

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 Conodont data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.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. Tailleux; 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"	<p>1 Pa element fragment <i>Bactrognathus excavatus</i> Branson and Mehl.</p> <p>16 Pa elements <i>Bispathodus stabilis</i> (Branson and Mehl) or <i>Bi. utahensis</i> Sandberg and Gutschick.</p> <p>1 "<i>Hindeodella</i>" <i>segaformis</i> Bischoff s.f. bar fragment.</p> <p><i>Idioproniodus conjunctus</i> (Gunnell), 6 Pa, 3 M, 6 Sa, and 18 Sb-Sc elements.</p> <p><i>Kladognathus</i> sp., 3 P, 8 M, 4 Sa, and 7 Sb-Sc elements.</p> <p>17 Pa elements <i>Polygnathus communis cairna</i> Hass.</p> <p>2 Pa fragments <i>Polygnathus</i> spp. indet.</p> <p>1 Pa element fragment <i>Pseudopolygnathus pinnatus</i> (Voges).</p> <p>2 <i>Scaliognathus praeanchoralis</i> Lane, Sandberg, and Ziegler fragments.</p> <p>6 Pb elements <i>Scaliognathus</i> sp. indet.</p> <p>48 indet. bar, blade, and platform fragments.</p> <p><u>Redeposited late Kinderhookian conodonts:</u></p> <p>13 Pa elements <i>Pseudopolygnathus primus</i> Branson and Mehl.</p> <p>3 incomplete Pa elements <i>Siphonodella isosticha</i> (Cooper).</p> <p>5 Pa element fragments <i>Siphonodella</i> sp. indet.</p> <p><u>Redeposited late Kinderhookian or early Osagean conodonts:</u></p> <p>8 Pa elements <i>Gnathodus punctatus</i> (Cooper).</p> <p><u>Unassigned elements:</u></p> <p>5 Pb (3 morphotypes) and 9 M (4 morphotypes).</p> <p>CAI=1.5–2</p> <p>[92AD50C; 32447–PC]</p>	<p>No older than late Early Mississippian; <i>Sc. anchoralis-Do. latus</i> Zone (middle Osagean) along with redeposited Kinderhookian and possibly early Osagean conodonts.</p> <p>This species association and mixture of biofacies and ages is characteristic of the Rim Butte unit.</p>	<p>Mixed biofacies and age; outer shelf or deeper water depositional setting, probably a turbidite.</p>	<p>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.</p> <p>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.</p> <p>This is the furthest northwest exposure of unit Mlri in the Howard Pass 1:250,000 quadrangle. Heavy-mineral concentrate includes phosphatic brachiopod fragments.</p> <p>Processed 10.1 kg of rock.</p>

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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 <i>Bispathodus utahensis</i> Sandberg and Gutschick? 7 " <i>Hindeodella</i> " <i>segaformis</i> Bischoff s.f. bar fragments. <i>Idioprioniodus conjunctus</i> (Gunnell), 2 Pa, 6 Pb, 5 M, 2 Sa, and 8 Sb-Sc elements. <i>Kladognathus</i> sp., 6 P, 12 M, 6 Sa, and 20 Sb-Sc elements. 20 Pa elements <i>Polygnathus communis</i> Branson and Mehl. 1 <i>Scaliognathus praeanchoralis</i> Lane, Sandberg, and Ziegler? fragment. 20 indet. bar, blade, and platform fragments. <u>Redeposited late Kinderhookian conodonts:</u> <i>Siphonodella</i> 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; <i>Sc. anchoralis-Do. latus</i> 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 <i>Bispathodus utahensis</i> Sandberg and Gutschick. 1 Pa element <i>Gnathodus pseudosemiglaber</i> Thompson and Fellows. 2 Pa element fragments <i>Gnathodus</i> sp. indet. 1 small bar fragment " <i>Hindeodella</i> " <i>segaformis</i> Bischoff s.f. 43 indet. bar, blade, and platform fragments. CAI=1.5 [92ADo274B; 32466–PC]	late Early Mississippian; within upper part of <i>Sc. anchoralis-Do. latus</i> 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.

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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 <i>Bispathodus stabilis</i> (Branson and Mehl) or <i>Bi. utahensis</i> 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 <i>Gnathodus pseudosemiglaber</i> Thompson and Fellows? <u>Unassigned elements:</u> 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; <i>Po. mehli</i> -lower <i>G. texanus</i> Zone through Lower <i>Cavusgnathus</i> 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 <i>Gnathodus texanus</i> Roundy. 23 indet. bar, blade, and platform fragments. CAI=1.5-2 [92AD59AA; 32453-PC]	late Early-early Late Mississippian; <i>Po. mehli</i> -lower <i>G. texanus</i> Zone through Lower <i>Cavusgnathus</i> 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.

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Locality No., map unit	Quadrangle, latitude/longitude	Conodont fauna and CAI [field No.; USGS collection No.]	Age	Biofacies	Remarks
23 DI	Howard Pass C-4 68°32'53"/ 158°06'35"	<p><u>Unassigned elements:</u> 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]</p>	Devonian-Mississippian	Indeterminate (too few conodonts).	<p>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 (DI), near base of ≈20-m-thick section of carbonate mudstone overlying less resistant, ≈4-m-thick fossiliferous interval. Processed 9.6 kg of rock.</p>
		<p>3 <i>Dvorakia</i> sp. elements. 6 Pa fragments of an ozarkodinid. 91 <i>Panderodus</i> spp. elements. 2 S (coniform) elements <i>Pelekysgnathus</i> sp. indet. 6 indet. bar, blade, and platform fragments. CAI=1.5 [92AD43E; 12466–SD]</p>	Early–Middle Devonian; corals restrict age to Pragian-Eifelian (middle Early–early Middle Devonian).	Panderodid biofacies; shallow-water shelf, relatively normal-marine depositional environment.	<p>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 (DI), at about middle of ≈4-m-thick fossiliferous interval underlying carbonate mudstone. Processed 9.2 kg of rock.</p>
24 Mlri	Howard Pass C-3 68°38'20"/ 157°32'30"	<p>1 Pa element <i>Bispathodus stabilis</i> (Branson and Mehl) or <i>B. utahensis</i> Sandberg and Gutschick. 1 Pa element <i>Polygnathus purus</i> Voges. <u>Unassigned elements:</u> 1 M and 1 Sa. 9 indet. bar, blade, and platform fragments. CAI=1–1.5 [92AD22A; 32428–PC]</p>	early Early Mississippian (Kinderhookian).	Indeterminate (too few conodonts); normal-marine depositional environment.	<p>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.</p>
27 Mlri	Howard Pass C-3 68°38'10"/ 157°31'40"	<p>1 juvenile Pa element <i>Gnathodus texanus</i> Roundy? 1 unassigned Pb element. 4 indet. bar, blade, and platform fragments. CAI=1 [92AD20–4.5; 32425–PC]</p>	latest Early–Late Mississippian; late Osagean (<i>Po. mehli</i> –Lower <i>G. texanus</i> Zone)–early Chesterian.	Indeterminate (too few conodonts); normal-marine depositional environment.	<p>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.</p>

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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 <i>Bispathodus utahensis</i> Sandberg and Gutschick (all large and partly incomplete). 1 Pa element <i>Doliognathus latus</i> Branson and Mehl. 5 <i>Idioproniodus</i> sp. indet. element fragments. 17 incomplete Pa elements of <i>Pseudopolygnathus</i> spp. <u>Unassigned elements:</u> 7 robust Pb (Osagean morphotype) and 1 M. 11 indet. bar, blade, and platform fragments. <u>Redeposited middle-late Kinderhookian conodonts:</u> 1 Pa element <i>Polygnathus inornatus</i> E.R. Branson. 2 Pa element fragments <i>Siphonodella</i> sp. indet. <u>Redeposited Famennian conodonts:</u> 1 Pa element <i>Palmatolepis</i> sp. CAI=1.5 [92AD20–14.5; 32426–PC]	No older than late Early Mississippian; <i>Sc. anchoralis-Do. latus</i> 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, brachiopod 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 <i>Bispathodus utahensis</i> Sandberg and Gutschick (all large and partly incomplete). 2 Pa elements <i>Gnathodus punctatus</i> (Cooper). 2 Pa element fragments <i>Polygnathus</i> spp. indet. 6 incomplete Pa elements <i>Pseudopolygnathus</i> 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 <i>G. typicus</i> Zone) if <i>G. punctatus</i> 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 <i>Bispathodus stabilis</i> (Branson and Mehl). 1 incomplete juvenile Pa element of <i>Gnathodus</i> sp. indet. 1 Sa element fragment of <i>Kladognathus</i> 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.

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33 Mlb	Howard Pass C-3 68°37'/ 157°34.5'	11 Pa element fragments <i>Gnathodus texanus</i> 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 <i>Polygnathus communis</i> Branson and Mehl. 1 juvenile Pa element <i>Polygnathus</i> sp. indet. <u>Unassigned elements:</u> 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'	<i>Hindeodus</i> aff. <i>H. crassidentatus</i> (Branson and Mehl), 1 Pb, 3 Sa, 2 Sb, and 16 Sc elements. <i>Kladognathus</i> sp. indet., 4 Sa, 2 Sb, and 13 Sc elements. <i>Syncladognathus geminus</i> (Hinde), 16 Pa, 12 Pb and 20 M and S elements. <u>Unassigned elements:</u> 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 syncladognathid-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 <i>Kladognathus</i> sp. indet. <u>Unassigned elements:</u> 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.

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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 <i>Bispathodus utahensis</i> Sandberg and Gutschick. <i>Kladognathus</i> sp. indet., 1 Sa and 1 Sc element fragments. 1 Pa element <i>Mestognathus praebeckmanni</i> Sandberg, Orchard, and von Bitter. 2 Pa elements <i>Synclydogathus geminus</i> (Hinde). 1 unassigned Pb element. 5 indet. bar, blade, and platform fragments. CAI=1.5 [91Tr24A.2; 31843-PC]	late Early Mississippian; Upper <i>G. typicus</i> Subzone to <i>Sc. anchoralis-Do. latus</i> 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 carbonate 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 <i>Bispathodus</i> cf. <i>B. utahensis</i> Sandberg and Gutschick. 2 posterior Pa element fragments of a cavusgnathoid. <i>Idioprioniodus</i> 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 <i>Palmatolepis</i> sp. indet. 1 anterior Pa element fragment of <i>Polygnathus</i> 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 <i>Polygnathus</i> 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. Tailleux; 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 <i>Bispathodus?</i> 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 <i>Bispathodus</i> aff. <i>B. utahensis</i> Sandberg and Gutschick. 3 P elements <i>Eotaphrus burlingtonensis</i> Pierce and Langenheim. 1 Pa element fragment <i>Gnathodus</i> sp. 8 Pa elements <i>Polygnathus communis</i> Branson and Mehl. 1 Pa element <i>Protognathodus cordiformis</i> Lane, Ziegler, and Sandberg. 3 Pa elements <i>Pseudopolygnathus nudus</i> Pierce and Langenheim morphotype 2. 12 Pa element fragments <i>Pseudopolygnathus</i> spp. <i>Scaliognathus anchoralis</i> 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 <i>Sc. anchoralis-Do. latus</i> 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 columnar 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. Tailleux; 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 <i>Bispathodus utahensis</i> Sandberg and Gutschick. 2 Pa elements <i>Doliognathus latus</i> Branson and Mehl. 1 juvenile Pa element <i>Dollymae</i> sp. indet. 4 Pa element fragments and juveniles <i>Gnathodus</i> sp. indet. 8 P elements <i>Geniculatus</i> sp. 24 " <i>Hindeodella</i> " <i>segaformis</i> Bischoff s.f. bar fragments. 15 Pa elements <i>Polygnathus communis</i> Branson and Mehl. 5 Pa elements <i>Pseudopolygnathus oxypageus</i> Lane, Sandberg, and Ziegler. 20 Pa element fragments <i>Pseudopolygnathus</i> spp. indet. <u>Unassigned elements:</u> 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. <u>Redeposited Kinderhookian conodonts:</u> 2 juvenile Pa fragments <i>Siphonodella</i> sp. indet. CAI=1.5-2 [91Tr09B; 31840-PC]	late Early Mississippian; lower half <i>Sc. anchoralis-Do. latus</i> 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. Tailleux; 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. <i>Hindeodus crassidentatus</i> (Branson and Mehl), 36 Pa and 1 Sc elements. <i>Kladognathus?</i> sp. indet., 6 Sa and 7 Sc elements. 75 Pa elements <i>Polygnathus communis communis</i> Branson and Mehl. 34 <i>Pseudopolygnathus multistriatus</i> 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) <i>Bispathodus utahensis</i> Sandberg and Gutschick or <i>B. stabilis</i> (Branson and Mehl). <i>Kladognathus</i> sp. indet., 1 M and 1 Sb-Sc element fragments. 14 Pa elements <i>Polygnathus communis communis</i> 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) <i>Bispathodus utahensis</i> Sandberg and Gutschick or <i>B. stabilis</i> (Branson and Mehl). 48 Pa elements <i>Polygnathus communis communis</i> 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; <i>Po. communis communis</i> 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.

