Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
2 Mlri	**Howard Pass C-5** 68°44'45"/ 158°55'35"	1 Pa element fragment *Bactrognathus excavatus* Branson and Mehl. 16 Pa elements *Bispathodus stabilis* (Branson and Mehl) or *Bi. utahensis* Sandberg and Gutschick. 1 "*Hindeodella*" *segaformis* Bischoff s.f. bar fragment. *Idioprioniodus conjunctus* (Gunnell), 6 Pa, 3 M, 6 Sa, and 18 Sb-Sc elements. *Kladognathus* sp., 3 P, 8 M, 4 Sa, and 7 Sb-Sc elements. 17 Pa elements *Polygnathus communis cairna* Hass. 2 Pa fragments *Polygnathus* spp. indet. 1 Pa element fragment *Pseudopolygnathus pinnatus* (Voges). 2 *Scaliognathus praeanchoralis* Lane, Sandberg, and Ziegler fragments. 6 Pb elements *Scaliognathus* sp. indet. 48 indet. bar, blade, and platform fragments. Redeposited late Kinderhookian conodonts: 13 Pa elements *Pseudopolygnathus primus* Branson and Mehl. 3 incomplete Pa elements *Siphonodella isosticha* (Cooper). 5 Pa element fragments *Siphonodella* sp. indet. Redeposited late Kinderhookian or early Osagean conodonts: 8 Pa elements *Gnathodus punctatus* (Cooper). Unassigned elements: 5 Pb (3 morphotypes) and 9 M (4 morphotypes). CAI=1.5–2 [92AD50C; 32447–PC]	No older than late Early Mississippian; *Sc. anchoralis-Do. latus* Zone (middle Osagean) along with redeposited Kinderhookian and possibly early Osagean conodonts. This species association and mixture of biofacies and ages is characteristic of the Rim Butte unit.	Mixed biofacies and age; outer shelf or deeper water depositional setting, probably a turbidite.	Possibly graded-bedded, partly silicified limestone rich in crinoid columnals. Thin section is medium- to coarse-grained, poorly sorted, diverse skeletal grainstone. Bioclasts chiefly crinoid ossicles (20–40 percent), along with lesser bryozoans, foraminifers, siliceous sponge spicules, brachiopod fragments, and ostracodes; lithoclasts include glauconite, micrite, noncalcareous (locally spiculitic) mudstone, and phosphate. Collected ≈15 m below top of ≈50- to 60-m-thick section of unit Mlri. Stratigraphic up seems to be to the south, based on sedimentary structures; section could be structurally thickened. If section is depositionally continuous, 92AD52A (loc. 3) should be near top and 50C should be near bottom. This is the furthest northwest exposure of unit Mlri in the Howard Pass 1:250,000 quadrangle. Heavy-mineral concentrate includes phosphatic brachiopod fragments. Processed 10.1 kg of rock.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
3 Mlri	**Howard Pass C-5** 68°43'55"/ 158°55'00"	57 Pa elements *Bispathodus utahensis* Sandberg and Gutschick? 7 "*Hindeodella*" *segaformis* Bischoff s.f. bar fragments. *Idioprioniodus conjunctus* (Gunnell), 2 Pa, 6 Pb, 5 M, 2 Sa, and 8 Sb-Sc elements. *Kladognathus* sp., 6 P, 12 M, 6 Sa, and 20 Sb-Sc elements. 20 Pa elements *Polygnathus communis* Branson and Mehl. 1 *Scaliognathus praeanchoralis* Lane, Sandberg, and Ziegler? fragment. 20 indet. bar, blade, and platform fragments. <u>Redeposited late Kinderhookian conodonts</u>: *Siphonodella* sp. indet., 4 juvenile Pa and 2 Pb elements. <u>Unassigned elements</u>: 6 Pb (3 morphotypes), 11 M (3 morphotypes), and 3 Sc (3 morphotypes). CAI=1.5–2 [92AD52A; 32448–PC]	No older than late Early Mississippian; *Sc. anchoralis-Do. latus* Zone (middle Osagean) along with redeposited Kinderhookian conodonts. This species association and mixture of biofacies and ages is characteristic of the Rim Butte unit.	Mixed biofacies and age; outer shelf or deeper water depositional setting, probably a turbidite.	Very fine grained, medium- to medium-dark-gray limestone containing fine-grained skeletal debris. Thin section is skeletal pack/grainstone; bioclasts mostly (80 percent) calcareous sponge spicules (to 3 mm long). Other grains include bryozoan, brachiopod and crinoid fragments, ostracode valves, and rounded clasts of noncalcareous mudstone. Collected from ≈10 m below rubble of mafic igneous sill, stratigraphically above(?) 92AD50C (loc. 2). Heavy-mineral concentrate includes ferruginous spines and spicules. Processed 11.2 kg of rock.
7 IPMap	**Howard Pass C-5** 68°39'15"/ 158°46'05"	2 Pa fragments *Bispathodus utahensis* Sandberg and Gutschick. 1 Pa element *Gnathodus pseudosemiglaber* Thompson and Fellows. 2 Pa element fragments *Gnathodus* sp. indet. 1 small bar fragment "*Hindeodella*" *segaformis* Bischoff s.f. 43 indet. bar, blade, and platform fragments. CAI=1.5 [92ADo274B; 32466–PC]	late Early Mississippian; within upper part of *Sc. anchoralis-Do. latus* Zone (middle Osagean).	Indeterminate (too few conodonts); slope or deeper water winnow.	Fine-grained, reddish-brown-weathering dolostone interbedded with ≈50 percent medium-dark-gray, ≈0.5-cm-thick (or less) chert layers containing sponge spicules. Thin section is dolomite crystal mosaic (crystals euhedral to subhedral; 20–150 µm in diameter) with irregular zones of chert locally rich in siliceous sponge spicules. Rocks here are an unusually carbonate-rich facies of unit IPMap. Lithologically similar to 92ABs180A (loc. 10) and to thin-bedded chert/dolostone at Lisburne Ridge (northeastern Howard Pass 1:250,000 quadrangle). Processed 9.6 kg of rock. Interbeds of medium- to dark gray chert (92ADo274A) contained corroded fragments of sponge spicules but no identifiable radiolarians.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
10 IPMap	**Howard Pass C-5** 68°37'50"/ 158°52'40"	All conodonts are small fragments and heavily coated and invaded by organic matter making CAI difficult to determine. 3 Pa element fragments *Bispathodus stabilis* (Branson and Mehl) or *Bi. utahensis* Sandberg and Gutschick. 51 indet. bar, blade, and platform fragments. CAI= ≈2 [92ABs180A; 32467–PC]	Mississippian; Kinderhookian-Meramecian (the age of sample 92ADo274B is middle Osagean).	Indeterminate (too few conodonts).	Dark-brownish-gray to brownish-black, light-gray- to slightly brownish-weathering, mostly micritic dolostone (some skeletal supportstone with clasts of brown mudstone) and dark-gray to black chert containing locally preserved, rare to abundant crinoid fragments; chert and dolostone interlayered (50:50) in 2- to 7-cm-thick beds. Sample from rubble at very top of ≈100-m-thick section of unusually carbonate-rich facies of unit IPMap. Rocks are similar to basal part of section at Lisburne Ridge; also resembles unit Mlri but is dolomitized and does not contain sills. Samples 92ADo274B (loc. 7) and 92ADo275 (table 2, loc. 8) are also from this facies. Heavy-mineral concentrate is chiefly barite(?) euhedra with intergrowths of dolomite rhombs. Processed 11.5 kg of rock. Chert overlying(?) this facies at this locality (92ABs180B; table 2) produced Late? Triassic radiolarians
21 IPMk	**Howard Pass C-5** 68°35'45"/ 158°27'20"	All conodonts partly coated and invaded by organic matter. 2 Pa element fragments *Gnathodus pseudosemiglaber* Thompson and Fellows? Unassigned elements: 2 Pb (2 morphotypes), 1 digyrate Pb? of Osagean morphotype, 1 Sa, and 1 Sc 42 indet. bar, blade, and platform fragments CAI=1.5–2 [92AD59A; 32452–PC]	late Early–early Late Mississippian; *Po. mehli*–lower *G. texanus* Zone through Lower *Cavusgnathus* Zone (late Osagean through Meramecian) on the basis of conodonts in underlying sample (92AD59AA); probably late Osagean.	Indeterminate (too few conodonts); mid-shelf or deeper water depositional environment.	Sample from 3- to 6-cm-thick bed of fine-grained, dark-gray, very light gray to medium-gray-weathering, very fetid limestone that has a ghostly texture of black spheroids (calcitized radiolarians?). Thin section is calcite crystal mosaic that contains relict, carbonate-replaced radiolarians. Sample taken ≈3 m below top of ≈30-m-thick section (poorly exposed and could be folded) mostly black chert (and (or) silicified mudstone) but including silty bands and spicules and ≈20–30 percent limestone. Uppermost part of section is light-gray chert that contains radiolarians of Mississippian? age (92AD59G, table 2). Processed 8.8 kg of rock.
		All conodonts partly coated and invaded by organic matter. 3 Pa elements *Gnathodus texanus* Roundy. 23 indet. bar, blade, and platform fragments. CAI=1.5–2 [92AD59AA; 32453–PC]	late Early–early Late Mississippian; *Po. mehli*–lower *G. texanus* Zone through Lower *Cavusgnathus* Zone (late Osagean through Meramecian); probably late Osagean.	Indeterminate (too few conodonts); mid-shelf or deeper water depositional environment.	Lithologically similar to 92AD59A, but a thicker bed (15–35 cm) that has obvious parallel and cross laminae on weathered surface. Thin section is calcite-replaced-radiolarian packstone that contains lesser sponge spicules; matrix is noncalcareous mud. Collected ≈15 m below 92AD59A. Heavy-mineral concentrate includes barite(?) and minor fluorite. Processed 9.3 kg of rock.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
23 Dl	**Howard Pass C-4** 68°32'53"/ 158°06'35"	Unassigned elements: 1 Pb (Devonian and Mississippian morphotype), 1 M, 1 Sb, and 1 Sc elements. 11 indet. bar, blade, and platform fragments. CAI=1.5 [92AD43D]	Devonian-Mississippian	Indeterminate (too few conodonts).	Sample from 4-cm-thick, evenly bedded, brownish-gray, peloidal lime grainstone containing possible mud intraclasts. Thin section is peloid-skeletal grainstone with abundant calcispheres and local fenestral fabric. Collected from unnamed Devonian limestone unit (Dl), near base of ≈20-m-thick section of carbonate mudstone overlying less resistant, ≈4-m-thick fossiliferous interval. Processed 9.6 kg of rock.
