pass	Wiseman	Chandalar	Christian	Selawik	Shungnak	Hughes	Bettles
Central belt & part of Northern thrust assemblages-Continued										
Dmu	X	X	X	X	X	X	----	----	----	----
Dmu[1]	X	X	X	X	X	X	----	----	----	----
Dmu[1]	----	X	X	X	----	----	----	----	----	----
Spl	----	X	X	----	----	----	----	----	----	----
DOb	X	----	----	----	----	----	----	----	----	----
DOc	X	X	----	----	X	----	----	----	----	----
OꝐc	X	X	----	----	X	----	----	----	----	----
OꝐc[1]	X	----	X	X	X	----	----	----	----	----
Pzbs	----	----	X	X	----	----	----	----	----	----
Pzm	X	X	X	X	X	X	X	----	----	----
Pzw	----	----	----	X	X	----	----	----	----	----
Pzw[1]	----	----	----	X	X	----	----	----	----	----
Pzp	X	X	----	----	X	----	----	----	----	----
Pzj	----	----	----	X	X	----	----	----	----	----
Pzb	X	X	----	----	----	----	----	----	----	----
PzꝐem	----	----	X	X	----	----	----	----	----	----
PzꝐcm	X	X	X	X	----	----	X	----	----	----
PzꝐm	----	X	X	----	----	----	----	----	----	----
PzꝐqs	----	X	X	X	X	----	----	----	----	----
PzꝐb	----	----	X	X	----	----	----	----	----	----
Ꝑam	X	X	----	----	----	----	----	----	----	----
Ꝑam[1]	X	X	----	----	----	----	----	----	----	----
Northern thrust assemblages										
MzDm	X	----	----	----	----	----	----	----	----	----
MDer	X	----	----	----	----	----	----	----	----	----
Doonerak antiform										
TRCs	----	----	----	X	X	----	----	----	----	----
SЄvs	----	----	----	X	X	----	----	----	----	----
Ruby terrane										
PzꝐbs	----	----	----	----	X	X	----	----	----	----
PzꝐsr	----	----	----	----	X	----	----	----	----	----
Igneous and metaplutonic rocks										
QTb	----	----	----	----	X	----	----	----	----	----
Kg	----	----	----	X	X	X	----	----	----	X
Km	----	----	----	----	X	----	----	----	----	----
Dg	----	X	X	X	X	----	----	X	----	----
PzꝐg	X	----	----	----	----	----	----	----	----	----
Ꝑg	X	----	X	X	----	----	----	----	----	----
Surficial deposits										
Qs	X	X	X	X	X	X	X	X	X	X

APPENDIX 1

CONODONT DATA FROM THE SOUTHERN BROOKS RANGE

By Julie A. Dumoulin and Anita G. Harris

Numerous conodont collections were made, mainly during the 1980's, to support geologic mapping in the southern Brooks Range. In this section we present a table (Table A-1) that lists more than 80 percent of all conodont faunas from this area that were examined by paleontologists of the U.S. Geological Survey (see section on Baird Mountains quadrangle below regarding the remaining 20%). The table provides the location, age, geologic unit, and thermal level of these collections, as well as the sample collector and identifier (ID) and some explanatory remarks.

Sources of data

The table contains about 520 collections, only one quarter of which have been previously published. Citations for published collections are given in the remarks column. Some cited references present faunal lists for and (or) illustrations of the collections they include; some also contain more detailed age information than is given here. Transcriptions of original fossil reports (including faunal lists) for about twenty percent of the collections in our table can be found online in the Alaska Paleontological Database at http://www.alaskafossil.org. Our table indicates all samples that were found in this database as of 12/10/06; the database is not yet complete, however, and more collections from the southern Brooks Range may be added later.

Conodont data are organized by quadrangle, listed from west (Baird Mountains) to east (Christian) (Sheet 1, Figure 1). Sample locations are based on latitudes and longitudes supplied by the collector. All samples were collected prior to common usage of GPS units by field geologists; thus, accuracies of these locations cannot be quantified. Most locations in the Baird Mountains quadrangle, and many in the Ambler River, Chandalar, and Wiseman quadrangles, were verified using original field maps and (or) notes of the geologists who collected them. In some cases, latitudes and longitudes in the original database were corrected to reflect locations documented on the field maps.

The collectors' original field numbers are given for all samples. Some collections, mainly those that are relatively age-diagnostic, also have a U.S. Geological Survey collection number; this is the number under which fossil collections are generally filed in the U.S. Geological Survey repository. An Examination and Report (E&R) number is provided for most samples; this is the identifying number of the unpublished U.S. Geological Survey report in which the collection was first described. The E&R number includes the year in which the collection was submitted; for example, E&R No. A-86-23 was written in 1986. It is important to note that the composition and age of most collections listed herein have not been reevaluated since they were originally analyzed; all samples that have been reexamined more recently are identified in the remarks column. Many E&R reports can be found in the Alaska Geology technical archives unit in the Alaska Science Center, Anchorage, Alaska.

U.S. Geological Survey geologists collected most of the samples listed in this table, but a few were submitted by employees of industry, academia, or the Alaska Division of Geology and Geophysical Surveys (DGGS). Anita G. Harris (formerly Epstein) identified the majority of the collections, with assistance from L.T. Lierman, R. Orndorff, Katherine Reed, K.S. Schindler, Nancy Stanton, W. Thompson, and D.J. Weary. John Repetski and Kirk Denkler identified the remainder of the collections.

The data table contains two fields for geologic unit represented by the collection, headed "Geologic unit (this map)" and "Geologic unit (source map)." Unit designation in the current map is given for all samples. Where this name appears in brackets, it indicates an outcrop of the unit in question is too small to show at the scale of the current map. The source map unit is taken from the cited reference for previously published faunas, and (or) was provided by the collector for some unpublished collections. For other samples (marked by an asterisk in the source map column), lithologic data, location, and (or) the age and nature of the conodonts have allowed us to determine the probable source map unit. Source map units for unpublished samples in the Baird Mountains, Wiseman, and Chandalar quadrangles are taken from unpublished documents prepared by Dumoulin in 1989 and 1990.

Color changes in conodonts reflect the thermal history of the rocks that contain them (Epstein and others, 1977). Harris and her co-workers determined conodont color alteration indices (CAIs) for almost all the collections in the database. Temperature ranges for CAI values were established from plots of experimental data by Epstein and others (1977) and Rejebian and others (1987); a CAI value of 1 indicates a temperature range of <50-80°C, whereas a value of 6 implies temperatures in excess of 360°C (Table A-2). CAI temperatures can be equated to burial depths for a given geothermal gradient; for example, in the Appalachian basin, overburdens of ~3,600-5,500 m produced CAI values of 3 (Harris and others, 1978). Although there is a general correspondence between CAI value and metamorphic history, CAI values can be affected by multiple factors, some of which are not related to metamorphism. Some implications of CAI values of conodonts from the southern Brooks Range are discussed briefly below.

Some conodont assemblages, particularly those from turbidites or other mass flow deposits, contain a component of older elements along with younger forms indigenous to the geologic unit in which they occur. Redeposited older conodonts have been found in several samples from the Baird Mountains, Hughes, and Chandalar quadrangles and are noted under remarks.

All samples listed herein were processed in order to obtain conodonts. In a few cases, the samples produced no conodonts but did yield other phosphatic fossils (such as acrotretid brachiopods) that provide age information. Such samples are noted in the remarks column.

Most collections in the database are stored at the U.S. Geological Survey in Reston, Virginia. However, faunas collected by geologists of Amoco Oil Corporation (less than one percent of the database) are not part of the USGS collection but were examined by Anita Harris at the Amoco offices in Oklahoma during the 1980's. Harris determined the age and CAI of the collections; Amoco provided sample locations.

DATA BY QUADRANGLE

The abundance of productive conodont collections in the southern Brooks Range varies greatly by quadrangle, reflecting both logistical and geologic factors (e.g., how much detailed mapping an area has received; abundance of carbonate units suitable for conodont sampling; and degree of metamorphism and deformation carbonate units have undergone). In this section, we summarize conodont data available by quadrangle, and indicate which map units have produced especially abundant or significant conodonts.

Baird Mountains Quadrangle

More than half of the samples in this database come from the Baird Mountains quadrangle. Only about 20 percent of these collections were published (Dumoulin and Harris, 1987; Karl and others, 1989b). Age, depositional environments, and paleogeographic affinities of conodont faunas from this area are summarized in Dumoulin and Harris (1992, 1994) and Dumoulin and others (2002). About 20 percent of the unpublished Baird Mountains collections can be found online in the Alaska Paleontological Database.

The Baird Mountains quadrangle yielded so many productive conodont samples that only about three-quarters of the USGS collections from this quadrangle are listed herein. (Virtually all USGS collections from the other quadrangles in the map area are listed). The Baird Mountains collections that we omitted are from heavily sampled areas where stratigraphic sections were measured and (or) detailed mapping was conducted (e.g, the Omar prospect; Folger and Schmidt, 1986). These collections contain age and CAI data redundant of those from collections that are listed in Table A-1. For example, if ten conodont collections from a single measured section have the same age and CAI value, only one or a few of these collections are listed. If the section produced a range of ages and (or) CAI values, enough collections are listed to encompass this range. To that end, the database presented here includes some previously unpublished collections that were taken from localities published by Karl and others (1989b); an asterisk in the remarks column indicates these collections.

The conodont collections that were previously published in Karl and others (1989b) limit the age ranges of map units such as the Baird Group (DOb), Dl, Dmu, DOc, and OPc. Previously unpublished collections presented here provide a more detailed picture of the geographic distribution of ages within these units, and within composite units such as MzDm, JDk, and MDer. Our data also document areas of notably high and low CAI values that are discussed further below.

Ambler River and Shungnak Quadrangles

Only a few of the 70 collections from the Ambler River and northern Shungnak quadrangles were published (Dumoulin and Harris, 1988; Pallister and Carlson, 1988; Pallister and others, 1989), but about a third of the collections are listed in the Alaska Paleontological Database. The relative paucity of collections from this area compared to the Baird Mountains likely reflects less sampling rather than a lack of suitable rock types; areas where concentrated sampling was conducted (such as around Blind Pass Mountain in the east-central part of the Ambler River quadrangle) yielded numerous productive samples.

In spite of the limited sampling carried out in this area, conodonts provide important age information for a number of units, including KJm, JDab, Pzpc, Pzm, Mkkl, DSc, and Spl. Collections from Pzm near Blind Pass Mountain are particularly important and suggest that further study and sampling of Pzm throughout the Ambler River quadrangle might produce stratigraphic successions detailed enough to allow inclusion of these rocks in DOb, DOc and (or) OPc. As in the Baird Mountains quadrangle, CAI values in this area show considerable variation that is discussed below.

Survey Pass and Hughes Quadrangles

About 70 percent of the 24 collections from the Survey Pass quadrangle were published (Nelson and Grybeck, 1980) and most of the unpublished collections are included in the Alaska

Paleontological Database. Only a few of the 20 collections in the northern Hughes quadrangle were published (Pallister and Carlson, 1988: Pallister and others, 1989) but most of the collections are listed in the Alaska Paleontological Database. Productive samples come mainly from the Mkl and Dmu units in the north and the KJm and JDab units in the south.

Metacarbonate rocks of the Central belt in Survey Pass have produced few conodonts, in contrast to equivalent rocks to the east and west. This is not due to lack of sampling; the Alaska Paleontological Database lists numerous barren samples collected from map unit Pzm in Survey Pass. The scarcity of conodonts recovered may be explained, at least in part, by small sample size. Only 2 kg of rock was processed for most samples from Survey Pass (Alaska Paleontological Database), but subsequent work in the Baird Mountains quadrangle demonstrated that larger samples were needed to obtain adequate conodont collections from metacarbonate rocks of the Brooks Range. Samples processed in the 1980's from other parts of the Central belt typically weighed three to six times as much as those from Survey Pass (A. Harris, unpublished fossil reports, 1983-1990). Rarity of productive conodont samples from central Survey Pass may also reflect geologic factors. The Arrigetch-Igikpak thermal high lies within the Survey Pass quadrangle; thus, metacarbonate rocks in this area may have experienced thermal levels sufficient to destroy most conodonts.

Wiseman, Chandalar, and Christian Quadrangles

Our database contains 130 collections from the Wiseman, Chandalar, and Christian quadrangles (only the western part of the Christian quadrangle is included). Less than 40 percent of these collections have been published (Dillon and others, 1987, 1988; Dumoulin and Harris, 1994; Adams, 1994; Moore and others, 1997a), and few collections from this area are included in the Alaska Paleontological Database.

Collections come chiefly from the northwestern part of the Chandalar quadrangle, where both DGGS and USGS personnel conducted detailed mapping. The high success rate of sampling in this area suggests that additional sampling of metacarbonate rocks elsewhere in these quadrangles would be worthwhile. Collections from this region constrain the age, depositional setting, and paleogeographic affinities of lower and middle Paleozoic map units such as OPc, DOc, Dmu, and Dhf (Dillon and others, 1987; Dumoulin and Harris, 1994; Dumoulin and others, 2002). Previously unpublished collections in Table A-1 provide useful age data from map units in the Angayucham terrane (JDab) and the Doonerak antiform (ŦCs).

GEOLOGIC IMPLICATIONS

Conodont data constrain the geologic, biogeographic, and thermal histories of the southern Brooks Range. A full discussion of these topics is beyond the scope of this text, but we highlight here some implications of the conodont collections, particularly those previously unpublished and (or) used to define the ages and affinities of the geologic units in the accompanying map.

Angayucham terrane

Carbonate strata associated with volcanic rocks of the Angayuchum terrane (map unit JDab) have yielded a number of conodont collections, chiefly from the Wiseman, Hughes, and Ambler River quadrangles, that indicate a range of ages and thermal levels. All of the stratigraphically useful collections in the Wiseman quadrangle, and two of those in the Hughes quadrangle, are Mississippian; of these, six are Early Mississippian and five (from Twelvemile Mountain in the Wiseman quadrangle and two localities in the northern Hughes quadrangle) are tightly dated as late Early Mississippian (middle Osagean). Shallow-water forms predominate in the Mississippian collections, and some assemblages have undergone post-mortem hydraulic transport. *Mestognathus*, a relatively uncommon shallow-water genus found in six of the Wiseman collections (A. Harris, unpublished data, 1984-2002), also occurs in samples of the Lisburne Group from the west-central and western Brooks Range (Dover and others, 2004; Dumoulin and others, 2006), north of the area encompassed by the current map. Several Early Mississippian conodont assemblages come from the same localities as younger (post-Mississippian) fossils: for example, Pennsylvanian? foraminifers are reported from Twelvemile Mountain by Bird (1977) and Permian foraminifers, bryozoans, and brachiopods occur at Heart Mountain (Patton and Miller, 1973). It is not known whether the Mississippian conodonts at these localities were reworked and redeposited into younger strata, or were produced by Mississippian carbonate rocks juxtaposed with Pennsylvanian? and Permian sections; the different ages could also reflect problems in correlating age ranges of different fossil groups.

Other stratigraphically useful conodont collections from the Angayucham terrane in the Ambler River and Hughes quadrangles have ages of Late Silurian-Early Devonian, Middle-earliest Late Devonian, Late Devonian, Middle Devonian-Early Mississippian, and Triassic. The Late Silurian-Early Devonian assemblage is the oldest fossil collection known from the Angayucham terrane.

CAI values of conodont assemblages from the Angayuchum terrane in our database encompass a wide range. In the southeastern Wiseman quadrangle, CAIs are 2-3, whereas those from the southwestern Wiseman quadrangle are 5 and some collections from the southeastern Ambler River quadrangle have values as high as 6-7. These data indicate a complex and heterogeneous thermal history for this terrane.

Phyllite belt

Conodont data constrain the age of carbonate rocks of the Phyllite belt (map unit Pzpc) as well as the protolith age of some parts of the mélange (map unit KJm) found in this area. Collections from Pzpc come from the Ambler River and Hughes quadrangles; stratigraphically restricted assemblages are mainly Middle Devonian but include Late Silurian-early Early Devonian and Mississippian. CAI values are mostly 5-5.5, but a few higher values of 6-7 may reflect hydrothermal fluid movement along faults, and one lower value (3-4) was found in the Hughes quadrangle.

Pallister and Carlson (1988) suggested that the mélange unit (KJm) was derived from adjacent units to the south (JDab) and north (Pzpc, Pzpg). Conodont data from KJm (from the Ambler River, Survey Pass, and Hughes quadrangles) generally support this contention. An assemblage of Middle Devonian (probably Givetian) age in KJm correlates well with a collection from Pzpc, whereas early Late Devonian (Frasnian) and late early Mississippian (middle Osagean) assemblages in KJm correlate with collections from JDab. However, conodonts of Early-early Middle Ordovician age obtained from a sample of KJm in the Survey Pass quadrangle are older than any strata known from either the phyllite belt or the Angayucham terrane, and correlate best with Central belt units such as OЄc. Several conodont collections from KJm in the northeastern Hughes quadrangle are no older than latest Mississippian (latest Chesterian) but include older, redeposited conodonts of Middle Devonian, Early Mississippian, and early Late Mississippian (Meramecian) age. These collections have striking similarities to those from the Lisburne Group in the Ipnavik River allochthon north of the map area (Dover and others, 2004), which also contain reworked older conodonts of Devonian and Early Mississippian age, including some of the same genera found in the Hughes quadrangle assemblages (A. Harris, unpublished fossil report, 1984). The Hughes assemblages, however, include conodonts younger than any that have been found in the Ipnavik River area Lisburne. CAI values confirm the heterogeneous nature of unit KJm. Most samples have CAIs of 5-5.5, but values as low as 3 and as high as 7 occur locally.

Schist Belt and Carbonate Rocks of Cosmos Hills

The Schist belt has produced few fossils, but a handful of collections from the D₽sc, ₽zsm, and Da units yielded conodonts. The most tightly dated collections from all three units are Devonian. Seven collections were obtained from the D₽sc unit in the Wiseman, Chandalar, Ambler River, and Baird Mountains quadrangles, and two of these are relatively age diagnostic. A collection from the western Wiseman quadrangle is Devonian, and one from eastern Wiseman, from dolostone in the Emma Creek schist of Moore and others (1997a), is early Early Devonian (Lochkovian). A single sample from unit ₽zsm in the Ambler River quadrangle is of late Early-Middle Devonian age, and a sample from Da in the Wiseman quadrangle is Devonian.

Conodonts indicate that carbonate rocks of the Cosmos Hills (map unit DSc) in the southern Ambler River quadrangle are in part older than previously believed. These strata were interpreted as Devonian (chiefly Middle Devonian) on the basis of megafossils (Patton and others, 1968; Fritts, 1970; Oliver and others, 1975; Hitzman and others, 1982), but conodonts demonstrate the presence of Lower Devonian (Emsian) and Upper Silurian strata.

All conodonts from the schist belt and unit DSc have CAIs of 5-6, indicating that the rocks containing these conodonts reached temperatures of at least 300°C (Table A-2; Rejebian and others, 1987).