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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) <i>Bispathodus utahensis</i> Sandberg and Gutschick or <i>B. stabilis</i> (Branson and Mehl). 3 Sb-Sc element fragments <i>Kladognathus</i> 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)	<i>Hindeodus</i> aff. <i>H. crassidentatus</i> (Branson and Mehl), 2 Pa and 1 M elements. 1 Sc element <i>Kladognathus</i> sp. indet. 2 Pa elements <i>Polygnathus communis</i> 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 <i>Hindeodus</i> aff. <i>H. crassidentatus</i> (Branson and Mehl). 1 Pa fragment mestognathid? 1 juvenile Pa element <i>Mestognathus</i> aff. <i>M. harmalai</i> 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. Tailleux; 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)	<p>Only +60-mesh fraction picked 46 Pa elements (all incomplete) <i>Bispathodus utahensis</i> Sandberg and Gutschick. <i>Idioproniodus</i> sp., 2 Pb, 3 Sa, and 8 Sc elements. 1 Pa element fragment <i>Pseudopolygnathus</i> sp.</p> <p><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]</p>	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.
		<p><i>Bispathodus</i> aff. <i>B. utahensis</i> Sandberg and Gutschick, 5 Pa and 1 Pb elements. 2 Pa elements <i>Hindeodus</i> aff. <i>H. crassidentatus</i> (Branson and Mehl). <i>Idioproniodus</i> sp. indet., 2 Sa and 9 Sc elements.</p> <p><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]</p>	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.
		<p>9 Pa element fragments <i>Bispathodus utahensis</i> Sandberg and Gutschick. 1 P element <i>Eotaphrus burlingtonensis</i> Pierce and Langenheim. 2 Sb elements <i>Synclydogmathus geminus</i> (Hinde).</p> <p><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]</p>	late Early Mississippian; middle (<i>Sc. anchoralis</i> – <i>Do. latus</i> Zone) to late (<i>Po. mehli</i> –Lower <i>G. texanus</i> 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. Tailleux; 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)	<i>Bispathodus</i> aff. <i>B. utahensis</i> 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 <i>Bispathodus</i> sp. indet. 1 juvenile Pa element <i>Clydogmathus?</i> sp. indet. <i>Kladognathus</i> sp., 2 Sa and 3 Sc elements. 5 Pa elements <i>Polygnathus communis communis</i> 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. <i>Bispathodus utahensis</i> Sandberg and Gutschick 413 Pa, 37 Pb, and 8 Sc elements. 2 incomplete Pa elements <i>Embsaygnathus</i> sp. indet. 1 juvenile Pa element <i>Gnathodus</i> sp. indet. <i>Hindeodus cristulus</i> (Youngquist and Miller), 2 Pa and 3 Pb elements. <i>Idioprioniodus conjunctus</i> (Gunnell), 7 Pa, 1 Pb, 5 M, 3 Sa, and 1 Sb elements. <i>Kladognathus tenuis</i> (Rexroad), 67 P, 102 M, 16 Sa, and 147 Sb-Sc elements. <i>Syncladognathus geminus</i> (Hinde), 1 Pa and 5 S elements. 34 Pa <i>Vogelgnathus postcampbelli</i> (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 syncladognathids).	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 (<i>Lithostrotion</i> (<i>Siphonodendron</i>) <i>sinuosum</i> (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. Tailleux; 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 <i>Cavusgnathus unicornis</i> Youngquist and Miller. <i>Bispathodus utahensis</i> Sandberg and Gutschick, 14 Pa (all incomplete) and 1 Pb elements. <i>Kladognathus tenuis</i> (Rexroad), 4 P, 25 M, 3 Sa, and 17 Sb-Sc elements. 1 Pa <i>Syncladognathus geminus</i> (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, <i>Bispathodus utahensis</i> does not seem to extend beyond the Meramecian and <i>Cavusgnathus</i> first appears in the late Meramecian.	Postmortem transport within or from the kladognathid biofacies; probably a mixture of shallow (cavusgnathid and syncladognathid) 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. <i>Bispathodus utahensis</i> Sandberg and Gutschick, 7 Pa (all incomplete) and 1 Pb elements. 16 small Pa element fragments <i>Bispathodus utahensis</i> Sandberg and Gutschick? <i>Kladognathus</i> 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 <i>Eotaphrus burlingtonensis</i> Pierce and Langenheim. <i>Kladognathus</i> 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; <i>Sc. anchoralis-Do. latus</i> Zone through <i>Po. mehli</i> –Lower <i>G. texanus</i> 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 <i>Polygnathus communis communis</i> Branson and Mehl. 2 Sb-Sc element fragments <i>Kladognathus</i> 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. Tailleux; 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 <i>Bispathodus utahensis</i> Sandberg and Gutschick. 4 Pa elements <i>Gnathodus texanus</i> Roundy. 107 indet. bar, blade, and platform fragments. CAI=1.5 [92AD32A; 32432-PC]	late Early–early Late Mississippian; late Osagean (<i>Po. mehli</i> –Lower <i>G. texanus</i> 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 DI	Howard Pass B-5 68°29'57"/ 158°35'35"	140 <i>Belodella devonica</i> (Stauffer) elements. <i>Polygnathus parawebbi</i> 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; <i>Po. costatus costatus</i> Zone through Lower <i>Po. varcus</i> 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 <i>Po. parawebbi</i> 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 <i>Belodella</i> sp. indet. element. <i>Polygnathus parawebbi</i> Chatterton, 15 Pa, 1 Pb, 1 M, and 1 Sb elements. 3 Pa element fragments <i>Polygnathus</i> sp. indet. 24 indet. bar, blade, and platform fragments. CAI=3 [92AD45C; 12465-SD]	early to middle Middle Devonian; <i>Po. costatus costatus</i> Zone through Lower <i>Po. varcus</i> 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. Tailleux; 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 DI	Howard Pass B-5 68°29'43"/ 158°35'00"	3 <i>Belodella</i> sp. elements. 1 <i>Dvorakia</i> sp. element. 4 <i>Neopanderodus</i> sp. elements. 1 Pb <i>Oulodus</i> sp. indet. element. 1 Pa element <i>Polygnathus</i> aff. <i>Po. eifelius</i> Bischoff and Ziegler. 6 Pa elements <i>Polygnathus linguiformis linguiformis</i> Hinde gamma morphotype. 15 Pa elements <i>Polygnathus parawebbi</i> Chatterton. 15 Pa element fragments or juveniles <i>Polygnathus</i> 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; <i>Po. ensensis</i> Zone on the basis of aff. <i>Po. eifelius</i> 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 <i>Belodella</i> sp. elements. 5 <i>Neopanderodus</i> sp. elements. 1 Pa element <i>Polygnathus linguiformis linguiformis</i> Hinde epsilon morphotype. 10 Pa elements <i>Polygnathus parawebbi</i> Chatterton. <i>Polygnathus</i> 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; <i>Po. ensensis</i> 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 <i>Belodella</i> sp. elements. <i>Polygnathus linguiformis linguiformis</i> 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; <i>Po. costatus costatus</i> Zone through <i>Po. ensensis</i> 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. Tailleux; 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 DI [cont.]	Howard Pass B-5 68°29'43"/ 158°35'00"	<i>Polygnathus linguiformis linguiformis</i> Hinde gamma morphotype, 3 Pa, 1 Pb, 1 M, and 1 Sc elements. 3 Pa element fragments <i>Polygnathus</i> sp. indet. 10 indet. bar, blade, and platform fragments. CAI=3 [92AD30B; 12463–SD]	middle Middle Devonian; <i>Po. costatus costatus</i> Zone through <i>Po. ensensis</i> 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 <i>Bactrognathus?</i> sp. indet. 3 Pa elements <i>Hindeodus crassidentatus</i> (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 DI	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 <i>Icriodus symmetricus</i> Branson and Mehl. 8 Pa elements (incomplete) <i>Polygnathus dubius</i> Hinde. 10 Pa element fragments <i>Polygnathus</i> sp. indet. <u>Unassigned elements:</u> 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; <i>Pa. transitans</i> Zone through Lower <i>Pa. hassi</i> 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. Tailleux; 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 DI	Howard Pass B-5 68°24'47"/ 158°53'30"	4 <i>Belodella devonica</i> (Stauffer) elements. 1 <i>Dvorakia</i> sp. indet. element. 20 juvenile to gerontic Pa elements <i>Polygnathus linguiformis linguiformis</i> Hinde γ morphotype. 22 juvenile to subadult Pa elements <i>Polygnathus parawebbi</i> Chatterton. <i>Polygnathus</i> 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; <i>To. k. australis</i> Zone to Lower <i>Po. varcus</i> 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 \approx 4 m above base of \approx 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 <i>Bispathodus utahensis</i> 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 \approx 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 μ m in diameter. Carbonate clasts include crinoid ossicles and sponge spicules. Processed 7.3 kg of rock.
		1 juvenile Pa element <i>Bactrognathus?</i> sp. 2 Pa elements <i>Doliognathus latus</i> Branson and Mehl. 8 bar fragments " <i>Hindeodella</i> " <i>segaformis</i> Bischoff s.f. 5 Pa elements <i>Polygnathus communis communis</i> Branson and Mehl. 3 Pb element fragments <i>Scaliognathus?</i> sp. indet. <u>Unassigned elements:</u> 7 M and 2 Sa. 40 indet. bar, blade, and platform fragments. CAI=2.5 [92AD214–18.5; 32464–PC]	late Early Mississippian; <i>Sc. anchoralis</i> - <i>Do. latus</i> 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 \approx 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 μ m 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. Tailleux; 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 <i>Bispathodus utahensis</i> Sandberg and Gutschick. 1 subadult Pa element <i>Gnathodus typicus</i> Cooper. 5 bar fragments " <i>Hindeodella</i> " <i>segaformis</i> Bischoff s.f. 12 Pa elements <i>Mestognathus praebeckmanni</i> Sandberg, Johnston, Orchard, and von Bitter. 5 Pa elements <i>Polygnathus communis communis</i> Branson and Mehl. 2 subadult Pa elements <i>Pseudopolygnathus</i> sp. indet. 2 Pa element fragments <i>Geniculatus claviger</i> Hass. 1 Pa element <i>Syncladognathus geminus</i> (Hinde). <u>Unassigned elements:</u> 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 <i>Sc. anchoralis-Do. latus</i> Zone (middle Osagean). <i>Mestognathus praebeckmanni</i> 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. 7K–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 <i>Bispathodus utahensis</i> Sandberg and Gutschick. 1 Pa element <i>Geniculatus claviger</i> Hass. 11 Pa elements (all growth stages) <i>Gnathodus semiglaber</i> (Bischoff). 1 small bar fragment " <i>Hindeodella</i> " <i>segaformis</i> Bischoff s.f. 5 <i>Idioprioniodus</i> sp. indet. element fragments. 1 juvenile Pa element <i>Pseudopolygnathus</i> sp. <u>Unassigned elements:</u> 2 M and 1 Sc. 110 indet. bar, blade, and platform fragments. CAI=3 [92ARm37B; 32471–PC]	late Early Mississippian; <i>Sc. anchoralis-Do. latus</i> 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. Tailleux; 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 <i>Bispathodus utahensis</i> Sandberg and Gutschick. 3 Pa element fragments <i>Doliognathus latus</i> Branson and Mehl. 17 small bar fragments " <i>Hindeodella</i> " <i>segaformis</i> Bischoff s.f. 6 Pa elements <i>Polygnathus communis communis</i> Branson and Mehl. 3 Pa element fragments <i>Geniculatus claviger</i> Hass. <u>Unassigned elements:</u> 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; <i>Sc. anchoralis-Do. latus</i> 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 <i>Ancyrodella</i> sp. indet. 3 <i>Belodella</i> sp. indet. elements. 1 Pa element <i>Palmatolepis hassi</i> Müller and Müller? <i>Palmatolepis</i> spp. indet., 5 Pa and 2 Pb element fragments. 1 Pa element fragment <i>Polygnathus</i> aff. <i>Po. evidens</i> Klapper and Lane. 39 Pa elements <i>Polygnathus pacificus</i> Savage and Funai. 27 Pa element fragments <i>Polygnathus</i> spp. indet. <u>Unassigned elements:</u> 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 <i>Pa. hassi</i> Zone to Upper <i>Pa. rhenana</i> 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 <i>Po. pacificus</i> 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 <i>Girvanella</i> 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 <i>Belodella resima</i> (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. Tailleux; 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 <i>Ancyrodella</i> sp. indet. 1 Pa element fragment <i>Polygnathus</i> 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 <i>Bispathodus utahensis</i> Sandberg and Gutschick. 2 Pa elements <i>Gnathodus cuneiformis</i> Mehl and Thomas. 2 Pa elements <i>Polygnathus communis communis</i> Branson and Mehl. <i>Scaliognathus anchoralis</i> Branson and Mehl, 30 M, 3 Sc, and 35 S element bar fragments. 1 digyrate Pb element. <u>Unassigned elements:</u> 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; <i>Sc. anchoralis-Do. latus</i> 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. <i>Bispathodus utahensis</i> Sandberg and Gutschick, 9 Pa, 1 Pb, 1 M, and 1 Sc elements. 1 Pa element <i>Gnathodus pseudosemiglaber</i> Thompson and Fellows (figured in Dumoulin and others, 1994, fig. 3H). 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. Tailleux; 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. <i>Bispathodus utahensis</i> 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) <i>Gnathodus semiglaber</i> Bischoff. 20 bar fragments (moderately long) " <i>Hindeodella</i> " <i>segaformis</i> 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 <i>G. typicus</i> Subzone or lower part <i>Sc. anchoralis-Do. latus</i> 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 chalcidony). 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. <i>Bispathodus utahensis</i> Sandberg and Gutschick, 6 Pa, 3 Pb, and 1 M elements. 3 Pa elements <i>Doliognathus latus</i> Branson and Mehl morphotype 3. 2 Pa elements <i>Gnathodus</i> sp. indet. 9 Pa elements <i>Polygnathus communis communis</i> Branson and Mehl. 1 Pa element <i>Protognathodus cordiformis</i> Lane, Sandberg, and Ziegler. <i>Scaliognathus anchoralis</i> 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 <i>Sc. anchoralis-Do. latus</i> Zone (early middle Osagean).	Scaliognathid; basal 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. 3C–G). Processed 10.5 kg of rock.

Table 2. Radiolarian data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by C.D. Blome and K.M. Reed unless otherwise indicated. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; AK, J.S. Kelley; ANs, S.W. Nelson; ANw, W.H. Nelson; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleux; and SK, S.M. Karl. Lithologic data under remarks are chiefly field descriptions; thin section observations by J.A. Dumoulin. No., number; loc, locality]

Locality No., map unit	Quadrangle, latitude/longitude	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
1 Mlri	Howard Pass C-5 68°44'50"/ 158°55'20"	Poorly preserved forms including <i>Albaillella</i> sp. aff. <i>A. cartalla</i> (fragments only) <i>Belowea</i> sp. <i>Scharfenbergia concentrica</i> <i>Scharfenbergia</i> sp. aff. <i>S. ruetae</i> . [92AD51E; USGS DR 1521]	Mississippian (Meramecian to Chesterian).	White-weathering, gray chert, 1 m below(?) mafic sill. In thin section, chert is fine-grained and pale gray, with 5–25 percent radiolarians; tests chiefly filled with chalcedony or, less commonly, opaque material.
		Poorly preserved forms including <i>Belowea</i> sp. <i>Scharfenbergia impella</i> group (usage of Holdsworth and Murchey, 1988) <i>Scharfenbergia</i> sp. cf. <i>S. tailleurensis</i> . [92AD51I; USGS DR 1522]	late Early to early Late Mississippian (Osagean to Meramecian).	A 5-cm-thick layer of light-gray to light-green chert, within an interval of red chert; ≈13 m stratigraphically below(?) 92AD51E. In thin section, chert is pale-gray and very fine grained, and contains abundant radiolarians; tests filled with coarser crystalline quartz or chalcedony.
4 IPMap	Howard Pass C-5 68°38'20"/ 158°57'40"	Poorly preserved forms including <i>Scharfenbergia impella</i> group <i>Scharfenbergia</i> sp. cf. <i>S. ruetae</i> Won. No abaillellids present. Abundant sponge spicules. [92ADo201; USGS DR 1473]	Mississippian (late Osagean to possibly Chesterian).	Black chert, locally orange-weathering.
5 JRo	Howard Pass C-5 68°39'08"/ 158°54'35"	Numerous robust-spined, bipolar radiolarians. Abundant spicules (some robust stauracts or hexactines) visible on etched surfaces. Bipolar spines exhibit an internal spicule that extends to the internal shell. Slight torsion of spines suggests <i>Pseudostylosphaera japonica</i> (Nakaseko and Nishimura). <i>Eptingium</i> sp. (possibly <i>E. manfredi</i> Dumitrica). A nassellarian that strongly resembles <i>Triassocampe</i> (possible <i>T. scalaris</i> Dumitrica, Kozur and Mostler). Several other nassellarians; in one, the apical chamber was swollen, wider than the upper chambers. <i>Sarla kretaensis</i> Kozur and Krahl. [92AK22a; USGS DR 1586]	Middle Triassic (Ladinian undifferentiated).	Chert, greenish gray, locally baritic, very thin and crumpled lens, thicker bedded; some small radiolarians.
		Etched surface shows numerous heavy grooved spines and large bipolar forms. The sample is a radiolarite that also contains abundant sponge spicules. <i>Eptingium manfredi</i> Dumitrica. <i>Triassistephanidium laticorne</i> Dumitrica. <i>Pseudostylosphaera compacta</i> (Nakaseko and Nishimura) (polar spines lacking torsion). All nassellarians poorly preserved. [92AK22b; USGS DR 1587]	Middle Triassic (Ladinian undifferentiated).	Chert, greenish gray, very thin and crumpled lens, thicker bedded; some small radiolarians. Sample from bank about 10 m to east of 92AK22a; chert is rusty weathering, and contains siliceous shale interbeds and no barite.
6 JPip	Howard Pass C-5 68°39'00"/ 158°51'20"	Poorly preserved forms including <i>Betraccium</i> cf. <i>B. deweveri</i> Blome <i>?Livarella</i> sp. (casts) <i>?Pseudoheliodiscus</i> sp. (broken cortical ring) <i>Saitoum</i> sp. (broken). [92ADo297A; USGS DR 1485]	Late Triassic (probably late Norian; <i>Betraccium deweveri</i> Zone of Blome, 1984).	Gray, translucent, thin-bedded chert that contains thin argillite partings.