		3 *Dvorakia* sp. elements. 6 Pa fragments of an ozarkodinid. 91 *Panderodus* spp. elements. 2 S (coniform) elements *Pelekysgnathus* sp. indet. 6 indet. bar, blade, and platform fragments. CAI=1.5 [92AD43E; 12466–SD]	Early–Middle Devonian; corals restrict age to Pragian-Eifelian (middle Early–early Middle Devonian).	Panderodid biofacies; shallow-water shelf, relatively normal-marine depositional environment.	Brownish-gray, grayish-orange-weathering, fossiliferous lime wackestone to packstone containing bryozoans and corals. Forms matrix to abundant large colonial corals of Pragian-Eifelian age (see table 3 for megafossil data). Thin section is coralline pack/wackestone that has a dolomitic matrix. Collected from unnamed Devonian limestone unit (Dl), at about middle of ≈4-m-thick fossiliferous interval underlying carbonate mudstone. Processed 9.2 kg of rock.
24 Mlri	**Howard Pass C-3** 68°38'20"/ 157°32'30"	1 Pa element *Bispathodus stabilis* (Branson and Mehl) or *B. utahensis* Sandberg and Gutschick. 1 Pa element *Polygnathus purus* Voges. Unassigned elements: 1 M and 1 Sa. 9 indet. bar, blade, and platform fragments. CAI=1–1.5 [92AD22A; 32428–PC]	early Early Mississippian (Kinderhookian).	Indeterminate (too few conodonts); normal-marine depositional environment.	Fine-grained limestone with abundant small burrows. Thin section is calcareous peloidal spiculite that contains calcispheres and brown mud clasts. Sample collected from very fine grained rock (periplatform ooze?) and may contain relatively indigenous faunas. Probably stratigraphically below samples at locality 27. If fauna is not reworked, this sample and that from locality 52 are the oldest recovered from unit Mlri.
27 Mlri	**Howard Pass C-3** 68°38'10"/ 157°31'40"	1 juvenile Pa element *Gnathodus texanus* Roundy? 1 unassigned Pb element. 4 indet. bar, blade, and platform fragments. CAI=1 [92AD20–4.5; 32425–PC]	latest Early–Late Mississippian; late Osagean (*Po. mehli*–Lower *G. texanus* Zone)–early Chesterian.	Indeterminate (too few conodonts); normal-marine depositional environment.	Platy, dark-brownish-gray, grayish-orange-weathering, fine-grained limestone riddled with tiny burrows; about 4.5 m below top of 42-m-thick section of unit Mlri. Thin section is spiculite; spicules chiefly siliceous (some calcareous) in a fine-grained carbonate matrix containing muddy wisps and burrow fills and minor radiolarians. Sample collected from very fine grained rock (periplatform ooze?) and may contain relatively indigenous faunas. Processed 8.5 kg of rock.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
27 Mlri [cont.]	**Howard Pass C-3** 68°38'10"/ 157°31'40"	121 Pa elements *Bispathodus utahensis* Sandberg and Gutschick (all large and partly incomplete). 1 Pa element *Doliognathus latus* Branson and Mehl. 5 *Idioprioniodus* sp. indet. element fragments. 17 incomplete Pa elements of *Pseudopolygnathus* spp. Unassigned elements: 7 robust Pb (Osagean morphotype) and 1 M. 11 indet. bar, blade, and platform fragments. Redeposited middle-late Kinderhookian conodonts: 1 Pa element *Polygnathus inornatus* E.R. Branson. 2 Pa element fragments *Siphonodella* sp. indet. Redeposited Famennian conodonts: 1 Pa element *Palmatolepis* sp. CAI=1.5 [92AD20–14.5; 32426–PC]	No older than late Early Mississippian; *Sc. anchoralis-Do. latus* Zone (middle Osagean or younger) along with redeposited Famennian (late Late Devonian) and middle-late Kinderhookian conodonts. This assemblage is typical of the Rim Butte unit of the Lisburne Group.	Lag concentrate or turbidite. Postmortem transport from or within the bispathodid biofacies.	Crinoidal lime pack/grainstone (probable gravity flow deposit) about 14.5 m below top of 42-m-thick section. Thin section is crinoidal pack/grainstone with lesser bryozoans, siliceous sponge spicules, ostracodes, gastropods, brachipod fragments, echinoderm spines, and phosphatic bioclasts; minor noncalcareous mud clasts, glauconite, and dolomite. Sample collected from carbonate turbidites (and thus may contain reworked faunas). Processed 7.0 kg of rock.
	Howard Pass C-3 68°38'10"/ 157°31'50"	10 Pa elements *Bispathodus utahensis* Sandberg and Gutschick (all large and partly incomplete). 2 Pa elements *Gnathodus punctatus* (Cooper). 2 Pa element fragments *Polygnathus* spp. indet. 6 incomplete Pa elements *Pseudopolygnathus* spp. 2 M elements of Osagean morphotype. 62 indet. bar, blade, and platform fragments. CAI=1.5 [92AD220–23; 32427–PC]	Early Mississippian; late Kinderhookian to earliest Osagean (Lower *G. typicus* Zone) if *G. punctatus* is indigenous.	Bispathodid-pseudopolygnathid; open-marine, middle shelf or deeper water depositional environment.	Sample from 60-cm-thick graded bed of crinoid-rich limestone about 40 m below top of 42-m-thick section; fault cuts section about 25 m above base. Thin section is skeletal grainstone containing 5–10 percent lithic clasts. Bioclasts are 90 percent crinoid ossicles, minor fragments of bryozoans, brachiopods, and ostracodes, and rare echinoderm spines. Lithic clasts include calcareous and siliceous spiculite, lime mudstone, and peloidal-calcisphere pack/grainstone. Sample collected from carbonate turbidites (may contain reworked faunas). Processed 6.3 kg of rock.
29 Mlri	**Howard Pass C-3** 68°35'55"/ 157°41'00"	3 Pa elements of *Bispathodus stabilis* (Branson and Mehl). 1 incomplete juvenile Pa element of *Gnathodus* sp. indet. 1 Sa element fragment of *Kladognathus* sp. indet. 2 unassigned Pb elements. 21 indet. bar, blade, and platform fragments. CAI=2 [91AD11J; 31744–PC]	late Early Mississippian (late Kinderhookian–middle Osagean).	Indeterminate	Sample from cross- and parallel-laminated, fine-grained limestone bed (70 cm thick), 1 m above base of 80-m-thick measured section of unit Mlri. Thin section is calcareous spiculite containing lesser siliceous spicules, calcite-replaced radiolarians, and laminae of noncalcareous mud. Table 4 contains additional data from this locality.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

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Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
33 Mlb	**Howard Pass C-3** 68°37'/ 157°34.5'	11 Pa element fragments *Gnathodus texanus* Roundy. 1 Pa element fragment of a rhachistognathid(?) 66 indet. bar, blade, and platform fragments. CAI=2 [91Tr32C; 31845–PC]	latest Early–Late Mississippian; late Osagean to early Chesterian; if the form identified as rhachistognathid(?) is indeed a rhachistognathid, then the age could be restricted to late Meramecian to early Chesterian.	Indeterminate, but assemblage strongly suggests postmortem transport from or within the gnathodid biofacies; moderate- to deep-water depositional setting.	Vuggy, fine- to medium-grained dolomite; sample from two large blocks (possible subcrop) on shoulder of slope. Thin section is dolomite crystal mosaic containing rare siliceous sponge spicules and <1 percent brown mudstone clasts.
35 Mu?	**Howard Pass C-3** 68°36.3'/ 157°34.3'	1 apatognathiform(?) element. 1 unassigned coniform element. 2 Pa element fragments of a hindeodid(?) 4 Pa elements *Polygnathus communis* Branson and Mehl. 1 juvenile Pa element *Polygnathus* sp. indet. Unassigned elements: 4 Pb (2 morphotypes), 3 M, and 4 Sc (2 morphotypes). 33 indet. bar, blade, and platform fragments. CAI=1–1.5 [91Tr35]	late Late Devonian (Famennian) or Early Mississippian (middle Kinderhookian to Osagean). If the elements designated hindeodid(?) are truly hindeodids, then the sample age is middle Kinderhookian to Osagean and the coniform element must be considered redeposited. If the elements designated hindeodid(?) are Famennian carminate ozarkodinids, then the age of the sample is Famennian.	Indeterminate	Sample from ≈1-ft-thick bed of medium-orange-weathering, sandy limestone to limy sandstone. Thin section is very fine grained, equigranular, angular, calcareous sandstone cemented with calcite. Calcareous clasts (30–40 percent of slide) include crinoid ossicles and brachiopod fragments; other clasts chiefly quartz (20 percent), and minor plagioclase feldspar, chert, biotite, opaque minerals, white mica, and chlorite. Sandy limestone is a common component of the Utukok Fm., but structural complexity at this locality makes unit assignment uncertain.