Central Belt

Conodont data provide important constraints on the ages, depositional settings, and paleobiogeographic affinities of lower and middle Paleozoic strata in the Central belt; these findings are presented in detail elsewhere (Dumoulin and Harris, 1987, 1988, 1994; Dillon and others, 1987, 1988; Karl and others, 1989b, Dumoulin and others, 2002) and are not further discussed here. Table A-1 does include, however, a large number of previously unpublished collections that more fully document the geographic distribution, age range, and thermal history of Mississippian and older strata in the Central belt.

Several previously unpublished collections in our table are noteworthy as they support the interpretation that Devonian units such as Dmu and the overlying Endicott Group were deposited on carbonate successions such as the Baird Group and related rocks. For example, a collection from the Nakolik River unit (included in our map unit Dmu) in the western Baird Mountains quadrangle contains some reworked older conodonts of late Middle-Late Ordovician age that were most likely derived from the Baird Group, and Devonian basal conglomerate (also included in our unit Dmu) in the northeastern Wiseman quadrangle yielded Silurian conodonts probably sourced by map unit DOc. Early Ordovician conodonts in basal carbonate conglomerate of the lowest unit of the Endicott Group (the Hunt Fork Shale; our map unit Dhf) in the northeastern Chandalar quadrangle could have been derived from older carbonates such as ₽zm; Ordovician conodonts occur in ₽zm to the east in the Christian quadrangle (Table A-1), and in equivalent strata to the northeast of our map area in the Arctic quadrangle (Brosgé and others, 2001).

Mississippian strata of the Central belt have received less discussion in the literature than older rocks. Some conodont collections from these units have been published (for example, collections from our map unit Ml in the Baird Mountains quadrangle appeared in Karl and others, 1989b) but most have not. In particular, Table A-1 includes a considerable number of previously unpublished conodont collections that document the Mississippian biostratigraphy of unit Mkkl in the east-central Ambler River quadrangle.

Conodont CAIs in the Central belt are mainly 5-5.5 and indicate that the rocks containing these conodonts reached temperatures of at least 300°C (Table A-2; Rejebian and others, 1987). In the Baird Mountains quadrangle, some conodonts have CAIs as high as 6.5, 7, and 8; these values generally occur in collections that contain a range of CAIs and (or) have textures (as detailed by Rejebian and others, 1987) that imply hydrothermal alteration. Many of these collections come from areas of known mineralization, such as the Omar and Powdermilk prospects, suggesting that other regions with anomalously high CAI values may be prospective for similar deposits. High CAIs could also reflect proximity to faults that served as conduits for hydrothermal fluid flow during tectonic events and (or) diagenetic processes such as dolomitization. A few collections with lower CAIs (4-4.5) are found near the northwestern boundary of the Central belt in the Baird Mountains C-5 quadrangle. The Devonian (and Mississippian?) strata that produced these conodonts may be fault-bounded successions derived from the northern thrust assemblages discussed below.

Northern Thrust Assemblages and Doonerak Antiform

Table A-1 contains a number of previously unpublished collections from the northern thrust assemblages (map units JCs, MDer, Mkl, and MzDm) and from the TRCs unit in the Doonerak antiform, as well as collections from these units that were published in Nelson and Grybeck (1980), Karl and others (1989b), and Adams (1994). These collections come chiefly from northern parts of the Baird Mountains, Survey Pass, and Wiseman quadrangles, and are particularly useful in defining biostratigraphy of Devonian units such as the Kugururok Formation (part of MzDm) and Eli Limestone (part of MDer) and the Carboniferous Lisburne Group (part of JCs, MDer, Mkl, and TRCs).

Conodont CAI values from this area are more heterogeneous and in part notably lower than values from the Central and Schist belts. Conodont-bearing units in these assemblages, as well as TRCs in the Doonerak antiform, produced numerous collections with CAIs of 4.5-5 or less. Lower CAI values are particularly abundant in the northwestern Baird Mountains quadrangle, where about half of the collections from MDer have CAIs of 4-4.5, and 85 percent of the collections from MzDm have CAIs ≤4 (some as low as 2.5-3). The CAI data thus demonstrate that Paleozoic strata in the Central and Schist belts experienced thermal levels higher than those of correlative strata in the Northern thrust assemblages and Doonerak antiform.

TABLE A-1. Conodont data

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Baird Mountains A-5	67	13.80	161	27.30	Ordovician-Devonian	DOb	Baird Group	5.0	5.5	85ADN125		A-85-39I	Dumoulin	Harris	
Baird Mountains B-3	67	26.30	160	10.50	Silurian-Mississippian	DPzsc	PzPku	5.5	5.5	83EK26G		A-83-27I	Ellersieck	Harris	Karl and others (1989b), Table 1, loc. 47.
Baird Mountains B-3	67	27.80	160	19.20	Late Silurian-Early Devonian	Pzm	Pzkm	5.5	6.0	85ADN151B	11398-SD	A-85-39H	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 46.
Baird Mountains B-3	67	16.10	160	29.80	Middle Ordovician-Middle Devonian	DPzsc	Dotu	5.0	5.5	83EK29I		A-83-27I	Ellersieck	Harris	Karl and others (1989b), Table 1, loc. 48.
Baird Mountains B-4	67	21.90	160	40.26	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.5	84SK181A	9944-CO	A-84-50E	Karl	Harris	Entry 7511 in Alaska Paleontological Database.
Baird Mountains B-4	67	27.30	160	42.30	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.5	86AD58H	10473-CO	A-86-33A	Dumoulin	Harris	From measured section along tributary to West Fork Omar River.
Baird Mountains B-4	67	27.30	160	42.30	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.5	6.5	86AD58J	10472-CO	A-86-33A	Dumoulin	Harris	From measured section along tributary to West Fork Omar River.
Baird Mountains B-4	67	27.30	160	42.30	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	6.0	86AD58M	10471-CO	A-86-33A	Dumoulin	Harris	From measured section along tributary to West Fork Omar River.
Baird Mountains B-4	67	27.30	160	42.30	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.5	86AD58N	10470-CO	A-86-33A	Dumoulin	Harris	From measured section along tributary to West Fork Omar River.
Baird Mountains B-4	67	24.60	160	43.40	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.0	84BT67A	9939-CO	A-84-50E	Thompson	Harris	
Baird Mountains B-4	67	27.10	160	43.70	Early Ordovician	DOb	Baird Group	5.5	6.0	84SK141A	9973-CO	A-84-50J	Karl	Harris	Entry 7614 in Alaska Paleontological Database.
Baird Mountains B-4	67	27.30	160	45.00	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.5	86AD71E	10479-CO	A-86-33A	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 41. From measured section 1.5 mi E of West Fork Omar River.
Baird Mountains B-4	67	27.30	160	45.00	middle Early Ordovician (early Arenigian)	DOb	Baird Group	7.0	8.0	86AD71F	10480-CO	A-86-33A	Dumoulin	Harris	*Karl and others (1989b), Table 1, loc. 41. From measured section 1.5 mi E of West Fork Omar River. CAI values suggest hydrothermal
Baird Mountains B-4	67	27.30	160	45.00	middle Early Ordovician (early Arenigian)	DOb	Baird Group	6.0	7.0	86AD71J	10483-CO	A-86-33A	Dumoulin	Harris	*Karl and others (1989b), Table 1, loc. 41. From measured section 1.5 mi E of West Fork Omar River.
Baird Mountains B-4	67	21.80	160	46.20	late Early Ordovician (middle Arenigian)	DOb	Baird Group	5.0	5.5	84EK118	9942-CO	A-84-50E	Ellersieck	Harris	Entry 7509 in Alaska Paleontological Database.
Baird Mountains B-4	67	27.90	160	48.70	middle Early Ordovician (early Arenigian)	DOb	Baird Group	6.5	6.5	8-1-84G	10496-CO	A-86-33A	Dumoulin	Harris	From measured section along northwest fork Omar River.
Baird Mountains B-4	67	27.90	160	48.70	middle Early Ordovician (early Arenigian)	DOb	Baird Group	7.0	8.0	8-1-84H	10497-CO	A-86-33A	Dumoulin	Harris	From measured section along northwest fork Omar River.
Baird Mountains B-4	67	27.90	160	48.70	Early Ordovician	DOb	Baird Group	8.0	8.0	8-1-84E	10495-CO	A-86-33A	Dumoulin	Harris	From measured section along northwest fork Omar River. CAI values indicate hydrothermal alteration.
Baird Mountains B-4	67	27.70	160	48.90	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.5	6.5	8-1-84L	10500-CO	A-86-33A	Dumoulin	Harris	From measured section along northwest fork Omar River.
Baird Mountains B-4	67	28.90	160	49.40	Middle Devonian (probably Givetian)	DOb	Baird Group	5.0	5.5	83EK22F	10886-SD	A-83-27I	Ellersieck	Harris	
Baird Mountains B-4	67	28.60	160	49.50	early Middle Ordovician	DOb	Baird Group	5.0	5.5	83EK22D	9812-CO	A-83-27I	Ellersieck	Harris	
Baird Mountains B-4	67	29.74	160	49.60	Middle Ordovician-Middle Devonian (possibly Givetian)	DOb	Baird Group	5.0	5.5	83EK22E		A-83-27I	Ellersieck	Harris	
Baird Mountains B-4	67	23.20	160	50.00	Early (but not earliest) Ordovician	DOb	Baird Group	5.5	5.5	84SK160A	9915-CO	A-84-50C	Karl	Harris	Entry 7399 in Alaska Paleontological Database.
Baird Mountains B-4	67	24.60	160	43.40	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.0	84BT67A	9939-CO	A-84-50E	Thompson	Harris	Entry 7500 in Alaska Paleontological Database.
Baird Mountains B-4	67	24.20	160	50.30	lower half Middle Ordovician (middle Arenigian-Llandeilian)	DOb	Baird Group	6.0	7.0	84SK158A	9964-CO	A-84-50I	Karl	Harris	Entry 7571 in Alaska Paleontological Database.
Baird Mountains B-4	67	29.60	160	50.90	late Early Devonian (Emsian)	DOb	Baird Group	5.0	6.0	8-13-83A	10750-SD	A-83-27	Harris	Harris	From drill core at Omar prospect.
Baird Mountains B-4	67	29.60	160	50.90	early Middle Devonian (Eifelian)	DOb	Baird Group	5.0	5.0	8-13-83D	10751-SD	A-83-27	Harris	Harris	From drill core at Omar prospect. Age based on overlapping ranges of conodonts and corals.
Baird Mountains B-4	67	27.76	160	50.96	late Late Ordovician	DOb	Baird Group	5.5	5.5	84ADN132C	9914-CO	A-84-50C	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 40. Entry 7391 in Alaska Paleontological Database.
Baird Mountains B-4	67	27.76	160	50.96	Late Silurian (possibly late Ludlovian)	DOb	Baird Group	6.5	6.5	84ADN132D	11512-SD	A-86-33A	Dumoulin	Harris	CAI values indicate hydrothermal alteration.
Baird Mountains B-4	67	27.76	160	50.96	middle Middle-Late Ordovician	DOb	Baird Group	5.5	5.5	84ADN132E	10515-CO	A-86-33A	Dumoulin	Harris	
Baird Mountains B-4	67	27.76	160	50.96	Middle Ordovician-Middle Devonian	DOb	Baird Group	6.0	7.0	84ADN132F		A-86-33A	Dumoulin	Harris	
Baird Mountains B-4	67	29.50	160	51.10	Early Ordovician	DOb	Baird Group	5.5	5.5	OM-154	10211-CO	A-85-35A	Folger	Harris	
Baird Mountains B-4	67	29.90	160	51.20	Ordovician-Devonian	DOb	Baird Group	5.5	6.0	OM-127		A-85-35A	Folger	Harris	
Baird Mountains B-4	67	27.60	160	51.60	Middle Devonian	DOb		5.0	5.0	AM6186-37			AMOCO	Harris	
Baird Mountains B-4	67	29.80	160	51.60	Middle Ordovician (possibly early Caradocian)	DOb	Baird Group	7.0	8.0	OM136	10246-CO	A-85-35B	Folger	Harris	CAI values indicate hydrothermal alteration.
Baird Mountains B-4	67	18.40	160	52.50	Silurian-Middle Devonian (possibly middle-early Late Silurian)	DOb	Baird Group	5.0	5.0	84ADN138A	11139-SD	A-84-50F	Dumoulin	Harris	Entry 7543 in Alaska Paleontological Database.
Baird Mountains B-4	67	29.50	160	52.65	early late Early Devonian (earliest Emsian)	DOb	Baird Group	5.0	5.0	OM-118	11227-SD	A-85-35A	Folger	Harris	Entry 6568 in Alaska Paleontological Database.
Baird Mountains B-4	67	28.00	160	53.80	Ordovician-Devonian	DOb	Baird Group	7.0	7.0	84SK185A		A-84-50E	Karl	Harris	Entry 7512 in Alaska Paleontological Database.
Baird Mountains B-4	67	24.20	160	56.40	early-middle Middle Ordovician (late Arenigian-Llandeilian)	DOb	Baird Group	5.0	5.5	85SK39A	10384-CO	A-85-39H	Karl	Harris	Karl and others (1989b), Table 1, loc. 42.
Baird Mountains B-4	67	24.00	160	56.70	Middle Ordovician	DOb	Baird Group	5.0	5.5	85SK40A	10385-CO	A-85-39H	Karl	Harris	
Baird Mountains B-5	67	28.10	161	21.80	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.5	6.0	8-4-84A	10298-CO	A-86-33A	Dumoulin	Harris	Dumoulin and Harris (1987), section C; *Karl and others (1989b), Table 1, loc. 38. From measured section on middle fork of Squirrel River.
Baird Mountains B-5	67	28.10	161	21.80	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.5	8-4-84B	10299-CO	A-86-33A	Dumoulin	Harris	Dumoulin and Harris (1987), section C; Karl and others (1989b), Table 1, loc. 38. From measured section on middle fork of Squirrel River.
Baird Mountains B-5	67	28.10	161	21.80	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.5	8-4-84D	10502-CO	A-86-33A	Dumoulin	Harris	Dumoulin and Harris (1987), section C; *Karl and others (1989b), Table 1, loc. 38. From measured section on middle fork of Squirrel River.

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Baird Mountains B-5	67	28.10	161	21.80	earliest Middle Ordovician	DOb	Baird Group	5.0	5.5	8-4-84N	10352-CO	A-86-33A	Dumoulin	Harris	Dumoulin and Harris (1987), section C; Karl and others (1989b), Table 1, loc. 38. From measured section on middle fork of Squirrel River.
Baird Mountains B-6	67	20.40	161	31.80	Middle Ordovician-Middle Devonian	DOb	Baird Group	5.0	5.5	81TR148D		NPRA-81-5A	Tailleur	Harris	
Baird Mountains B-6	67	18.00	161	32.90	Silurian-Middle Devonian	DOb	Baird Group	5.0	5.0	85ADN127B	11280-SD	A-85-39A	Dumoulin/Karl	Harris	Entry 6655 in Alaska Paleontological Database.
Baird Mountains B-6	67	23.10	161	33.70	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.0	85BT91A	10394-CO	A-85-39I	Thompson	Harris	
Baird Mountains B-6	67	24.80	161	36.40	Middle Ordovician-Middle Devonian	DOb	Baird Group	5.0	5.0	85SK239D		A-85-39H	Karl	Harris	
Baird Mountains B-6	67	24.00	161	40.10	Silurian-Middle Devonian	DOb	Baird Group	5.0	5.5	85ADN98A		A-85-39H	Dumoulin	Harris	Age based on overlapping ranges of conodonts and gastropods.
Baird Mountains B-6	67	29.80	161	41.60	Late Silurian-Middle Devonian	DOb	Baird Group	5.0	5.0	85JS52	11391-SD	A-85-39H	Schmidt	Harris	
Baird Mountains B-6	67	29.10	161	43.80	middle Late Silurian-early Early Devonian (latest Ludlovian-middle Gedinnian)	[DOb]	*Baird Group	5.0	5.5	85JS55	11417-SD	A-85-39I	Schmidt	Harris	Sample from an outcrop of unit DOb too small to show on map.
Baird Mountains B-6	67	27.60	161	44.20	middle Late Silurian-Early Devonian (late Ludlovian-Emsian)	DOb	Baird Group	5.0	5.0	85BT67A	11304-SD	A-85-39B	Thompson	Harris	Entry 6664 in Alaska Paleontological Database.
Baird Mountains B-6	67	29.10	161	45.20	Middle-Late Devonian	Dmu		5.0	5.0	85JS57	11392-SD	A-85-39H	Schmidt	Harris	
Baird Mountains B-6	67	23.00	161	47.50	Middle Devonian	DOb	Baird Group	5.0	5.5	85BT87A	11418-SD	A-85-39I	Thompson	Harris	
Baird Mountains B-6	67	21.30	161	49.70	Early Ordovician	DOb	Baird Group	5.0	5.0	85ADN97A	10357-CO	A-85-39D	Dumoulin	Harris	
Baird Mountains B-6	67	22.10	161	49.90	Middle Devonian (possibly Givetian)	DOb	Baird Group	5.0	5.5	85ADN70A	11413-SD	A-85-39I	Dumoulin	Harris	
Baird Mountains B-6	67	24.20	161	53.40	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.5	85ADN96A	10371-CO	A-85-39H	Dumoulin	Harris	
Baird Mountains B-6	67	22.00	161	53.70	Middle-Late Devonian	DOb	Baird Group	5.0	5.0	85SK237A	11305-SD	A-85-39B	Karl	Harris	Entry 6665 in Alaska Paleontological Database.
Baird Mountains B-6	67	25.90	161	54.80	Silurian-Early Devonian (probably Silurian)	DOb	Baird Group	5.0	5.0	85PF106A	11395-SD	A-85-39H	Folger	Harris	
Baird Mountains C-1	67	36.41	159	9.35	Cambrian (probably Middle Cambrian)	OЄc	OCc	ND	ND	88AD49A		A-89-4	Dumoulin	Rowell	Sample consists of acrotretid brachiopod valves identified by A. Rowell, University of Kansas.
Baird Mountains C-1	67	36.23	159	9.72	Cambrian (probably Middle Cambrian)	OЄc	OCc	5.0	5.0	87AD8C	10647-CO	A-87-13D	Dumoulin	Harris, Dutro	Karl and others (1989b), Table 1, loc. 57. Sample contains protoconodont (identified by Harris) and acrotretid brachiopod valves (identified by J.T, Dutro, Jr.); CAI value is at least 5 but cannot be more precisely determined from a protoconodont.
Baird Mountains C-1	67	36.10	159	11.20	Middle-Late Ordovician	OЄc	OCc	5.0	5.5	86AD75B	10485-CO	A-86-33A	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 56.
Baird Mountains C-1	67	42.30	159	12.70	Silurian (probably Late)-Early Devonian	DOc	DOc	5.0	5.5	87AD35Z	11859-SD	A-87-13C	Dumoulin	Harris	
Baird Mountains C-1	67	40.20	159	14.70	Ordovician	DOc	DOc?	5.0	5.0	87AD39C	10654-CO	A-87-13C	Dumoulin	Harris	
Baird Mountains C-1	67	40.20	159	14.70	late Late Ordovician (middle Maysvillian-Gamachian)	DOc	DOc?	5.0	5.0	87AD39D	10596-CO	A-87-13A	Dumoulin	Harris	
Baird Mountains C-1	67	40.00	159	15.30	Middle Ordovician-Middle Devonian	DOc	DOc	5.5	5.5	84SK163B		A-84-50C	Karl	Harris	Entry 7400 in Alaska Paleontological Database.
Baird Mountains C-1	67	40.84	159	15.83	Middle Ordovician (late Llanvirnian-early Caradocian)	OЄc	OCc	5.0	5.0	87AD33B	10594-CO	A-87-13A	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 58.
Baird Mountains C-1	67	40.84	159	15.83	Middle Ordovician (late Llanvirnian-early Caradocian)	OЄc	OCc	5.0	5.0	87AD33C	10595-CO	A-87-13A	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 58.
Baird Mountains C-1	67	44.20	159	16.70	middle Silurian-late Early Devonian (Wenlockian-early Emsian), possibly middle-Late Silurian	DOc	DOc	5.5	6.0	86AD53A	11503-SD	A-86-33A	Dumoulin	Harris	
Baird Mountains C-1	67	40.50	159	17.20	Late Silurian-early Early Devonian, probably Late Silurian (Ludlovian)	DOc	DOc	5.0	5.0	87ATi59A	11860-SD	A-87-13C	Till	Harris	
Baird Mountains C-1	67	41.00	159	20.20	Silurian-Early Devonian	DOc	DOc	5.0	5.0	86ATi54B	11517-SD	A-86-33D	Till	Harris	
Baird Mountains C-1	67	35.31	159	22.11	very latest Cambrian-early Early Ordovician	OЄc	OCc	5.5	5.5	8-12-83C	9775-CO	A-83-27G	Harris	Harris	Dumoulin and Harris (1987), section A; *Karl and others (1989b), Table 1, loc. 55. From measured section S of Mt. Angayukaqsraq.
Baird Mountains C-1	67	35.31	159	22.11	early Middle Ordovician (earliest Llanvirnian)	OЄc	OCc	5.0	5.0	8-3-83X	9777-CO	A-83-27G	Harris	Harris	Dumoulin and Harris (1987), section A; Karl and others (1989b), Table 1, loc. 55. From measured section S of Mt. Angayukaqsraq.
Baird Mountains C-1	67	35.31	159	22.11	late Early Ordovician-early Middle Ordovician	OЄc	OCc	5.0	5.0	74ATR126.4	8295-CO	A-75-6	Tailleur	Harris	Entry 1896 in Alaska Paleontological Database.
Baird Mountains C-1	67	44.16	159	28.00	Middle Ordovician-Middle Devonian	DOc	DOc	5.0	5.0	84JS65E		A-84-50C	Schmidt	Harris	Entry 7387 in Alaska Paleontological Database.
Baird Mountains C-1	67	44.09	159	28.27	Late Ordovician (possibly latest Ordovician)	DOc	DOc	5.0	5.0	66ATR82.3	10716-CO	A-89-10	Tailleur	Harris	
Baird Mountains C-1	67	35.80	159	28.50	Middle Ordovician-Devonian	OЄc	OCc	5.0	5.5	83SK136A		A-83-27I	Karl	Harris	
Baird Mountains C-1	67	36.00	159	28.75	middle Early-very earliest Middle Ordovician (early-middle Arenigian)	OЄc	OCc	5.0	5.0	86AD63J	10477-CO	A-86-33A	Dumoulin	Harris	
Baird Mountains C-1	67	36.00	159	28.80	Middle-middle Late Ordovician	OЄc	OCc	5.0	5.0	86AD63L	10478-CO	A-86-33A	Dumoulin	Harris	
Baird Mountains C-1	67	44.99	158	59.99	middle Silurian-Early Devonian (Wenlockian-early Emsian)	DOc	DOc	5.0	5.0	85SK326A	11426-SD	A-85-39J	Karl	Harris	Karl and others (1989b), Table 1, loc. 59.
Baird Mountains C-2	67	36.50	159	31.50	late Early-early Late Cambrian	OЄc	OCc	5.0	5.0	86AD50A	10487-CO	A-86-33A	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 54.
Baird Mountains C-2	67	36.45	159	31.50	Early-early Middle Ordovician	OЄc	OCc	5.0	5.0	86AD50B	10488-CO	A-86-33A	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 54.
Baird Mountains C-2	67	36.40	159	31.50	Middle-Late Ordovician	OЄc	OCc	6.5	7.0	86AD50E	10489-CO	A-86-33A	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 54.
Baird Mountains C-2	67	44.50	159	32.90	late Late Ordovician (Richmondian)	DOc	DOc	5.0	5.0	85ADN138B	10358-CO	A-85-39E	Dumoulin	Harris	*Karl and others (1989b), Table 1, loc. 52. From measured section ~5 mi N of VABM Silver.