Table 2. Radiolarian 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	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
8 IPMap	Howard Pass C-5 68°39'10"/ 158°45'50"	Poorly preserved forms including <i>?Belowea</i> sp. (fragments) <i>?Paleoxyphostyla</i> sp. (robust spines only) <i>Scharfenbergia impella</i> group (flattened and distorted tests of younger morphotypes). [92ADo275A; USGS DR 1482]	Mississippian (possibly Meramecian-Chesterian).	Medium- to dark-gray, thin- to thick-bedded chert containing abundant carbonate interbeds.
9 IPMap	Howard Pass C-5 68°38'06"/ 158°42'30"	Poorly preserved forms including <i>Albaillella</i> sp. (one broken short-bodied test) <i>Scharfenbergia impella</i> group (flattened and distorted tests). Robust sponge spicules. [92ADo272A; USGS DR 1480]	Mississippian (Osagean-Meramecian)	Sample of chert that underlies zone of reddish cherty argillite; some light-weathering bedding surfaces have radiolarians.
10 JPip	Howard Pass C-5 68°37'50"/ 158°52'40"	Poorly preserved forms including Medial and distal parts of spines questionably belonging to <i>?Capnuchosphaera</i> sp. and (or) <i>?Icrioma</i> sp. [92ABs180B; USGS DR 1506]	?Late Triassic	Sample from an interval of unit JPip too small to show on geologic map; sample is greenish gray chert that overlies unit IPMap. Conodonts (table 1) from dolostone layers in unit IPMap at this locality are Mississippian.
11 JPip	Howard Pass C-5 68°37'30"/ 158°51'50"	Poorly preserved assemblage including <i>?Eptingium</i> sp. (heavy triradiate spine fragments) <i>Triassocampe</i> sp. (casts with little ornamentation). 92ADo226B; USGS DR 1477)	Middle Triassic (probably Ladinian)	Grayish-green chert and cherty argillite; fairly radiolarian-rich.
12 IPMap	Howard Pass C-5 68°37'30"/ 158°51'40"	Poorly preserved assemblage including <i>Scharfenbergia impella</i> group <i>Scharfenbergia tailleurense</i> Holdsworth and Murchey Abundant twisted, bladed spines. [92ADo225B; USGS DR 1476]	Probably Mississippian (late Meramecian or slightly younger).	Sample from top of black, locally orange-weathering chert unit, just below contact with red chert and argillite of unit PIPs.
13 JRo	Howard Pass C-5 68°34'50"/ 158°55'55"	Poorly preserved assemblage including <i>Capnuchosphaera</i> sp. (tumidaspine fragments only) <i>?Pseudoheliodiscus</i> sp. (cortical ring fragments). [92ADo194B; USGS DR 1472]	Late Triassic (late Carnian or Norian)	Radiolarian-rich, medium-gray- to tan-weathering, predominantly cherty rocks; tan color may reflect bleaching and alteration.
15 JPe	Howard Pass C-5 68°35'55"/ 158°48'00"	Poorly preserved forms including <i>?Latentifistula</i> sp. (recrystallized central portions) <i>?Nazarovella</i> sp. (guttered arms only) <i>Pseudotormentus</i> sp. (Y-shaped central part and arms) Abundant recrystallized spumellarians with no external meshwork. Large sponge spicules. [92ABs172; USGS DR 1504]	Permian (post-Wolfcampian)	Light-greenish-gray to light-gray chert abundantly stained with iron-oxide; underlies Otuk Formation.
16 JPe	Howard Pass C-5 68°35'30"/ 158°48'05"	Poorly preserved forms including <i>Eptingium manfredi manfredi</i> (partial test and spines) <i>Plafkerium</i> sp. cf. <i>P. firmum</i> <i>Pseudostylosphaera coccostyla</i> <i>Triassocampe</i> sp. aff. <i>T. deweveri</i> <i>Triassocampe</i> sp. [92ABs181A; USGS DR 1509]	Middle Triassic (Ladinian)	
		Poorly preserved forms including <i>Capnodoce</i> sp. aff. <i>C. baldiensis</i> Blome <i>?Pseudostylosphaera</i> sp. (partial tests) Abundant casts of <i>Triassocampe</i> spp. [92ABs181B; USGS DR 1510]	Late Triassic (probably Carnian; <i>Capnodoce</i> Zone of Blome, 1984, and Blome and others, 1988).	

Table 2. Radiolarian 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	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
17 IPMk	Howard Pass C-5 68°35'/ 158°43.5'	Bipolar (two-spine forms). Incomplete robust tests (granular) with ?bifurcating points; also isolated, heavily grooved spines. Unidentifiable entactiniids. [92ATr38A; USGS DR 1583]	Probably Paleozoic	Rubble and subcrop of thick-bedded black chert.
18 JTo	Howard Pass C-5 68°34'55"/ 158°43'15"	Etched surface—granular, with pits and rare casts and molds of spumellarians; no spines seem to be connected to these "molds;" spicules are abundant. The +80 fraction mostly composed of flakes (veinlets), a few coarse-meshed spumellarian fragments preserved. Fragment of a nassellarian that has costae resembling those of <i>Corum</i> Blome. Several broken spines assignable to <i>Capnuchosphaera</i> De Wever. A few <i>Khalerosphaera</i> spine fragments. Heavy grooved spines. A non-age diagnostic and poorly preserved conodont fragment. [92ATr38C; USGS DR 1585]	Late Triassic (late Carnian to late middle Norian).	Chert rubble, just below subcrop contact with <i>Monotis</i> -bearing limestone.
19 JTo	Howard Pass C-5 68°36'15"/ 158°37'55"	Poorly preserved forms including ? <i>Canoptum</i> sp. (casts only) ? <i>Capnuchosphaera</i> sp. (tumidaspine fragments) <i>Triassocampe</i> sp. [92ADo264B; USGS DR 1479]	Triassic, undifferentiated (?Carnian)	Grayish-green chert, just below contact with <i>Monotis</i> -bearing limestone.
20 IPMap	Howard Pass C-5 68°37'01"/ 158°35'05"	Poorly preserved forms including ? <i>Belowea</i> sp. (fragments) <i>Scharfenbergia impella</i> group (sensu Won) Poorly preserved undescribed spumellarians. Rare sponge spicules. [92ADo283A; USGS DR 1484]	Mississippian (Visean, undifferentiated).	Rubble of medium-gray to grayish-green chert; locally orange-weathering, covered with black lichen, and containing abundant radiolarians. No limestone interbeds.
21 IPMk	Howard Pass C-5 68°35'45"/ 158°27'20"	Poorly preserved forms including Broken arms questionably belonging to the <i>Scharfenbergia impella</i> group Large, broken grooved spines. [92AD59G; USGS DR 1524]	Pre-Permian (?Mississippian)	Light-gray chert that contains from few to 25 percent radiolarians; local green-weathering laminae. Thin section is light-brown, fine-grained chert with thin laminae of dark-brown mud and 10–20 percent spicules and radiolarians. Conodonts (table 1) from limestone immediately underlying the chert at this locality are Mississippian (probably late Osagean).
25 JPip	Howard Pass C-3 68°38'15"/ 157°32'35"	Spumellarian casts stand out in high relief on etched surfaces. Radiolarite, but radiolarians and spicules pervasively poorly preserved and recrystallized. Spicules are flattened and could be poorly preserved fragments of <i>Pseudoheliodiscus</i> Kozur and Mostler. Isolated spines assignable to <i>Capnuchosphaera</i> sp. Several poorly preserved nassellarians (interior casts and at least two with numerous chambers; these are questionably assigned to <i>Latium</i> Blome or <i>Canoptum</i> Pessagno). [92ATr09A; USGS DR 1578]	Late Triassic (late Carnian to late middle Norian).	Ribbon-bedded, medium-greenish-gray-weathering, medium-to dark-gray chert; sample from top 1 ft of north-dipping, ≈5-m-thick section.

Table 2. Radiolarian 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	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
25 JPip [cont.]	Howard Pass C-3 68°38'15"/ 157°32'35"	Etched surfaces show radiolarian outlines as simple forms. Small spicules and spines are present. The >80 fraction (the smallest residue for the third wash) contains a few featureless spheres. A few fragments of nassellarians exhibit costae similar to <i>Corum perfectum</i> Blome. <i>Corum</i> sp. ? <i>Latium</i> sp. <i>Triassocampe</i> sp. <i>Xipha pessagnoii</i> (Nakaseko & Nishimura) <i>Xipha</i> sp. [92ATr9B; USGS DR 1579]	Late Triassic (Carnian)	Sample from bottom 1 ft of ≈5-m-thick chert section, upper part of which was sampled as 92ATr9A
		The etched surface shows numerous spicules or perhaps broken spines, but radiolarian preservation poor. A fragment of a large spumellarian exhibits a complex mesh and a heavy grooved spine. A spindle-like cast of a nassellarian interior (consisting of six rings that do not change appreciably in diameter). A few hexactine spicules, but spicules are not common. [92ATr9C; USGS DR 1580]	Mesozoic	Sample from 1-ft interval in middle of ≈5-m-thick chert section, upper part of which was sampled as 92ATr9A.
IPMap		Etched surfaces show the rock is radiolarian-rich—spines and spicules abundant; large pieces of clear quartz are common. Some matrix fragments exhibit veins(?) that intersect at several angles; interstices are filled with crystalline(?) quartz. One short, grooved primary spine. Rare short fragments of very robust spicules. Fragments of "ladders," both coarse and regular pores. Bladed spines that have spinules on the blade edges. Several poorly preserved fragments of ?latentifistulid centers (suggesting <i>Paronaella impella</i> Group forms). Fragments of spicules that have a curved, flattened double head, like a long curved double-bladed axe. [92ATr9X; USGS DR 1581]	Late Paleozoic. (While the forms are poorly preserved and are not identifiable to the species level, the presence of ladder-like forms and bladed spines are consistent with late Paleozoic faunas and probably pre-Permian faunas).	Sample from nodular, concretionary chert mass (probable interval of unit IPMap that is too small to show on the geologic map).
26 JPip	Howard Pass C-3 68°38'2.4"/ 157°32'45"	Poorly preserved forms including <i>Capnodoce</i> sp. (partial tests that have broken primary spines) <i>Corum</i> sp. (broken tests) ? <i>Pseudosaturiniforma</i> sp. (partial cortical ring). [92AD21A; USGS DR 1515]	Late Triassic (late Carnian to middle Norian; <i>Capnodoce</i> Zone of Blome, 1984, and Blome and others, 1988).	Sample from uppermost m of ≈5-m-thick chert interval; green, gray, and tan banded chert in 5-cm-thick beds. In thin section, fine-grained, dark, laminated chert containing with a few percent spicules and radiolarians.

Table 2. Radiolarian 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	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
26 JPip [cont.]	Howard Pass C-3 68°38'2.4"/ 157°32'45"	Poorly preserved forms including <i>Capnuchosphaera</i> sp. (broken tumidaspines only) <i>Latium</i> sp. (casts) <i>?Xenorum</i> sp. (broken spines and partial cortical shells) <i>Xipha striata</i> Blome. [92AD21B; USGS DR 1516]	Late Triassic (early to middle Norian; probably <i>Xipha striata</i> Subzone of the <i>Capnodoce</i> Zone of Blome, 1984).	Sample from 2 m below top of ≈5-m-thick chert interval; green and white banded chert in 5-cm-thick beds. In thin section, chert is fine-grained, greenish-brown, clay-rich(?) and contains minor spicules and radiolarians.
28 IPMap	Howard Pass C-3 68°37'52"/ 157°30'50"	Etched surfaces show abundant radiolarians and hints of spicules. Quite thoroughly recrystallized, preservation of all radiolarians is poor. Several varieties of spumellarians suggested. Several poor triangular to tetrahedral forms that probably are varieties of <i>Scharfenbergia</i> . Coarse forms are probably spumellarians with matrix. A few stubby albaillellids (resembling <i>A. cartalla</i> Ormiston and Lane). Fragment of a taller, narrower albaillellid. [92ATr8A; USGS DR 1575]	Mississippian (probably Osagean to Meramecian).	Gray to varicolored chert rubble, locally green and glassy.
		Etched surfaces appear uniformly recrystallized; radiolarians are casts only. Fragments of multi-shelled spumellarians possessing simple, thin spines. Fragments of thick spicules, simple and bladed spines with spinules. A long ichnofossil (?worm tube). A few forms resemble scharfenbergids. Multi-spined spumellarians. Scraps of pore mesh and portions of "latentifistulid" rays (not ladders) that have irregular pore patterns; these last suggest the " <i>Paronaella impella</i> group" for which Holdsworth and Murchey (1988) indicate a range of late Osagean to Morrowan(?). [92ATr8B1; USGS DR 1576]	Late Paleozoic (probably pre-Permian)	Rubble of dark gray chert ≈20 m downhill from 92ATr8A.

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Locality No., map unit	Quadrangle, latitude/ longitude	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
28 IPMap [cont.]	Howard Pass C-3 68°37'52"/ 157°30'50"	Etched surface has very well aligned but somewhat squashed radiolarians, granular, heavily recrystallized. Many recrystallized spumellarians that have broken, delicate spines. Numerous flat (not tetrahedral) triangular forms referable to <i>Scharfenbergia</i> —possibly <i>Scharfenbergia ruetae</i> (Ormiston and Lane) (see Holdsworth and Murchey, 1988, plate 34.4, figs. 16 and 17). Poorly preserved multi-shell spumellarians. Moderately robust spicules. Several very poorly preserved and broken forms assignable to <i>Albaillella</i> Deflandre; these appear to be short tests and could be <i>A. cf. A. cartalla</i> Ormiston and Lane, which Holdsworth and Murchey (1988) suggested is a pre-Chesterian taxon. [92ATr8B2; USGS DR 1577]	Mississippian (probably Meramecian)	Chert rubble lithologically identical to, but ≈20 m downslope from, 92ATr8A.
31 JPe	Howard Pass C-3 68°37.5'/ 157°34.4'	Short, blunt spines of <i>Eptingium</i> (or possibly a <i>Pseudostylosphaera</i>). Bipolar, three- and four-spined forms that have stout spines. Fragmentary nassellarian that has a rounded cephalic area. [91Tr22C; USGS DR 1598]	Triassic (probably Ladinian or Carnian).	Rubble of light-weathering, medium gray chert.
34 JPip	Howard Pass C-3 68°36.5'/ 157°34.75'	Fragment of <i>Livarella</i> sp. <i>?Capnodoce</i> sp. Etched pieces contain many thin-rimmed <i>Pseudoheliodiscus</i> (cf. the form shown in plate 33.2 of Blome and others, 1988, and some that have broader rims). No nassellarians found. Rare grooved spines (none including main part of test.) Three-spined forms uniformly lacking mesh details. [91Tr15C; USGS DR 1595]	Late Triassic (probably Norian)	Fine rubble of hematitic, red-weathering chert having a somewhat earthy texture and containing impressions of <i>Monotis</i> .
		Multishelled, heavy grooved-spine spumellarian. <i>?Khalerosphaera</i> spine tip. Nassellarian fragment. Three-spined form with stubby, slightly twisted spine. [91Tr15CX; USGS DR 1596]	Probably Triassic	Rubble of thin-bedded, medium-gray chert, variable to light-weathering, adjacent to chert sampled as 91Tr15C.
		<i>Emiluvia</i> sp. <i>Staurodoras</i> sp. <i>Eptingium</i> sp. Stout twisted spines not attached to main part of test. [91Tr15E; USGS DR 1597]	Triassic (probably Ladinian)	Earthy-textured chert associated with dark-gray-weathering, platy, tuffaceous(?) rock; slightly northwest of 91Tr15C and 15CX.