37 Mlb	**Howard Pass C-3** 68°36.6'/ 157°31.9'	*Hindeodus* aff. *H. crassidentatus* (Branson and Mehl), 1 Pb, 3 Sa, 2 Sb, and 16 Sc elements. *Kladognathus* sp. indet., 4 Sa, 2 Sb, and 13 Sc elements. *Synclydognathus geminus* (Hinde), 16 Pa, 12 Pb and 20 M and S elements. Unassigned elements: 1 Pb and 2 Sc. 143 indet. bar, blade, and platform fragments. CAI=1.5–2 [91Tr28A; 31844–PC]	late Early Mississippian; Osagean to early Meramecian, probably Osagean. This species association is similar to that found in the lower part of the Wachsmuth Limestone in its type area (Chandler Lake quadrangle).	Postmortem transport within or from the synclydognathid-hindeodid biofacies; relatively shallow to moderate water depth depositional environment.	Thick-bedded, medium-gray, fine-grained dolostone containing irregular black chert layers, interbedded with grayish-black, very fine grained, baritic(?) dolostone. Thin section is dolostone having relict peloidal-skeletal grainstone texture locally preserved; one mud-filled burrow contains siliceous sponge spicules and a few radiolarians.
41 Mlb	**Howard Pass C-3** 68°35.7'/ 157°30'	1 mid Pa fragment of a cavusgnathoid. 2 Sa element fragments of *Kladognathus* sp. indet. Unassigned elements: 1 M and 2 Sb. 25 indet. bar, blade, and platform fragments. CAI=1.5 [91Tr24A.1; 31842–PC]	Mississippian; Osagean to Chesterian.	Indeterminate; too few conodonts.	Talus blocks <1 m in size of very fine grained, medium-yellowish-gray to grayish-yellow, massive carbonate rock. Stratigraphic position within unit uncertain. Thin section is brecciated dolostone containing skeletal fragments. Original texture probably a sparsely skeletal mudstone-wackestone. Bioclasts (5–25 percent of the sample) are crinoid ossicles and possible brachiopod and bryozoan fragments; minor detrital quartz. Heavy-mineral concentrate includes rare phosphatic brachiopod fragments.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
41 Mlb [cont.]	**Howard Pass C-3** 68°35.7'/ 157°30'	1 Pa element *Bispathodus utahensis* Sandberg and Gutschick. *Kladognathus* sp. indet., 1 Sa and 1 Sc element fragments. 1 Pa element *Mestognathus praebeckmanni* Sandberg, Orchard, and von Bitter. 2 Pa elements *Synclydognathus geminus* (Hinde). 1 unassigned Pb element. 5 indet. bar, blade, and platform fragments. CAI=1.5 [91Tr24A.2; 31843–PC]	late Early Mississippian; Upper *G. typicus* Subzone to *Sc. anchoralis-Do. latus* Zone (middle Osagean). This species association is like that found in the lower part of the Wachsmuth Limestone in its type area (Chandler Lake quadrangle). The platform facies of the Lisburne Group at Mount Bupto (locs. 69–72) is, at least in part, the same age as the strata at this locality, but the conodont species association from Mount Bupto is generally representative of a more open-marine, deeper water environment.	Indeterminate, too few conodonts. Postmortem transport (probable lag concentrate) within or from a very shallow water depositional environment.	Talus blocks <1 m in size of very fine grained, medium-yellowish-gray to grayish-yellow, massive carabonate rock. Stratigraphic position within unit uncertain. Thin section is a skeletal packstone to grain-rich wackestone; muddy matrix is dolomitized. Skeletal fragments include crinoid ossicles, foraminifers, bryozoan and brachiopod fragments, echinoderm spines, possible ostracode shells and red algae, and a possible gastropod; <1 percent detrital quartz. Rubble of medium-gray-weathering, black to blackish-brown, petroliferous shale near this locality (91JS31D) may correlate with petroliferous rocks exposed on the north side of Mount Bupto (loc. 58).
44 Mlri	**Howard Pass C-3** 68°35.4'/ 157°37.7'	1 Pa element fragment of *Bispathodus* cf. *B. utahensis* Sandberg and Gutschick. 2 posterior Pa element fragments of a cavusgnathoid. *Idioprioniodus* sp., 2 Pa, 2 Pb, and 2 Sa elements. 62 indet. bar, blade, and platform fragments. <u>Redeposited Late Devonian conodonts:</u> 1 mid Pa element fragment of *Palmatolepis* sp. indet. 1 anterior Pa element fragment of *Polygnathus* sp. indet. CAI=1.5 [91Tr36D; 31846–PC]	No older than late Early Mississippian (late Osagean); the species association includes Late Devonian conodonts, and the youngest elements in this collection could be of late Osagean or younger Mississippian age.	Indeterminate	Talus blocks from subcrop of very dark to brownish-gray, very fine grained, muddy, turbiditic limestone (grainstone and carbonate mudstone?). Thin section is skeletal-peloidal grainstone including bryozoans, crinoid ossicles, brachiopods, and rare foraminifers. Peloids consistent in size (40–80 µm). Rare orange-brown micritic (dolomitic?) clasts; irregular shapes suggest deposition before complete lithification. Minor but notable disseminated siliceous sponge spicules (24–60 µm in diameter).
52 Mlri	**Howard Pass C-3** 68°32.4'/ 157°28.9'	3 Pa element fragments of *Polygnathus* sp. indet. of Middle Devonian to Kinderhookian morphotype (specimens corroded). 1 indet. bar fragment. CAI=1.5 [91Tr50.1]	Middle Devonian–early Early Mississippian (Kinderhookian).	Indeterminate	Carbonate talus block. Thin section is a breccia; matrix is clear, relatively coarse-grained anhedral calcite that has undulatory extinction. "Clasts" include brown, noncalcareous mudstone, dark, clotty micrite, crinoid ossicles, dolostone, and chert. Some of the micrite clasts contain chalcedony-filled radiolarians and siliceous sponge spicules (240 and 60 µm in diameter, respectively). If fauna is not reworked, this sample and that from locality 24 are the oldest recovered from unit Mlri.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
56 Mlri	**Howard Pass C-3** 68°32.05'/ 157°32.8'	1 Pa element fragment *Bispathodus*? sp. indet. CAI no higher than 2 [91Tr45E]	latest Devonian–Mississippian.	Indeterminate	Sample from dense, grayish-black, dark-buff-weathering, fine-grained limestone in 30-cm-thick interbeds within ≈2-m-thick interval of platy shale; thin section is sponge spiculite, possibly bioturbated. Spicules (10–30 percent of slide) mostly siliceous but some calcareous and others pyritized. Local pale lenses of calcareous spicules and lesser peloids and micritized bioclasts in matrix of sparry calcite cement. Heavy-mineral concentrate includes phosphatic brachiopod fragments.
58 Mlb	**Howard Pass C-3** 68°31.2'/ 157°30.1'	1 unassigned Pb element of Devonian and Mississippian morphotype. 19 indet. bar, blade, and platform fragments; all specimens badly broken and partly to substantially covered with organic matter. CAI=1.5 or 2 [91Tr40A]	Devonian to Mississippian, probably Mississippian.	Indeterminate	Sample from upper part of unit Mlb; ≈25 m below scarp of massive brecciated cherts. From ≈1-ft-thick layer of carbonate within platy mudstone. Grayish-black, grayish-buff-weathering, partly laminated, carbonaceous dolostone. Thin section is carbonaceous dolomite crystal mosaic. Rocks at about this stratigraphic horizon but a few hundred meters northeast (90AD54; 90JS16) include black, very fine-grained, petroliferous, and phosphatic carbonate. Chert overlying carbonate at this locality contains Paleozoic (possibly Permian) radiolarians (table 2.)
59 Mlri	**Howard Pass C-3** 68°31.1'/ 157°35.5'	Only partly picked; conodonts abundant. 1 Pa element *Bispathodus* aff. *B. utahensis* Sandberg and Gutschick. 3 P elements *Eotaphrus burlingtonensis* Pierce and Langenheim. 1 Pa element fragment *Gnathodus* sp. 8 Pa elements *Polygnathus communis* Branson and Mehl. 1 Pa element *Protognathodus cordiformis* Lane, Ziegler, and Sandberg. 3 Pa elements *Pseudopolygnathus nudus* Pierce and Langenheim morphotype 2. 12 Pa element fragments *Pseudopolygnathus* spp. *Scaliognathus anchoralis* Branson and Mehl, 2 Pa and 8 S element fragments. <u>Unassigned elements</u>: 10 Pb (4 morphotypes), 9 M (2 morphotypes), 1 Sa, and 4 Sc (2 morphotypes). 44 indet. bar, blade, and platform fragments. CAI= ≈2 + heavy gray patina. [91Tr13; 31841–PC]	late Early Mississippian; lower half *Sc. anchoralis-Do. latus* Zone (middle Osagean). The species association is typical of Lisburne Group rocks of the Rim Butte unit.	Postmortem hydraulic mixing of mid-shelf to deep-water biofacies.	Sample from 2 m of Lisburne Group exposed below diabase sill. Lenticularly interbedded, dark, very fine grained limestone and black chert. Thin section is recrystallized carbonate with little relict texture; one possible crinoid columnal noted and minor disseminated opaque minerals.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
60 Mlri	**Howard Pass C-3** 68°31.07'/ 157°36.05'	Only partly picked; conodonts abundant. 8 Pa element fragments *Bispathodus utahensis* Sandberg and Gutschick. 2 Pa elements *Doliognathus latus* Branson and Mehl. 1 juvenile Pa element *Dollymae* sp. indet. 4 Pa element fragments and juveniles *Gnathodus* sp. indet. 8 P elements *Geniculatus* sp. 24 "*Hindeodella" segaformis* Bischoff s.f. bar fragments. 15 Pa elements *Polygnathus communis* Branson and Mehl. 5 Pa elements *Pseudopolygnathus oxypageus* Lane, Sandberg, and Ziegler. 20 Pa element fragments *Pseudopolygnathus* spp. indet. Unassigned elements: 3 robust Pb, 17 M (4 morphotypes), 2 Sa, 2 Sb (2 morphotypes), and 7 Sc (+3 morphotypes). 101 indet. bar, blade, and platform fragments. 10 ichthyoliths. Redeposited Kinderhookian conodonts: 2 juvenile Pa fragments *Siphonodella* sp. indet. CAI=1.5-2 [91Tr09B; 31840–PC]	late Early Mississippian; lower half *Sc. anchoralis-Do. latus* Zone (middle Osagean). The species association and the redeposition of Kinderhookian conodonts is typical of the Rim Butte unit.	Mixed biofacies; postmortem hydraulic mixing of moderately deep water biofacies.	Brownish-gray, fine grainstone interlayered with <50 percent black chert. Within 1–2 m of top of underlying diabase sill. Thin section is recrystallized carbonate with little relict texture—chiefly anhedral calcite crystals.