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Baird Mountains C-2	67	44.50	159	32.90	late Late Ordovician (Richmondian)	DOc	DOc	5.0	5.0	85ADN138I	10372-CO	A-85-39H	Dumoulin	Harris	*Karl and others (1989b), Table 1, loc. 52. From measured section ~5 mi N of VABM Silver.
Baird Mountains C-2	67	39.40	159	33.80	Middle Ordovician-Middle Devonian	DOc	DOc	5.0	5.0	81EK524		NPRA-81-5A	Ellersieck	Harris	
Baird Mountains C-2	67	39.40	159	34.00	Middle Ordovician-Middle Devonian	DOc	DOc	5.0	5.5	85ADN61D		A-85-39D	Dumoulin	Harris	
Baird Mountains C-2	67	39.40	159	34.00	Middle-Late Ordovician	DOc	DOc	5.0	5.5	85ADN61E	10370-CO	A-85-39A	Dumoulin	Harris	
Baird Mountains C-2	67	40.10	159	34.60	Middle Ordovician-Middle Devonian	DOc	DOc	5.0	5.0	85ADN64A		A-85-39D	Dumoulin	Harris	
Baird Mountains C-2	67	39.90	159	34.70	middle-Late Silurian	DOc	DOc	5.0	5.0	85ADN63B	11367-SD	A-85-39D	Dumoulin	Harris	
Baird Mountains C-2	67	39.70	159	37.20	Middle Ordovician	OЄc	OCc	5.0	5.0	88AD45B	10699-CO	A-89-4	Dumoulin	Harris	
Baird Mountains C-2	67	41.10	159	37.20	Middle Ordovician (late Llanvirnian)	OЄc	OCc	5.0	5.0	87AD17D	10593-CO	A-87-13A	Dumoulin	Harris	
Baird Mountains C-2	67	41.20	159	37.30	late Early Silurian (Llandoverian)	[DOc]	DOc	5.0	5.0	87AD17C	11768-SD	A-87-13A	Dumoulin	Harris	Sample from an outcrop of unit DOc too small to show on map.
Baird Mountains C-2	67	40.60	159	37.90	Middle Ordovician (latest Llanvirnian-Llandeilian)	OЄc	OCc	5.0	5.0	88AD52B	10700-CO	A-89-4	Dumoulin	Harris	From measured section ~1 km SE of Sheep Creek.
Baird Mountains C-2	67	40.60	159	37.90	Middle Ordovician (latest Llanvirnian-Llandeilian)	OЄc	OCc	5.0	5.0	88AD52C	10701-CO	A-89-4	Dumoulin	Harris	From measured section ~1 km SE of Sheep Creek.
Baird Mountains C-2	67	40.60	159	37.90	Middle-Late Ordovician (late Llanvirnian-very early Caradocian)	OЄc	OCc	5.0	5.0	88AD52D	10702-CO	A-89-4	Dumoulin	Harris	From measured section ~1 km SE of Sheep Creek.
Baird Mountains C-2	67	41.40	159	38.10	Middle Ordovician	OЄc	OCc	5.0	5.5	8-6-84A	10351-CO	A-85-39D	Harris	Harris	Dumoulin and Harris (1987), section B; Karl and others (1989b), Table 1, loc. 53. From measured section on NW side of Sheep Creek.
Baird Mountains C-2	67	41.30	159	38.10	Middle Ordovician	OЄc	OCc	5.0	5.0	83EK14A	9809-CO	A-83-27I	Ellersieck	Harris	
Baird Mountains C-2	67	41.00	159	38.10	Late Ordovician-middle Silurian	DOc	DOc	5.0	5.5	85ADN60A	11356-SD	A-85-39D	Dumoulin	Harris	Dumoulin and Harris (1987), section B; *Karl and others (1989b), Table 1, loc. 53. From measured section on NW side of Sheep Creek.
Baird Mountains C-2	67	41.00	159	38.10	middle-early Late Silurian (Wenlockian-Ludlovian)	DOc	DOc	5.0	5.5	85ADN60D	11358-SD	A-85-39D	Dumoulin	Harris	Dumoulin and Harris (1987), section B; *Karl and others (1989b), Table 1, loc. 53. From measured section on NW side of Sheep Creek.
Baird Mountains C-2	67	41.00	159	38.10	middle-Late Silurian	DOc	DOc	5.0	6.0	8-7-84G	11359-SD	A-85-39D	Harris	Harris	Dumoulin and Harris (1987), section B; *Karl and others (1989b), Table 1, loc. 53. From measured section on NW side of Sheep Creek.
Baird Mountains C-2	67	40.90	159	38.10	middle-early Late Silurian (Wenlockian-Ludlovian)	DOc	DOc	5.0	7.0	88AD52H	11931-SD	A-89-4	Dumoulin	Harris	
Baird Mountains C-2	67	41.35	159	38.30	middle-Late Silurian	DOc	DOc	6.5	7.0	8-6-84H	11355-SD	A-85-39D	Harris	Harris	Dumoulin and Harris (1987), section B; Karl and others (1989b), Table 1, loc. 53. From measured section on NW side of Sheep Creek. CAI values indicate hydrothermal alteration.
Baird Mountains C-2	67	40.95	159	38.40	Late Silurian (very probably Ludlovian)	DOc	DOc	5.0	5.5	8-7-84F	11360-SD	A-85-39D	Harris	Harris	Dumoulin and Harris (1987), section B; *Karl and others (1989b), Table 1, loc. 53. From measured section on NW side of Sheep Creek.
Baird Mountains C-2	67	40.70	159	38.40	Middle Ordovician-Middle Devonian	OЄc	OCc?	5.0	5.5	88AD44A		A-89-4	Dumoulin	Harris	
Baird Mountains C-2	67	39.45	159	38.56	Silurian-Early Devonian (probably middle-early Late Silurian)	DOc	DOc?	5.0	5.0	88JS13B	11932-SD	A-89-4	Schmidt	Harris	
Baird Mountains C-3	67	33.00	160	16.80	early Middle Ordovician (late Llanvirnian-early Llandeilian)	PzЄcm	Dotq	5.0	5.0	84EK101	9971-CO	A-84-50J	Ellersieck	Harris	Karl and others (1989b), Table 1, loc. 44. Entry 7593 in Alaska Paleontological Database.
Baird Mountains C-3	67	30.11	160	16.88	early Early Mississippian (Kinderhookian)	Pzm	Pzkm	5.0	5.0	83SK281A	29223-PC	A-83-27I	Karl	Harris	Karl and others (1989b), Table 1, loc. 45.
Baird Mountains C-3	67	40.86	160	23.78	Ordovician-Permian	Dl	Dl?	5.0	5.0	8-4-83A		A-83-27H	Harris	Harris	
Baird Mountains C-3	67	30.90	160	30.00	Middle-Late Devonian	Dmu		5.0	5.0	83JS74A	10881-SD	A-83-27M	Schmidt	Harris	
Baird Mountains C-4	67	42.00	160	40.90	Middle-Late Devonian	Dmu	Nakolik River unit	5.0	5.0	83SK141A	10888-SD	A-83-27I	Karl	Harris	Contains redeposited conodonts of late Middle-Late Ordovician age.
Baird Mountains C-4	67	35.50	160	41.30	Ordovician (probably Early Ordovician)	DOb	Baird Group	5.5	5.5	8-9-84B	10584-CO	A-87-9	Harris	Harris	
Baird Mountains C-4	67	44.70	160	42.30	Middle Devonian (probably Givetian)	Dl	Nakolik River unit	5.0	5.0	8-4-83G	10747-SD	A-83-27	Harris	Harris	Age based on corals found in this sample.
Baird Mountains C-4	67	43.30	160	46.00	Early-earliest Late Devonian	Dl	Dl?	5.0	5.0	8-5-83A	10748-SD	A-83-27	Harris	Harris	
Baird Mountains C-4	67	40.80	160	45.90	Middle-early Late Devonian (probably Middle Devonian)	Dl	Dl	5.0	5.0	8-8-83B	10847-SD	A-83-27H	Harris	Harris	
Baird Mountains C-4	67	31.00	160	48.40	Early-early Middle Ordovician	DOb	Baird Group	5.5	6.0	74ABE201	8296-CO	A-74-17	Brosgé	Epstein	Sample consists of cobbles from stream gravel. Entry 5919 in Alaska Paleontological Database.
Baird Mountains C-4	67	30.40	160	51.00	Ordovician-Devonian	DOb	Baird Group	5.0	6.5	8-13-83F		A-83-27F	Harris	Harris	
Baird Mountains C-4	67	42.75	160	51.00	Middle-Late Devonian	Dl	Dl	5.0	5.5	83SK156C	10879-SD	A-83-27M	Karl	Harris	
Baird Mountains C-4	67	30.50	160	51.40	middle-late Early Ordovician	DOb	Baird Group	5.5	6.5	8-13-83E	9753-CO	A-83-27F	Harris	Harris	
Baird Mountains C-4	67	42.75	160	51.60	Middle Devonian (latest Eifelian-late Givetian)	Dl	Dl	5.0	5.5	83SK155A	10884-SD	A-83-27I	Karl	Harris	
Baird Mountains C-4	67	31.75	160	51.75	middle-late Early Ordovician	DOb	Baird Group	6.5	6.5	84ADN128B	9946-CO	A-84-50F	Dumoulin	Harris	Entry 7541 in Alaska Paleontological Database.
Baird Mountains C-4	67	31.42	160	51.76	middle Early-earliest Middle Ordovician (early middle-early late Arenigian)	DOb	Baird Group	5.5	5.5	84ADN129B	9916-CO	A-84-50C	Dumoulin	Harris	Entry 7389 in Alaska Paleontological Database.
Baird Mountains C-4	67	31.80	160	51.80	early Middle Ordovician	DOb	Baird Group	8.0	8.0	84ADN128A	9945-CO	A-84-50F	Dumoulin	Harris	Entry 7539 in Alaska Paleontological Database.
Baird Mountains C-4	67	30.30	160	52.00	middle late Early Devonian (middle Emsian)	DOb	Baird Group	5.0	6.0	8-13-83H	10843-SD	A-83-27F	Harris	Harris	
Baird Mountains C-4	67	42.70	160	52.00	Late Devonian	Dmu	Nakolik River unit	5.5	5.5	83SK153A	10889-SD	A-83-27I	Karl	Harris	