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Locality No., map unit	Quadrangle, latitude/ longitude	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
36 JPip	Howard Pass C-3 68°36.2'/ 157°34.1'	<i>Capnuchosphaera</i> spp. spines. <i>Castrum perornatum</i> Blome. Narrow-rimmed cortical ring assignable to <i>Acanthocircus</i> sp. <i>Khalerosphaera</i> blade fragment. Poorly preserved nassellarian fragments. [91Tr33A; USGS DR 1604]	Late Triassic (late Carnian to late middle Norian).	Rubble of dark-brownish-gray chert, locally glassy luster, weathers medium-greenish-gray with earthy rinds.
38 JRo	Howard Pass C-3 68°36.3'/ 157°31.1'	<i>Khalerosphaera</i> spine tip. <i>Capnuchosphaera</i> spine tip. Fragments of either <i>Acanthocircus</i> or <i>Pseudoheliodiscus</i> . Abundant twisted spines. [91Tr26C; USGS DR 1599]	Triassic (Norian)	Rubble of black, thin-bedded chert associated with cherty paper shale.
39 JPip	Howard Pass C-3 68°36'25"/ 157°28'20"	Poorly preserved and recrystallized forms including Latentifistulid-like form (casts only). [92ARm44A; USGS DR 1490]	?Permian	White-weathering, black chert with radiolarians.
42 JRo	Howard Pass C-3 68°35.5'/ 157°29.2'	All radiolarians fragmentary in this residue. Rare tightly twisted spines that resemble those belonging to <i>Xenorum</i> . Bipolar forms. Fragment of a nassellarian. Tiny spine tip of <i>Khalerosphaera</i> . [91Tr29B; USGS DR 1601]	Triassic (probably Late Triassic)	Buff to orange stream cuts of medium-light-gray-weathering, dark-brownish-gray chert, in 5- to 10-cm-thick beds, underlain by mudstone.
43 JPe	Howard Pass C-3 68°35,6'/ 157°36.5'	<i>Capnuchosphaera</i> spp. <i>Corum perfectum</i> Blome. Fragments of twisted spines. Blades of <i>Khalerosphaera</i> . Delicate <i>Pseudoheliodiscus</i> with thin rim. [91Tr38C; USGS DR 1612]	Triassic (early to middle Norian)	Relatively thick-bedded, contorted chert, associated with <i>Monotis</i> -bearing limestone.
45 JPip	Howard Pass C-3 68°35.3'/ 157°37.3	Poor sample. Ring fragments of <i>Acanthocircus</i> or <i>Pseudoheliodiscus</i> . Possible <i>Capnuchosphaera</i> spine. Bladed spine tip of <i>Khalerosphaera</i> . [91Tr37A; USGS DR 1608]	Late Triassic (possibly Norian)	Medium-green, medium- to thick-bedded chert; sample from highest part of exposure.
		Robust bladed spines with spinules, some light torsion (see sample 91Tr36A). Ladder ray (? <i>Pseudotormentus</i>). Partial <i>Pseudoalbaillella</i> sp. possessing a short skirt (perhaps a " <i>scalprata</i> " morphotype). <i>Follicucullus</i> , more swollen than <i>F. scholasticus</i> m. II Ishiga but less swollen than <i>F. charveti</i> Caridroit and De Wever. [91Tr37B; USGS DR 1609]	Late Permian. Although this mix is not documented, <i>Follicuculus</i> is Guadalupian and this morphotype of <i>Pseudoalbaillella</i> may be this young.	Red-weathering, crumpled chert, containing local jasperoid lumps; sample from middle of chert exposure at this locality.
46 JPii	Howard Pass C-3 68°35.1'/ 157°37.5'	Several kinds of <i>Latentifistula</i> spp. Apical horn of a <i>Pseudoalbaillella</i> . Irregular mesh on lattice/ladder ray. Extremely long-bladed spines on etched surfaces. [91Tr36A; USGS DR 1607]	Permian (undifferentiated)	Strongly deformed, thin-bedded, red-weathering chert.

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Locality No., map unit	Quadrangle, latitude/longitude	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
53 JPip	Howard Pass C-3 68°32'/ 157°29'	Reddish chert residue containing poorly preserved forms only. Bladed spines exhibiting spinules. Possible <i>Ormistonella</i> -like fragments. Arm fragments generically called "ladders." Possible apical tip of <i>Pseudoalbaillella</i> sp. [91Tr43B; USGS DR 1615]	Permian (possibly mid-Permian)	Medium-greenish-gray- and red-weathering chert, locally nodular.
57 IPMap	Howard Pass C-3 68°31.8'/ 157°28.7'	Tetrahedral or at least inflated <i>Scharfenbergia</i> morphotypes. Fragment of an "impella" ray. Bladed spine fragments. Heavy grooved spines with some torsion, cf. <i>Paleoxiphostylus</i> , some attached to fragments of central part of test and at least one suggesting four-armed forms may be present. [91Tr42C; USGS DR 1614]	Mississippian (probably Meramecian or Chesterian).	Rubble of light-weathering, medium-gray chert.
58 JPe	Howard Pass C-3 68°31.3'/ 157°30'	Mostly poorly preserved spumellarians, casts only. Fragments of long primary spines. One latticed, broken ray (arm). Possible fragment that may be the apical tip of <i>Pseudoalbaillella</i> . [91Tr40B; USGS DR 1613]	Paleozoic (possibly Permian)	Sample from nodular-bedded, medium-greenish-gray chert (locally red-weathering) that overlies unit Mlb; lithology resembles that of unit PIPs. Conodonts (table 1) from upper part of unit Mlb at this locality are of probable Mississippian age.
62 JPe	Howard Pass C-3 68°30.9'/ 157°36.8'	Flattened nassellarian casts (possibly <i>Corum</i> Blome). <i>Capnuhosphaera</i> spp. spine fragments. Narrow-rim <i>Pseudoheliodiscus</i> fragment. [91Tr3A; USGS DR 1592]	Late Triassic (early to late middle Norian).	Medium-gray, dark- to greenish-gray chert in even, 5- to 10-cm-thick beds, exposed along stream cut; sample 91Tr3A from slightly northwest of 91Tr2A.
	68° 30.8'/ 157° 36.0'	Spumellarians that have strong, grooved spines. Poorly preserved casts of nassellarian. [91Tr2A; USGS DR 1591]	Mesozoic, probably Triassic (Ladinian or younger).	
63 JPii	Howard Pass C-3 68°30.75'/ 157°36.1'	Poorly preserved sample contains scraps of nassellarians. Bladed spines with tips that resemble those of <i>Khalerosphaera</i> . <i>Pseudoheliodiscus</i> sp. with narrow rim (indicating that it is not <i>P. sandspitensis</i>). Cortical shell fragments that have twisted spines. [91Tr1B; USGS DR 1590]	Late Triassic (Norian, undifferentiated)	Dark-olive-gray chert in distorted, 5- to 25-cm-thick layers, bleached greenish-gray in part.
65 Kmp	Howard Pass C-3 68°30.1'/ 157°37.0'	<i>Scharfenbergia</i> spp. strongly tetrahedral and flatter morphologies. Bipolar forms, possibly <i>Belowea</i> or <i>Paleoxiphostylus</i> <i>?Callela</i> sp. An "impella"-type ray. [91Tr14A; USGS DR 1593]	Possibly Late Mississippian	Medium-bedded, medium-gray, light-greenish-gray- to white-weathering chert.
		<i>Scharfenbergia</i> spp., poorly preserved "impella" ray fragments. [91Tr14B; USGS DR 1594]	Possibly Late Mississippian	Hematite-stained, dark-gray to black chert, locally light-weathering; sample from larger, higher ridge a few hundred feet south of 91Tr14A.
76 IPMap	Howard Pass B-5 68°29'2.4"/ 158°25'58"	Poorly preserved forms including Forms assignable to <i>Scharfenbergia impella</i> group. Rare sponge spicules. [92ADo101B; USGS DR 1470]	Mississippian, undifferentiated	Grayish-green, radiolarian-rich chert.

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Locality No., map unit	Quadrangle, latitude/longitude	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
77 IPMap (or JIPip)	Howard Pass B-5 68°29'2.4"/ 158°25'50"	Poorly preserved forms including <i>Scharfenbergia impella</i> -like forms (too recrystallized to positively identify). Also broken bladed spines. Common sponge spicules. [92ADo100B; USGS DR 1469]	?Mississippian, possibly younger	Red siliceous argillite, stratigraphically higher than 92ADo101B (loc. 76). Stratigraphic unit uncertain; sample taken from rocks that appear transitional between unit IPMap and overlying unit J IPip.
78 JPip	Howard Pass B-5 68°28'55"/ 158°25'50"	Poorly preserved assemblage including <i>Betraccium</i> sp. (one broken specimen) <i>Capnuchosphaera</i> sp. (broken tumidaspines) <i>Khaleosphaera</i> sp. (broken spines) <i>Pseudoheliodiscus</i> sp. (cortical ring fragments). [92ADo99B; USGS DR 1468]	Late Triassic (middle or late Norian)	Bedded, complexly folded, gray chert; sample taken just below zone of red chert.
79 JPip	Howard Pass B-5 68°28'55"/ 158°25'37"	Poorly preserved assemblage including <i>Capnuchosphaera</i> sp. (isolated tumidaspines) <i>Laxtorum</i> sp. <i>Livarella</i> sp. <i>Pseudoheliodiscus</i> sp. cf. <i>P. finchi</i> Pessagno <i>Saitoum</i> sp. [92ADo98B; USGS DR 1467]	Late Triassic (late middle to early late Norian; <i>Pantanellium silberlingi</i> Subzone of the <i>Betraccium deweveri</i> Zone, Blome, 1984, and Blome and others, 1988).	Sample from rubble of maroon to grey-green bedded chert, containing abundant radiolarians, underlying unit Kop. The association of <i>Livarella</i> sp. with <i>Capnuchosphaera</i> sp. suggests that <i>Livarella</i> may extend down into the middle Norian, at least in North American rock sequences.
80 JPip	Howard Pass B-5 68°28'55"/ 158°25'19"	Poorly preserved assemblage including <i>Acanthocircus</i> sp. (cortical ring fragments) <i>Canoptum</i> sp. cf. <i>C. unicum</i> Pessagno and Whalen <i>Canoptum</i> sp. <i>Droltus</i> sp. <i>Pantanellium</i> cf. <i>P. kungaense</i> Pessagno and Blome <i>Pantanellium</i> sp. [92ADo96B; USGS DR 1466]	Early Jurassic (Hettangian or Sinemurian).	Green-gray bedded chert; uppermost part of unit J IPip, at contact with unit Kop.
81 JPii	Howard Pass B-5 68°27'3.6"/ 158°36'7.2"	Radiolarians poorly preserved; most exhibit little or no external meshwork or pore structure. <i>Canoptum</i> sp. cf. <i>C. dixonii</i> (Pessagno and Poisson) <i>Canoptum</i> sp. <i>Canutus</i> sp. <i>Katroma</i> sp. <i>Orbiculiforma</i> sp. aff. <i>O. multifora</i> Pessagno and Poisson <i>Orbiculiforma</i> sp. [91ANs23A; USGS DR 1349]	Early Jurassic (probably Pliensbachian or Toarcian).	Laminated radiolarian chert in apparent fault contact with graywacke of the Okpikruak Formation. Although the fauna is poorly preserved, the co-occurrence of conoptids having 12-14 post-abdominal chambers, such as <i>Canoptum dixonii</i> , as well as abundant <i>Orbiculiforma</i> sp., indicate a definite Early Jurassic age, and a probable Pliensbachian age.
82 JPii	Howard Pass B-5 68°26'42"/ 158°36'50"	Radiolarians poorly preserved, most lacking preserved external meshwork or visible pore structure. <i>Bagotum</i> sp. <i>Canutus</i> sp. cf. <i>C. hainaensis</i> Pessagno and Whalen <i>Hsuum</i> aff. <i>H. belliatum</i> Pessagno and Whalen <i>Parvicingula</i> sp. <i>Saitoum</i> sp. [91ANs23B; USGS DR 1350]	Early Jurassic (Pliensbachian or Toarcian).	Uppermost chert at this locality, in fault(?) contact with Okpikruak Formation; sample includes both red and green-gray chert. Sample 91ANs23B may be slightly younger than 91ANs23A, as the former contains forms possessing a pronounced horn and robust circumferential ridges assignable to <i>Parvicingula</i> sp. The poor preservation makes an accurate specific assignment impossible.

Table 2. Radiolarian data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by C.D. Blome and K.M. Reed unless otherwise indicated. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; AK, J.S. Kelley; ANs, S.W. Nelson; ANw, W.H. Nelson; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleux; and SK, S.M. Karl. Lithologic data under remarks are chiefly field descriptions; thin section observations by J.A. Dumoulin. No., number; loc, locality]

Locality No., map unit	Quadrangle, latitude/longitude	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
83 JPii	Howard Pass B-5 68°26'35"/ 158°37'20"	Radiolarians recrystallized, poorly preserved, all lacking preserved external meshwork or visible pore structure. No nassellarians or cone-shaped casts visible in the coarse or fine dry acid residue. Several large, broken entactiniids preserved that are similar in geometry and spine structure to <i>Parentactinia itsukaichiensis</i> Sashida and Tonishi. <i>?Pseudoalbaillella</i> sp. [91ANs23C; USGS DR 1351]	?Paleozoic	Chert south of samples 91ANs23A and 23B. The poor preservation of all forms makes it impossible to assign an accurate age, but the absence of nassellarians and presence of abundant entactiniids suggest a possible pre-Mesozoic (Paleozoic) age.
84 IPMap	Howard Pass B-5 68°26'28"/ 158°32'17"	Poorly preserved forms including <i>?Albaillella</i> (?) <i>undulata</i> (cast) <i>?Albaillella</i> sp. (fragments only) Rare and corroded isolated bladed spines. [92ARm101A; USGS DR 1494]	?Mississippian	Chert, chiefly red, that contains subordinate, irregular greenish layers.
85 JPip	Howard Pass B-5 68°25'34"/ 158°37'37"	All radiolarians recrystallized, poorly preserved, lacking preserved external meshwork or visible pore structure. ?nassellarians (several cone-shaped casts that have distinct ridges that may be circumferential ridges). [91ANs24B; USGS DR 1353]	?Mesozoic	Red and green chert that contains visible radiolarians.
90 JPii	Howard Pass B-5 68°23'35"/ 158°50'13"	Poorly preserved assemblage including <i>Capnodoce</i> sp. (isolated spine) <i>Capnuhosphaera</i> sp. (isolated tumidaspines) <i>Syringocapsa turgida</i> <i>Triassocampe</i> sp. [92ADo29; USGS DR 1457]	Late Triassic (late Carnian to late middle Norian; <i>Capnodoce</i> Zone of Blome, 1984, and Blome and others, 1988).	Medium-gray and grayish-green, thin-bedded chert; locally weathers light cream-colored. Sample from white and black banded chert; white layers contain abundant radiolarians.
93 JPii	Howard Pass B-5 68°22'40"/ 158°49'50"	Poorly preserved forms including <i>Albaillella</i> sp. cf. <i>A. levis</i> <i>Deflandrella</i> (?) <i>manica</i> (arm fragments) <i>?Ishigaum</i> sp. (cast). [92ABs54; USGS DR 1495]	middle Permian (probably Guadalupian).	Sample from interval of whitish-gray-weathering chert; underlain and overlain by black chert.
94 JPip	Howard Pass B-5 68°22'23"/ 158°47'2.4"	Poorly preserved forms including <i>Capnuhosphaera</i> sp. (individual primary spines and broken shells) <i>Pseudoheliodiscus</i> sp. (small fragments of cortical outer ring). [92ADo83B; USGS DR 1463]	Late Triassic (Carnian or Norian)	Medium-gray and grayish-green chert, near rubble of red and brown argillite.
95 JPip	Howard Pass B-5 68°22'15"/ 158°47'24"	Poorly preserved assemblage including <i>Betraccium</i> sp. <i>Capnuhosphaera</i> sp. (broken tumidaspines) <i>Livarella</i> sp. <i>Pantanellium</i> sp. [92ADo83E ₁ ; USGS DR 1464]	Late Triassic (latest middle to early late Norian; <i>Pantanellium silberlingi</i> Subzone of the <i>Betraccium deweveri</i> Zone of Blome, 1984; also see Blome and others, 1988).	Red chert, about 1,000 ft southwest of 92ADo83B. The association of <i>Livarella</i> sp. with <i>Capnuhosphaera</i> sp. suggests that <i>Livarella</i> may extend down into the middle Norian, at least in North American rock sequences.