61 IPMk	**Howard Pass C-3** 68°31'/ 157°35.5'	2 indeterminate bar fragments CAI=1.5–2 [91Tr05B]	Silurian-Permian	Indeterminate (too few conodonts).	Sample from 1-m-thick lens of medium-brownish-gray-weathering, calcareous mudstone within black noncalcareous mudstone. Thin-section is carbonaceous dolomite crystal mosaic. Heavy-mineral concentrate includes very minor fluorite and barite(?).
64 Mlri	**Howard Pass C-3** 68°30.7'/ 157°36.0'	3 indeterminate ramiform fragments CAI=1.5 [91Tr08]	Silurian-Permian	Indeterminate (too few conodonts).	Very fine grained, dark-gray, fractured limestone. Thin section is brecciated interlayers of dark, noncalcareous mudstone containing 20–40 percent sponge spicules, and fine-grained limestone containing minor sponge spicules and rare relict radiolarians.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
66 Mlb	**Howard Pass C-3** 68°30.7'/ 157°34.6'	Only partly picked; conodonts abundant. *Hindeodus crassidentatus* (Branson and Mehl), 36 Pa and 1 Sc elements. *Kladognathus*? sp. indet., 6 Sa and 7 Sc elements. 75 Pa elements *Polygnathus communis communis* Branson and Mehl. 34 *Pseudopolygnathus multistriatus* Mehl and Thomas. <u>Unassigned elements</u>: 9 Pb (2 morphotypes), 23 M (5 morphotypes), 2 Sb (2 morphotypes), and 6 Sc (2 morphotypes). 32 indet. bar, blade, and platform fragments. CAI=1.5 [91Tr07A; 31839–PC]	Early Mississippian (late Kinderhookian through Osagean); equivalent in age to the Kuna Formation and part of the Wachsmuth Limestone.	Postmortem transport from or within the polygnathid-hindeodid-pseudopolygnathid biofacies. Represents normal-marine, mid-shelf to upper-slope depositional environment.	Sample from 1-ft-diameter block of very finely vuggy, fine- to medium-grained, light- to medium-gray-weathering, very light-gray to creamy dolostone containing thin lenses of black chert along with crinoid columnals >¼ inch in diameter. From apparent subcrop near top of 30-m-thick section and within 3 m of contact with overlying black chert. Some vugs contain solid hydrocarbons. Thin-section is coarse-crystalline (0.2–0.4 mm) dolostone containing a few skeletal fragments (mostly crinoid ossicles) that may still be calcite.
67 Mlb	**Howard Pass C-3** 68°30'53"/ 157°32'00"	3 Pa elements (incomplete) *Bispathodus utahensis* Sandberg and Gutschick or *B. stabilis* (Branson and Mehl). *Kladognathus* sp. indet., 1 M and 1 Sb-Sc element fragments. 14 Pa elements *Polygnathus communis communis* Branson and Mehl. 1 unassigned Sc element. 21 indet. bar, blade, and platform fragments. CAI=1.5 [92AD47A; 32439–PC]	Early Mississippian, probably no older than late Kinderhookian.	Indeterminate (too few conodonts); probably normal-marine depositional environment. Conodont species association is similar to that found in some samples of the Rough Mountain Creek unit (Mlr).	Sample from 5-cm-thick undulatory beds of lime crinoidal packstone-grainstone with millimeter-thick shaly partings. Thin section is crinoidal grainstone along with minor dolomite and chert. Collected ≈20 m stratigraphically below 92AD49A (loc. 68) and ≈340 m below the top of the Mlb unit. Heavy-mineral concentrate includes gastropod steinkerns. Processed 9.0 kg of rock.
		16 Pa elements (mostly incomplete) *Bispathodus utahensis* Sandberg and Gutschick or *B. stabilis* (Branson and Mehl). 48 Pa elements *Polygnathus communis communis* Branson and Mehl (small juveniles to adults). <u>Unassigned elements:</u> 9 M (4 morphotypes), 1 Sa, 1 Sb, and 4 Sc (2 morphotypes). 46 indet. bar, blade, and platform fragments. CAI=1.5 [92AD47E; 32440–PC]	Early Mississippian, probably no older than late Kinderhookian.	Polygnathid. Normal-marine depositional environment; *Po. communis communis* was eurytopic but did not occur in large numbers in restricted marine environments. Conodont species association is similar to that found in some samples of the Rough Mountain Creek unit (Mlr).	Thin (4- to 8-cm-thick), nodular-bedded to evenly bedded, skeletal (crinoidal-bryozoan?) lime pack/grainstone with local shaly partings. Thin section is partly silicified skeletal supportstone; bioclasts include abundant crinoid ossicles, brachiopod and bryozoan fragments, and siliceous sponge spicules. Collected at the lowest exposed beds here, ≈20 m stratigraphically below 92AD47A and ≈360 m below the top of unit Mlb. Processed 10.9 kg of rock.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
68 Mlb	**Howard Pass C-3** 68°30'55"/ 157°31'45"	3 Pa elements (incomplete) *Bispathodus utahensis* Sandberg and Gutschick or *B. stabilis* (Branson and Mehl). 3 Sb-Sc element fragments *Kladognathus* sp. indet. <u>Unassigned elements:</u> 3 Pb and 3 M (2 morphotypes). 19 indet. bar, blade, and platform fragments. CAI=1.5 [92AD49A; 32438–PC]	Early Mississippian, probably no older than late Kinderhookian.	Indeterminate (too few conodonts); probably normal-marine depositional environment. Conodont species association is similar to that found in some samples of the Rough Mountain Creek unit (Mlr).	Sample from 5–15 cm-thick layers and lenses of dolostone intercalated with similarly thick layers and lenses of chert showing skeletal wackestone to packstone texture. Thin section is dolomite crystal mosaic containing rare relict crinoid ossicles and spicules. Collected from lowest outcrop of dolostone and chert, ≈155 m below 92AD33–120 (loc. 71) and ≈320 m below the top of unit Mlb. Heavy-mineral concentrate is chiefly fluorite. Processed 10.1 kg of rock.
69 Mlb	**Howard Pass C-3** North-south traverse through section of unit Mlb; 68°30.6'/ 157°32.45' (base, 47A) to 68°30.5'/ 157°32.45' (top, 47F)	*Hindeodus* aff. *H. crassidentatus* (Branson and Mehl), 2 Pa and 1 M elements. 1 Sc element *Kladognathus* sp. indet. 2 Pa elements *Polygnathus communis* Branson and Mehl. 2 unassigned M elements. 12 indet. bar, blade, and platform fragments. CAI=1.5 [91Tr47A; 31847–PC]	late Early Mississippian (Osagean)	Indeterminate	Samples at this locality from traverse through section of unit Mlb exposed along creek bisecting Mount Bupto. Sample 47A from base of section; approximately equivalent to strata at loc. 67. >3 m of massive, medium- to fine-grained, dark-brownish-gray, medium-gray-weathering limestone (probable encrinite) in 5- to 45-cm-thick beds. Thin section is skeletal packstone. Bioclasts (as much as 3 mm in diameter) include crinoid ossicles, bryozoans, small bivalves (brachiopods and (or) ostracodes), and siliceous sponge spicules; some bioclasts partly micritized. A few thin seams of noncalcareous mud contain very abundant sponge spicules. Heavy-mineral concentrate includes pyritized spine steinkerns.
		1 mid-Pa element fragment of a bispathodid? 1 Pa fragment *Hindeodus* aff. *H. crassidentatus* (Branson and Mehl). 1 Pa fragment mestognathid? 1 juvenile Pa element *Mestognathus* aff. *M. harmalai* von Bitter, Sandberg, and Orchard. <u>Unassigned elements</u>: 2 Pb and 2 Sc. 7 indet. bar, blade, and platform fragments. CAI=1.5–2 [91Tr47B; 31848–PC]	Early Mississippian (late Kinderhookian–early Osagean).	Indeterminate	Sample from <5- m-thick interval of thick-bedded, dark-gray to brownish-gray, fine-grained, encrinitic limestone. Thin section is skeletal grainstone; bioclasts mostly bryozoans and lesser crinoid ossicles and brachiopods. Some bioclasts partly silicified; others have micritized rims. Local areas of dolomitic mud rich in calcareous spicules; some muddy zones may be burrows. Heavy-mineral concentrate includes phosphatic brachiopod fragments.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
69 Mlb [cont.]	**Howard Pass C-3** North-south traverse through section of unit Mlb; 68°30.6'/ 157°32.45' (base, 47A) to 68°30.5'/ 157°32.45' (top, 47F)	**Only +60-mesh fraction picked** 46 Pa elements (all incomplete) *Bispathodus utahensis* Sandberg and Gutschick. *Idioprioniodus* sp., 2 Pb, 3 Sa, and 8 Sc elements. 1 Pa element fragment *Pseudopolygnathus* sp. <u>Unassigned elements</u>: 2 Pb, 65 M (+4 morphotypes), 5 Sa, and 10 Sc (2 morphotypes). 94 indet. bar, blade, and platform fragments. CAI=1.5–2 [91Tr47C; 31849–PC]	late Early Mississippian (Osagean)	Bispathodid biofacies; normal-marine, outer shelf to basin depositional environment.	Sample from ≈15-m-thick ribbed outcrop consisting chiefly of grayish-black chert in 5- to 10-cm-thick beds; locally abundant lenses of very fine grained, medium-brownish-gray, medium-buff-weathering dolostone within chert. Thin section is skeletal supportstone. Most of slide is silicified; one end is dolomitized. Relict skeletal grains include bryozoans, crinoid ossicles, ostracodes and minor siliceous sponge spicules. Heavy-mineral concentrate includes phosphatic brachiopod fragments.