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Baird Mountains C-4	67	37.75	160	52.36	middle Early-early Middle Ordovician	DOb	Baird Group	5.0	5.5	8-10-84G	10507-CO	A-86-33A	Dumoulin	Harris	Dumoulin and Harris (1987), section D; *Karl and others (1989b), Table 1, loc. 34. From measured section near Nakolik River.
Baird Mountains C-4	67	37.75	160	52.36	Early Ordovician (middle Arenigian)	DOb	Baird Group	5.0	5.5	8-10-84I	10296-CO	A-86-33A	Dumoulin	Harris	Dumoulin and Harris (1987), section D; Karl and others (1989b), Table 1, loc. 34. From measured section near Nakolik River. Contains redeposited Late Cambrian conodonts.
Baird Mountains C-4	67	37.75	160	52.36	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.5	8-11-84A	10506-CO	A-86-33A	Dumoulin	Harris	Dumoulin and Harris (1987), section D; Karl and others (1989b), Table 1, loc. 34. From measured section near Nakolik River.
Baird Mountains C-4	67	30.50	160	52.80	middle-late Early Ordovician	DOb	Baird Group	7.0	8.0	OM-151	10248-CO	A-85-35B	Folger	Harris	Entry 6580 in Alaska Paleontological Database.
Baird Mountains C-4	67	34.30	160	53.00	Middle-early Late Devonian (Eifelian-earliest Frasnian)	Dl	Nakolik River(?) unit	5.0	5.5	85PF135A	11397-SD	A-85-39H	Folger	Harris	
Baird Mountains C-4	67	30.80	160	53.80	Middle Ordovician (probably middle to late Middle Ordovician)	DOb	Baird Group	7.0	8.0	OM145	10247-CO	A-85-35B	Folger	Harris	Entry 6579 in Alaska Paleontological Database.
Baird Mountains C-4	67	32.25	160	54.30	late Early Devonian (lower half of Emsian)	DOb	Baird Group	5.0	5.0	74ATR134.1.1	9600-SD	A-74-16	Tailleur	Epstein	Entry 5900 in Alaska Paleontological Database.
Baird Mountains C-4	67	37.90	160	54.66	Early Ordovician	DOb	Baird Group	5.0	5.5	85ADN50E	10367-CO	A-85-39G	Dumoulin	Harris	From measured section near Nakolik River.
Baird Mountains C-4	67	38.40	160	55.00	Early Ordovician	DOb	Baird Group	5.0	5.5	85ADN50H	10368-CO	A-85-39G	Dumoulin	Harris	From measured section near Nakolik River.
Baird Mountains C-4	67	38.66	160	55.00	Middle (probably very latest Middle)-Late Ordovician	DOb	Baird Group	5.0	5.5	85ADN50J	10369-CO	A-85-39G	Dumoulin	Harris	From measured section near Nakolik River.
Baird Mountains C-4	67	31.16	160	56.10	Early Ordovician	DOb	Baird Group	5.0	5.0	85MF77D	10425-CO	A-85-39J	Flaherty	Harris	
Baird Mountains C-4	67	33.50	160	59.50	Middle Devonian	DOb	Baird Group	5.0	5.5	85JS99A	11419-SD	A-85-39I	Schmidt	Harris	
Baird Mountains C-4	67	36.50	160	59.50	Middle Devonian	Dmu	Nakolik River unit	5.5	5.5	84SK197A	11143-SD	A-84-50I	Karl	Harris	Entry 7574 in Alaska Paleontological Database.
Baird Mountains C-4	67	42.40	160	59.60	middle Middle Devonian (very latest Eifelian-lower half of Givetian)	Dmu	Nakolik River unit	5.0	5.5	83SK150A	10752-SD	A-83-27	Karl	Harris	Age likely lower half of Givetian, based on overlapping ranges of conodonts and Givetian-Frasnian corals in this sample.
Baird Mountains C-5	67	37.78	161	0.53	late Middle Devonian (Givetian, possibly very latest Givetian)	Dmu	Nakolik River unit	5.0	5.5	84SK193A	11142-SD	A-84-50I	Karl	Harris	Entry 7573 in Alaska Paleontological Database.
Baird Mountains C-5	67	39.32	161	0.64	Silurian-Permian	Dmu		5.0	5.0	85BT105A		A-85-39I	Thompson	Harris	
Baird Mountains C-5	67	32.00	161	1.60	Early Ordovician	DOb	Baird Group	5.0	5.5	84PF249R	9972-CO	A-84-50J	Folger	Harris	Entry 7613 in Alaska Paleontological Database.
Baird Mountains C-5	67	37.80	161	1.80	Middle Ordovician-Middle Devonian	Dmu	Nakolik River unit	5.5	6.0	84SK191		A-84-50C	Karl	Harris	Entry 7402 in Alaska Paleontological Database.
Baird Mountains C-5	67	32.50	161	4.50	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.5	85SK44A	10386-CO	A-85-39H	Karl	Harris	
Baird Mountains C-5	67	38.50	161	4.80	Middle Devonian	Dl	Nakolik River unit	5.0	5.5	84SK189	11147-SD	A-84-50J	Karl	Harris	Entry 7615 in Alaska Paleontological Database.
Baird Mountains C-5	67	37.70	161	5.50	Middle-Late Devonian	DOb		5.0	5.5	81EK364C	10512-SD	NPRA-81-A	Ellersieck	Harris	
Baird Mountains C-5	67	38.10	161	5.50	middle Middle Devonian (middle Eifelian-early Givetian)	Dmu	Nakolik River unit (Dnl)	5.0	5.5	84EK132A	11144-SD	A-84-50J	Ellersieck	Harris	Karl and others (1989b), Table 1, loc. 33. Entry 7610 in Alaska Paleontological Database.
Baird Mountains C-5	67	38.10	161	5.50	middle Middle Devonian (early-middle Givetian)	Dmu	Nakolik River unit (Dnl)	5.0	5.5	84EK132C	11145-SD	A-84-50J	Ellersieck	Harris	Karl and others (1989b), Table 1, loc. 33. Entry 7611 in Alaska Paleontological Database.
Baird Mountains C-5	67	37.20	161	5.70	Early Devonian (earliest Emsian)	DOb	Baird Group	5.5	5.5	81TR127C	10463-SD	NPRA-81-5	Tailleur	Harris	
Baird Mountains C-5	67	40.50	161	5.90	Middle Devonian	Dmu		5.0	5.0	81BX137H	10491-SD	NPRA-81-5	Tailleur	Harris	
Baird Mountains C-5	67	32.33	161	6.00	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.5	85SK43A	10374-CO	A-85-39H1	Karl	Harris	
Baird Mountains C-5	67	37.90	161	6.50	Middle Ordovician-Middle Devonian	DOb	Baird Group	5.0	5.5	85JS86F	11393-SD	A-85-39H	Dumoulin	Harris	
Baird Mountains C-5	67	40.30	161	10.20	latest Early-Middle Devonian ((latest Emsian-Givetian)	Dl	Nakolik River unit	5.0	5.5	85BT98B	11422-SD	A-85-39I	Thompson	Harris	
Baird Mountains C-5	67	39.80	161	10.50	late Middle-early Late Devonian (Givetian-early Frasnian)	Dl	Nakolik River unit	5.0	5.0	85ADN105H	11374-SD	A-85-39D	Dumoulin	Harris	
Baird Mountains C-5	67	39.80	161	10.90	Middle Ordovician-Middle Devonian	Dl	Nakolik River unit	4.0	4.5	85ADN105D		A-85-39D	Dumoulin	Harris	
Baird Mountains C-5	67	39.50	161	11.00	Late Devonian-early Early Mississippian	Dl	Nakolik River unit	4.5	5.0	85SK248E		A-85-39H	Karl	Harris	
Baird Mountains C-5	67	33.30	161	12.50	Middle Ordovician-Middle Devonian	DOb	Baird Group	5.0	5.5	85SK115A		A-85-39H	Karl	Harris	
Baird Mountains C-5	67	34.66	161	15.33	early-middle Early Ordovician	DOb	Baird Group	5.0	5.5	85SK53A	10375-CO	A-85-39H1	Karl	Harris	
Baird Mountains C-5	67	37.80	161	16.30	Middle Ordovician-Middle Devonian (probably Silurian-Middle Devonian)	DOb	Baird Group	5.0	6.0	85JS41A		A-85-39H	Schmidt	Harris	CAI values indicate hydrothermal alteration.
Baird Mountains C-5	67	37.80	161	16.40	middle Silurian-Middle Devonian (possibly Middle Devonian)	DOb	Baird Group	5.0	5.5	85JS41C	11416-SD	A-85-39I	Schmidt	Harris	
Baird Mountains C-5	67	35.50	161	17.50	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.5	85SK57A	10376-CO	A-85-39H1	Karl	Harris	
Baird Mountains C-5	67	39.40	161	17.90	early early Middle Devonian (early Eifelian)	DOb	Baird Group	5.0	5.0	84EK182	11140-SD	A-84-50I	Ellersieck	Harris	Karl and others (1989b), Table 1, loc. 32. Entry 7562 in Alaska Paleontological Database.
Baird Mountains C-5	67	39.30	161	18.20	Late Devonian	Dmu	Nakolik River unit	6.0	7.0	84EK183A	11146-SD	A-84-50J	Ellersieck	Harris	Karl and others (1989b), Table 1, loc. 31. Entry 7612 in Alaska Paleontological Database.
Baird Mountains C-5	67	35.50	161	19.20	middle-late Early Ordovician	DOb	Baird Group	6.5	7.0	85PF176A	10383-CO	A-85-39H	Folger	Harris	
Baird Mountains C-5	67	33.50	161	20.20	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.0	5.5	85ADN99A, B, F&H	10363, 64, 65 &66-CO	A-85-39F	Dumoulin	Harris	From measured section S of Agashashok River.
Baird Mountains C-5	67	30.51	161	20.60	middle Late Silurian (latest Ludlovian)-early Early Devonian	DOb	Baird Group	5.0	5.5	84SK202A	11097-SD	A-84-50C	Karl	Harris	Entry 7487 in Alaska Paleontological Database.

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Baird Mountains C-5	67	30.60	161	20.80	probably Silurian (possibly middle-Late Silurian; Wenlockian-Ludlovian)	DOb	Baird Group	5.5	6.0	8-8-84A	11539-SD	A-86-33F	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 36. From measured section near middle fork of Squirrel River.
Baird Mountains C-5	67	30.60	161	20.80	middle-early Late Silurian (Wenlockian-Ludlovian, possibly Ludlovian)	DOb	Baird Group	5.5	5.5	8-8-84B	11289-SD	A-86-33F	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 36. From measured section near middle fork of Squirrel River.
Baird Mountains C-5	67	32.80	161	21.25	middle Early Ordovician (early Arenigian)	DOb	Baird Group	5.5	5.5	84SK207A	9974-CO	A-84-50J	Karl	Harris	Entry 7616 in Alaska Paleontological Database.
Baird Mountains C-5	67	30.47	161	21.43	Late Silurian-Middle Devonian	DOb	Baird Group	5.0	5.0	84SK200A	110099-SD	A-84-50C	Karl	Harris	Entry 5196 in Alaska Paleontological Database.
Baird Mountains C-5	67	30.20	161	21.50	earliest late Early Devonian (earliest Emsian)	DOb	Baird Group	5.0	5.0	8-5-84C	11094-SD	A-84-50C	Harris	Harris	Dumoulin and Harris (1987), section E; Karl and others (1989b), Table 1, loc. 37. Entry 7483 in Alaska Paleontological Database. From measured section near middle fork of Squirrel River.
Baird Mountains C-5	67	30.04	161	21.70	Early-early Late Silurian (Llandoverian-Ludlovian)	DOb	Baird Group	6.0	7.0	8-5-84A	11093-SD	A-84-50C	Harris	Harris	Entry 7404 in Alaska Paleontological Database.
Baird Mountains C-5	67	41.20	161	21.70	Middle Ordovician-Permian	Dmu	Nakolik River(?) unit	5.0	5.0	85JS50B		A-85-39H	Schmidt	Harris	
Baird Mountains C-5	67	40.20	161	21.86	Silurian-Devonian	DOb	Baird Group	5.0	5.0	85PF62A	11394-SD	A-85-39H	Folger	Harris	
Baird Mountains C-5	67	32.63	161	22.75	Early-Middle Ordovician (Arenigian-Caradocian)	DOb	Baird Group	5.0	5.5	84SK208A	9975-CO	A-84-50J	Karl	Harris	Entry 7617 in Alaska Paleontological Database.
Baird Mountains C-5	67	38.00	161	22.00	Late Devonian-Mississippian	[Mkl?]	Baird(?) Group	4.5	4.5	81EK455A		NPRA-81-5A	Ellersieck	Harris	Conodont fauna and lithology (cherty dolostone) suggest sample comes from an outcrop of Lisburne Group (in unit Mkl) too small to show on map.
Baird Mountains C-5	67	32.10	161	23.25	early Early Ordovician	DOb	Baird Group	5.5	6.0	84SK210	9937-CO	A-84-50D	Karl	Harris	Karl and others (1989b), Table 1, loc. 35. Entry 7376 in Alaska Paleontological Database.
Baird Mountains C-5	67	37.80	161	23.60	Silurian-Middle Devonian	DOb	Baird Group	5.0	5.5	85SK61A	11420-SD	A-85-39I	Karl	Harris	
Baird Mountains C-5	67	38.80	161	24.70	Middle-Late Devonian	Dmu	Nakolik River unit	5.0	5.0	85SK111A	11421-SD	A-85-39I	Karl	Harris	
Baird Mountains C-5	67	37.81	161	26.03	Silurian-Middle Devonian	DOb	Baird(?) Group	5.0	5.0	81TR130A		NPRA-81-5A	Tailleur	Harris	
Baird Mountains C-5	67	35.45	161	29.99	Middle Ordovician-Middle Devonian	DOb	Baird Group	5.0	5.5	85JS83A		A-85-39H	Schmidt	Harris	
Baird Mountains C-6	67	31.83	161	33.22	Early Devonian (Lochkovian-earliest Emsian)	DOb	Baird(?) Group	5.0	5.0	85PF122D	11396-SD	A-85-39H	Folger	Harris	
Baird Mountains C-6	67	30.80	161	37.30	Late Silurian-middle Early Devonian (Ludlovian-early Emsian, possibly early Emsian)	DOb	Baird(?) Group	5.0	5.0	85BT93A	11415-SD	A-85-39I	Thompson	Harris	
Baird Mountains C-6	67	41.83	161	38.75	latest Devonian (middle Famennian)-Mississippian	JDk	Endicott Group (Kayak Shale)	5.0	5.0	81EK259		NPRA-81-5A	Ellersieck	Harris	Karl and others (1989b), Table 1, loc. 21; foraminifers from this locality indicate an age of Mississippian (Osagean or younger).
Baird Mountains C-6	67	31.20	161	40.70	Middle Ordovician-Permian	Dmu	Nakolik River unit	5.0	5.5	85ADN72AA		A-85-39H	Dumoulin	Harris	
Baird Mountains C-6	67	44.50	161	54.30	late Middle-early Late Devonian (Givetian-Frasnian)	MDer	Baird(?) Group	4.0	4.0	86AD38A	11502-SD	A-86-33A	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 20.
Baird Mountains C-6	67	30.50	161	57.70	Middle Ordovician-Middle Devonian	DOb	Baird Group	5.0	5.5	85SK176A		A-85-39H	Karl	Harris	
Baird Mountains C-6	67	41.67	161	58.49	Late Devonian-Mississippian	MDer	Utukok Formation (top)	5.0	5.0	85BT94B		A-85-39I	Thompson	Harris	
Baird Mountains C-6	67	34.30	161	58.50	middle Silurian (late early Wenlockian)	DOb	Baird Group	5.5	5.5	86MZ053A	11518-SD	A-86-33D	Zayatz	Harris	Karl and others (1989b), Table 1, loc. 23.
Baird Mountains C-6	67	41.60	161	58.60	latest Late Devonian-early Late Mississippian (late Famennian-Meramecian)	MDer	Kogruk Formation (base)	5.0	5.0	85BT94A	29867-PC	A-85-39I	Thompson	Harris	
Baird Mountains C-6	67	38.80	161	59.20	late Late Devonian (Famennian)	MDer	Eli Limestone	5.0	5.0	85ADN85A	11372-SD	A-85-39D	Dumoulin	Harris	
Baird Mountains C-6	67	39.90	161	59.30	latest Devonian-Early Mississippian (late late Famennian-earliest Osagean)	MDer	Lisburne Gp. (Utukok Fm.?)	4.0	4.5	85SK245B		A-85-39J	Karl	Harris	
Baird Mountains C-6	67	40.50	161	59.99	early Early Mississippian (Kinderhookian-earliest Osagean)	MDer	Lisburne Gp. (Utukok Fm.)	4.0	4.0	85SK244D	29900-PC	A-85-39J	Karl	Harris	
Baird Mountains D-1	67	53.48	159	6.07	Middle Ordovician (probably Llandeilian-earliest Caradocian)	OꞒc	OCc	5.0	5.0	83SK167A	9813-CO	A-83-27I	Karl	Harris	
Baird Mountains D-1	67	53.40	159	6.10	Middle Ordovician (latest Llanvirnian-early Caradocian)	OꞒc	OCc	5.0	5.0	85ADN143A	10373-CO	A-85-39H	Dumoulin	Harris	*Karl and others (1989b), Table 1, loc. 49.
Baird Mountains D-1	67	53.40	159	6.10	middle Middle-early Late Ordovician (possibly late Middle Ordovician)	OꞒc	OCc	5.5	5.5	85ADN143X	10516-CO	A-86-33A	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 49.
Baird Mountains D-1	67	54.00	159	6.80	Late Ordovician (possibly Richmondian)	DOc	DOc	5.0	5.5	85ADN142C	10392-CO	A-85-39I	Dumoulin	Harris	
Baird Mountains D-1	67	53.38	159	9.84	Silurian-Middle Devonian	DOc	DOc	5.0	5.0	83PF03B	10887-SD	A-83-27I	Folger	Harris	
Baird Mountains D-1	67	47.53	159	14.17	middle Late Mississippian (latest Meramecian-early Chesterian)	Ml	Kogruk Formation	5.0	5.0	83ADN102E	28976-PC	A-83-27	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 60.
Baird Mountains D-1	67	45.20	159	16.10	Middle Ordovician-Middle Devonian	DOc	DOc	5.0	5.5	8-2-83G		A-83-27J	Karl	Harris	From measured section N of Mt. Angayukaqsraq.
Baird Mountains D-1	67	45.35	159	16.48	Silurian-Mississippian	Ml	Kogruk Formation	5.0	5.0	8-2-83A		A-83-27J	Harris	Harris	From measured section N of Mt. Angayukaqsraq.
Baird Mountains D-1	67	47.10	159	20.00	Middle Ordovician-Silurian	DOc	DOc	5.0	5.0	8-6-83E		A-83-27D	Harris	Harris	
Baird Mountains D-1	67	47.10	159	20.60	Middle Ordovician-Silurian	DOc	DOc	5.0	5.0	8-6-83D		A-83-27D	Harris	Harris	
Baird Mountains D-1	67	47.10	159	21.30	Middle Ordovician-Silurian	DOc	DOc	5.0	5.0	8-6-83C		A-83-27D	Harris	Harris	