Table 2. Radiolarian data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by C.D. Blome and K.M. Reed unless otherwise indicated. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; AK, J.S. Kelley; ANs, S.W. Nelson; ANw, W.H. Nelson; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleux; and SK, S.M. Karl. Lithologic data under remarks are chiefly field descriptions; thin section observations by J.A. Dumoulin. No., number; loc, locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
95 JPip [cont.]	Howard Pass B-5 68°22'16"/ 158°47'24"	Poorly preserved assemblage including Cortical ring fragments assigned to either <i>Acanthocircus</i> or <i>Pseudoheliodiscus</i> sp. (ring fragments missing secondary spines) <i>?Corum</i> sp. (poorly preserved forms with little ornamentation). [92ADo83E ₂ ; USGS DR 1465]	Probably Late Triassic	Green chert, about 75 ft south of 92ADo83E ₁ .
96 JDbc	Howard Pass B-5 68°22'55"/ 158°38'20"	Poorly preserved and unidentifiable recrystallized casts of nassellarians. [92ARm25A; USGS DR 1487]	Triassic or younger	Radiolarian chert that may be part of a tectonic melange or major fault zone.
102 PMap	Howard Pass B-4 68°22'41"/ 158°08'40"	Poorly preserved forms including those questionably assigned to the <i>Scharfenbergia impella</i> group. Also poorly preserved undescribed spumellarians and rare spicules. [91AD13A; USGS DR 1513]	Probably Mississippian (Meramecian or younger).	Medium-gray to black, vitreous chert, weathering white to gray and (locally) reddish-brown; 10-15 percent radiolarians visible on most fresh surfaces. Thin section is pale to dark-brown chert that contains 10-40 percent radiolarians; quartz crystals within tests are generally finer grained than those in the matrix.
JPip		Only identifiable forms are spine fragments questionably assignable to <i>?Capnuchosphaera</i> sp. [91AD13J; USGS DR 1514]	?Late Triassic	Tan-weathering, pale- to medium-green, vitreous chert; beds 2- to 10-cm thick. Pyrite locally abundant, radiolarians few to 15 percent. Chert associated with (apparently interbedded with) maroon, green, and black mudstone. Thin section is pale chert with minor, poorly preserved radiolarians (some tests replaced by zeolite?) and trace detrital quartz. Rocks represent interval of unit JPip too small to show on geologic map.
104 JDbc	Howard Pass B-4 68°22'01"/ 158°13'05"	All radiolarians recrystallized, poorly preserved as casts and molds only. Cone-shaped ?nassellarians. <i>?Pseudostylosphaera</i> sp. (recrystallized, ellipsoidal cortical shell, nodose, with robust, twisted primary spines). [91ANs18A; USGS DR 1348]	?Middle or Late Triassic	Red interpillow chert in massive, amygdaloidal basalt.
107 JPe	Howard Pass B-4 68°21'18"/ 158°00'58"	Poorly preserved forms including Broken <i>Eptingium</i> -like inflated spines <i>Triassocampe</i> sp. (casts). [92ADo313; USGS DR 1486]	Triassic (questionable Middle Triassic)	Gray to grayish-green chert.
108 JDbc	Howard Pass B-4 68°21'14"/ 158°17'20"	All radiolarians recrystallized and poorly preserved as casts and molds. Spherical to ovoid, flattened casts of spumellarians, occasional isolated, broken spines. <i>?Bagotum</i> sp. <i>?Pantanellium</i> sp. (poorly preserved casts that have bipolar primary spines). [91ANs14A; USGS DR 1347]	?Early Jurassic	Gray chert, associated with sheared, amygdaloidal pillow basalt.
109 JDbc	Howard Pass B-4 68°21'10"/ 158°17'10"	Few, sparse nassellarians. [86SK238A; USGS MR 7266]	Triassic	Chert associated with red-weathering basalt, in fault contact with vesicular basalt and limestone. Sample identified by B. Murchey, USGS.

Table 2. Radiolarian data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by C.D. Blome and K.M. Reed unless otherwise indicated. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; AK, J.S. Kelley; ANs, S.W. Nelson; ANw, W.H. Nelson; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleux; and SK, S.M. Karl. Lithologic data under remarks are chiefly field descriptions; thin section observations by J.A. Dumoulin. No., number; loc, locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
110 JDbc	Howard Pass B-4 68°21'05"/ 158°16'50"	Poorly preserved spumellarians, recrystallized, several pyritized. ?capnuchosphaerid primary spine (broken and poorly preserved; these distinct primary spines that belong in the radiolarian family Capnuchosphaeridae are hollow in their proximal parts, triradiate and sometimes twisting in their medial parts, and are solid and circular in axial section in their distal parts). ?conodont fragment (recrystallized and poorly preserved). [91ANs13A; USGS DR 1346]	?Triassic	Sample from 4-cm-thick layer of gray chert in section of brown-weathering, sheared basalt.
115 JPe (or IPMk)	Howard Pass B-4 68°19'52"/ 158°16'23"	<i>Scharfenbergia tailleurense</i> group Holdsworth and Murchey. [86SK240B; USGS MR 7269]	Late Mississippian–Early Pennsylvanian (Chesterian–Morrowan).	Gray and buff chert, interbedded with siliceous argillite; at base of exposed section. Lithology and fauna appear transitional between those of units IPMk and JPe. The robust group <i>Scharfenbergia tailleurense</i> commonly occurs near or at the boundary between the Lisburne and Etivluk groups. Sample identified by B. Murchey, USGS.
117 JRo	Howard Pass B-4 68°19'15"/ 158°19'10"	Few, sparse nassellarians. [86SK239A; USGS MR 7268]	Triassic	Gray chert. Sample identified by B. Murchey, USGS. Previously published fossil data from approximately this locality (table 4).
127 JRo	Howard Pass B-3 68°28'30"/ 157°44'46"	Poorly preserved forms including <i>Acanthocircus</i> sp. cf. <i>A. hexagonus</i> (Yao) <i>Capnuchosphaera</i> sp. (tumidaspine fragments only). [92ADo214B; USGS DR 1475]	Late Triassic (early late Carnian to late middle Norian).	Medium- to thick-bedded, medium-gray chert with light-weathering partings.
128 IPMap	Howard Pass B-3 68°29'2.4"/ 157°26'06"	Poorly preserved assemblage including ?Scharfenbergia spp. <i>Albaillella</i> cf. <i>A. cartalla</i> . Rare sponge spicules. [92ADo67B; USGS DR 1461]	Mississippian (pre-Chesterian, probably Meramecian).	Thin-bedded, grayish-green to gray radiolarian chert, interbedded with olive to grayish-green siliceous argillite.
129 IPMap	Howard Pass B-3 68°26'13"/ 157°40'45"	No identifiable forms except for poorly preserved broken arms possibly assignable to the <i>Scharfenbergia impella</i> group. Abundant sponge spicules. [92ADo202B; USGS DR 1474]	?Paleozoic (?Mississippian)	Bright reddish-orange-weathering, light- to medium-gray to grayish-green chert; thin bedded with locally abundant radiolarians. Abundant vein quartz in radiolarian sample residue.
130 JRo	Howard Pass B-3 68°26'24"/ 157°33'00"	Poorly preserved forms with little external meshwork remaining including unidentifiable spumellarians and a nassellarian questionably identified as ? <i>Corum</i> sp. [91ADo48A; USGS DR 1453]	Possibly Late Triassic (Carnian/Norian).	Gray-weathering, brown to gray radiolarian chert in float (no outcrop); probably thin bedded. Overlies <i>Monotis</i> -bearing limestone member of Otuk.
134 KJmv	Howard Pass B-3 68°26'24"/ 157°26'10"	Poorly preserved assemblage including ?Canutus sp. Other recrystallized crushed and distorted nassellarians Rare spumellarian fragments. [92ADo81B; USGS DR 1462]	?Early Jurassic (?Sinemurian or ?Pliensbachian).	Dark chert float associated with volcanic and volcanoclastic rocks.

Table 2. Radiolarian data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by C.D. Blome and K.M. Reed unless otherwise indicated. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; AK, J.S. Kelley; ANs, S.W. Nelson; ANw, W.H. Nelson; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleux; and SK, S.M. Karl. Lithologic data under remarks are chiefly field descriptions; thin section observations by J.A. Dumoulin. No., number; loc, locality]

Locality No., map unit	Quadrangle, latitude/longitude	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
135 JPip	Howard Pass B-3 68°25'44"/ 157°17'45"	Poorly preserved forms including <i>Capnuchosphaera</i> sp. (tumidaspine fragments) <i>Pseudoheliodiscus</i> sp. (fragment of cortical ring) Isolated twisted spines. [92ARm63A; USGS DR 1491]	Late Triassic (late Carnian?, Norian)	Tightly folded, light-gray to green and light-brown to cream-colored chert in beds 1-15 cm thick; structurally below mafic igneous rock.
136 JPip	Howard Pass B-3 68°25'48"/ 157°17'05"	Poorly preserved forms including <i>?Canoptum</i> sp. (casts) <i>Capnuchosphaera</i> sp. (isolated tumidaspines) <i>Corum</i> sp. cf. <i>C. perfectum</i> (casts only) <i>Xenorum</i> sp. (fragments of cortical shell and primary spines). [92ABs125; USGS DR 1503]	Late Triassic (late Carnian to middle Norian; <i>Capnodoce</i> Zone of Blome, 1984, and Blome and others, 1988).	Light-greenish-gray-weathering, dark-gray, vitreous chert with conchoidal fracture, orange-brown iron stain, and locally abundant radiolarians; beds 1-10 cm thick (average ≈6 cm).
137 JDbc	Howard Pass B-3 68°24'40"/ 157°28'40"	Poorly preserved forms including Abundant casts of spumellarians with little external meshwork <i>?Nazarovella</i> sp. (guttered rays) <i>?Pseudoalbaillella</i> sp. (poorly preserved fragment). Rare sponge spicules. [92ABs85; USGS DR 1498]	?Permian	Light-reddish-gray and light-blue-green chert in float along with basalt.
138 JDbc	Howard Pass B-3 68°24'36"/ 157°27'05"	Poorly preserved assemblage containing abundant radiolarian fragments, isolated bladed spines, and a narrow, undescribed conical albaillellid of Mississippian aspect. [91ADo53B; USGS DR 1454]	pre-Permian (probably Mississippian)	Green chert forms films and masses between volcanic pillows; sample from a persistent chert bed about 3 ft thick that contains abundant radiolarians.
139 JDbc	Howard Pass B-3 68°24'22"/ 157°27'36"	Poorly to moderately preserved assemblage including <i>Emiluvia</i> (?) <i>cochleata</i> <i>Eptingium manfredi manfredi</i> <i>Pseudostylosphaera coccostyla</i> <i>Pseudostylosphaera hellenica</i> <i>Triassocampe</i> sp. [92ABs79B; USGS DR 1497]	Middle Triassic (Ladinian)	Bedded chert and thinly laminated limestone in outcrop, rubble, and float. Sample from olive-gray to dark-gray, pale yellow-orange-weathering chert that contains locally abundant radiolarians; beds 0.3-15 cm thick.
141 JDbc	Howard Pass B-3 68°23'56"/ 157°27'15"	Poorly preserved casts including <i>?Acanthocircus</i> sp. or <i>?Pseudoheliodiscus</i> sp. (cortical ring fragments) <i>?Capnodoce</i> sp. (broken inflated primary spines) <i>Capnuchosphaera</i> sp. (tumidaspines only) <i>?Corum</i> sp. <i>Pachus</i> sp. <i>?Pseudostylosphaera</i> sp. (partial test). [92ARm73B; USGS DR 1492]	Late Triassic (late Carnian or early Norian).	Dark-greenish-gray chert containing radiolarians, beneath Memorial Creek volcanic rocks.
151 JPe	Howard Pass B-3 68°19'23"/ 157°45'22"	Poorly preserved forms including <i>Albaillella</i> (?) <i>asymmetrica</i> <i>Pseudoalbaillella</i> sp. aff. <i>P. longicornis</i> <i>Entactinia</i> cf. <i>E. itsukaichiensis</i> Small bladed spines in fine (>63 μm) residue. [92ARm41A; USGS DR 1489]	Mid-Permian (Leonardian or Guadalupian).	Chert containing abundant radiolarians.
152 JPe	Howard Pass B-3 68°19'23"/ 157°45'11"	Poorly preserved forms including <i>?Pseudoalbaillella</i> sp. (broken and crushed fragments). [92ARm40A; USGS DR 1488]	?Permian (based on questionable occurrence of <i>?Pseudoalbaillella</i> sp.).	Float of light gray chert above Kuna Formation.

Table 2. Radiolarian data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[All faunas identified by C.D. Blome and K.M. Reed unless otherwise indicated. Letters in field number refer to collector: ABs, S. Bie; AD, J.A. Dumoulin; ADo, J.H. Dover; AK, J.S. Kelley; ANs, S.W. Nelson; ANw, W.H. Nelson; ARm, R.T. Miyaoka; (A)Tr, I.L. Tailleux; and SK, S.M. Karl. Lithologic data under remarks are chiefly field descriptions; thin section observations by J.A. Dumoulin. No., number; loc, locality]

Locality No., map unit	Quadrangle, latitude/longitude	Radiolarian fauna [field No.; USGS collection No.]	Age	Remarks
157 Kmp	Howard Pass C-5 68°41'53"/ 158°27'50"	? <i>Latentifistula impella</i> (Ormiston and Lane) Group. Sponge spicules (abundant, but less abundant than radiolarians; include hexactine spicules [Hexactinellida] and ?anatriaene, strongyle, and large matted monaxon spicules [Demospongiae?]). Preservation = 2 on a scale of 1–5. [86Tr2A; USGS MR 7272]	Mississippian? Poorly preserved stauraxon radiolarians in this sample are more likely Paleozoic (Mississippian?) rather than Mesozoic forms.	Sample from chert closely associated with large slab (or boudin) of tasmanites-bearing rock; chert residue is medium gray. <i>L. impella</i> and abundant sponge spicules are common near time-transgressive facies boundary of Kuna Formation and Etivluk Group (for instance, transition zone between limestone and chert at Nigu Bluff, eastern Howard Pass quadrangle). Sample identified by B. Murchey, USGS.
		<i>Capnodoce</i> sp. Nassellarians. Twisted, bladed spines. A few hexactine sponge spicules. Preservation = 2 on a scale of 1–5. [86Tr2F; USGS MR 7275]	Late Triassic	Sample near base of uppermost chert interval at this locality; below (north) of Okpikruak Formation and above oil shale. Chert residue is white and coarse-grained. Sample identified by B. Murchey, USGS.
		<i>Capnodoce</i> or <i>Capnuchosphaera</i> sp. Nassellarians. Preservation = 2 on a scale of 1–5. [86Tr2G; USGS MR 7295]	Late Triassic	Top of uppermost chert interval at this locality; chert residue is black. Sample identified by B. Murchey, USGS.
159 JPip	Howard Pass B-4 68°27'0"/ 158°18'18"	Theoperid radiolarians. Conodonts. Poor foraminifers. [79ANw8A; USGS MR 1116]	Triassic (Late?)	Bedded gray chert, associated with black siltstone and dark-gray graywacke. Sample identified by D.L. Jones and B. Murchey, USGS.
189 JPii	Howard Pass C-3 68°40'1.2"/ 157°34'8.4"	Poorly preserved "complex" <i>Paronaella</i> sp. Large spherical spumellariina, having three thick but very short, blunt primary spines. This fauna is probably <i>Pseudoalbaillella</i> assemblage (Holdsworth and Jones, 1980). [64Tr209R1; USGS MR 3151]	Pennsylvanian or Early Permian; equivalent to or younger than the youngest radiolarian faunas at Nigu Bluff (Murchey and others, 1981).	Red- and green-weathering chert; associated with tasmanite, fine-grained clastic rocks, and mafic rocks. Sample identified by B. Murchey and C.D. Blome, USGS.
		Latenodiotidae fam. nov. ad. int. Nazarov Subfamily Latenofistulinae?: fragments Subfamily Latenodiotinae?: poor specimen. [64Tr209R2; USGS MR 3152]	Late Pennsylvanian (?) or Permian; this fauna is younger than MR 3151, and younger than any known faunas at Nigu Bluff.	Red weathering chert. Sample identified by B. Murchey and C.D. Blome, USGS.