		Bispathodus aff. *B. utahensis* Sandberg and Gutschick, 5 Pa and 1 Pb elements. 2 Pa elements *Hindeodus* aff. *H. crassidentatus* (Branson and Mehl). *Idioprioniodus* sp. indet., 2 Sa and 9 Sc elements. <u>Unassigned elements</u>: 2 Pb (2 morphotypes) and 8 M (3 morphotypes). 78 indet. bar, blade, and platform fragments. CAI=1.5–2 [91Tr47D; 31851–PC]	Early Mississippian (late Kinderhookian–Osagean).	Indeterminate	Interlayered black chert and carbonate containing some fossil fragments. Thin section is dolostone (crystals 0.1–1.0 mm) with little relict texture.
		9 Pa element fragments *Bispathodus utahensis* Sandberg and Gutschick. 1 P element *Eotaphrus burlingtonensis* Pierce and Langenheim. 2 Sb elements *Synclydognathus geminus* (Hinde). <u>Unassigned elements</u>: 7 Pb (3 morphotypes), 26 M (+3 morphotypes), 2 Sa, 1 Sb, and 18 Sc (2 morphotypes). 125 indet. bar, blade, and platform fragments. CAI=1.5–2 [91Tr47E; 31852–PC]	late Early Mississippian; middle (*Sc. anchoralis-Do. latus* Zone) to late (*Po. mehli*–Lower *G. texanus* Zone) Osagean.	Indeterminate (too few generically identifiable conodonts).	Sample from ≈5 m of interbedded dolostone and chert. Chert, in beds as much as 25 cm thick, appears to be silicified encrinite; dolostone in undulous beds that locally contain wavy laminations. Thin section mostly dolostone (crystals 30–160 µm) with some relict, locally silicified bioclasts (bryozoans and possible crinoid ossicles and brachiopod fragments). Several layers of dark brown, noncalcareous mud rich in siliceous sponge spicules. Lithofacies and biofacies of these strata suggest correlation with 92AD33–91 (loc. 71).

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
69 Mlb [cont.]	**Howard Pass C-3** North-south traverse through section of unit Mlb; 68°30.6'/ 157°32.45' (base, 47A) to 68°30.5'/ 157°32.45' (top, 47F)	*Bispathodus* aff. *B. utahensis* Sandberg and Gutschick, 7 Pa and 1 Pb elements. Digyrate apparatus, 1 Pa and 1 Sa elements. <u>Unassigned elements</u>: 2 Pb (2 morphotypes), 1 M, 1 Sb, and 6 Sc. 19 indet. bar, blade, and platform fragments. CAI=1.5 [91Tr47F; 31853–PC]	Early–early Late Mississippian (late Kinderhookian–Meramecian).	Indeterminate	Outcrop of chiefly light-gray chert, but collection is encrinitic dolomite from mostly cherty talus block. Sample is stratigraphically highest collection made at this locality. Thin section is mostly dolostone but contains relict calcite crinoid ossicles (2–5 mm in diameter); original texture probably crinoidal grainstone.
70 Mlb	**Howard Pass C-3** 68°30'14"/ 157°32'35"	3 Pa element fragments *Bispathodus* sp. indet. 1 juvenile Pa element *Clydognathus?* sp. indet. *Kladognathus* sp., 2 Sa and 3 Sc elements. 5 Pa elements *Polygnathus communis communis* Branson and Mehl. <u>Unassigned elements</u>: 2 Pb (2 morphotypes) and 2 M (2 morphotypes). 21 indet. bar, blade and platform fragments. CAI=1.5–2 [91Tr47G; 31854–PC]	late Early Mississippian (Osagean)	Indeterminate	Distinctly bedded bioclastic limestone resembling 91Tr47A and B (loc. 69) and probably a structural repeat of the interval that produced those samples. Thin section is skeletal grainstone; bioclasts include crinoid ossicles, echinoderm spines, bryozoans, and brachiopods. Heavy-mineral concentrate includes phosphatized bioclasts and steinkerns, and phosphatic brachiopod fragments.
71 Mlb	**Howard Pass C-3** Measured section extends from 68°30'40"/ 157°31'00" (top) to 68°30'32"/ 157°31'34" (base)	This is an extremely abundant sample; only part of the +60 mesh nonmagnetic heavy-mineral concentrate was picked. *Bispathodus utahensis* Sandberg and Gutschick 413 Pa, 37 Pb, and 8 Sc elements. 2 incomplete Pa elements *Embsaygnathus* sp. indet. 1 juvenile Pa element *Gnathodus* sp. indet. *Hindeodus cristulus* (Youngquist and Miller), 2 Pa and 3 Pb elements. *Idioprioniodus conjunctus* (Gunnell), 7 Pa, 1 Pb, 5 M, 3 Sa, and 1 Sb elements. *Kladognathus tenuis* (Rexroad), 67 P, 102 M, 16 Sa, and 147 Sb-Sc elements. *Synclydognathus geminus* (Hinde), 1 Pa and 5 S elements. 34 Pa *Vogelgnathus postcampbelli* (Austin and Husri). <u>Unassigned elements:</u> 3 Pb (2 morphotypes), and 2 Sc. +200 indet. bar, blade, and platform fragments. CAI=1.5 [92AD33–0.2; 32433–PC]	early Late Mississippian (late Meramecian) based on stratigraphic position above 92AD33–30.	Bispathodid-kladognathid: open-marine, outer shelf (platform) or deeper water depositional environment (based on absence of cavusgnathids and common hindeodids and synclydognathids).	Samples at this locality from a 165-m-thick measured section of unit Mlb (upper part); on trend with (and <0.25 mi south of) section measured by Armstrong (1970). Sample from 3-m-thick interval of >80 percent chert. Collected from less cherty, uppermost 0.5 m of dolostone in 5- to 8-cm-thick beds interlayered with cherty bands (10–15 percent) that preserve crinoidal pack/grainstone texture. Thin section is dolomitized crinoidal packstone. Collected 0.2 m below top of measured section; ≈30 m below top of unit Mlb. Heavy-mineral concentrate: chiefly fluorite, phosphatic brachiopod fragments, conodonts, and lesser ichthyoliths. Processed 10.5 kg of rock. Section contains brachiopods and rugose corals of late Osagean or Meramecian age, and colonial corals (*Lithostrotion* (*Siphonodendron*) *sinuosum* (Kelly)) and endothyrid foraminifers of Meramecian age (Armstrong, 1970, 1975).

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
71 Mlb [cont.]	**Howard Pass C-3** Measured section extends from 68°30'40"/ 157°31'00" (top) to 68°30'32"/ 157°31'34" (base)	10 Pa elements *Cavusgnathus unicornis* Youngquist and Miller. *Bispathodus utahensis* Sandberg and Gutschick, 14 Pa (all incomplete) and 1 Pb elements. *Kladognathus tenuis* (Rexroad), 4 P, 25 M, 3 Sa, and 17 Sb-Sc elements. 1 Pa *Synclydognathus geminus* (Hinde). <u>Unassigned elements:</u> 2 M (2 morphotypes). 201 indet. bar, blade, and platform fragments. CAI=1.5 [92AD33–30; 32434–PC]	early Late Mississippian (late Meramecian); thus far, *Bispathodus utahensis* does not seem to extend beyond the Meramecian and *Cavusgnathus* first appears in the late Meramecian.	Postmortem transport within or from the kladognathid biofacies; probably a mixture of shallow (cavusgnathid and synclydognathid) and somewhat deeper platform (bispathodid and kladognathid) biofacies. Open-marine depositional environment.	Sample from 60-cm-thick massive bed (with irregular laminae due to silicified bioclasts) of fetid dolostone containing hydrocarbon-filled vugs and 5–10 percent chert nodules preserving skeletal (including crinoidal) wackestone and packstone textures. Thin section is dolomite crystal mosaic containing 10–15 percent elongate vugs, some of which are lined with solid hydrocarbons. Collected 30 m below top of measured section. Processed 7.0 kg of rock.
		Mostly broken conodonts—all the +60 mesh heavy-mineral concentrate was picked, but only part of the 60- to 100-mesh fraction was picked. *Bispathodus utahensis* Sandberg and Gutschick, 7 Pa (all incomplete) and 1 Pb elements. 16 small Pa element fragments *Bispathodus utahensis* Sandberg and Gutschick? *Kladognathus* sp. indet., 3 P, 9 M, 2 Sa, and 11 Sb-Sc elements (all fragments). 41 indet. bar, blade, and platform fragments. CAI=1.5 [92AD33–61.5A; 32435–PC]	late Early–early Late Mississippian (middle Osagean–Meramecian); based on constraints from under- and overlying collections.	Postmortem transport within or from the bispathodid-kladognathid biofacies; open-marine depositional environment.	Sample from 50-cm-thick bed of dolostone immediately underlying chert that has crinoidal grainstone texture. Thin section is dolomite-crystal mosaic containing a few relict crinoid ossicles and having 5–10 percent chiefly intercrystalline porosity. Collected 61.5 m below top of measured section. Processed 7.7 kg of rock.
		2 P element fragments *Eotaphrus burlingtonensis* Pierce and Langenheim. *Kladognathus* sp. indet., 9 M, 3 Sa, and 6 Sb-Sc elements (all fragments). 33 indet. bar, blade, and platform fragments. CAI=1.5 [92AD33–91; 32436–PC]	late Early Mississippian; *Sc. anchoralis-Do. latus* Zone through *Po. mehli*–Lower *G. texanus* Zone (middle-late Osagean).	Postmortem transport from the kladognathid biofacies; eotaphrids are shallow-water, high-energy forms, thus this collection suggests proximity to a high-energy depositional regime.	Sample from 30 cm × 2 m-long lens of dolostone within chert that has crinoidal-skeletal packstone-grainstone texture. Thin section is dolomite crystal mosaic that contains a chert lens displaying relict bioclasts (chiefly crinoid ossicles). Collected 91 m below top of measured section. Heavy-mineral concentrate is chiefly fluorite. Processed 7.5 kg of rock.