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Baird Mountains D-1	67	47.10	159	21.80	Late Silurian (Ludlovian-middle Pridolian)	DOc	DOc	5.0	5.0	8-6-83A	10835-SD	A-83-27D	Harris	Harris	Karl and others (1989b), Table 1, loc. 50.
Baird Mountains D-1	67	49.25	159	21.75	Silurian-Devonian (probably Silurian-Early Devonian)	DOc	DOc	5.0	5.0	83EK08G	10885-SD	A-83-27I	Harris	Harris	
Baird Mountains D-1	67	49.30	159	22.00	Silurian-Early Devonian	DOc	DOc	5.0	5.0	86AD57B	11505-SD	A-86-33A	Dumoulin	Harris	
Baird Mountains D-1	67	49.45	159	22.00	middle Silurian-Early Devonian	DOc	DOc	5.0	5.0	86AD57A	11506-SD	A-86-33A	Dumoulin	Harris	
Baird Mountains D-1	67	51.80	159	22.00	Late Silurian (possibly late Ludlovian-middle Pridolian)	DOc	DOc	5.0	5.0	86AD54Z	11504-SD	A-86-33A	Dumoulin	Harris	
Baird Mountains D-1	67	47.10	159	22.50	Late Ordovician-Devonian	DOc	DOc	5.0	5.0	8-6-83B		A-83-27D	Harris	Harris	
Baird Mountains D-1	67	48.69	159	24.95	Middle Ordovician-Devonian	DOc	DOc	5.5	5.5	86JS17B		A-86-33A	Dumoulin	Harris	
Baird Mountains D-1	67	47.20	159	28.00	middle-Late Silurian	DOc	DOc	5.0	5.0	85ADN140B	11376-SD	A-85-39H	Dumoulin	Harris	
Baird Mountains D-1	67	47.20	159	28.00	latest Early-early Late Silurian (late Llandoverian-Ludlovian)	DOc	DOc	5.0	5.0	85ADN140D	11377-SD	A-85-39H	Dumoulin	Harris	
Baird Mountains D-1	67	47.30	159	28.10	middle Late Silurian (late Ludlovian-middle Pridolian)	DOc	DOc	5.0	5.0	85ADN141A	11379-SD	A-85-39H	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 51.
Baird Mountains D-1	67	45.00	159	29.70	Silurian-Early Devonian	DOc	DOc	5.0	5.0	87AD29Z	11858-SD	A-87-13C	Dumoulin	Harris	
Baird Mountains D-2	67	46.69	159	30.84	late Late Ordovician (Richmondian)	DOc	DOc	5.0	5.0	86AD67B	10562-CO	A-86-33D	Dumoulin	Harris	
Baird Mountains D-2	67	46.47	159	33.10	Middle Ordovician-Middle Devonian	DOc	DOc?	5.0	5.0	8-6-83F		A-83-27D	Harris	Harris	
Baird Mountains D-2	67	46.30	159	33.10	Middle Ordovician-Middle Devonian	DOc	DOc	5.0	5.0	87AD6A		A-87-13A	Dumoulin	Harris	
Baird Mountains D-2	67	46.50	159	34.70	Middle Ordovician-Middle Devonian	DOc	DOc?	5.5	6.0	8-6-83H		A-83-27D	Harris	Harris	
Baird Mountains D-2	67	46.50	159	34.70	Middle Ordovician-Middle Devonian	DOc	DOc?	5.0	5.0	8-6-83I		A-83-27D	Harris	Harris	
Baird Mountains D-2	67	46.10	159	35.60	very latest Ordovician (late Richmondian)	DOc	DOc	5.0	5.0	8-7-84K	10579-CO	A-86-33E	Harris	Harris	
Baird Mountains D-2	67	46.10	159	35.60	Late Ordovician (probably middle Maysvillian-Richmondian)	DOc	DOc	5.0	5.0	83EK13A	9808-CO	A-83-27I	Ellersieck	Harris	
Baird Mountains D-2	67	46.50	159	36.00	Middle Ordovician-Middle Devonian	DOc	DOc?	5.0	5.0	8-6-83J		A-83-27D	Harris	Harris	
Baird Mountains D-4	67	46.00	160	41.00	latest Middle Devonian (late Givetian)	Dl	Nakolik River unit	5.0	5.0	8-4-83D$_1$	10846-SD	A-83-27H	Harris	Harris	Karl and others (1989b), Table 1, loc. 28.
Baird Mountains D-4	67	45.00	160	43.50	Middle-Late Devonian	Dl	*Nakolik River unit	5.0	5.0	81MD137C	10493-SD	NPRA-81-5	Mayfield	Harris	
Baird Mountains D-4	67	46.60	160	49.30	early Late Devonian (Frasnian)	Dl	Nakolik River unit	5.0	5.0	83SK148A	10882-SD	A-83-27I	Karl	Harris	Karl and others (1989b), Table 1, loc. 27.
Baird Mountains D-4	67	46.80	160	50.00	Late Devonian	Dmu	Nakolik River unit	5.0	5.0	83SK147A	10883-SD	A-83-27I	Karl	Harris	
Baird Mountains D-4	67	46.40	160	50.20	Middle Ordovician-Permian	Dmu	Nakolik River unit	5.0	5.5	8-10-84F		A-87-9	Harris	Harris	
Baird Mountains D-4	67	47.82	160	56.49	late Early-Middle Devonian (Emsian-Givetian)	Dmu	Nakolik River unit	5.0	5.0	84EK180	11092-SD	A-84-50C	Ellersieck	Harris	Entry 7398 in Alaska Paleontological Database.
Baird Mountains D-5	67	48.00	161	13.50	Silurian-Permian	Mkl	MDl?	5.0	5.0	85ADN106E		A-85-39A	Dumoulin	Harris	Entry 6654 in Alaska Paleontological Database.
Baird Mountains D-5	67	51.30	161	14.80	latest Devonian (late Famennian)-Early Mississippian	Dn	Limestone above Noatak Sandstone (MDl)	5.0	5.0	84JS20B		A-84-50I	Schmidt	Harris	Entry 7565 in Alaska Paleontological Database.
Baird Mountains D-5	67	51.60	161	15.00	latest Devonian (late Famennian)-Early Mississippian (probably late Famennian)	Dn	Limestone above Noatak Sandstone (MDl)	5.0	5.0	84JS22	11132-SD	A-84-50D	Schmidt	Harris	Karl and others (1989b), Table 1, loc. 25. Entry 7363 in Alaska Paleontological Database.
Baird Mountains D-5	67	48.73	161	16.11	Silurian-Permian	Mkl	Kogruk Formation	5.0	5.0	85ADN108B		A-85-39B	Dumoulin	Harris	Entry 6663 in Alaska Paleontological Database.
Baird Mountains D-5	67	45.66	161	22.76	Devonian-Mississippian	[Mcp]	IPMC (Kuna? Formation)	5.0	5.0	84JS16F		A-84-50I	Schmidt	Harris	Entry 7564 in Alaska Paleontological Database. Sample is from an outcrop of Mcp too small to show on map.
Baird Mountains D-6	67	57.50	161	31.50	late Middle Devonian (middle Givetian)	MzDm	IPDl	3.5	4.0	85ADN86E	11414-SD	A-85-39I	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 2.
Baird Mountains D-6	67	57.70	161	31.60	latest Mississippian-earliest Pennsylvanian (latest Chesterian-very early Morrowan)	MzDm	IPDl	4.0	4.0	85ADN86B	29865-PC	A-85-39I	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 2.
Baird Mountains D-6	67	58.60	161	32.10	late Early Mississippian (Osagean)	MzDm	Ml	3.0	3.0	85BT83B	29866-PC	A-85-39I	Thompson	Harris	
Baird Mountains D-6	67	54.39	161	35.11	late Late Devonian-early Late Mississipian	MDer	Kogruk Formation	5.5	5.5	86AD25A		A-86-33D	Dumoulin	Harris	
Baird Mountains D-6	67	52.05	161	36.00	latest Devonian (late Famennian)-Mississippian	JDk	IPMC (Kuna? Formation)	5.0	5.0	81EK220E		NPRA-81-5	Ellersieck	Harris	Collection reexamined and age confirmed 6/00 by A. Harris. Karl and others (1989b), Table 1, loc. 29.
Baird Mountains D-6	67	58.82	161	36.46	latest Devonian (latest Famennian)	MzDm	Kugururok Formation	3.5	4.0	85ADN91E	11373-SD	A-85-39D	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 1.
Baird Mountains D-6	67	48.15	161	36.54	latest Devonian-early Early Mississippian (late Famennian-middle Osagean)	JDk	Endicott Group (Kayak? Shale)	5.0	5.0	79MD184B		NPRA-79-4C	Mayfield	Harris	
Baird Mountains D-6	67	49.70	161	36.60	Early Mississippian (probably Kinderhookian)	JDk	Kayak Shale	5.0	5.0	84EK8	29635-PC	A-84-50I	Ellersieck	Harris	Karl and others (1989b), Table 1, loc. 12. Entry 7555 in Alaska Paleontological Database.
Baird Mountains D-6	67	55.00	161	37.00	Middle Ordovician-Middle Devonian	MzDm	Baird(?) Group	4.0	4.0	86MZ022A		A-86-33D	Zayatz	Harris	
Baird Mountains D-6	67	55.80	161	40.80	late Middle-early Late Devonian (Givetian-Frasnian)	MzDm	Kugururok Formation	3.5	4.0	86AD21J	11514-SD	A-86-33D	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 5.
Baird Mountains D-6	67	53.30	161	42.00	late Late Devonian (late Famennian)	MzDm	Kugururok Formation	3.0	3.0	84EK52	11131-SD	A-84-50D	Ellersieck	Harris	Entry 7362 in Alaska Paleontological Database.
Baird Mountains D-6	67	52.70	161	43.80	Middle-Late Devonian	MzDm	Kugururok Formation	4.5	5.5	85ADN94F	11276-SD	A-85-39A	Dumoulin	Harris	Entry 6653 in Alaska Paleontological Database.
Baird Mountains D-6	67	45.50	161	44.10	early Early Mississippian (Kinderhookian)	JDk	Mlt	5.0	5.0	85SK192B	29777-PC	A-85-39A	Karl	Harris	Karl and others (1989b), Table 1, loc. 19. Entry 6657 in Alaska Paleontological Database.
Baird Mountains D-6	67	50.20	161	45.00	latest Devonian-early Late Mississippian (late Famennian-Meramecian)	MDer	Kogruk(?) Formation	5.0	5.5	86AD31A		A-86-33D	Dumoulin	Harris	
Baird Mountains D-6	67	49.10	161	47.00	Early Mississippian (late Kinderhookian-Osagean)	MDer	Utukok Formation	5.5	5.5	85SK87A	29855-PC	A-85-39H	Karl	Harris	
Baird Mountains D-6	67	49.30	161	47.60	Late Mississippian (late Meramecian-Chesterian)	MDer	Kogruk Formation	5.5	6.0	86AD14A	29972-PC	A-86-33D	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 13.

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Baird Mountains D-6	67	49.40	161	48.00	late Early-Late Mississippian (late Osagean-earliest Chesterian)	MDer	Kogruk Formation	4.0	4.5	86AD14B	29973-PC	A-86-33D	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 13.
Baird Mountains D-6	67	46.20	161	48.50	Middle Devonian-Early Mississippian	JDk	Kayak Shale	5.0	5.0	85SK201A		A-85-39H	Karl	Harris	CAI cannot be precisely determined because of adventitious organic and mineral matter but is greater than 4.5.
Baird Mountains D-6	67	48.70	161	49.10	latest Devonian-Early Mississippian (late Famennian-Osagean)	MDer	Eli Limestone	4.0	4.5	85BT78B		A-85-39H	Thompson	Harris	
Baird Mountains D-6	67	48.70	161	49.10	late Late Devonian (Famennian)	MDer	Eli Limestone	4.0	4.5	85BT78C	11386-SD	A-85-39H	Thompson	Harris	
Baird Mountains D-6	67	48.60	161	49.30	late Late Devonian (middle-late Famennian)	MDer	Eli Limestone	4.0	4.0	85ADN78B	11302-SD	A-85-39B	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 14. Entry 6660 in Alaska Paleontological Database.
Baird Mountains D-6	67	49.90	161	50.00	Middle-Late Devonian	MzDm	Kugururok Formation	5.0	5.0	85BT79A	11387-SD	A-85-39H	Thompson	Harris	
Baird Mountains D-6	67	47.00	161	50.00	Late Devonian	MDer		4.5	4.5	AM4194-34			AMOCO	Harris	
Baird Mountains D-6	67	46.15	161	50.29	early Middle Devonian (Eifelian-earliest Givetian)	MDer	Baird(?) Group	5.0	5.5	85BT74B	11385-SD	A-89-39H	Thompson	Harris	
Baird Mountains D-6	67	46.10	161	50.30	Silurian-Middle Devonian	MDer	Baird(?) Group	4.0	4.5	86AD35A	11515-SD	A-86-33D	Dumoulin	Harris	
Baird Mountains D-6	67	47.20	161	50.60	Middle Ordovician-Early Devonian	MDer	Baird(?) Group	5.5	6.0	85ADN71C		A-85-39D	Dumoulin	Harris	
Baird Mountains D-6	67	47.30	161	50.70	Early (late Emsian)-Middle Devonian	MDer	Baird(?) Group	5.5	6.0	85ADN71E	11368-SD	A-85-39D	Dumoulin	Harris	
Baird Mountains D-6	67	47.30	161	50.80	Middle Devonian	MDer	Baird(?) Group	5.5	5.5	85ADN71G	11369-SD	A-85-39D	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 16.
Baird Mountains D-6	67	47.30	161	51.00	Late Devonian (probably Frasnian)	MDer	Eli Limestone	5.0	5.0	85ADN71L	11370-SD	A-85-39D	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 15.
Baird Mountains D-6	67	47.30	161	51.10	Middle-Late Devonian	MDer	Eli Limestone	4.5	4.5	84EK12B	11056-SD	A-84-50A	Ellersieck	Harris	
Baird Mountains D-6	67	47.30	161	51.10	Middle Devonian	MDer	Eli Limestone	4.5	4.5	84EK12A	11090-SD	A-84-50C	Ellersieck	Harris	Entry 7392 in Alaska Paleontological Database.
Baird Mountains D-6	67	47.30	161	51.20	late Middle Devonian (Givetian, probably lower half of Givetian)	MDer	Eli Limestone	4.5	5.0	84ADN69A	11137-SD	A-84-50F	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 15. Entry 7517 in Alaska Paleontological Database.
Baird Mountains D-6	67	46.70	161	52.50	Early Mississippian (probably Kinderhookian)	MDer	Utukok Formation	4.5	4.5	84ADN66H	29382-PC	A-84-50	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 18. Entry 7497 in Alaska Paleontological Database.
Baird Mountains D-6	67	46.70	161	52.50	middle late Early Mississippian (middle Osagean)	MDer	Utukok Formation (top)	4.5	4.5	84ADN66A	29383-PC	A-84-50	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 18. Entry 7498 in Alaska Paleontological Database.
Baird Mountains D-6	67	46.80	161	53.00	late Early-earliest Late Mississippian (late Osagean-early Meramecian)	MDer	Kogruk Formation	4.5	4.5	84ADN65A	29381-PC	A-84-50	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 17. Entry 7496 in Alaska Paleontological Database.
Baird Mountains D-6	67	46.80	161	53.00	latest Early Mississippian (late Osagean)	MDer	Kogruk Formation (base)	4.5	4.5	84ADN65D	29411-PC	A-84-50	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 17.
Baird Mountains D-6	67	46.00	161	53.00	Late Devonian (very probably Famennian)	MDer	Eli Limestone	4.5	4.5	85BT77B	11375-SD	A-85-39D	Thompson	Harris	
Baird Mountains D-6	67	46.10	161	53.00	Ordovician-Triassic	MDer	Eli(?) Limestone	5.0	5.0	85ADN77A		A-85-39H	Dumoulin	Harris	
Baird Mountains D-6	67	46.00	161	53.20	latest Devonian-earliest Mississippian (latest Famennian-early Kinderhookian)	MDer	Eli Limestone	5.0	5.0	85ADN76F		A-85-39A	Dumoulin	Harris	Entry 6652 in Alaska Paleontological Database.
Baird Mountains D-6	67	48.20	161	53.20	latest Middle-earliest Late Devonian (latest Givetian-earliest Frasnian)	MzDm	Kugururok Formation	3.5	3.5	85ADN79Z	11371-SD	A-85-39D	Dumoulin	Harris	Karl and others (1989b), Table 1, loc. 10.
Baird Mountains D-6	67	48.20	161	53.20	latest Early-Middle Devonian (late Emsian-Givetian)	MzDm	Kugururok Formation	2.5	3.0	81EK269	10511-SD	NPRA-81-5	Ellersieck	Harris	Karl and others (1989b), Table 1, loc. 10.
Baird Mountains D-6	67	45.70	161	53.60	Late Devonian	MDer	Eli Limestone	4.5	4.5	85BT82A	11388-SD	A-85-39H	Thompson	Harris	
Baird Mountains D-6	67	47.00	161	54.90	Silurian-Permian (probably Devonian-Mississippian)	MzDm		4.0	4.0	86MZ014A		A-86-33D	Zayatz	Harris	Sample consists of dolostone blocks in melange.
Baird Mountains D-6	67	45.70	161	55.60	latest Devonian-Mississippian	MDer	Kogruk Formation	4.5	5.5	86AD11B		A-86-33D	Dumoulin	Harris	
Baird Mountains D-6	67	49.60	161	55.80	late Middle-early Late Devonian (Givetian-Frasnian)	MzDm	Dl	3.5	4.0	85ADN82B	11303-SD	A-85-39B	Dumoulin	Harris	Entry 6661 in Alaska Paleontological Database.
Baird Mountains D-6	67	49.60	161	55.80	Early Mississippian (possibly Kinderhookian)	MzDm	Ml	3.5	3.5	85ADN84A	29802-PC	A-85-39B	Dumoulin	Harris	Entry 6662 in Alaska Paleontological Database.

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Ambler River A-1	67	0.90	156	1.02	Middle Devonian	KJm		5.5	5.5	83ADN123B	10911-SD	A-83-42D	Dumoulin	Harris	
Ambler River A-1	67	0.50	156	2.00	Late Devonian (Frasnian)	KJm	Pzm (Pzb)	3.0	4.0	7-9-84F	11038-SD	A-84-45A	Harris	Harris	Pallister and Carlson (1988), Table 1, loc. 1; Pallister and others (1989), Table 2, loc. 1. Entry 7235 in Alaska Paleontological Database.
Ambler River A-1	67	0.60	156	2.20	Middle-Late Devonian	KJm		5.0	5.0	83CC149	10857-SD	A-84-9	Carlson (Patton)	Harris	Entry 5131 in Alaska Paleontological Database.
Ambler River A-1	67	1.90	156	16.50	Late Devonian	JDab	Pzm (KJm)	5.5	6.0	7-12-84H	11104-SD	A-84-45B	Harris	Harris	Pallister and Carlson (1988), Table 1; Pallister and others (1989), Table 2. Entry 7255 in Alaska Paleontological Database.
Ambler River A-1	67	3.46	156	17.54	early early Late Devonian (early Frasnian)	KJm	Pzm (KJm)	5.0	5.0	7-12-84J	11105-SD	A-84-45B	Harris	Harris	Pallister and Carlson (1988), Table 1; Pallister and others (1989), Table 2. Entry 7257 in Alaska Paleontological Database.
Ambler River A-2	67	9.00	156	52.00	Middle Devonian-Early Mississippian	JDab	Lisburne Group	7.0	7.0	82TR76A		NPRA-82-10	Tailleur	Harris	
Ambler River A-2	67	3.40	156	52.90	middle Silurian-Devonian	DSc	Baird Group ("Bornite Dolomite" of Hitzman and others, 1982)	5.0	5.0	83TR62	10875-SD	A-84-19	Tailleur	Harris	Entry 5241 in Alaska Paleontological Database.
Ambler River A-2	67	4.20	156	53.40	Ordovician-Triassic	JDab	Lisburne(?) Group ("Beaver Creek Phyllite" of Hitzman and others, 1982)	6.0	6.0	83TR64		A-84-19	Tailleur	Harris	Cosmos Hills (Ruby Creek area). Entry 5243 in Alaska Paleontological Database.
Ambler River A-2	67	4.20	156	53.50	Silurian-Permian	JDab		5.5	5.5	82TR70			Tailleur	Harris	Cosmos Hills (Ruby Creek area).
Ambler River A-2	67	1.93	156	54.69	Early Devonian	DSc		5.0	5.0	83TR56	10874-SD	A-84-19	Tailleur	Harris	Entry 5239 in Alaska Paleontological Database.
Ambler River A-3	67	1.80	157	1.75	middle-Late Silurian (Wenlockian-Pridolian)	DSc		5.0	5.0	85ADN168A	11381-SD	A-85-39A	Dumoulin	Harris	Collection reexamined and age revised 5/31/91 by A. Harris.
Ambler River A-3	67	3.50	157	1.80	Late Silurian-Early Devonian (Wenlockian-early Emsian, possibly Wenlockian-Pridolian)	DSc		5.0	5.0	85ADN161D	11380-SD	A-85-39H	Dumoulin	Harris	Collection reexamined and age revised 5/31/91 by A. Harris.
Ambler River A-3	67	3.58	157	1.98	middle Silurian-Early Devonian (Wenlockian-early Emsian, probably Wenlockian-Ludlovian)	DSc		5.0	5.0	85ADN163A	11318-SD	A-85-39C	Dumoulin	Harris	Collection reexamined and age revised 5/31/91 by A. Harris. Entry 6668 in Alaska Paleontological Database.
Ambler River A-3	67	4.60	157	7.00	late Early Devonian (early Emsian)	DSc		5.0	5.0	83TR67B	10920-SD	A-84-19	Tailleur	Harris	Entry 5247 in Alaska Paleontological Database. This location is approximate.
Ambler River A-4	67	12.80	157	47.20	Middle Ordovician-Middle Devonian	Pzpc		6.0	7.0	7-13-84B		A-84-45B	Harris	Harris	Entry 7260 in Alaska Paleontological Database.
Ambler River A-5	67	14.70	158	2.60	Late Silurian-Early Devonian	JDab		5.0	5.0	84APA119A	11036-SD	A-84-45A	Patton	Harris	Entry 7231 in Alaska Paleontological Database.
Ambler River A-5	67	14.90	158	6.30	Middle Devonian	Pzpc		7.0	7.0	83TR51	10873-SD	A-84-19	Tailleur	Harris	Entry 5237 in Alaska Paleontological Database.
Ambler River A-5	67	4.90	158	28.40	Early-Middle Triassic	[JDab?]		3.0	3.0	82JCHD32	MES-33267	P&S-85-3B	Jones	Harris	The location of this sample is suspect; we could not confirm or disprove it. Age and CAI of conodonts suggest sample from carbonate rocks in JDab.
Ambler River B-1	67	23.28	156	9.40	early Late Mississippian (late Meramecian)	Mkkl	Lisburne Group	5.0	5.5,6	86AD82A	29936-PC	A-86-33b	Dumoulin	Harris	Collection reexamined and age confirmed 10/94 by A. Harris.
Ambler River B-1	67	26.70	156	10.70	early Early Mississippian (middle-late Kinderhookian)	Mkkl	*Endicott Group (Kayak Shale)	5.0	5.5	86AD96D	29940-PC	A-86-33b	Dumoulin	Harris	Collection reexamined and age confirmed 10/94 by A. Harris. Kayak Shale equivalent in age and biofacies. Conodonts suggest a high-energy, shallow-water environment.
Ambler River B-1	67	24.40	156	11.89	latest Late Mississippian (latest Chesterian)	Mkkl	*Lisburne Group	5.5	5.5	87Tr32B	30156-PC	A-88-1	Tailleur	Harris	Collection reexamined and age confirmed 10/94 by A. Harris. Equivalent in age to upper part of Alapah Limestone.
Ambler River B-1	67	24.40	156	11.89	Silurian-Permian	Mkkl	Endicott(?) Group (Kayak? Shale)	5.0	5.0	87TR32A		A-88-1	Tailleur	Harris	
Ambler River B-1	67	24.50	156	12.30	late Late Devonian-early Early Mississippian (latest Famennian-Kinderhookian, probably Kinderhookian)	Mkkl	Endicott Group (Kayak Shale)	5.0	5.5	86JS34E		A-86-33c	Schmidt /Dumoulin	Harris	Collection reexamined and age confirmed 10/94 by A. Harris. Conodonts indicate a relatively high-energy, shallow-water environment.
Ambler River B-1	67	25.56	156	12.70	Late Mississippian (late Meramecian-Chesterian, possibly late Meramecian-early Chesterian)	Mkkl	Lisburne Group (uppermost part)	5.5	6.5	83Mu25	29374-PC	A-84-48	Mull	Harris	Collection reexamined and age confirmed 10/94 by A. Harris. Entry 7322 in Alaska Paleontological Database.
Ambler River B-1	67	25.46	156	15.92	late Early-early Late Mississippian (Osagean-Meramecian)	Mkkl	Lisburne Group	5.0	5.0	93JT57	32360-PC	O-94-19	Toro	Harris	Equivalent in age to Wachsmuth Limestone or lower part of Alapah Limestone
Ambler River B-1	67	25.50	156	16.00	early Early Mississippian (Kinderhookian)	Mkkl	*Endicott Group (Kayak Shale)	5.0	5.0	76Tr96B	27437-PC	A-76-34	Tailleur	Harris/R epetski	Collection reexamined and age revised 10/94 by A. Harris. Conodonts suggest a shallow-water, high-energy environment. Entry 5684 in Alaska Paleontological Database.
Ambler River B-1	67	25.60	156	16.00	early Late Mississippian (late Meramecian)	Mkkl	Lisburne Group	5.0	5.0	76Tr161F	28083-PC	NPRA-81-1	Tailleur	Harris	Collection reexamined and age confirmed 10/94 by A. Harris.
Ambler River B-1	67	25.50	156	17.00	Early Mississippian (middle Kinderhookian-Osagean)	Mkkl	Lisburne Group	5.5	6.0	82Tr75C		NPRA-82-10	Tailleur	Harris	Collection reexamined and age confirmed 10/94 by A. Harris.
Ambler River B-1	67	25.52	156	18.75	Silurian-Permian	Mkkl	Lisburne(?) Group	5.0	5.0	93JT24		O-94-19	Toro	Harris	
Ambler River B-1	67	26.00	156	19.40	early Late Mississippian (late Meramecian-early Chesterian)	Mkkl	Lisburne(?) Group	5.0	5.0	86AD84C	29937-PC	A-86-33b	Dumoulin	Harris	Collection reexamined and age confirmed 10/94 by A. Harris.