Table 3. Megafossil data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[Letters in field number refer to collector: ABe, W.P. Brosgé; AD, J.A. Dumoulin; ADo, J.H. Dover; ANs, S.W. Nelson; ATr, I.L. Tailleux; and JS, J.M. Schmidt. No., number; indet., indeterminate; colln., collection; loc., locality]

Locality No., map unit	Quadrangle, latitude/longitude	Fossils [field No.; USGS collection No.]	Age	Remarks
23 DI	Howard Pass C-4 68°32'53"/ 158°06'35"	Corals: <i>Cystiphyllodes</i> sp. cf. <i>C. lenzi</i> Pedder and McLean, 1982 [43J] “ <i>Radiastraea</i> ”? sp. [43I] <i>Taimyrophyllum</i> spp. [43I] <i>Favosites</i> sp. [43H] <i>Pachyfavosites</i> sp. [43G] Stromatoporoids: <i>Coenostelodictyon</i> sp. [43F] [92AD43F, G, H, I and J]	late Early to early Middle Devonian (Pragian to Eifelian).	Corals identified by W.A. Oliver, Jr., USGS; stromatoporoids identified by C.W. Stock, University of Alabama. <i>C. lenzi</i> is known only from the Road River Formation in the Royal Creek section, Yukon Territory. Table 1 contains conodont data from this locality.
73 DI	Howard Pass B-5 68°29'57"/ 158°35'35"	Brachiopods: <i>Schizophoria</i> sp. <i>Cassidirostrum</i> ? sp. <i>Cupularostrum</i> ? sp. <i>Spinatrypa (Isospinatrypa)</i> sp. [92AD45B; 11950-SD]	early Middle Devonian (early Eifelian).	Identified by R.B. Blodgett, Oregon State University. <i>Spinatrypa (Isospinatrypa)</i> sp. is conspecific with an undescribed species from the upper part of the Cheeneetnuk Limestone of west-central Alaska. Table 1 contains conodont data from this locality.
		Brachiopods: <i>Cassidirostrum</i> ? sp. <i>Spinatrypa (Isospinatrypa)</i> sp. <i>Costacranaena</i> n. sp. [92AD45C; 11951-SD]	early Middle Devonian (early Eifelian).	
74 DI	Howard Pass B-5 68°29'43"/ 158°35'00"	Brachiopods: <i>Spinatrypa (Isospinatrypa)</i> sp. [92AD30B; 11949-SD]	early Middle Devonian (early Eifelian).	Identified by R.B. Blodgett, Oregon State University. <i>Spinatrypa (Isospinatrypa)</i> sp. is conspecific with an undescribed species from the upper part of the Cheeneetnuk Limestone of west-central Alaska. Baxter and Blodgett (1994) reported the brachiopod <i>Droharhynchia rzhonsnitskayae</i> n. sp. from this general locality (50ABe53; USGS colln. 3370-SD); brachiopods of this genus may also occur in the Kolyma region of northeastern Siberia. Table 1 contains conodont data from this locality.
86 DI	Howard Pass B-5 68°25'12"/ 158°56'06"	Stromatoporoids: <i>Actinostroma</i> of a rather robust sort. [92ADo19A, B]	Probably early Late Devonian (Frasnian).	Identified by C.W. Stock, University of Alabama. Corals of possible early Late Devonian (Frasnian) age (station 51T118, colln. 51ATr424; USGS colln. 3375) reported from this general locality by J.T. Dutro, Jr., USGS, 1953, unpub. report.
87 DI	Howard Pass B-5 68°24'40"/ 158°54'00"	Stromatoporoids [69A, D] and corals [69C]: Poorly preserved specimens of a ramose stromatoporoid, most likely <i>Stachyodes</i> sp. [69A] alveolitic coral [69C] Probably <i>Stictostroma</i> sp.; possibly the closely related <i>Stromatoporella</i> sp. [69D] [92AD69A, C, and D]	early Late Devonian; <i>Pa. transitans</i> Zone through Lower <i>Pa. hassi</i> Zone (early, but not very earliest, Frasnian) based on conodonts; stromatoporoids are compatible with this age.	Identified by C.W. Stock, University of Alabama. Table 1 contains conodont data from this locality. Tentaculitids, ostracodes and an ammonite cephalopod of probable late Middle-early Late Devonian age (station 51T122, colln. 51ATr439; USGS colln. 3377) reported from this general locality by J.T. Dutro, Jr., USGS, 1953, unpub. report.
98 PDlc	Howard Pass B-5 68°23'35"/ 158°36'32"	Numerous prisms apparently derived from shells of the bivalve <i>Atomodesma</i> sp. are visible in thin section [92AD23]	Permian? (<i>Atomodesma</i> is of Permian age).	Identified by J.A. Dumoulin; identical prisms occur in unnamed limestone of Permian age in the Medfra quadrangle, west-central Alaska
103 JDbc	Howard Pass B-4 68°22'20"/ 158°13'05"	Molds and casts of <i>Neospirifer</i> sp., a spiriferid brachiopod [91ANs17A]	Early Pennsylvanian–Permian; probably Early Permian.	Identified by J.T. Dutro, Jr., USGS. Sample from volcanoclastic(?) sandstone interlayered with basalt.

Table 3. Megafossil data (previously unpublished) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[Letters in field number refer to collector: ABe, W.P. Brosgé; AD, J.A. Dumoulin; ADo, J.H. Dover; ANs, S.W. Nelson; ATr, I.L. Tailleux; and JS, J.M. Schmidt. No., number; indet., indeterminate; colln., collection; loc., locality]

Locality No., map unit	Quadrangle, latitude/ longitude	Fossils [field No.; USGS collection No.]	Age	Remarks
125 Mik	Howard Pass B-4 68°19'40"/ 157°52'35"	Disarticulated valve of a nukuloid pelecypod. Indet. nautiloids and ammonoids. Gastropods: <i>Angyomphalus (Angyomphalus)</i> sp. Indet. gastropod with cancellate sculpture. [91JS38]	<i>Angyomphalus (Angyomphalus)</i> sp. indicates an age of late Middle Devonian (Givetian) to Lower Carboniferous; other megafossils do not further constrain age. Conodonts from this locality are early Early Mississippian (Kinderhookian).	Pelecypod identified by J. Pojeta, Jr., USGS; all other specimens identified by R.B. Blodgett, Oregon State University. All samples from concretions in uppermost part of Kayak Shale. Table 4 contains conodont data from this locality.

Table 4. Paleontological data (published since 1980) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[Letters in field number refer to collector: AD, J.A. Dumoulin; ADo, J.H. Dover; AHe, Carl Huie; AK, J.S. Kelley; AMH, M.L. Miller; AMM, M. Mullens; ANk, W.J. Nokleberg; ANs, S.W. Nelson; Ha, E. Harris; Mu, C.G. Mull; JS (and STA), J.M. Schmidt, and Tr, I.L. Tailleux. CAI, conodont color alteration index. *, latitude/longitude herein corrected from previously published version. No., number; loc. locality; indet., indeterminate]

Locality No., map unit	Quadrangle, latitude/longitude	Fossils [field No.; USGS collection No.]	Age [CAI]	Reference, remarks (see "References cited" following section on biostratigraphic data)
14 Mu	Howard Pass C-5 68°33'43"/ 158°51'45"	Conodonts [92AD57E; 32451-PC]	early Early Mississippian; middle to early late Kinderhookian (Upper <i>Si. duplicata</i> Zone to lower part <i>Si. isosticha</i> -Upper <i>Si. crenulata</i> Zone). [2 or 3]	Dumoulin and Harris, 1997, table 1, loc. 15.
29 Mlri	Howard Pass C-3 68°35'55"/ 157°41'00"	Conodonts [91AD11A, G; 31745-PC, 31746-PC]	No older than late Early Mississippian (no older than middle Osagean); both samples contain redeposited conodonts of early Early Mississippian (Kinderhookian) age. [2-2.5]	Dumoulin and others, 1993, table 1, loc. 19. Sample from 80-m-thick measured section of unit Mlri; 11A, 70 m above base of section; 11G, 80 m above base of section. Table 1 contains additional conodont data from this locality.
30 IPMap	Howard Pass C-3 68°37'05"/ 157°36'00"	Conodonts [91Tr17; 31721-PC]	Mississippian [1.5-2]	Dumoulin and others, 1993, table 1, loc. 15. Sample from Bion barite deposit of Kelley and others (1993), from about 25 m below chert containing Late Mississippian or Early Pennsylvanian radiolarians.
32 IPMap	Howard Pass C-3 68°37'30"/ 157°33'14"*	Conodonts [91Tr30; 31767-PC]	late Early Mississippian (Osagean, but not earliest) [1.5]	Dumoulin and others, 1993, table 1, loc. 15.
40 IPMap	Howard Pass C-3 68°36'10"/ 157°29'35"	Conodonts [91Tr23; 31720-PC]	middle Mississippian (latest Osagean to Meramecian; probably middle Meramecian). [1.5-2]	Dumoulin and others, 1993, table 1, loc. 16. Sample from a layer of calcitized radiolarite in the Stack barite deposit of Kelley and others (1993).
47 Mlri	Howard Pass C-3 68°33'58"/ 157°35'10"	Conodonts [90AD61Z; 30939-PC]	No older than late Early Mississippian (no older than early Osagean); contains redeposited conodonts of early Early Mississippian (Kinderhookian) age. [3-3.5]	Dumoulin and others, 1993, table 1, loc. 20. A few specimens have a surficial gray patina suggesting rapid heating; sample taken 5 m above a mafic sill.
48 IPMap	Howard Pass C-3 68°33'43"/ 157°30'22"*	Conodonts [91Tr39; 31722-PC]	late Early Mississippian (Osagean; Upper <i>typicus</i> Zone through most of <i>anchoralis-latus</i> Zone). [1.5-2]	Dumoulin and others, 1993, table 1, loc. 18. From 70-m-thick measured section 0.8 km east of the Abby Creek barite deposit of Kelley and others (1993). Sample from a baritic limestone bed 34 m above base of section.
IPMap/JIPip		Radiolarians [91AK22C] [91AK22B]	Late Mississippian (Meramecian or Chesterian) Early or Middle Pennsylvanian (Morrowan or Atokan)	Kelley and others, 1993, fig. 5. Sample 91AK22C taken several meters below 91AK22B and about 30 m above 91Tr39; both radiolarian samples from chert that is lithologically transitional between units IPMap/JIPip.
49 Mlri	Howard Pass C-3 68°32'55"/ 157°30'20"	Conodonts [90AD67G; 30944-PC]	No older than late Early Mississippian (no older than middle Osagean); contains redeposited conodonts of early Early Mississippian (Kinderhookian) age. [2]	Dumoulin and others, 1993, table 1, loc. 23.

Table 4. Paleontological data (published since 1980) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[Letters in field number refer to collector: AD, J.A. Dumoulin; ADO, J.H. Dover; AHe, Carl Huie; AK, J.S. Kelley; AMH, M.L. Miller; AMM, M. Mullens; ANK, W.J. Nokleberg; ANs, S.W. Nelson; Ha, E. Harris; Mu, C.G. Mull; JS (and STA), J.M. Schmidt, and Tr, I.L. Tailleux. CAI, conodont color alteration index. *, latitude/longitude herein corrected from previously published version. No., number; loc. locality; indet., indeterminate]

Locality No., map unit	Quadrangle, latitude/ longitude	Fossils [field No.; USGS collection No.]	Age [CAI]	Reference, remarks (see "References cited" following section on biostratigraphic data)
50 Mlri	Howard Pass C-3 68°33'00"/ 157°29'30"	Conodonts [90AD66A; 30943-PC]	late Early Mississippian (early Osagean; <i>typicus</i> Zone) [3-4]	Dumoulin and others, 1993, table 1, loc. 22. About 25 percent of specimens have a surficial gray patina suggesting nearby hydrothermal and (or) igneous activity.
51 Mlri	Howard Pass C-3 68°32'58"/ 157°29'10"	Conodonts [90AD64F; 30940-PC]	No older than late Early Mississippian (no older than middle Osagean, middle <i>anchoralis-latus</i> Zone); contains redeposited conodonts of early Early Mississippian (Kinderhookian) age. [2.5-3]	Dumoulin and others, 1993, table 1, loc. 22. Sample taken 16.5 m below a mafic sill.
54 Mlri	Howard Pass C-3 68°32'00"/ 157°34'55"	Conodonts [91AD6F, U; 31741-PC, 31742-PC]	No older than late Early Mississippian (no older than middle Osagean); 6F contains redeposited conodonts of early Early Mississippian (Kinderhookian) age. [1.5-2]	Dumoulin and others, 1993, table 1, loc. 21. From 67-m-thick measured section within unit Mlri; 6F, 5.5 m above base of section and about 0.5 m above mafic sill; 6U, 61 m above base of section.
55 Mlri	Howard Pass C-3 68°32'03"/ 157°34'15"	Conodonts [91AD2B; 31740-PC]	late Early Mississippian (lower $\frac{2}{3}$ of Osagean; <i>typicus</i> Zone-most of <i>anchoralis-latus</i> Zone). [1.5]	Dumoulin and others, 1993, table 1, loc. 21. From top of Mlri unit, about 0.25 m below contact with overlying Innaitchiak Chert. The lowermost beds of the Innaitchiak here consist of white- to light-gray- weathering, light-green to gray chert that produced very poorly preserved radiolarians (91JS28E; USGS DR 1528) of possible Late Paleozoic age.
97 JDbc	Howard Pass B-5 68°22'52"/ 158°38'35"	Brachiopods [78ANK35]	Early Permian	Nelson and Nelson, 1982, table 1, loc. 4. Fossils are probably in tectonic inclusions; locality described as melange by collector.
99 PDlc	Howard Pass B-5 68°24'18"/ 158°27'11"	Conodonts [79ANs25C; 10018-SD]	early Late Devonian (Frasnian) [2.5]	Nelson and Nelson, 1982, table 1, loc. 3.
100 JPip	Howard Pass B-4 68°24'50"/ 158°17'10"	Radiolarians [79ANs2E]	Pennsylvanian (Morrowan) to Permian (Guadalupian)	Nelson and Nelson, 1982, table 1, loc. 1.
101 Mi	Howard Pass B-4 68°23'/ 157°55.8'	Conodonts [84STA04; 29639-PC]	early Early Mississippian (middle to late Kinderhookian). [3.5]	Mull and others, 1997, table 1. Story Creek Zn-Pb prospect.
105 Mlri	Howard Pass B-4 68°21'35"/ 158°08'50"*	Conodonts [91JS35D; 31753-PC]	No older than early Late Mississippian (no older than late Meramecian); contains redeposited conodonts of Early Mississippian (late Kinderhookian and Osagean) age. [3.5]	Dumoulin and others, 1993, table 1, loc. 25. Mafic sill at least 7 m thick occurs 5 m above sample site.
106 Mi	Howard Pass B-4 68°22'05"/ 158°04'52"*	Brachiopods [93Mu78-1]	early Early Mississippian (late Kinderhookian; <i>Calvustrigis rutherfordi</i> Zone).	Mull and others, 1997, table 1.