		3 incomplete Pa elements *Polygnathus communis communis* Branson and Mehl. 2 Sb-Sc element fragments *Kladognathus* sp. indet. 4 indet. bar, blade, and platform fragments. CAI=1.5 [92AD33–120; 32437–PC]	Early Mississippian, probably Osagean.	Indeterminate (too few conodonts).	Sample from 50-cm-thick bed of fetid dolostone containing relict crinoids and solid hydrocarbons in vugs. Thin section is dolomite crystal mosaic that contains rare relict crinoid ossicles. Collected 120 m below top of measured section. Heavy-mineral concentrate is chiefly fluorite. Processed 6.8 kg of rock.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
72 Mlb	**Howard Pass C-3** 68°30'40"/ 157°30'55"	All conodonts are partly to extensively coated with organic matter. 1 Pa element *Bispathodus utahensis* Sandberg and Gutschick. 4 Pa elements *Gnathodus texanus* Roundy. 107 indet. bar, blade, and platform fragments. CAI=1.5 [92AD32A; 32432–PC]	late Early–early Late Mississippian; late Osagean (*Po. mehli*–Lower *G. texanus* Zone) through Meramecian.	Indeterminate (too few generically determinate conodonts).	Buff-weathering, very fine grained dolostone intercalated with black siliceous mudstone; uppermost part of unit Mlb. Stratigraphically above strata at loc. 71; equivalent to, or slightly stratigraphically below, strata at loc. 58. Thin section is fine-crystalline dolostone, with lenses of chert that contain siliceous sponge spicules and lesser radiolarians. Processed 6.4 kg of rock.
73 Dl	**Howard Pass B-5** 68°29'57"/ 158°35'35"	140 *Belodella devonica* (Stauffer) elements. *Polygnathus parawebbi* Chatterton, 38 Pa, 16 Pb, 7 M, 6 Sa, 4 Sb, and 6 Sc elements (all Pa elements have their basal plate still attached). 46 indet. bar, blade, and platform fragments. 6 ichthyoliths. CAI=3 [92AD45B; 12464–SD]	early to middle Middle Devonian; *Po. costatus costatus* Zone through Lower *Po. varcus* Subzone; Eifelian, but not very earliest, through early Givetian. According to R. Blodgett (table 3) brachiopods from this locality suggest an early Eifelian age.	Belodellid-polygnathid biofacies, probably polygnathid biofacies as belodellids were probably surface swimmers. Because belodellids are abundant and the Pa elements of the *Po. parawebbi* still have their basal plate attached, the environment of deposition was probably below or near wave base in a shelf depositional setting.	Dolomitic brachiopod packstone. Thin section is dolomite crystal mosaic containing a few silicified bioclasts, including probable brachiopod fragments and crinoid ossicles. Collected from unnamed Devonian limestone, stratigraphically equivalent(?) to 92AD45C but in different facies. These rocks stratigraphically underlie strata at loc. 74; ≈130 m of total section exposed at the two localities. Heavy-mineral concentrate is chiefly phosphatic brachiopod fragments. Brachiopods of early Eifelian age collected from this locality (see table 3).
		1 *Belodella* sp. indet. element. *Polygnathus parawebbi* Chatterton, 15 Pa, 1 Pb, 1 M, and 1 Sb elements. 3 Pa element fragments *Polygnathus* sp. indet. 24 indet. bar, blade, and platform fragments. CAI=3 [92AD45C; 12465–SD]	early to middle Middle Devonian; *Po. costatus costatus* Zone through Lower *Po. varcus* Subzone; Eifelian, but not very earliest, through early Givetian. According to R. Blodgett (table 3) brachiopods here suggest an early Eifelian age.	Polygnathid biofacies; shelfal depositional environment; higher energy environment than 92AD45B.	Limy brachiopod packstone. Thin section is brachiopod-crinoid wackestone; matrix dolomitized and bioclasts largely silicified. Collected from unnamed Devonian limestone, stratigraphically equivalent(?) to 92AD 45B, but in different facies. Brachiopods of early Eifelian age collected from this locality (see table 3).

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
74 Dl	**Howard Pass B-5** 68°29'43"/ 158°35'00"	3 *Belodella* sp. elements. 1 *Dvorakia* sp. element. 4 *Neopanderodus* sp. elements. 1 Pb *Oulodus* sp. indet. element. 1 Pa element *Polygnathus* aff. *Po. eifelius* Bischoff and Ziegler. 6 Pa elements *Polygnathus linguiformis linguiformis* Hinde gamma morphotype. 15 Pa elements *Polygnathus parawebbi* Chatterton. 15 Pa element fragments or juveniles *Polygnathus* spp. indet. <u>Unassigned elements</u>: 1 Pb, 1 M, and 3 Sc (2 morphotypes). 26 indet. bar, blade, and platform fragments. CAI=3 [92AD28A–22; 12460–SD]	middle Middle Devonian; *Po. ensensis* Zone on the basis of aff. *Po. eifelius* and the age of underlying collection 92AD28A–4; Eifelian-Givetian boundary interval.	Polygnathid biofacies: the taphonomy of the conodonts indicates postmortem transport within this biofacies as most ramiform elements have been winnowed out; relatively high-energy shallow- to mid-shelf depositional setting.	Skeletal lime grainstone lenses containing crinoid ossicles and bryozoans. Thin section is skeletal packstone with locally well developed geopetal fabric and minor peloids. Diverse bioclasts include crinoid ossicles, foraminifers, and fragments of bryozoans, brachiopods, gastropods, and ostracodes; many bioclasts are micritized. Collected from locally youngest(?) part of unnamed Devonian limestone; 130 m of total section exposed here and at loc. 73. Heavy-mineral concentrate includes phosphatic brachiopod fragments, phosphatized bryozoan and gastropod fragments, and conodont pearls.
		8 *Belodella* sp. elements. 5 *Neopanderodus* sp. elements. 1 Pa element *Polygnathus linguiformis linguiformis* Hinde epsilon morphotype. 10 Pa elements *Polygnathus parawebbi* Chatterton. *Polygnathus* spp. indet., 23 Pa and 4 M elements. <u>Unassigned elements</u>: 8 Pb (3 morphotypes), 1 Sa, 1 Sb and 9 Sc (3 morphotypes). 70 indet. bar, blade, and platform fragments. 1 phosphatized gastropod steinkern. CAI=3 [92AD28A–4; 12461–SD]	middle Middle Devonian; *Po. ensensis* Zone on the basis of conodonts in this and in overlying sample 92AD28A–22; Eifelian-Givetian boundary interval.	Polygnathid biofacies: the taphonomy of the conodonts indicates postmortem transport within this biofacies as most ramiform elements have been winnowed out; the polygnathid species suggest a relatively high-energy, shallow to mid-shelf depositional setting.	Skeletal lime grainstone lenses containing crinoid ossicles. Thin section is crinoidal pack/grainstone with brachiopod and coral fragments, ostracodes, and minor carbonate intraclasts; many bioclasts are micritized. Collected from unnamed Devonian limestone, 18 m stratigraphically below 92AD28A–22.
		3 *Belodella* sp. elements. *Polygnathus linguiformis linguiformis* Hinde, 7 Pa, 2 Pb, 3 M, 1 Sa and 1 Sb elements. 41 indet. bar, blade, and platform fragments. CAI=3 [92AD29–8; 12462–SD]	middle Middle Devonian; *Po. costatus costatus* Zone through *Po. ensensis* Zone (upper part of range limited by age of overlying collections); Eifelian, but not very earliest Eifelian, into earliest Givetian.	Indeterminate (too few conodonts); undoubtedly within, or transported from, polygnathid biofacies; possibly near limit of environmental tolerance of polygnathids as all conodonts are small.	Sandy(?) dolostone interlayered with chert bands. Thin section is dolostone containing rare relict crinoid ossicles and thin phosphatic shells; dolomite crystals ≤120 µm. Collected from unnamed Devonian limestone, at least 12 m stratigraphically below 92AD28A–4.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
74 Dl [cont.]	**Howard Pass B-5** 68°29'43"/ 158°35'00"	*Polygnathus linguiformis linguiformis* Hinde gamma morphotype, 3 Pa, 1 Pb, 1 M, and 1 Sc elements. 3 Pa element fragments *Polygnathus* sp. indet. 10 indet. bar, blade, and platform fragments. CAI=3 [92AD30B; 12463–SD]	middle Middle Devonian; *Po. costatus costatus* Zone through *Po. ensensis* Zone (upper part of range limited by age of overlying collections); Eifelian, but not very earliest Eifelian, into earliest Givetian.	Indeterminate (too few conodonts); probably from or within polygnathid biofacies; normal-marine, shelfal depositional environment.	Partly silicified brachiopod packstone. Thin section is brachiopod packstone containing crinoid ossicles and gastropods; many bioclasts silicified and matrix largely dolomitized. Collected from unnamed Devonian limestone, about 10 m above 92AD29–8 and slightly lower(?) than 928AD28A–4. Brachiopods of early Eifelian age collected from this locality (see table 3). Heavy-mineral concentrate includes 7 gastropod, 1 ostracode, and 3 tentaculitid phosphatized steinkerns.