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Ambler River B-1	67	26.00	156	19.40	early Early Mississippian (Kinderhookian)	Mkkl	Endicott Group (Kayak Shale)	5.0	5.5	7-11-84B	29614-PC	A-84-45b	Harris	Harris	Collection reexamined and age revised 10/94 by A. Harris. Conodonts indicate a shallow-water, relatively high-energy environment. Entry 7247 in Alaska Paleontological Database.
Ambler River B-1	67	26.35	156	19.56	Silurian-Permian	Mkkl	Lisburne? Group	5.0	5.0	93JT10		O-94-19	Toro	Harris	
Ambler River B-3	67	25.00	157	4.80	late Early Devonian (middle Emsian)-Middle Devonian	Pzsm		5.0	5.5	7-13-84F	11088-SD	A-84-45B	Harris	Harris	Entry 7276 in Alaska Paleontological Database.
Ambler River B-3	67	22.90	157	13.80	Ordovician-Early Devonian	DPsc		5.0	5.5	87AD69G		A-87-13A	Dumoulin	Harris	
Ambler River B-5	67	15.50	158	3.60	Middle Devonian	Pzpc		5.0	5.5	7-13-84D	11086-SD	A-84-45B	Harris	Harris	Entry 7274 in Alaska Paleontological Database.
Ambler River B-5	67	15.50	158	3.60	Middle Devonian-earliest Frasnian	Pzpc		5.0	5.5	7-13-84E	11087-SD	A-84-45B	Harris	Harris	Entry 7275 in Alaska Paleontological Database.
Ambler River B-5	67	15.20	158	6.40	late Middle Devonian (Givetian)	Pzpc		5.0	5.0	83TR48	10922-SD	A-84-19A	Tailleur	Harris	Entry 5231 in Alaska Paleontological Database.
Ambler River B-5	67	15.30	158	6.40	middle Middle Devonian (middle Eifelian-early Givetian)	Pzpc	Baird? Group	5.0	5.0	83TR49	10872-SD	A-84-19	Tailleur	Harris	Entry 5236 in Alaska Paleontological Database.
Ambler River B-5	67	16.72	158	14.44	late Early Mississippian (middle Osagean)	Pzpc		5.0	5.0	86ATi72	29974-PC	A-86-33c	Till	Harris	Jade Mountains carbonate. Age confirmed 1/07 by A. Harris.
Ambler River B-5	67	17.30	158	15.70	probably Early-early Late Mississippian	Pzpc	Lisburne? Group	5.0	5.0	83TR46		A-84-19A,B	Tailleur	Harris	Jade Mountains. Entry 5230 in Alaska Paleontological Database.
Ambler River B-5	67	17.30	158	15.70	Silurian-Permian	Pzpc		5.0	5.0	86ATi71A		A-86-33c	Till	Harris	
Ambler River B-6	67	20.30	158	38.90	middle Silurian-late Early Devonian (Wenlockian-Emsian)	Pzpc		5.0	5.5	88AD66A	11930-SD	A-89-4	Dumoulin	Harris	
Ambler River B-6	67	18.60	158	50.80	Late Silurian-early Early Devonian (Lochkovian)	Pzpc		5.0	5.0	86ATi66	11513-SD	A-86-33B	Till	Harris	
Ambler River C-1	67	30.40	156	1.50	early Late Silurian (earliest to late, but not latest, Ludlovian)	Spl	Dbl (Mayfield and Tailleur, 1978)	5.0	5.0	87JS38D	11857-SD	A-87-13A	Schmidt /Dumoulin	Harris	Collection reexamined and age confirmed 10/94 by A. Harris. Conodonts indicate normal marine, platform to off-platform setting.
Ambler River C-1	67	35.00	156	5.50	Silurian-early Late Mississippian (possibly Late Devonian-Meramecian)	Mu	Lisburne Group (Utukok Formation)	5.0	5.0	87AD66C		A-87-13A	Dumoulin	Harris	
Ambler River C-1	67	32.20	156	16.70	Ordovician, possibly Early Ordovician	Pzm		5.5	6.0	87AD49A	10643-CO	A-87-13A	Dumoulin	Harris	
Ambler River C-1	67	31.80	156	21.50	late Early-early Middle Ordovician	Pzm		5.0	5.5	87AD48A	10641-CO	A-87-13A	Dumoulin	Harris	
Ambler River C-1	67	31.80	156	21.50	late Late Ordovician	Pzm		5.0	5.0	87AD48B	10642-CO	A-87-13A	Dumoulin	Harris	
Ambler River C-1	67	33.57	156	22.77	middle to early Late Silurian (Wenlockian-Ludlovian)	Spl		5.0	5.5	87AD51	11769-SD	A-87-13A	Dumoulin	Harris	Dumoulin and Harris (1988), locality C.
Ambler River C-1	67	30.80	156	23.00	Late Silurian (late Ludlovian)	Pzm		5.0	5.0	87AD58A	11855-SD	A-87-13A	Dumoulin	Harris	
Ambler River C-1	67	33.80	156	23.00	Middle Ordovician-Middle Devonian	Spl		5.0	5.0	87AD50AA		A-87-13A	Dumoulin	Harris	
Ambler River C-1	67	32.00	156	24.00	middle Silurian-late Early Devonian (Wenlockian-Emsian)	Pzm		5.0	5.0	87AD61A	11856-SD	A-87-13A	Dumoulin	Harris	
Ambler River C-1	67	31.50	156	24.50	Upper Ordovician-Middle Devonian	Pzm		5.0	5.0	87AD54A		A-87-13A	Dumoulin	Harris	
Ambler River C-1	67	31.30	156	24.80	middle Silurian (Wenlockian)-Late Silurian	Pzm		5.0	5.0	87AD53A	11870-SD	A-87-13E	Dumoulin	Harris	
Ambler River C-1	67	31.20	156	25.00	Late Ordovician	Pzm		5.0	5.0	87AD56A	10644-CO	A-87-13A	Dumoulin	Harris	
Ambler River C-1	67	31.70	156	28.00	middle Silurian (Wenlockian)-Late Silurian	Pzm		5.0	5.0	87AD70C	11871-SD	A-87-13E	Dumoulin	Harris	
Ambler River C-2	67	43.00	156	38.40	Silurian-Middle Devonian	Pzm		5.5	5.5	79ABE99			Brosgé	Harris	Entry 8050 in Alaska Paleontological Database.
Ambler River C-2	67	43.30	156	40.00	middle to early Late Silurian (Wenlockian-Ludlovian)	Spl	Ds (Mayfield and Tailleur, 1978)	5.0	5.0	86AD85H, L, O, R	11507-SD	A-86-33B	Dumoulin	Harris	Dumoulin and Harris (1988), locality A.
Ambler River C-2	67	43.75	156	44.00	Middle Ordovician-Early Silurian	Pzm		5.0	5.5	76TR190E	8669-CO	A-76-35	Tailleur	Harris	
Ambler River C-2	67	37.64	156	55.45	Middle Ordovician-Middle Devonian	Pzm	Baird? Group	5.0	5.5	76TR86B	9803-SD	A-76-35	Tailleur	Repetski /Harris	
Ambler River D-2	67	45.67	156	52.79	Silurian-Middle Devonian	Spl	Ds (Mayfield and Tailleur, 1978)	5.0	5.0	86AD100F	11511-SD	A-86-33B	Dumoulin	Harris	Dumoulin and Harris (1988), locality B.
Ambler River D-5	67	46.70	158	3.60	Early Mississippian	Pzm		4.5	5.0	6186-13			AMOCO	Harris	
Ambler River D-5	67	47.75	158	4.45	Middle Ordovician-Middle Devonian	Dmu	Wacke and carbonate unit	5.0	5.5	76TR3E	9802-SD	A-76-35	Tailleur	Repetski /Harris	
Ambler River D-6	67	53.00	158	49.00	Early Silurian (latest Llandoverian)	Spl	Pzbs (Mayfield and Tailleur, 1978)	5.5	6.0	86AD66C	11516-SD	A-86-33C	Dumoulin	Harris	Dumoulin and Harris (1988), locality D.
Ambler River D-6	67	46.80	158	56.70	probably Early or Middle Ordovician	[DOc?]		6.0	6.0	76TR50E	8668-CO	A-76-35	Tailleur	Repetski /Harris	Sample is from an outcrop of DOc? too small to show on map.
Ambler River D-6	67	45.80	158	58.40	Silurian-Mississippian	DOc		5.0	5.0	86AD65A		A-86-33b	Dumoulin	Harris	
Shungnak D-2	66	56.30	156	38.00	Silurian-Permian	JDab		5.0	5.0	68551N,I,K		O-69-12	AMOCO?	Harris	

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Survey Pass A-6	67	0.20	155	55.00	Ordovician-Devonian (likely Ordovician-Silurian)	KJm	Pzl	5.0	5.0	78ANS020A		A-78-21	Nelson	Harris	Nelson and Grybeck (1980), Table 1, loc. 80. Entry 8260 in Alaska Paleontological Database.
Survey Pass A-6	67	0.30	155	55.50	Middle-Late Devonian	KJm	Pzm (Pzb)	4.0	4.5	7-12-84G	11103-SD	A-84-45B	Harris	Harris	Pallister and Carlson (1988), Table 1, loc. 2; Pallister and others (1989), Table 2, loc. 2.
Survey Pass A-6	67	0.20	155	58.20	Middle Devonian-Early Mississippian	KJm	Pzm (Pzb)	5.0	5.5	7-12-84E		A-84-45B	Harris	Harris	Pallister and Carlson (1988), Table 1, loc. 2; Pallister and others (1989), Table 2, loc. 2. Entry 7252 in Alaska Paleontological Database.
Survey Pass A-6	67	0.30	155	58.90	Silurian-Permian	KJm	Pzm (Pzb)	5.0	5.5	7-12-84C		A-84-45B	Harris	Harris	Pallister and Carlson (1988), Table 1, loc. 2; Pallister and others (1989), Table 2, loc. 2. Entry 7250 in Alaska Paleontological Database.
Survey Pass A-6	67	0.30	155	58.90	Early-early Middle Ordovician (Tremadocian-Arenigian)	KJm		5.5	5.5	7-12-84D	9918-CO	A-84-45B	Harris	Harris	Entry 7251 in Alaska Paleontological Database.
Survey Pass A-6	67	0.30	155	58.90	probably middle Late Devonian (Frasnian)	KJm	Pzm (Pzb)	5.5	6.0	7-12-84F	11102-SD	A-84-45B	Harris	Harris	Pallister and Carlson (1988), Table 1, loc. 2; Pallister and others (1989), Table 2, loc. 2. Entry 7253 in Alaska Paleontological Database.
Survey Pass C-1	67	36.50	153	3.50	Middle Ordovician-Triassic	Mu	Kayak(?) Shale	5.5	5.5	78AMH177C		A-79-6	Nelson (Miller)	Harris	Nelson and Grybeck (1980), Table 1, loc. 61.
Survey Pass C-4	67	32.04	154	52.98	early Middle Ordovician (middle-late Llanvirnian)	OЄc		5.0	5.0	93JT141	11121-CO	O-94-19	Toro	Harris	
Survey Pass C-6	67	35.49	155	55.80	Middle Ordovician-Middle Devonian	Pzm	Skajit Limestone	5.0	5.0	78ANS028A		A-78-21	Nelson	Harris	Nelson and Grybeck (1980), Table 1, loc. 55. Entry 8269 in Alaska Paleontological Database.
Survey Pass D-1	67	58.80	153	14.10	late Early Devonian-middle Mississippian	Mkl	Limestone in Kayak Shale	5.5	5.5	78AMM12C		A-79-6	Nelson (Mullen)	Harris	Nelson and Grybeck (1980), Table 1, loc. 5.
Survey Pass D-1	67	59.00	153	14.40	Late Mississippian (probably late Meramecian-early Chesterian)	Mkl	Lisburne Group	5.0	5.0	78ABE236B	27473-PC	A-78-23	Brosgé	Harris	Nelson and Grybeck (1980), Table 1, loc. 6. Entry 8708 in Alaska Paleontological Database.
Survey Pass D-1	67	45.60	153	16.00	Late Devonian	Dmu	Dl	5.0	5.0	78ANS0054A	9963-SD	A-78-21	Nelson	Harris	Nelson and Grybeck (1980), Table 1, loc. 53. Entry 8330 in Alaska Paleontological Database.
Survey Pass D-1	67	45.00	153	28.50	Middle-Late Devonian (Givetian-Frasnian)	Dmu	Dl	5.0	5.0	77ANS202A	9798-SD	A-77-17	Nelson	Harris	Nelson and Grybeck (1980), Table 1, loc. 52. Entry 2220 in Alaska Paleontological Database.
Survey Pass D-1	67	49.10	153	28.50	Middle Devonian-Early Mississippian	Dmu	Dl	5.0	5.0	78AMH158A		A-79-6A	Nelson (Miller)	Harris	Nelson and Grybeck (1980), Table 1, loc. 51. Megafossils (echinoderms and corals) at this locality are Late Devonian (Frasnian?)
Survey Pass D-2	67	46.10	153	45.00	Middle-Late Devonian	Dmu	Dcg	5.0	5.0	78ANS205A		A-78-30	Nelson	Harris	Nelson and Grybeck (1980), Table 1, loc. 48.
Survey Pass D-4	67	53.70	154	33.50	post-Ordovician Paleozoic	Mkl	Kayak Shale	5.0	5.0	78ANS164A		A-79-6	Nelson	Harris	Nelson and Grybeck (1980), Table 1, loc. 19.
Survey Pass D-4	67	53.70	154	33.50	Late Devonian-Early Mississippian (late Famennian-Kinderhookian)	Mkl	Kayak Shale	4.5	5.0	78ANS164B		A-79-6	Nelson	Harris	Nelson and Grybeck (1980), Table 1, loc. 19.
Survey Pass D-4	67	55.50	154	36.30	Late Devonian-Early Mississippian (late Famennian-early Kinderhookian)	Mkl	Limestone in Kayak Shale	5.0	5.0	78ADG145A		A-79-6	Grybeck	Harris	Nelson and Grybeck (1980), Table 1, loc. 18. Ostracodes at this locality are Early-early Late Mississippian (Kinderhookian-Meramecian).
Survey Pass D-4	67	55.10	154	38.90	Late Devonian-Early Mississippian (late Famennian-early Kinderhookian)	Mkl	Kayak Shale	4.5	5.0	78ADG142B		A-79-6	Grybeck	Harris	Nelson and Grybeck (1980), Table 1, loc. 13.
Survey Pass D-4	67	54.90	154	40.00	Late Devonian-Early Mississippian (late Famennian-middle Osagean)	Mkl	Kayak Shale	5.0	5.0	78ADG141B		A-79-6	Grybeck	Harris	Nelson and Grybeck (1980), Table 1, loc. 16.
Survey Pass D-6	67	56.49	155	41.01	late Late Devonian (late Famennian)	Mkl	Lisburne Group	4.0	4.0	78ANS029A	9953-SD	A-78-21	Nelson	Harris	Nelson and Grybeck (1980), Table 1, loc. 9. Entry 8271 in Alaska Paleontological Database. Conodonts may be reworked.
Survey Pass D-6	67	57.66	155	41.34	Late Devonian-Early Mississippian (late Famennian-Kinderhookian, probably Kinderhookian)	Mkl		4.5	5.0	79ABE110C			Brosgé	Harris	Entry 8051 in Alaska Paleontological Database.
Survey Pass D-6	67	56.46	155	41.47	Silurian-Triassic	Mkl	Kayak Shale	4.5	5.0	78ANS181A		A-79-6	Nelson	Harris	Nelson and Grybeck (1980), Table 1, loc. 8.
Survey Pass D-6	67	57.56	155	41.60	Late Devonian-Early Mississippian (Famennian-Kinderhookian)	Mkl	Kayak Shale	4.0	4.0	78ANS182A		A-79-6	Nelson	Harris	Nelson and Grybeck (1980), Table 1, loc. 3. Megafossils (echinoderms, bryozoans, and brachiopods) at this locality are Early Mississippian.
Hughes D-1	66	57.6	153	20.1	Middle Devonian-earliest Late Devonian (Eifelian-earliest Frasnian)	JDab	Pzm (KJm)	5.0	5.5	7-9-84B	11015-SD		Harris	Harris	Pallister and Carlson (1988), Table 1, loc. 7; Pallister and others (1989), Table 2, loc. 7. Entry 7226 in Alaska Paleontological Database.
Hughes D-2	66	59.40	153	51.70	No older than latest Mississippian (latest Chesterian)	KJm		5.5	5.5	7-8-84A	29367-PC	A-84-45	Harris	Harris	Entry 7213 in Alaska Paleontological Database. Contains redeposited conodonts of Middle Devonian, Early Mississippian, and early Late Mississippian (Meramecian) ages.