Table 4. Paleontological data (published since 1980) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[Letters in field number refer to collector: AD, J.A. Dumoulin; ADo, J.H. Dover; AHe, Carl Huie; AK, J.S. Kelley; AMH, M.L. Miller; AMM, M. Mullens; ANk, W.J. Nokleberg; ANs, S.W. Nelson; Ha, E. Harris; Mu, C.G. Mull; JS (and STA), J.M. Schmidt, and Tr, I.L. Tailleux. CAI, conodont color alteration index. *, latitude/longitude herein corrected from previously published version. No., number; loc. locality; indet., indeterminate]

Locality No., map unit	Quadrangle, latitude/longitude	Fossils [field No.; USGS collection No.]	Age [CAI]	Reference, remarks (see "References cited" following section on biostratigraphic data)
111 JDbc	Howard Pass B-4 68°21' / 158°16'15"	Corals, stromatoporoids [79ANs41E]	early Late Devonian (Frasnian)	Nelson and Nelson, 1982, table 1, loc. 6. Sample 92AD25E (table 1) from approximately this locality contains conodonts of middle Frasnian age.
112 JDbc	Howard Pass B-4 68°20'56" / 158°16'00"	Conodonts [79ANs41C; 10091-SD]	Late Devonian [7]	Nelson and Nelson, 1982, table 1, loc. 7. Sample 92AD25H (table 1) from approximately this locality contains conodonts of Frasnian age.
113 JDbc	Howard Pass B-4 68°20'42" / 158°17'	Conodonts [78ANs205B]	Late Devonian (middle Famennian)–late Early Mississippian (middle Osagean). [3.5-4]	Nelson and Nelson, 1982, table 1, loc. 9. Collected from limestone within Copter Peak basalt unit of Siniktanneyak mafic complex.
114 JDbc	Howard Pass B-4 68°20' / 158°19'23"	Corals, brachiopods [78AMM35C]	Middle-Late Devonian	Nelson and Nelson, 1982, table 1, loc. 11. Collected from limestone within Copter Peak basalt unit of Siniktanneyak mafic complex.
		Conodonts [78AMM35D]	Devonian-Triassic [3]	
116 Mk	Howard Pass B-4 68°19'44" / 158°16'16"*	Brachiopods, echinoderms, sponge(?) [78AMH194A]	Middle Devonian–Early Mississippian	Nelson and Nelson, 1982, table 1, loc. 10.
		Conodonts [93Mu80; 32213-PC]	early Early Mississippian (Kinderhookian) [3 or 4]	Mull and others, 1997, table 1. Limestone and shale member of Kayak Shale (Mull and others, 1997).
117 JRo	Howard Pass B-4 68°19'20" / 158°19'05"	Pelecypods, radiolarians [79ANs31A]	Late Triassic (Norian)	Nelson and Nelson, 1982, table 1, loc. 12. Sample 86SK239A (table 2) from approximately this locality contains radiolarians of Triassic age.
		Conodonts [79ANs31B]	Middle Triassic (Anisian and (or) Ladinian)	
118 Mk	Howard Pass B-4 68°18'58" / 158°18'58"	Brachiopods, corals, echinoderms [78ANs135B]	Late Devonian–Early Mississippian	Nelson and Nelson, 1982, table 1, loc. 13.
119 Mk	Howard Pass B-4 68°18.7' / 158°05.8'	Conodonts [93Mu73; 32217-PC]	Devonian to Early Mississippian; probably early Early Mississippian (Kinderhookian). [3 or 4]	Mull and others, 1997, table 1. Shale member of the Kayak Shale (Mull and others, 1997).
120 Mikv	Howard Pass B-4 68°19' / 158°04.5'	Conodonts [91JS36Z; 31754-PC]	early Early Mississippian (Kinderhookian) [3-3.5]	Dumoulin and Harris, 1997, table 1, loc. 3, and Mull and others, 1997, table 1. Limestone and shale member of the Kayak Shale (Mull and others, 1997); sample from limestone that stratigraphically overlies about 10 m of volcanoclastic rocks (in Kayak Shale) and underlies spiculitic chert (Kuna Formation).

Table 4. Paleontological data (published since 1980) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[Letters in field number refer to collector: AD, J.A. Dumoulin; ADo, J.H. Dover; AHe, Carl Huie; AK, J.S. Kelley; AMH, M.L. Miller; AMM, M. Mullens; ANK, W.J. Nokleberg; ANs, S.W. Nelson; Ha, E. Harris; Mu, C.G. Mull; JS (and STA), J.M. Schmidt, and Tr, I.L. Tailleux. CAI, conodont color alteration index. *, latitude/longitude herein corrected from previously published version. No., number; loc. locality; indet., indeterminate]

Locality No., map unit	Quadrangle, latitude/ longitude	Fossils [field No.; USGS collection No.]	Age [CAI]	Reference, remarks (see "References cited" following section on biostratigraphic data)
122 Mikv	Howard Pass B-4 68°17.7' / 157°58.8'	Conodonts [91JS37G; 31755-PC]	early Early Mississippian (middle to late Kinderhookian). [3.5-4]	Dumoulin and Harris, 1997, table 1, loc. 4, and Mull and others, 1997, table 1. Limestone and shale member of the Kayak Shale (Mull and others, 1997).
123 Mik	Howard Pass B-4 68°20'10" / 157°52'58"	Conodonts [92ADo248B; 32207-PC]	early Early Mississippian (probably Kinderhookian) [3 or 4]	Dumoulin and Harris, 1997, table 1, loc. 9, and Mull and others, 1997, table 1. Sandstone member of the Kayak Shale (Mull and others, 1997).
124 Mik	Howard Pass B-4 68°20' / 157°52'30"*	Conodonts [92ADo316B; 32208-PC]	early Early Mississippian (probably Kinderhookian) [3 or 4]	Dumoulin and Harris, 1997, table 1, loc. 9, and Mull and others, 1997, table 1. Sandstone member of the Kayak Shale (Mull and others, 1997); probably stratigraphically lower than 92ADo248B (loc. 123).
125 Mik	Howard Pass B-4 68°19'40" / 157°52'35"	Conodonts [91JS38A; 31756-PC]	early Early Mississippian (Kinderhookian) [3.5-4]	Dumoulin and Harris, 1997, table 1, loc. 5. Limestone and shale member of the Kayak Shale (Mull and others, 1997). See table 3 for megafossil data from this locality.
IPMk		[91JS38B; 31757-PC]	Early Mississippian [CAI indeterminate; conodonts covered with amorphous organic matter]	Dumoulin and others, 1993, table 1, loc. 8. Stratigraphically overlies 38A.
126 Mik	Howard Pass B-4 68°19' / 157°51'10"*	Conodonts [92ADo239B2; 32209-PC]	early Early Mississippian (Kinderhookian) [≈3.5]	Dumoulin and Harris, 1997, table 1, loc. 8, and Mull and others, 1997, table 1. Shale member of the Kayak Shale (Mull and others, 1997).
131 Mlr	Howard Pass B-3 68°27'08" / 157°31'02"	Conodonts [92AD46A; 32446-PC]	early Early Mississippian (middle to late—but not latest—Kinderhookian). [1.5]	Dumoulin and others, 1993, table 1, loc. 14. Sample 92AD46A is from strata that structurally underlie 92ADo78 and 79; 46A is 0.5 m below base of Kuna Formation.
132 Mik	Howard Pass B-3 68°26'50" / 157°31'00"	Conodonts [92ADo79A; 32216-PC]	early Early Mississippian (middle to late Kinderhookian). [2]	Dumoulin and Harris, 1997, table 1, loc. 14. Sample 92ADo79A is from ≈75 m stratigraphically above 92ADo78B (loc. 133).
133 Mik	Howard Pass B-3 68°26'48" / 157°30'35"*	Conodonts [92ADo78B; 33320-PC]	early Early Mississippian; early to middle Kinderhookian (<i>Si. sulcata</i> Zone into lowest part of the Lower <i>Si. crenulata</i> Zone). [2]	Dumoulin and Harris, 1997, table 1, loc. 14.
140 JDbc	Howard Pass B-3 68°24'00" / 157°27'10"	Conodonts [92AD37D; 32443-PC]	early Early Mississippian (middle to late Kinderhookian). [3]	Dumoulin and Harris, 1997, table 1, loc. 16. Sample from carbonate thrust beneath (and locally intercalated with?) basalt of unit JDbc.
142 Mk	Howard Pass B-3 68°22'55" / 157°40'50"	Conodonts [91ADo70E; 31747-PC]	early Early Mississippian (middle to late Kinderhookian). [≈3]	Dumoulin and Harris, 1997, table 1, loc. 6, and Mull and others, 1997, table 1. Limestone and shale member of the Kayak Shale (Mull and others, 1997). Sample 91ADo70E is from strata about 20 m structurally (and stratigraphically?) above 91ADo70C (loc. 143).

Table 4. Paleontological data (published since 1980) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[Letters in field number refer to collector: AD, J.A. Dumoulin; ADo, J.H. Dover; AHe, Carl Huie; AK, J.S. Kelley; AMH, M.L. Miller; AMM, M. Mullens; ANk, W.J. Nokleberg; ANs, S.W. Nelson; Ha, E. Harris; Mu, C.G. Mull; JS (and STA), J.M. Schmidt, and Tr, I.L. Tailleux. CAI, conodont color alteration index. *, latitude/longitude herein corrected from previously published version. No., number; loc. locality; indet., indeterminate]

Locality No., map unit	Quadrangle, latitude/ longitude	Fossils [field No.; USGS collection No.]	Age [CAI]	Reference, remarks (see "References cited" following section on biostratigraphic data)
143 Mk	Howard Pass B-3 68°22'52"/ 157°40'50"	Conodonts [91ADo70C; 31748-PC]	early Early Mississippian (middle to late Kinderhookian). [≈3]	Dumoulin and Harris, 1997, table 1, loc. 6, and Mull and others, 1997, table 1. Limestone and shale member of the Kayak Shale (Mull and others, 1997).
144 Mlr	Howard Pass B-3 68°23'30"/ 157°39'15"	Conodonts [91AD9F; 31743-PC]	early Early Mississippian (Kinderhookian) [2-2.5]	Dumoulin and Harris, 1997, table 1, loc. 1.
145 Mik	Howard Pass B-3 68°22'30"/ 157°37'16"*	Conodonts [92Mu22; 32210-PC]	early Early Mississippian (Kinderhookian) [3.5]	Mull and others, 1997, table 1. Limestone and shale member of the Kayak Shale (Mull and others, 1997).
148 Mlr	Howard Pass B-3 68°19'36"/ 157°45'15"	Conodonts [92AD55-0; 32449-PC]	early Early Mississippian (Kinderhookian) [4]	Dumoulin and Harris, 1997, table 1, loc. 2. About 1 km southwest of type section of the Kuna Formation. Sample 55-0 is from near or at top of Rough Mountain Creek unit.
Mk		[92AD55-22; 32450-PC]	early Early Mississippian (Kinderhookian) [4]	Sample 55-22 is from the limestone and shale member of the Kayak Shale, about 12 m below contact with Rough Mountain Creek unit.
149 Mlr	Howard Pass B-3 68°19'38"/ 157°45'05"	Conodonts [92AD73G; 32462-PC]	early Early Mississippian (Kinderhookian) [4]	Dumoulin and Harris, 1997, table 1, loc. 2. Structural repeat of section at 92AD55 located 0.2 km to northeast; sample from about 6 m below top of Rough Mountain Creek unit.
150 Mlr	Howard Pass B-3 68°19'30"/ 157°44'55"	Conodonts [92AD72-5; 32461-PC]	early Early Mississippian (Kinderhookian) [4]	Dumoulin and Harris, 1997, table 1, loc. 2. From chert-rich outcrop about 5 m below top of Rough Mountain Creek unit.
153 Mk	Howard Pass B-3 68°20.5'/ 157°13'	Conodonts [93JS03E]	Late Devonian-Mississippian [4]	Dumoulin and Harris, 1997, table 1, loc. 13, and Mull and others, 1997, table 1. These authors assign rocks at this locality to the lower part of Isikut unit, several meters above contact with underlying Kanayut Conglomerate.
154 Mk	Howard Pass B-3 68°20'24"/ 157°13' 23"*	Brachiopods [93Ha109]	early Early Mississippian (late Kinderhookian; <i>Calvustrigis rutherfordi</i> Zone).	Mull and others, 1997, table 1. These authors assign rocks at this locality to the Isikut unit.
155 Mlr	Howard Pass B-3 68°15'29"/ 157°20'17"*	Conodonts [93Mu63-1; 32202-PC]	early Early Mississippian (Kinderhookian) [3.5]	Mull and others, 1997, table 1. From an interval of Rough Mountain Creek unit too small to show on geologic map.
Mi	Howard Pass B-3 68°15'25"/ 157°20'20"*	Conodonts [93Mu63-2; 32200-PC]	early Early Mississippian (Kinderhookian) [3.5]	Mull and others, 1997, table 1. These authors assign rocks at this locality to the limestone and shale member of Kayak Shale.

Table 4. Paleontological data (published since 1980) from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[Letters in field number refer to collector: AD, J.A. Dumoulin; ADO, J.H. Dover; AHe, Carl Huie; AK, J.S. Kelley; AMH, M.L. Miller; AMM, M. Mullens; ANk, W.J. Nokleberg; ANs, S.W. Nelson; Ha, E. Harris; Mu, C.G. Mull; JS (and STA), J.M. Schmidt, and Tr, I.L. Tailleux. CAI, conodont color alteration index. *, latitude/longitude herein corrected from previously published version. No., number; loc. locality; indet., indeterminate]

Locality No., map unit	Quadrangle, latitude/ longitude	Fossils [field No.; USGS collection No.]	Age [CAI]	Reference, remarks (see "References cited" following section on biostratigraphic data)
155 Mi [cont.]	Howard Pass B-3 68°15'22"/ 157°20'17"	Conodonts, brachiopods [93Ha136; 32194-PC]	Conodonts indicate early Early Mississippian (middle to late Kinderhookian); brachiopods indicate Carboniferous. [3.5-4]	Mull and others, 1997, table 1.
156 Mi	Howard Pass B-3 68°15'07"/ 157°20'10"	Conodonts, brachiopods [93Mu63; 32201-PC]	Brachiopods indicate early Early Mississippian (late Kinderhookian; <i>Calvustrigis rutherfordi</i> Zone); conodonts indicate middle to late Kinderhookian. [3.5]	Mull and others, 1997, table 1. These authors assign rocks at this locality to the limestone and shale member of Kayak Shale.
158 JPii	Howard Pass C-3 68°36.5' / 157°20.0'	Radiolarians [78Tr232A; MR 5346]	Late Triassic	Murchey and others, 1988, table 32.3. Sample location approximate; based on latitude and longitude in Murchey and others (1988).
160 IPMap	Howard Pass B-4 68°23.92' / 158°05'	Radiolarians [77AHe56; MR 0035]	Early(?) Mississippian	Murchey and others, 1988, table 32.3. Sample location approximate; based on latitude and longitude in Murchey and others (1988).