75 Mlri	**Howard Pass B-5** 68°29.6'/ 158°35.1'	2 Pb and 1 Sc elements *Bactrognathus*? sp. indet. 3 Pa elements *Hindeodus crassidentatus* (Branson and Mehl). 1 unassigned Sc element. 23 indet. bar, blade, and platform fragments. CAI=3.5–4 [92AD26D; 32431–PC]	Probably late Early Mississippian (Osagean).	Indeterminate (too few conodonts).	Probable turbidite; 10-cm-thick, parallel- and cross-laminated, light- to medium-gray-weathering (locally yellow-tan), dark-gray limestone intercalated with black mudstone and chert. Thin section is laminated spiculite that contains roughly equal amounts of calcareous and siliceous spicules. Collected ≈1.5 m above base of outcrop and 15 m below mafic sill. Heavy-mineral concentrate: chiefly fused clusters of spines and (or) spicules with druses of phosphate. Processed 7.3 kg of rock.
87 Dl	**Howard Pass B-5** 68°24'40"/ 158°54'00"	All conodonts have a substantial amount of adhering organic matter so that CAI is difficult to determine. 2 P elements *Icriodus symmetricus* Branson and Mehl. 8 Pa elements (incomplete) *Polygnathus dubius* Hinde. 10 Pa element fragments *Polygnathus* sp. indet. Unassigned elements: 4 Pb (2 morphotypes), 3 M, 1 Sb, and 3 Sc (2 morphotypes). 56 indet. bar, blade, platform, and coniform fragments. CAI=3 [92AD69B; 12468–SD]	early Late Devonian; *Pa. transitans* Zone through Lower *Pa. hassi* Zone (early, but not very earliest, Frasnian).	Polygnathid; most conodonts are incomplete, suggesting moderate- to high-energy, middle- to shallow-shelf, normal-marine depositional environment.	Massive, unbedded, crinoidal lime wacke/ packstone with stromatoporoids. Thin section is partly dolomitized stromatoporoid wackestone; subordinate bioclasts include crinoid ossicles and brachiopod fragments. Collected from isolated outcrop (fault block?) topographically (and stratigraphically?) below 92AD68C. Table 3 contains megafossil data from this locality. Processed 11.1 kg of rock.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
88 Dl	**Howard Pass B-5** 68°24'47"/ 158°53'30"	4 *Belodella devonica* (Stauffer) elements. 1 *Dvorakia* sp. indet. element. 20 juvenile to gerontic Pa elements *Polygnathus linguiformis linguiformis* Hinde γ morphotype. 22 juvenile to subadult Pa elements *Polygnathus parawebbi* Chatterton. *Polygnathus* spp. indet., 33 Pa (fragments), 27 Pb, 12 M, 4 Sa, 33 Sb (2 morphotypes), and 15 Sc (2 morphotypes). +100 indet. long bar and blade fragments. CAI=3 [92AD70A; 12469–SD]	early–middle Middle Devonian; *To. k. australis* Zone to Lower *Po. varcus* Subzone (middle Eifelian–early Givetian). This sample matches the conodont assemblages in 92AD28A–4 and 92AD28A–22 (loc. 74) rather well. Brachiopods of Late Devonian age (station 51T123, colln. 51ATr441; USGS colln. 3367) reported from this general locality by J.T. Dutro, Jr., USGS, 1953, unpub. report.	Polygnathid. The polygnathids are abundant, relatively well preserved, and all elements of the apparatus are present. The conodonts have not been hydraulically sorted. Probably quiet-water, middle-shelf depositional environment.	Sample from 25-cm-thick bed of very sooty, fossiliferous (sparse crinoids and gastropods) micritic limestone with limy shale partings. Thin section is lime mudstone containing sparse, 2-mm-thick laminae of skeletal wacke/ packstone; bioclasts include crinoid ossicles and calcareous sponge spicules. Collected ≈4 m above base of ≈10-m-thick outcrop of unnamed Devonian unit. Lithology is similar and age is equivalent to that at 92AD28A (loc. 74). Heavy-mineral concentrate includes phosphatic brachiopod fragments. Processed 11.0 kg of rock.
89 Mlri	**Howard Pass B-5** 68°23'10"/ 158°54'00"	1 juvenile Pa element *Bispathodus utahensis* Sandberg and Gutschick. 4 indet. bar fragments. CAI=2.5 [92AD214–1.5; 32463–PC]	late Early Mississippian; late Kinderhookian–middle Osagean on the basis of conodonts in this and in overlying sample 92AD214–18.5.	Indeterminate (too few conodonts); probably normal-marine depositional environment.	Samples at this locality from ≈85-m-thick measured section of unit Mlri. Section consists of interbedded limestone turbidites and shale (0–47 m), mostly shale (47–60 m), and mostly chert (60–85 m). Turbidites here are similar to those in the Mlri unit in the Howard Pass C-3 quadrangle, 30 mi to the east, but background sediment here is more shaly and less cherty than to the east. Sample 92AD214–1.5 is from 1.5 m above base of section. Sample is fine-grained limestone; 8-cm-thick, parallel- and cross-laminated turbidite that has a scoured base and contains disseminated pyrite. Thin section is very fine-grained, cross-bedded, calcite-cemented quartz-carbonate sandstone. Quartz grains (20–50 percent of slide) are angular, chiefly 40–90 µm in diameter. Carbonate clasts include crinoid ossicles and sponge spicules. Processed 7.3 kg of rock.
		1 juvenile Pa element *Bactrognathus*? sp. 2 Pa elements *Doliognathus latus* Branson and Mehl. 8 bar fragments "*Hindeodella*" *segaformis* Bischoff s.f. 5 Pa elements *Polygnathus communis communis* Branson and Mehl. 3 Pb element fragments *Scaliognathus*? sp. indet. Unassigned elements: 7 M and 2 Sa. 40 indet. bar, blade, and platform fragments. CAI=2.5 [92AD214–18.5; 32464–PC]	late Early Mississippian; *Sc. anchoralis-Do. latus* Zone (middle Osagean).	Indeterminate (too few conodonts); outer shelf or deeper water depositional environment.	Lithology similar to 92AD214–1.5, but collected from a fetid, 40-cm-thick graded bed, a few meters below mafic dike and 18.5 m above base of ≈85-m-thick measured section. Thin section is normally graded, parallel-laminated, quartz-carbonate sandstone cemented with calcite. Quartz grains (20–30 percent of slide) are angular, chiefly 60–90 µm in diameter. Carbonate clasts include crinoid ossicles and sponge spicules (some spicules partly pyritized). Processed 6.0 kg of rock.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
89 Mlri [cont.]	**Howard Pass B-5** 68°23'10"/ 158°54'00"	13 Pa elements *Bispathodus utahensis* Sandberg and Gutschick. 1 subadult Pa element *Gnathodus typicus* Cooper. 5 bar fragments "*Hindeodella*" *segaformis* Bischoff s.f. 12 Pa elements *Mestognathus praebeckmanni* Sandberg, Johnston, Orchard, and von Bitter. 5 Pa elements *Polygnathus communis communis* Branson and Mehl. 2 subadult Pa elements *Pseudopolygnathus* sp. indet. 2 Pa element fragments *Geniculatus claviger* Hass. 1 Pa element *Synclydognathus geminus* (Hinde). Unassigned elements: 9 Pb (4 morphotypes), 6 M (2 morphotypes), 2 Sb, and 7 Sc (6 morphotypes). 66 indet. bar, blade, and platform fragments. CAI=2.5–3 [92AD214–44; 32465–PC]	late Early Mississippian *Sc. anchoralis-Do. latus* Zone (middle Osagean). *Mestognathus praebeckmanni* is a rare conodont. It occurs in another sample from a turbidite within deeper water facies of the Lisburne Group (Akmalik Chert) in the central Howard Pass quadrangle (table 4, loc. 32; Dumoulin and others, 1993, table 1 and fig. 7*K–M*).	Mixed biofacies; probable slope or deeper water depositional environment with admixture from the shallowest-water mestognathid biofacies.	Similar lithology to 92AD214–1.5, but collected from a 20-cm-thick bed scoured into black, fissile shale; sample taken 44 m above base of ≈85-m-thick measured section. Thin section is fine- to medium-grained skeletal grainstone, cemented chiefly with calcite but locally with chert. Diverse bioclasts include crinoid ossicles (20–50 percent of bioclasts), foraminifers (5–10 percent), ostracodes, brachiopods, and echinoid spines. Some bioclasts are micritized; others are partly or completely replaced by silica or pyrite. Minor brown mud clasts and <1percent disseminated quartz silt. Base of grainstone bed is scoured into dark brown shale containing 5–10 percent disseminated quartz silt. Heavy-mineral concentrate includes a pyritized ostracode steinkern. Processed 6.6 kg of rock.
91 Mlri	**Howard Pass B-5** 68°23'30"/ 158°48'55"	20 Pa elements *Bispathodus utahensis* Sandberg and Gutschick. 1 Pa element *Geniculatus claviger* Hass. 11 Pa elements (all growth stages) *Gnathodus semiglaber* (Bischoff). 1 small bar fragment "*Hindeodella*" *segaformis* Bischoff s.f. 5 *Idioprioniodus* sp. indet. element fragments. 1 juvenile Pa element *Pseudopolygnathus* sp. Unassigned elements: 2 M and 1 Sc. 110 indet. bar, blade, and platform fragments. CAI=3 [92ARm37B; 32471–PC]	late Early Mississippian; *Sc. anchoralis-Do. latus* Zone (middle Osagean).	Bispathodid-gnathodid; outer platform to upper slope depositional environment.	Light-gray limestone interbedded with black and gray chert. Heavy-mineral concentrate includes phosphatized composite grains and bioclasts and phosphatic brachiopod fragments. Processed 5.5 kg of rock.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
92 Mlri	**Howard Pass B-5** 68°23'/ 158°49'40"	2 Pa elements *Bispathodus utahensis* Sandberg and Gutschick. 3 Pa element fragments *Doliognathus latus* Branson and Mehl. 17 small bar fragments "*Hindeodella*" *segaformis* Bischoff s.f. 6 Pa elements *Polygnathus communis communis* Branson and Mehl. 3 Pa element fragments *Geniculatus claviger* Hass. Unassigned elements: 3 Pb (2 Osagean morphotypes), 9 M, and 2 Sc. 151 indet. bar, blade, and platform fragments. CAI=3 [92ARm31C; 32470–PC]	late Early Mississippian; *Sc. anchoralis-Do. latus* Zone (middle Osagean).	Mixed biofacies typical of unit Mlri turbidites. Slope or deeper water depositional environment.	Platy limestone. Heavy-mineral concentrate includes phosphatized and (or) pyritized bioclasts and grains, and rare phosphatized gastropods. Processed 4.3 kg of rock.