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Hughes D-2	66	59.40	153	51.70	Late Devonian	KJm	Nuka? Formation	5.0	5.5	7-8-84B	11008-SD	A-84-45	Harris	Harris	Entry 7214 in Alaska Paleontological Database. Sample from greenish calcareous sandstone that contains feldspar and rounded quartz pebbles; if this is truly Nuka Formation, conodont must be reworked.
Hughes D-2	66	59.40	153	51.70	No older than latest Mississippian (latest Chesterian)	KJm	Lisburne Group of Ipnavik River allochthon?	5.0	5.5	7-8-84C	29368-PC	A-84-45	Harris	Harris	Entry 7215 in Alaska Paleontological Database. Contains redeposited conodonts of Early Mississippian and early Late Mississippian (Meramecian) ages.
Hughes D-2	66	57.40	154	0.00	late Early Mississippian (middle Osagean)	JDab	Lisburne Group	4.0	4.0	7-10-84A	29613-PC	A-84-45B	Harris	Harris	Entry 7239 in Alaska Paleontological Database.
Hughes D-3	66	58.00	154	1.00	Middle Devonian (very probably Givetian)	KJm		5.0	5.0	84APA103C	11035-SD	A-84-45A	Patton	Harris	Entry 7229 in Alaska Paleontological Database.
Hughes D-4	66	56.60	154	51.00	Devonian-Mississippian	JDab		5.0	5.5	7-8-84J		A-84-45	Harris	Harris	Entry 7222 in Alaska Paleontological Database.
Hughes D-4	66	57.10	154	45.10	Early Mississippian	Pzpc		3.0	4.0	7-10-84B	29407-PC	A-84-45A	Harris	Harris	Entry 7236 in Alaska Paleontological Database.
Hughes D-4	66	57.10	154	44.60	Middle-Late Devonian	Pzpc		5.0	5.0	7-8-84F	11011-SD	A-84-45	Harris	Harris	Entry 7218 in Alaska Paleontological Database.
Hughes D-4	66	57.10	154	44.60	Middle-Late Devonian	Pzpc		5.0	5.5	7-8-84G	11012-SD	A-84-45	Harris	Harris	Entry 7219 in Alaska Paleontological Database.
Hughes D-4	66	57.90	154	51.90	Middle-Late Devonian	KJm		5.0	5.0	7-8-84K	11013-SD	A-84-45	Harris	Harris	
Hughes D-4	66	57.90	154	51.90	Middle-earliest Late Devonian (Middle Devonian-earliest Frasnian)	KJm		5.0	5.5	7-8-84L	11014-SD	A-84-45	Harris	Harris	Entry 7224 in Alaska Paleontological Database.
Hughes D-4	66	58.10	154	52.40	latest Devonian-Early Mississippian (late Famennian-Osagean)	KJm		5.5	7.0	7-10-84H		A-84-45B	Harris	Harris	Entry 7243 in Alaska Paleontological Database. Range in CAI values suggests contact metamorphism; sample is block of carbonate within mafic rocks.
Hughes D-4	66	58.10	154	52.40	late Late Devonian-late Early Mississippian (late Famennian-Osagean)	KJm		5.0	5.5	7-10-84I		A-84-45A	Harris	Harris	Entry 7244 in Alaska Paleontological Database.
Hughes D-5	66	57.60	155	19.00	Middle-earliest Late Devonian (Middle Devonian-earliest Frasnian)	KJm	Pzm (KJm)	5.0	5.5	7-8-84D	11009-SD	A-84-45	Harris	Harris	Pallister and Carlson (1988), Table 1, loc. 8; Pallister and others (1989), Table 2, loc. 8. Entry 7216 in Alaska Paleontological Database.
Hughes D-5	66	57.60	155	19.00	Middle Devonian-earliest Late Devonian (Eifelian-earliest Frasnian)	KJm		5.0	5.5	7-8-84E	11010-SD	A-84-45	Harris	Harris	Entry 7217 in Alaska Paleontological Database.
Hughes D-6	66	57.30	155	31.90	Early Devonian-Early Pennsylvanian	JDab	Lisburne Group	4.5	5.0	72TR50			Tailleur	Harris	
Hughes D-6	66	57.40	155	32.10	Triassic (early Late Triassic [Carnian]?)	JDab		5.0	5.0	84APA72B	MES-33269	A-85-25	Jones /Patton	Denkler	Entry 6344 in Alaska Paleontological Database. Radiolarians from this sample indicate a Carnian? age; conodonts are latest Middle-Late Triassic (late Ladinian-early Norian).
Hughes D-6	66	57.40	155	31.80	late Early Mississippian (middle Osagean)	JDab	Pzm (Pzb)	5.0	5.0	7-12-84A	29615-PC	A-84-45B	Harris	Harris	Pallister and Carlson (1988), Table 1, loc. 4; Pallister and others (1989), Table 2, loc. 4. Entry 7248 in Alaska Paleontological Database.
Hughes D-6	66	59.30	155	43.80	Middle-Late Devonian	JDab	Pzm (KJm)	5.0	5.0	7-9-84D	11037-SD	A-84-45A	Harris	Harris	Pallister and Carlson (1988), Table 1, loc. 3; Pallister and others (1989), Table 3, loc. 3. Entry 7233 in Alaska Paleontological Database.

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Wiseman A-1	67	10.30	150	15.10	Early-Late Mississippian	JDab		2.0	2.0	84JCHD17C	29647-PC	P&S-85-3A	Jones	Harris	Cathedral Mountain.
Wiseman A-1	67	9.20	150	28.30	Silurian-Triassic	JDab		2.0	3.0	75TR140			Tailleur	Harris	Twelvemile Mountain.
Wiseman A-1	67	9.20	150	28.20	late Early Mississippian (middle Osagean)	JDab		2.5	2.5	82-S-953	29242-PC	A-84-10	Silberling	Harris	Twelvemile Mountain. Collection reexamined and age confirmed 2/02 by A. Harris. Conodonts suggest a high-energy depositional setting.
Wiseman A-1	67	8.50	150	29.00	late Early-Late Mississippian (Osagean-Chesterian)	JDab		2.0	2.5	88AD37A	30291-PC	A-89-4	Dumoulin	Harris	Twelvemile Mountain. Collection reexamined and age revised 2/02 by A. Harris. Conodonts indicate post-mortem hydraulic transport of shallow-water forms.
Wiseman A-1	67	8.50	150	29.00	late Early Mississippian (middle Osagean)	JDab		2.5	2.5	88AD37B	30290-PC	A-89-4	Dumoulin	Harris	Twelvemile Mountain. Collection reexamined and age revised 2/02 by A. Harris. Conodonts represent mixed, chiefly shallow-water biofacies.
Wiseman A-1	67	8.50	150	29.00	late Early Mississippian (middle Osagean)	JDab		2.0	2.5	88AD37C	30289-PC	A-89-4	Dumoulin	Harris	Twelvemile Mountain. Collection reexamined and age revised 2/02 by A. Harris. Conodonts probably represent a lag concentrate.
Wiseman A-5	67	10.70	152	12.90	Devonian	Da		5.0	5.0	81DN55	10622-SD		Brosgé	Harris	
Wiseman A-5	67	4.90	152	28.40	Early Mississippian	JDab		5.0	5.0	73TR7.1	28582-PC		Tailleur	Harris	Heart Mountain.
Wiseman A-5	67	4.82	152	29.38	Mississippian-Triassic	JDab		5.0	5.0	7-7-84B			Harris	Harris	Heart Mountain.
Wiseman A-6	67	5.30	152	43.50	Mississippian (Kinderhookian-Meramecian)	JDab		5.0	5.0	82-S-905	29241-PC	PS-84-2	Silberling	Harris	Collection reexamined and age confirmed 2/02 by A. Harris.
Wiseman B-1	67	23.30	150	12.90	early Early Devonian (Lochkovian)	DⱣsc	Emma Creek schist	5.0	5.0	89TM314	11973-SD	A-89-14	Moore	Harris	Moore and others (1997a), Table 2.
Wiseman B-1	67	21.70	150	14.00	Ordovician-Triassic	DⱣsc	Emma Creek schist	5.5	5.5	88SK105A		A-89-16	Karl	Harris	Moore and others (1997a), Table 2.
Wiseman B-1	67	22.00	150	15.00	probably Silurian-Devonian	DⱣsc	Emma Creek schist	5.5	6.0	88SK104A	11995-SD	A-89-16	Karl	Harris	Moore and others (1997a), Table 2.
Wiseman B-1	67	17.40	150	16.30	Early Silurian-Late Devonian	DⱣsc	Emma Creek schist	5.0	5.0	90ATi1C	12074-SD	A-90-4B	Till	Harris	Moore and others (1997a), Table 2.
Wiseman B-6	67	28.26	152	52.98	Middle Devonian-Early Mississippian	Mu		5.0	5.0	79DN275			Dillon	Harris	Foraminifers from this locality are of possible Mississippian age (see entry 3804 in Alaska Paleontological Database).
Wiseman B-6	67	28.85	152	59.56	Middle Devonian	Dhf		5.0	5.0	81DN134	10624-SD		Brosgé	Harris	This is an atypically old age for Hunt Fork Shale; the conodonts may have been reworked from an older source, or derived from an unrecognized outcrop of Dmu.
Wiseman B-6	67	28.50	152	59.00	Middle-Late Devonian	Dhf		5.0	5.0	81DN135	10625-SD		Brosgé	Harris	
Wiseman C-1	67	36.42	150	6.40	Middle-Late Devonian	Dhf	Beaucoup Formation	5.0	5.0	89APR124A	11965-SD	A-89-14	Plafker	Harris	
Wiseman C-1	67	34.90	150	8.20	early Middle Ordovician	OⱣc	Snowden Creek unit	5.0	5.0	89ATi18A	10728-CO	A-89-14	Till	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 35.
Wiseman C-1	67	41.60	150	20.50	Middle-Late Devonian	Dhf		5.0	5.5	82ADU3B	11307-SD	A-84-21	Dutro	Denkler	
Wiseman C-1	67	39.60	150	28.60	Late Devonian	Dhf		5.0	5.0	82ABE322B		A-84-21	Brosgé	Harris	
Wiseman C-2	67	34.60	150	44.50	Early-Late Devonian	Dhf		5.0	5.0	82ABE289		A-84-21	Brosgé	Harris	
Wiseman C-2	67	42.70	150	50.20	Middle-Late Devonian	Dhf		5.0	5.5	82ABE317A		A-84-21	Brosgé	Harris	
Wiseman C-2	67	40.60	150	53.50	Middle-Late Devonian	Dhf		5.0	5.0	82ABE318		A-84-21	Brosgé	Harris	
Wiseman C-4	67	43.30	151	30.20	Silurian-Triassic	S€vs		5.0	5.0	81ABE113A			Brosgé	Harris	
Wiseman C-4	67	35.30	151	38.70	Middle Ordovician-Late Devonian	Dmu		5.0	5.0	82ABE240J		A-84-21	Dutro	Harris	
Wiseman C-6	67	44.27	152	43.24	Middle-Late Devonian	Dmu		5.0	5.0	81ABE94B	10626-SD		Brosgé	Harris	
Wiseman C-6	67	33.60	152	52.40	Middle Devonian	Dmu		5.0	5.0	81DN105	10623-SD		Brosgé	Harris	
Wiseman D-1	67	45.30	150	1.50	late Middle-Late Devonian	Ᵽzw		5.0	5.0	89TM282A	11972-SD	A-89-14	Moore	Harris	
Wiseman D-1	67	56.69	150	25.42	Silurian	Dmu	Devonian basal conglomerate	5.0	5.0	7-28-84A	11100-SD	A-85-11	Harris	Harris	Entry 6349 in Alaska Paleontological Database. Conodonts derived from clasts(?) of carbonate in possible deformed conglomerate.
Wiseman D-1	67	56.30	150	25.70	Late Devonian-Early Mississippian (Kinderhookian)	ꞦCs	Lisburne(?) Group	5.5	6.0	7-28-84B		A-85-11	Harris	Harris	Entry 6350 in Alaska Paleontological Database.
Wiseman D-1	67	56.20	150	25.70	early Early Mississippian (Kinderhookian)	ꞦCs	Kayak Shale	5.0	5.0	7-28-84C	29610-PC	A-85-11	Harris	Harris	Entry 6351 in Alaska Paleontological Database.
Wiseman D-1	67	56.20	150	25.80	Early-Middle Pennsylvanian (Morrowan)	ꞦCs	Lisburne Group	5.0	5.0	7-28-84E	29611-PC	A-85-11	Harris	Harris	Entry 6352 in Alaska Paleontological Database.
Wiseman D-1	67	56.25	150	26.80	latest Mississippian-Middle Pennsylvanian (latest Chester-early Atokan)	ꞦCs	Lisburne Group (top)	4.5	5.0	84AKA19-1	29612-PC	O-85-22	Adams	Harris	Adams (1994), sheet 8; Amawk Creek section.
Wiseman D-1	67	56.25	150	26.80	latest Mississippian-Middle Pennsylvanian (latest Chester-early Atokan)	ꞦCs	Lisburne Group (top)	5.0	5.5	84AKA19-2	29607-PC	O-85-21	Adams	Harris	Adams (1994), sheet 8; Amawk Creek section. Entry 6087 in Alaska Paleontological Database.
Wiseman D-2	67	54.90	150	40.30	Early-Middle Pennsylvanian (Morrowan-Atokan)	ꞦCs	Lisburne Group	4.5	5.0	89AD45F	30298-PC	A-89-14	Dumoulin	Harris	
Wiseman D-2	67	55.45	150	42.42	latest Mississippian-Middle Pennsylvanian (latest Chester-early Atokan)	ꞦCs	Lisburne Group (top)	4.5	5.0	84AKA4-1	29343-PC	O-84-43	Adams	Harris	Adams (1994), sheet 9; Bombardment Creek section. Entry 5204 in Alaska Paleontological Database.

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Wiseman D-2	67	55.45	150	42.42	latest Mississippian-Middle Pennsylvanian (latest Chester-early Atokan)	ŦCs	Lisburne Group (top)	4.5	5.0	84AKA4-3	29366-PC	O-84-43	Adams	Harris	Adams (1994), sheet 9; Bombardment Creek section. Entry 5206 in Alaska Paleontological Database.
Wiseman D-2	67	55.00	150	42.50	Late Triassic	ŦCs	Shublik Formation	5.0	5.0	82TR42C	MES 32767		Tailleur	Harris	
Wiseman D-2	67	55.50	150	42.70	Early-Middle Pennsylvanian (Morrowan)	ŦCs	Lisburne Group	4.5	5.0	89AD44C	30296-PC	A-89-14	Dumoulin	Harris	
Wiseman D-2	67	55.50	150	42.70	late Late Mississippian-early Early Pennsylvanian	ŦCs	Lisburne Group	5.0	5.0	89AD44Z	30297-PC	A-89-14	Dumoulin	Harris	
Wiseman D-2	67	53.00	150	45.00	Late Mississippian	ŦCs		3.0	4.0	5462-4			AMOCO	Harris	
Wiseman D-2	67	52.92	150	53.33	Mississippian	ŦCs		5.5	5.5	84DN268	29582-PC	O-85-14	Dillon	Harris	
Wiseman D-2	67	52.70	150	53.50	Early Mississippian (late Kinderhookian-late Osagean)	ŦCs		5.0	5.5	84ADU2	29803-PC	A-84-22	Dutro	Denkler	Collection reassessed and age confirmed 1/07 by A. Harris.
Wiseman D-2	67	53.00	150	54.60	Middle Devonian-Late Devonian	Dmu		5.0	5.5	82ADU3B	11307-SD	A-84-22	Dutro	Harris	
Wiseman D-3	67	50.80	151	2.20	Early Silurian	SЄvs		5.0	5.5	84ADU5	11447-SD	A-84-22	Dutro	Harris	Additional material from this sample was processed and age was refined; revised age reported by Harris in E&R P&S-86-4.
Wiseman D-3	67	51.90	151	6.80	Middle Devonian-Early Mississippian	Dmu		5.0	5.0	81ABE29B			Brosgé	Harris	
Wiseman D-3	67	58.20	151	14.30	Late Mississippian (late Meramecian-early Chesterian)	JCs	*Lisburne Group	4.0	4.5	84AKA1-2	29908-PC	O-86-37	Adams	Harris	Tinayguk River section.
Wiseman D-6	67	47.00	152	50.00	Middle Devonian	Dmu	Sillyasheen unit	5.0	5.0	81ABE163A	10627-SD		Brosgé	Harris	