Table 5. Early fossil collections from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[Letters in field number refer to collector: (A)La, A.H. Lachenbruch; AMg, M.D. Mangus; K, AKt, B.H. Kent, Jr.; R, ARr, H.N. Reiser; T, (A)Tr, I.L. Tailleux. *Many collections in the west-central Howard Pass quadrangle published by Elder and others (1989) are mislocated; these locations have been replotted herein using the original field station maps and notes. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/longitude	Fossils [field station No. (field collection. No.); USGS collection No.]	Age	Remarks (see "References cited" following section on biostratigraphic data)
161 Mlri?	Howard Pass C-5 68°43'19"/ 158°53'24"	Spores: Well-preserved assemblage including <i>Hymenozonotriletes lepidophytus</i> Kedo [65ATr55.1, 55.2]	late Late Devonian (upper Famennian or Strunian).	Identified by R.A. Scott, USGS, April 1970, unpublished fossil report on shipments A-65-5D, 6D. Sample from clay shale, mudstone, and siltstone associated with hematitic quartz-pebble conglomerate and sandstone (to south) and carbonaceous shale interbedded with carbonaceous chert (to north). Spore-bearing strata included here with unit Mlri but may be previously unrecognized, unnamed older unit underlying unit Mlri. Similar rocks produced an identical spore assemblage 5.6 km east of the map area (65ATr122; Howard Pass C-2 quadrangle).
162 Kop	Howard Pass C-5 68°45'/ 158°48'32"*	Bivalves: <i>Buchia sublaevis</i> Keyserling [51T51 (51ATr177F); 23574]	early Early Cretaceous (early Valanginian).	Elder and others, 1989, table 1, loc. 95. Fossils occur in a section of dark clay shale with 30% very fine grained, dark-gray, rippled to even-bedded sandstone.
163 Mlri	Howard Pass C-5 68°32'49"/ 158°49'12"	Ammonoid cephalopod: <i>Münsteroceras</i> sp. [51T106 (51ATr392); 13240-PC]	Early Mississippian (late Tournaisian).	Gordon, 1957, p. 6, 13–15, 18. Both fossils from thinly interbedded gray-black chert, limestone, and calcareous shale. Sample 51ATr392 is from 440 ft stratigraphically below base of 105-ft-thick igneous sill; 51ATr393 is from 30 ft above sill.
		Ammonoid cephalopod: <i>Protocanites?</i> sp. [51T106 (51ATr393); 13241-PC]	Probably Early Mississippian (Tournaisian?).	
164 JPe	Howard Pass C-5 68°34'41"/ 158°46'37"	Bivalve: <i>Monotis</i> sp. cf. <i>alaskana</i> Smith [51K133 (51AKt169); 24052]	Late Triassic (Norian)	Identified by B. Kummel, December 1952, unpublished fossil report on shipment A-52-9. Fossil from limestone bed with abundant <i>Monotis</i> sp.
165 JRo	Howard Pass C-5 68°36'25"/ 158°44'17"	Bivalve: <i>Monotis subcircularis</i> Gabb [51K117 (51AKt150); 24051]	Late Triassic (Norian)	Identified by B. Kummel, December 1952, unpublished fossil report on shipment A-52-9. Fossil from gray coquinooid limestone interbedded with chert.
166 JRo	Howard Pass C-5 68°34'01"/ 158°44'02"	Bivalve: <i>Halobia cordillerana</i> Smith [51K103 (51AKt135); 24050]	Late Triassic (Carnian)	Identified by B. Kummel, December 1952, unpublished fossil report on shipment A-52-9. Fossil from light gray limestone associated with shale.
167 KJo	Howard Pass C-5 68°44'24"/ 158°25'44"*	Bivalves: <i>Buchia sublaevis</i> Keyserling <i>?B. keyserlingi</i> (Lahusen) [51T77 (51ATr266F); 23577]	early Early Cretaceous (early Valanginian).	Elder and others, 1989, table 1, loc. 99, and Jones and Grantz, 1964, p. 1464–65. Bivalves at this locality originally identified (by R. Imlay, USGS, 1952) as <i>B. rugosa</i> (Fischer) of Late Jurassic age, but reassigned to <i>B. cf. sublaevis</i> by Imlay in 1964. Fossils occur in coquinooid limestone.
168 KJo	Howard Pass C-5 68°44'13"/ 158°25'48"*	Bivalve: <i>Buchia sublaevis</i> Keyserling [51T75 (51ATr257F); 23697]	early Early Cretaceous (Valanginian)	Elder and others, 1989, table 1, loc. 99. Bivalves at this locality originally identified (by R. Imlay, USGS, 1952) as <i>B. rugosa</i> (Fischer) of Late Jurassic age, but reassigned to <i>B. cf. sublaevis</i> by Imlay in 1964. Fossils occur in 1-m-thick bed of coquinooid limestone.

Table 5. Early fossil collections from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[Letters in field number refer to collector: (A)La, A.H. Lachenbruch; AMg, M.D. Mangus; K, AKt, B.H. Kent, Jr.; R, ARr, H.N. Reiser; T, (A)Tr, I.L. Tailleir. *Many collections in the west-central Howard Pass quadrangle published by Elder and others (1989) are mislocated; these locations have been replotted herein using the original field station maps and notes. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/longitude	Fossils [field station No. (field collection. No.); USGS collection No.]	Age	Remarks (see "References cited" following section on biostratigraphic data)
169 Kon	Howard Pass C-5 68°42'25"/ 158°27'36"*	Bivalve: <i>Buchia crassicollis solida</i> (Lahusen) [51T72 (51ATr231F); 23576]	early Early Cretaceous (middle to late Valanginian).	Elder and others, 1989, table 1, loc. 96. Fossils occur in section of well-indurated, medium-yellow sandstone, in ≈1-m-thick beds, interbedded with shale and siltstone.
170 Koi	Howard Pass C-5 68°41'46"/ 158°28'26"*	Bivalve: <i>Buchia crassicollis solida</i> (Lahusen) [51T69 (51ATr209F); 23575]	early Early Cretaceous (middle to late Valanginian).	Elder and others, 1989, table 1, loc. 94. Bivalves at this locality originally identified (by R. Imlay, USGS, 1952) as <i>?B.subokensis</i> (Pavlow) and <i>B. cf. B. uncitoides</i> (Pavlow) and assigned a Berriasian age. Fossils occur in a 5-m-thick zone of rippled sandstone, in 2- to 4-m-thick beds; shells are abundant and in parallel alignment.
		Bivalve: <i>Buchia cf. volgensis</i> (Lahusen) [65Tr46.2; M2944]	early Early Cretaceous (Berriasian)	Elder and others, 1989, table 1, loc. 98. <i>Buchia</i> from medium-bedded "rhythmites" (of sandstone and shale), at least several hundred meters above base of formation.
171 Koi	Howard Pass C-5 68°41'02"/ 158°23'56"	Bivalve: <i>?B.subokensis</i> (Pavlow) [51K56 (51AKt57F)]	early Early Cretaceous (Berriasian?)	Near (perhaps equivalent to) M1268 in Elder and others, 1989, table 1, loc. 97. Fossil occurs in a section of greenish sandstone interbedded with shale.
172 Koi	Howard Pass C-5 68°40'26"/ 158°28'01"*	Bivalve: <i>Buchia crassicollis solida</i> (Lahusen) [51K67 (51AKt72F); 24041]	early Early Cretaceous (middle to late Valanginian).	Elder and others, 1989, table 1, loc. 93. Fossil occurs in a section of interbedded sandstone and shale.
173 JRo	Howard Pass C-5 68°32'42"/ 158°35'42"	Bivalve: <i>Monotis cf. subcircularis</i> Gabb [65Tr61.2; M2982]	Late Triassic (late Norian)	Identified by N.J. Silberling, USGS, November 1965, unpublished fossil report on shipment A-65-13M. Fossil from gray, platy-bedded, <i>Monotis</i> -bearing limestone, locally silicified, near top of Otuk Formation.
174 IPMk	Howard Pass C-5 68°31'55"/ 158°28'19"	Ammonoid cephalopod: <i>Bollandites kiligwae</i> Gordon, n. sp. [51Tr89 (51ATr319); 13204-PC]	Late Mississippian (middle Visean; Meramecian).	Gordon, 1957, p. 6, 7, 13-15, 18. Fossil from calcareous concretion in interbedded black chert and shale, about 150 ft above base of exposed section.
175 IPMk	Howard Pass C-5 68°31'08"/ 158°32'10"	Nautiloid cephalopod: <i>Cycloceras</i> sp. Ammonoid cephalopod: <i>Ammonellites polaris</i> Gordon, n. sp. [50T219 (50ATr300F); 11857-PC]	Early Mississippian (early Visean; middle or late Osagean).	Gordon, 1957, p. 6, 13-15, 17. Fossils from isolated 125-ft section of black platy shale containing calcareous nodules.
		Coiled nautiloid cephalopod Form recalls the genera <i>Millkoninckioceras</i> , <i>Subvestinautilus</i> , and <i>Lispoceras</i> , but fits none of them perfectly. [77Tr12G; 28594-PC]	Early Mississippian (early Visean; middle or late Osagean).	Identified by M. Gordon, Jr., USGS, July 1982, unpublished fossil report on shipment NPRA-81-1. Fossil from black siliceous shale, impure chert, and limestone; same locality as 50T219.
176 JRo	Howard Pass C-5 68°30'47"/ 158°34'08"	Bivalve: <i>Monotis subcircularis</i> Gabb [51R101 (51ARr141); 24053]	Late Triassic (Norian)	Identified by B. Kummel, December 1952, unpublished fossil report on shipment A-52-9. Fossil from thinly interbedded chert and shale.

Table 5. Early fossil collections from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

[Letters in field number refer to collector: (A)La, A.H. Lachenbruch; AMg, M.D. Mangus; K, AKt, B.H. Kent, Jr.; R, ARr, H.N. Reiser; T, (A)Tr, I.L. Tailleux. *Many collections in the west-central Howard Pass quadrangle published by Elder and others (1989) are mislocated; these locations have been replotted herein using the original field station maps and notes. No., number; indet., indeterminate; loc., locality]

Locality No., map unit	Quadrangle, latitude/longitude	Fossils [field station No. (field collection. No.); USGS collection No.]	Age	Remarks (see "References cited" following section on biostratigraphic data)
177 JFo	Howard Pass C-5 68°30'32"/ 158°34'26"	Bivalve: <i>Monotis subcircularis</i> Gabb [51R101 (51ARr142); 24054]	Late Triassic (Norian)	Identified by B. Kummel, December 1952, unpublished fossil report on shipment A-52-9. Fossil from black massive chert.
178 Koi	Howard Pass C-4 68°40'16"/ 157°48'47"*	Bivalve: <i>Buchia crassicolis solida</i> (Lahusen) [49AMg46; 24657]	early Early Cretaceous (middle to late Valanginian).	Elder and others, 1989, table 1, loc. 101.
179 Koi	Howard Pass C-4 68°33'47"/ 157°55'19"*	Bivalves: <i>Buchia okensis</i> (Pavlow) <i>Buchia subokensis</i> (Pavlow) [49La38 (49ALa74F); 21821]	early Early Cretaceous (Berriasian)	Elder and others, 1989, table 1, loc. 102; Jones and Grantz, 1964. Bivalves at this locality originally identified (by R. Imlay, USGS, 1950) as <i>B. crassicolis</i> Keyserling of Valanginian age. Fossils occur in section of graywacke and shale.
180 JPii	Howard Pass C-4 68°32'10"/ 157°51'22"	Bivalve: <i>Monotis subcircularis</i> Gabb [51T97(51ATr344); 24049]	Late Triassic (Norian)	Identified by B. Kummel, December 1952, unpublished fossil report on shipment A-52-9. Fossil occurs in very fine grained, dark-green to dark-brown sandstone containing abundant shell fragments.
181 Koi	Howard Pass C-3 68°34'23"/ 157°46'44"*	Bivalve: <i>Buchia crassicolis solida</i> (Lahusen) [50K233 (50AKt285); 22522]	early Early Cretaceous (middle to late Valanginian).	Elder and others, 1989, table 1, loc. 99. Fossil from fine-grained, dark-gray-green, micaceous graywacke.
182 KJo	Howard Pass C-3 68°37'30"/ 157°35'17"*	Bivalve: <i>Buchia crassicolis solida</i> (Lahusen) [50K164 (50AKt219F); 22519]	early Early Cretaceous (middle to late Valanginian).	Elder and others, 1989, table 1, loc. 100. Fossil from medium-grained, dark-gray-green graywacke.
183 KMi	Howard Pass C-3 68°38'28"/ 157°28'08"*	Bivalve: <i>Buchia</i> sp. [50K210 (50AKt257); 22521]	Jurassic or Cretaceous	Elder and others, 1989, table 1, loc. 104. Fossil from thin-bedded, fine-grained, gray-green graywacke with local iron staining.
184 Kop	Howard Pass C-3 68°36'58"/ 157°28'41"*	Bivalve: <i>Buchia crassicolis solida</i> (Lahusen) [50K135 (50AKt185); 22518]	early Early Cretaceous (middle to late Valanginian).	Elder and others, 1989, table 1, loc. 104. Fossil from cherty, medium-grained, dark-green graywacke.
185 KJo	Howard Pass C-3 68°36'/ 157°30'22"*	Bivalve: <i>Buchia sublaevis</i> Keyserling [50T115 (50ATr166F); 22507]	early Early Cretaceous (early Valanginian).	Elder and others, 1989, table 1, loc. 103; Jones and Grantz, 1964. Bivalves at this locality originally identified (by R. Imlay, USGS, 1952) as <i>B. aff. B. bronni</i> (Rouiller) of Late Jurassic age, but reassigned to <i>B. cf. sublaevis</i> by Imlay in 1964. Fossils occur in float of coquinoid limestone.
186 JDbc	Howard Pass B-4 68°24'11"/ 158°14'42"	Brachiopods: <i>Aulacella?</i> sp. rhynchonelloid, indet. <i>Cyrtospirifer</i> sp. spiriferoid, indet. "Athyris" (<i>Angelica</i> -type) [77Tr15.2; 10353-SD]	Late Devonian (probably Famennian)	Identified by J.T. Dutro, Jr., USGS, February 1981, report on shipment NPRA-81-1. Fossils from rubble of calcareous arenite associated with mafic igneous rocks.

Table 5. Early fossil collections from the west-central part of the Howard Pass quadrangle, Alaska—Continued.

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Locality No., map unit	Quadrangle, latitude/ longitude	Fossils [field station No. (field collection. No.); USGS collection No.]	Age	Remarks (see "References cited" following section on biostratigraphic data)
187 JFo	Howard Pass B-3 68°28'08"/ 157°45'47"	Bivalve: <i>Monotis subcircularis</i> Gabb [51T102 (51ATr367); 24036]	Late Triassic (Norian)	Identified by B. Kummel, December 1952, unpublished fossil report on shipment A-52-10. Fossil from section of shale and sandstone containing a few interbeds and concretions of calcareous shale. Exact location of sample along line of traverse is uncertain.
188 KDe (KJo?)	Howard Pass B-3 68°24'50"/ 157°12'04"*	Bivalve: <i>Buchia rugosa</i> (Fischer) [51T010 (51ATr19F); 23598]	Late Jurassic (Kimmeridgian)	Elder and others, 1989, table 1, loc. 109. Bivalves at this locality were originally identified (by R. Imlay, USGS, 1952) as <i>B. bronni</i> (Rouiller) and <i>B. cf. mosquensis</i> (von Buch) of Late Jurassic age; "probable" but "poorly preserved" <i>B. cf. mosquensis</i> was confirmed by Imlay in 1964. <i>B. mosquensis</i> and <i>B. concentrica</i> reported from this locality in Imlay and Detterman (1973, p. 26, loc. 4). Fossils from lenses of poorly developed pelecypod coquina within pebbly siltstone.