111 JDbc	**Howard Pass B-4** 68°21'00"/ 158°16'15"	1 posterior Pa element fragment *Ancyrodella* sp. indet. 3 *Belodella* sp. indet. elements. 1 Pa element *Palmatolepis hassi* Müller and Müller? *Palmatolepis* spp. indet., 5 Pa and 2 Pb element fragments. 1 Pa element fragment *Polygnathus* aff. *Po. evidens* Klapper and Lane. 39 Pa elements *Polygnathus pacificus* Savage and Funai. 27 Pa element fragments *Polygnathus* spp. indet. Unassigned elements: 3 Pb (2 morphotypes), 8 M (4 morphotypes), 1 Sa, and 3 Sc (2 morphotypes). 104 indet. bar, blade, and platform fragments. 11 conodont pearls. CAI=2–2.5 [92AD25E;12458–SD]	middle early Late Devonian (Lower *Pa. hassi* Zone to Upper *Pa. rhenana* Zone; middle Frasnian).	Polygnathid biofacies. Taphonomy of the conodonts indicates postmortem transport within this biofacies as most ramiform elements have been winnowed out; the characteristics of *Po. pacificus* suggest a middle- to outer-shelf depositional environment. The polygnathids have not moved beyond their biofacies as juveniles, subadults, and adults are present in this assemblage.	Nodular, 1- to 2-cm-thick beds of fine-grained skeletal lime wackestone. Thin section is skeletal wacke/packstone; diverse bioclasts include crinoid ossicles (to 3 mm in diameter), various types of algae (including *Girvanella* sp.), ostracodes, gastropods, calcispheres, echinoid spines, and fragments of stromatoporoids, bryozoans, and trilobites. Matrix is peloidal and locally dolomitized, and contains minor detrital quartz and altered volcanic(?) lithic clasts. Collected from a discrete ≈10 × 20 m block of unnamed Devonian limestone within Copter Peak basalt unit of Siniktanneyak mafic complex. Corals and stromatoporoids of Frasnian age were previously reported from this locality (table 4; fossil loc. 6 of Nelson and Nelson, 1982).
		1 *Belodella resima* (Philip). 8 conodont pearls. CAI=1.5 [78Cx27A1]	Silurian-Devonian	Indeterminate	Collected from discrete carbonate block within Copter Peak basalt unit, slightly northwest of 92AD25E.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
112 JDbc	**Howard Pass B-4** 68°20'56"/ 158°16'00"	1 posterior Pa element fragment *Ancyrodella* sp. indet. 1 Pa element fragment *Polygnathus* sp. indet. 6 indet. bar, blade, and platform fragments. CAI=3 [92AD25H; 12459–SD]	early Late Devonian (Frasnian)	Indeterminate (too few conodonts). Conodonts suggest normal-marine, shelfal environment.	Massive, stromatoporoid-crinoidal lime packstone. Thin section is skeletal packstone containing <1 percent angular quartz silt; diverse bioclasts include crinoid ossicles, stromatoporoid fragments, and algae(?). Collected from a discrete ≈10 × 20 m block of unnamed Devonian limestone within Copter Peak basalt unit of Siniktanneyak mafic complex. Conodonts of Late Devonian age previously reported from this locality (table 4; fossil locality 7 of Nelson and Nelson, 1982).
146 IPMk	**Howard Pass B-3** 68°20'00"/ 157°44'35"	Organic matter invades or partly covers all conodonts; consequently CAI difficult to determine. 3 Pa elements *Bispathodus utahensis* Sandberg and Gutschick. 2 Pa elements *Gnathodus cuneiformis* Mehl and Thomas. 2 Pa elements *Polygnathus communis communis* Branson and Mehl. *Scaliognathus anchoralis* Branson and Mehl, 30 M, 3 Sc, and 35 S element bar fragments. 1 digyrate Pb element. Unassigned elements: 20 Pb (+4 morphotypes), 5 Sa (2 morphotypes), 7 Sb (2 morphotypes), and 16 Sc (2 morphotypes). +130 indet. bar, blade, and platform fragments. CAI= ≈3 [92AD35C-15.5; 32442–PC]	late Early Mississippian; *Sc. anchoralis-Do. latus* Zone (middle Osagean).	Scaliognathid; basinal depositional environment.	Sample from 80 × 45 cm concretion of fine-grained, sooty, fetid, black, medium-gray-weathering limestone (calcified radiolarite?). Thin section is calcareous radiolarian packstone; radiolarian tests (50–80 percent of slide; replaced and filled with polycrystalline calcite) and lesser calcareous sponge spicules in a matrix of brown, fine-crystalline calcite. Collected from 15.5 m above base of ≈68 m-thick section of Kuna Formation at type locality (as designated in Mull and others, 1982); section is mostly silicified mudstone and <10 percent limestone. Processed 11.1 kg of rock.
	Howard Pass B-3 68°20'02"/ 157°44'32"	Organic matter invades or partly covers all conodonts; consequently CAI difficult to determine. *Bispathodus utahensis* Sandberg and Gutschick, 9 Pa, 1 Pb, 1 M, and 1 Sc elements. 1 Pa element *Gnathodus pseudosemiglaber* Thompson and Fellows (figured in Dumoulin and others, 1994, fig. 3*H*). 68 indet. bar, blade, and platform fragments. CAI= ≈3 [92AD35C-62; 31782–PC]	late Early–early Late Mississippian (late middle Osagean–Meramecian).	Indeterminate (too few conodonts); conodonts suggest basin facies.	Fine-grained, dark-gray to black, locally burrowed(?) limestone rubble (possible concretion). Thin section is dark, very fine grained carbonate containing rare, calcite-replaced radiolarians and locally abundant brown clasts of noncalcareous mud. Collected 62 m above base of section and 46.5 m above 92AD35C-15.5. Processed 8.7 kg of rock.

Table 1. Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by A.G. Harris. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleur; and Cx, S.M. Curtis. CAI, conodont color alteration index. Lithologic data under remarks are field descriptions unless otherwise indicated; thin section observations by J.A. Dumoulin. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
147 IPMk	**Howard Pass B-3** 68°19'55"/ 157°44'10"	Organic matter invades or partly covers all conodonts; consequently CAI difficult to determine. *Bispathodus utahensis* Sandberg and Gutschick (juveniles and adults), 12 Pa, 2 Pb, 7 M, 1 Sa, 3 Sb, and 14 Sc elements. 30 Pa elements (adults and juveniles) *Gnathodus semiglaber* Bischoff. 20 bar fragments (moderately long) "*Hindeodella*" *segaformis* Bischoff s.f. Digyrate apparatus elements: 2 Pa (2 morphotypes), 1 Pb, 1 M, 1 Sa, 2 Sc. <u>Unassigned elements</u>: 1 Pa fragment, 19 Pb (+4 morphotypes), 4 M (2 morphotypes), 3 Sa, and 5 Sc. 70 indet. bar, blade, and platform fragments. CAI= ≈3 [92AD35AA; 32441–PC]	late Early Mississippian; Upper *G. typicus* Subzone or lower part *Sc. anchoralis-Do. latus* Zone (early middle Osagean) on the basis of age constraints from overlying sample.	Bispathodid-gnathodid; slope or basin depositional setting.	Sample from 4- to 10-cm-thick beds of dark- to medium-dark-gray limestone (calcitized radiolarite?). Thin section is dark, finely intergrown carbonate and silica containing locally abundant brown clasts of noncalcareous mud and scattered, variously preserved radiolarians (some calcite replaced, some pyritized, and some filled with chalcedony). Collected at type locality of Kuna Formation (as designated in Mull and others, 1982); from small outcrop at stream level ≈15 m west and 12 m topographically lower than base of 92AD35A measured section. If 92AD35AA strata are in place, they are the lowest exposure at the type locality. Processed 9.8 kg of rock.
		Organic matter invades or partly covers all conodonts; consequently CAI difficult to determine. Collection extremely abundant, only partly picked. *Bispathodus utahensis* Sandberg and Gutschick, 6 Pa, 3 Pb, and 1 M elements. 3 Pa elements *Doliognathus latus* Branson and Mehl morphotype 3. 2 Pa elements *Gnathodus* sp. indet. 9 Pa elements *Polygnathus communis communis* Branson and Mehl. 1 Pa element *Protognathodus cordiformis* Lane, Sandberg, and Ziegler. *Scaliognathus anchoralis* Branson and Mehl, 4 Pa, 54 M, and 174 Sa, Sb, and Sc (moderate to very long bar fragments) elements. <u>Unassigned elements</u>: 69 Pb (+4 morphotypes), 2 Sb, and 1 Sc. 22 indet. bar, blade, and platform fragments. CAI= ≈3 [92AD35A–9A; 31781–PC]	late Early Mississippian; lower part of *Sc. anchoralis-Do. latus* Zone (early middle Osagean).	Scaliognathid; basinal depositional environment.	Sample from 40 × 90-cm concretion of black limestone (calcitized radiolarite?) in fissile black shale. Thin section is calcareous radiolarian packstone; radiolarian tests (replaced and filled with calcite), lesser calcareous sponge spicules, and locally abundant brown clasts of mud and phosphate in a matrix of brown mud. Radiolarians and spicules make up ≈70–80 percent of slide. Collected 9 m above base of 25-m-thick partial section (92AD35A) of Kuna Formation at type locality. Some conodonts from this sample are figured and described in Dumoulin and others (1994, fig. 3*C–G*). Processed 10.5 kg of rock.