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Chandalar A-4	67	12.90	148	45.60	Silurian-Triassic	JDab		ND	ND	82JCHD22A		P&S-85-3A	Jones	Harris	
Chandalar B-6	67	26.40	149	37.90	Early Ordovician-Late Triassic	D₽sc		5.0	5.0	89ATi2A		A-89-14	Till	Harris	
Chandalar C-5	67	39.50	149	23.70	middle Silurian-early Late Silurian	DOc	Mathews River unit	5.0	5.5	90AD2A	12069-SD	A-90-4B	Dumoulin	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 34.
Chandalar C-5	67	39.50	149	23.70	middle-Late Silurian	DOc		5.0	5.5	90ANK023A	12070-SD	A-90-4B	Nokleberg	Harris	
Chandalar C-5	67	40.50	149	24.80	Middle-Late Ordovician	DOc		5.0	5.0	90AD5B	10829-CO	A-90-4B	Dumoulin	Harris	
Chandalar C-5	67	40.50	149	24.80	Middle-Late Ordovician	DOc		5.0	5.0	90AD5D	10830-CO	A-90-4B	Dumoulin	Harris	
Chandalar C-6	67	46.30	149	31.40	Middle-Late Ordovician	DOc	Mathews River unit	5.0	5.0	89AD25D	10723-CO	A-89-14	Dumoulin	Harris	
Chandalar C-6	67	42.30	149	32.00	late Early-early Middle Ordovician	O₽c		5.0	5.0	89APR144	10726-CO	A-89-14	Plafker	Harris	
Chandalar C-6	67	44.70	149	34.00	Late Devonian	Dhf	Hunt Fork Shale	5.0	5.0	90TM514B	12079-SD	A-90-4B	Moore	Harris	
Chandalar C-6	67	36.50	149	34.80	Middle Ordovician-Middle Devonian	₽zm		5.0	5.0	89AD14A		A-89-14	Dumoulin	Harris	
Chandalar C-6	67	44.30	149	36.10	early Late Devonian (Frasnian)	Dmu	Beaucoup Formation	5.0	5.0	85TR62A	11264-SD	A-85-36A	Tailleur	Harris	Dillon and others (1987), Table 1, loc. 4; Dillon and others (1988), Table 1, loc. 7.
Chandalar C-6	67	44.30	149	36.10	Middle-Late Devonian	Dmu	Beaucoup Formation	5.0	5.0	85TR62B	11265-SD	A-85-36A	Tailleur	Harris	Dillon and others (1987), Table 1, loc. 4; Dillon and others (1988), Table 1, loc. 7.
Chandalar C-6	67	36.06	149	36.12	middle Silurian-Middle Devonian	₽zm		5.0	5.0	89AD11C	11961-SD	A-89-14	Dumoulin	Harris	
Chandalar C-6	67	43.90	149	38.10	early Middle Ordovician	O₽c	Snowden Creek unit	5.0	5.0	89TM274B	10729-CO	A-89-14	Moore	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 30.
Chandalar C-6	67	33.90	149	41.20	Early-Late Ordovician	O₽c	Snowden Creek unit	5.0	5.0	89AD20A	10722-CO	A-89-14	Dumoulin	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 36.
Chandalar C-6	67	44.80	149	41.80	middle Middle Ordovician	O₽c	Snowden Creek unit	5.0	5.0	89AD29Z	10724-CO	A-89-14	Dumoulin	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 28.
Chandalar C-6	67	42.80	149	47.70	early-middle Middle Ordovician	O₽c	Snowden Creek unit	5.0	5.0	90AD26B	10834-CO	A-90-4B	Dumoulin	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 31.
Chandalar C-6	67	43.60	149	49.80	Middle-Late Devonian	Dhf	Beaucoup Formation	5.0	5.0	89APR147	11967-SD	A-89-14	Plafker	Harris	
Chandalar C-6	67	37.10	149	51.20	Early Ordovician-Late Triassic	₽zpЄqs		5.0	5.0	89AD18B		A-89-14	Dumoulin	Harris	
Chandalar C-6	67	44.70	149	54.30	late Middle-early Late Devonian	Dhf	Beaucoup Formation	5.0	5.0	89APR146	11966-SD	A-89-14	Plafker	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 27.
Chandalar C-6	67	40.40	149	58.00	late Middle-early Late Devonian	Dhf	Beaucoup Formation	5.0	5.0	89TM240B	11971-SD	A-89-14	Moore	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 33.
Chandalar C-6	67	44.80	149	58.60	Middle-Late Devonian	Dhf		5.5	5.5	82DN310		A-84-21	Dillon	Harris	
Chandalar D-2	67	51.00	147	51.10	Early Ordovician	Dhf		5.0	5.0	6249-149			AMOCO	Harris	Conodonts could be derived from clasts of older carbonate rock redeposited in conglomerate; Brosgé and Reiser (1964) mapped basal conglomerate with carbonate clasts at this locality.
Chandalar D-4	67	59.00	148	33.70	early Late Devonian (early to middle Frasnian)	Dl	Beaucoup Formation	5.0	5.0	90TM476A	12078-SD	A-90-4B	Moore	Harris	Dumoulin and Harris (1994), Appendix 1, p. 66.
Chandalar D-5	67	59.20	149	21.70	early Late Devonian (Frasnian)	Dmu	Nutirwik Creek unit	5.0	5.0	90TM453B	12076-SD	A-90-4B	Moore	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 5.
Chandalar D-5	67	57.90	149	23.50	late Middle-Late Devonian	Dmu		5.0	5.0	90TM452A	12075-SD	A-90-4B	Moore	Harris	
Chandalar D-5	67	56.10	149	24.00	Middle Ordovician-Middle Devonian	Dmu		5.0	5.0	90AD15A		A-90-4B	Dumoulin	Harris	
Chandalar D-5	67	49.20	149	26.20	late Middle-early Late Devonian	Dhf		5.0	5.0	90ALU45A	12072-SD	A-90-4B	Lull	Harris	
Chandalar D-6	67	59.00	149	30.60	Early Ordovician-Late Triassic	₽zm	Skajit Limestone	5.0	5.0	90TM468C		A-90-4B	Moore	Harris	
Chandalar D-6	67	54.80	149	31.40	late Early-early Middle Devonian (Emsian-Eifelian)	DOc	Devonian limestone unit	5.0	5.0	90ABD31	12064-SD	A-90-4B	Blodgett	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 6.
Chandalar D-6	67	54.80	149	31.40	Late Ordovician	DOc	Mathews River unit	5.0	5.0	90AD20G	10828-CO	A-90-4B	Dumoulin	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 6.
Chandalar D-6	67	54.60	149	31.50	Late Ordovician-Middle Devonian	DOc	*Mathews River unit	5.5	5.5	84DN142A&B		O-87-12	Dillon	Harris	
Chandalar D-6	67	54.80	149	31.50	Late Ordovician-Late Silurian	DOc	Mathews River unit	5.0	5.0	90ABD33		A-90-4B	Blodgett	Harris	
Chandalar D-6	67	54.30	149	32.10	Middle Ordovician-Silurian	DOc	*Mathews River unit	5.0	5.0	84DN141		O-87-12	Dillon	Harris	
Chandalar D-6	67	50.80	149	32.10	Middle-Late Devonian	Dhf	Beaucoup Formation	5.0	5.0	89ATi71A	11969-SD	A-89-14	Till	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 15.
Chandalar D-6	67	53.40	149	32.70	Middle Ordovician-Middle Devonian	DOc	Mathews River unit	5.0	5.0	89ATi75A		A-89-14	Till	Harris	

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Chandalar D-6	67	49.50	149	32.80	middle Middle Ordovician	OЄc	Snowden Creek unit	5.0	5.0	90TM448	10851-CO	A-90-4B	Moore	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 19.
Chandalar D-6	67	49.10	149	34.80	latest Late Cambrian-Early Ordovician	OЄc	Snowden Creek unit	5.0	5.5	89ATi68C		A-89-14	Till	Harris	Conodonts are likely redeposited, as seen in collections 90AD25A and B from this locality.
Chandalar D-6	67	49.10	149	34.80	very earliest Middle Ordovician (late Arenigian)	OЄc	Snowden Creek unit	5.0	5.0	90AD25A	10826-CO	A-90-4A	Dumoulin /Moore	Harris /Repetski	Dumoulin and Harris (1994), Appendix 1, loc. 18. Contains redeposited conodonts of Late Cambrian and (or) Early Ordovician age.
Chandalar D-6	67	49.10	149	34.80	very earliest Middle Ordovician (late Arenigian)	OЄc	Snowden Creek unit	5.0	5.0	90AD25B	10827-CO	A-90-4A	Dumoulin /Moore	Harris /Repetski	Dumoulin and Harris (1994), Appendix 1, loc. 18. Contains redeposited conodonts of Late Cambrian and (or) Early Ordovician age.
Chandalar D-6	67	52.20	149	35.30	late Middle-Late Ordovician	DOc	Mathews River unit	5.0	5.0	90AD21Y	10833-CO	A-90-4B	Dumoulin	Harris	
Chandalar D-6	67	52.20	149	35.30	Middle Ordovician-Middle Devonian	DOc	Mathews River unit	5.0	5.0	90AD22A		A-90-4B	Dumoulin	Harris	
Chandalar D-6	67	45.90	149	35.50	Early-Middle Ordovician	OЄc	Om	5.0	5.0	7-30-84D	9912-CO	O-85-14A	Dillon	Harris	Dillon and others (1987), Table 1, loc. 5; Dillon and others (1988), Table 1, loc. 8.
Chandalar D-6	67	52.20	149	35.70	late Late Ordovician	DOc	Mathews River unit	5.0	5.0	90AD21AA	10831-CO	A-90-4B	Dumoulin	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 12.
Chandalar D-6	67	52.20	149	35.70	early Late Devonian (Frasnian)	[Dmu]	Nutirwik Creek unit	5.0	5.0	90AD21E	12071-SD	A-90-4B	Dumoulin	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 12. Conodonts are from a fault sliver of Nutirwik Creek unit (Devonian) too small to show on map.
Chandalar D-6	67	52.20	149	35.70	Middle-Late Ordovician	DOc	Mathews River unit	5.0	5.0	90AD21I	10832-CO	A-90-4B	Dumoulin	Harris	
Chandalar D-6	67	55.25	149	36.25	Middle Ordovician-Late Permian	Pzm	Skajit Limestone	5.0	5.0	89TM290A		A-89-14	Moore	Harris	
Chandalar D-6	67	49.50	149	36.40	Early-middle Silurian	DOc	Mathews River unit	5.0	5.0	89ATi74A	11970-SD	A-89-14	Till	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 17.
Chandalar D-6	67	50.70	149	38.40	Silurian-Permian	Dmu	Obpm*	5.0	5.5	84DN121		O-85-14	Dillon	Harris	Dillon and others (1988), Table 1, loc. 30. Conodont age is incompatible with unit age on source map.
Chandalar D-6	67	47.03	149	38.45	Middle-Late Ordovician	OЄc		5.0	5.0	83DN338	9797-CO	O-84-26	Dillon	Harris	
Chandalar D-6	67	47.10	149	38.50	Middle Ordovician	OЄc	Obpm	5.0	5.5	7-27-84I	9906-CO	O-85-14A	Dillon	Harris	Dillon and others (1987), Table 1, loc. 9; Dillon and others (1988), Table 1, loc. 13.
Chandalar D-6	67	49.50	149	38.90	Early-middle Silurian	DOc	Mathews River unit	5.0	5.0	89AD36E	11963-SD	A-89-14	Dumoulin	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 16.
Chandalar D-6	67	49.50	149	39.00	Early Silurian-Early Devonian	DOc	Mathews River unit	5.0	5.0	89AD36A	11962-SD	A-89-14	Dumoulin	Harris	
Chandalar D-6	67	49.50	149	39.30	Early-Middle Ordovician	[OЄc]	Om (D87), Dsk (D88)*	5.0	5.5	84DN251	9904-CO	O-85-14	Dillon	Harris	Dillon and others (1987), Table 1, loc. 13; Dillon and others (1988), Table 1, loc. 26. Sample is from an outcrop of OPc too small to show on map.
Chandalar D-6	67	46.60	149	40.30	Middle-Late Devonian	Dhf		5.0	5.0	89ATi39A	11968-SD	A-89-14	Till	Harris	
Chandalar D-6	67	52.60	149	41.40	late Middle-Late Ordovician	DOc	Mathews River unit	5.0	5.0	89AD41A	10725-CO	A-89-14	Dumoulin	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 10.
Chandalar D-6	67	47.61	149	41.54	Silurian-Mississippian	Pzm	Skajit Limestone (D88), Pzs (D&H94)	5.5	5.5	84DN249		O-85-14	Dillon	Harris	Dillon and others, 1988, Table 1, loc. 16; Dumoulin and Harris (1994), Appendix 1, loc. 23.
Chandalar D-6	67	52.60	149	41.50	Late Ordovician	DOc	Mathews River unit (D&H94)	5.5	5.5	84DNS109A	10582-CO	O-87-12	Dillon	Harris	Dillon and others (1988), Table 1, loc. 38; Dumoulin and Harris (1994), Appendix 1, loc. 9.
Chandalar D-6	67	47.20	149	41.60	Ordovician-Devonian	Dhf	Beaucoup Formation	5.0	5.0	84DN250		O-85-14	Dillon	Harris	Dillon and others (1988), Table 1, loc. 15.
Chandalar D-6	67	52.80	149	41.60	late Late Ordovician-Early Silurian	DOc	Mathews River unit	5.0	5.5	89AD42A	11964-SD	A-89-14	Dumoulin	Harris	
Chandalar D-6	67	52.10	149	41.70	Middle-Late Ordovician	OЄc	Om	5.5	5.5	84DN127	9903-CO	O-85-14	Dillon	Harris	Dillon and others (1987), Table 1, loc. 16; Dillon and others (1988), Table 1, loc. 39.
Chandalar D-6	67	51.50	149	41.70	Middle Ordovician	OЄc	Obpm	5.5	5.5	84DNS106	9902-CO	O-85-14	Dillon	Harris	Dillon and others (1987), Table 1, loc. 15; Dillon and others (1988), Table 1, loc. 41.

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Chandalar D-6	67	52.60	149	42.30	Middle Ordovician-Middle Devonian	DOc	Mathews River unit	5.0	5.5	89AD40F		A-89-14	Dumoulin	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 11.
Chandalar D-6	67	52.77	149	42.34	Middle Ordovician-Middle Devonian	DOc	Mathews River unit	5.0	5.0	89AD39E		A-89-14	Dumoulin	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 8.
Chandalar D-6	67	48.20	149	42.40	Late Cambrian-Late Permian	Dmu		ND	ND	89TM285A		A-89-14	Moore	Harris	
Chandalar D-6	67	52.60	149	42.50	early Late Ordovician	DOc	Mathews River unit (D&H94)	5.5	5.5	84DNS110	10583-CO	O-87-12	Dillon	Harris	Dillon and others (1988), Table 1, loc. 37; Dumoulin and Harris (1994), Appendix 1, loc. 8.
Chandalar D-6	67	57.96	149	43.75	Givetian-Frasnian	Dhf	Beaucoup Formation	5.0	5.0	90ABD29A	12062-SD	A-90-4B	Blodgett	Harris	
Chandalar D-6	67	57.96	149	43.75	Givetian-Frasnian	Dhf	Beaucoup Formation	5.0	5.0	90ABD29B	12063-SD	A-90-4B	Blodgett	Harris	
Chandalar D-6	67	48.00	149	43.90	Ordovician-Triassic	Pzm	Skajit Limestone (D87, 88), Pzs (D&H94)	6.0	6.0	7-27-84C		O-85-14A	Dillon	Harris	Dillon and others, 1987, Table 1, loc. 11; Dillon and others, 1988, Table 1, loc. 20; Dumoulin and Harris (1994), Appendix 1, loc. 21.
Chandalar D-6	67	46.90	149	44.30	Middle Ordovician	OPzc	Snowden Creek unit (D&H94)	5.0	5.0	7-30-84A	9911-CO	O-85-14A	Dillon	Harris	Dillon and others, 1987, Table 1, loc. 10; Dillon and others, 1988, Table 1, loc. 17; Dumoulin and Harris (1994), Appendix 1, loc. 22.
Chandalar D-6	67	51.30	149	46.50	early Late Ordovician	DOc	Mathews River unit	5.0	5.0	89APR170	10727-CO	A-89-14	Plafker	Harris	Dumoulin and Harris (1994), Appendix 1, loc. 13.
Chandalar D-6	67	48.80	149	46.80	Middle Ordovician-Middle Devonian	Dmu	Skajit Limestone	5.5	6.0	84DN153	11080-SD	O-85-14	Dillon	Harris	Dillon and others (1988), Table 1, loc. 31.
Chandalar D-6	67	51.10	149	49.20	Middle Ordovician-Middle Devonian	[Pzm]		5.0	5.0	89AD43B		A-89-14	Dumoulin	Harris	Sample is from an outcrop of Pzm too small to show on map.
Chandalar D-6	67	51.10	149	49.20	Middle Ordovician-Middle Devonian	[Pzm]		5.0	5.0	90ABD28		A-90-4B	Blodgett	Harris	Sample is from an outcrop of Pzm too small to show on map.
Chandalar D-6	67	45.60	149	51.70	Middle-Late Devonian	Dhf	Beaucoup Formation	5.0	5.5	84DN190	11082-SD	O-85-14	Dillon	Harris	Dillon and others, 1987, Table 1, loc. 3; Dillon and others, 1988, Table 1, loc. 6; Dumoulin and Harris (1994), Appendix 1, loc. 26.
Chandalar D-6	67	45.90	149	52.50	Middle-Late Devonian	Dhf	Df	5.0	5.5	84DN187	11081-SD	O-85-14	Dillon	Harris	Dillon and others (1987), Table 1, loc. 2; Dillon and others (1988), Table 1, loc. 5.
Chandalar D-6	67	53.10	149	55.40	Middle Devonian-Early Mississippian	Dhf		5.0	5.0	85TR64A		A-85-36C	Tailleur	Harris	
Chandalar D-6	67	53.10	149	55.40	Middle-Late Devonian	Dhf		5.5	5.5	85TR64B	11424-SD	A-85-36C	Tailleur	Harris	
Chandalar D-6	67	55.70	149	57.00	Early-Middle Ordovician	[OPzc]	Om, or Hunt Fork Shale	5.0	5.5	83MU84-4	9849-CO	A-84-48	Mull	Harris	Dillon and others (1987), Table 1, loc. 25; Dillon and others (1988), Table 1, loc. 57. Entry 7352 in Alaska Paleontological Database. Sample may be from an outcrop of OPc too small to show on map.

TABLE A-1. Conodont data–Continued.

[Ages listed in this table have not been revised to reflect changes in stratigraphic terminology that have occurred since the ages given here were determined. For example, the former Llandeilo Series (Middle Ordovician) is now considered a stage of the Llanvirn Series and Ordovician and Silurian stages formerly designated as Caradocian, Ashgillian, Llandoverian, etc. are now called Caradoc, Ashgill, and Llandovery (Fortey and others, 1995). Geologic unit (source map) from cited reference (if published) or provided by collector; * in this column indicates unit determination made by Dumoulin based on lithology, location, and (or) age and nature of conodonts. * in remarks column indicates previously unpublished collection from localities published by Karl and others (1989b)]

QUADRANGLE	LAT DEG	LAT MIN	LONG DEG	LONG MIN	AGE	GEOLOGIC UNIT (THIS MAP)	GEOLOGIC UNIT (SOURCE MAP)	CAI MIN	CAI MAX	FIELD NO	USGS NO	E&R NO	COLLECTOR	ID	REMARKS
Christian D-6	67	55.00	146	33.00	Late Ordovician	[Pzm]	*Skajit? Limestone	5.0	5.0	6249-92			AMOCO	Harris	May be slightly mislocated; probably from nearby Pzm.
Christian D-6	67	50.00	146	55.00	Late Devonian-Mississippian	[Dhf]	Hunt Fork Shale	3.0	3.0	6249-93			AMOCO	Harris	May be slightly mislocated; probably from nearby Dhf.

Table A-2. Temperature ranges for Color Alteration Indices (CAIs) of conodonts.

[Taken from Epstein and others (1977), Rejebian and others (1985), and Watts and others (1994). Temperature ranges for conodonts from an Ahrrenius plot of experimental data. For CAIs ≤5.5, ranges represent heating durations of 500 million to 1 million years (lower temperature is 500 m.y.-value); for values ≥6, ranges cover durations of 1,000 years to 500 m.y.]

Minimum CAI	Temperature (°C)
1	<50-80
1.5	50-90
2	60-140
2.5	100-150
3	120-190
3.5	150-200
4	190-250
4.5	250-300
5	300-480
5.5	>360
6	360-550
6.5	440-610
7	490-720
8	>600