Alaska Geology

Newsletter of the *Alaska Geological Society*

Denali's Muldrow Glacier Surge 2021-2022

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On March 4, 2021, K2 pilot, Chris Palm was flying on the north side of Denali and noticed unusual crevasse activity on the Muldrow Glacier. He texted a couple glaciologists he just happened to know and by March 5th researchers across Alaska had reviewed satellite imagery and confirmed the Muldrow Glacier was moving fast and had finally begun its long-awaited surge since the last one over six decades ago.

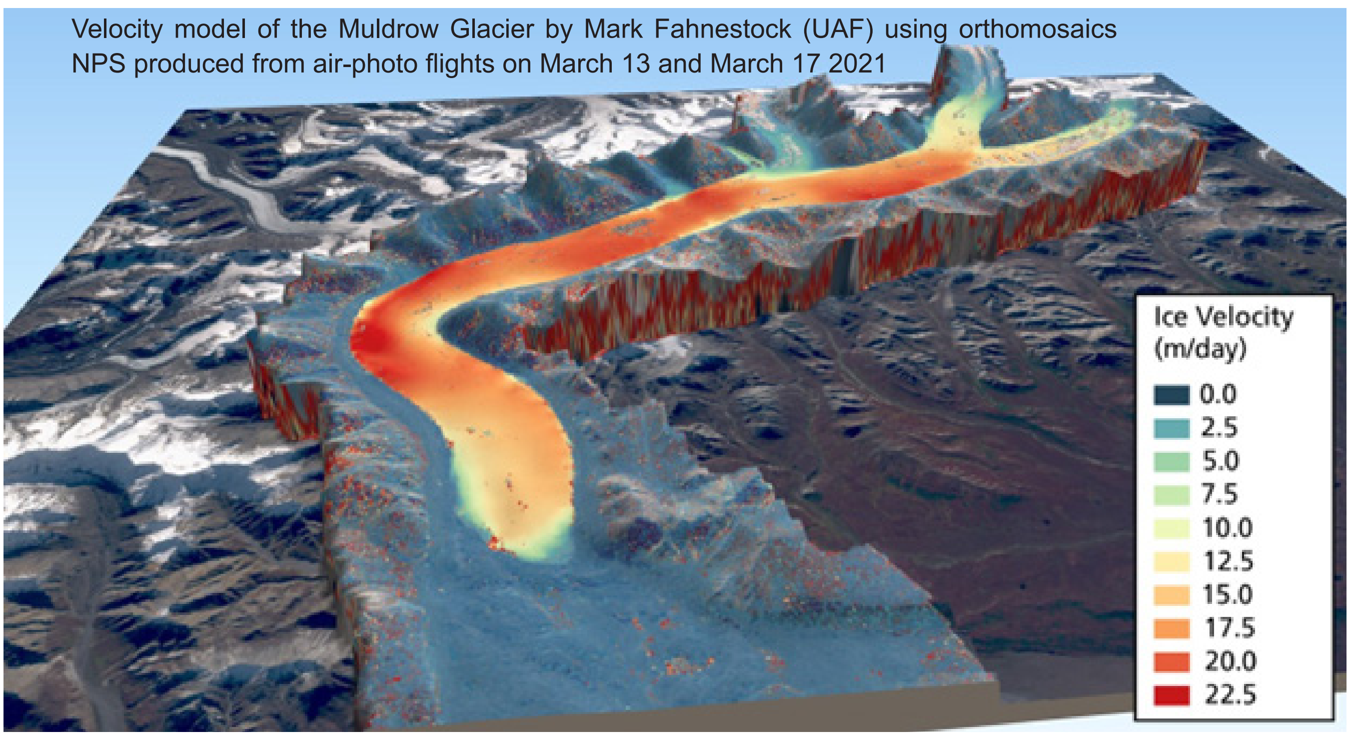
The Muldrow Glacier is a 39-mile-long surge-type glacier that originates high on the northeastern slope of Denali and meltwater forms the McKinley River. The last surge of the Muldrow occurred in 1956-57, at which time the glacier advanced over 4 miles. After hearing of the surge, the NPS held emergency planning meetings with as many scientists as possible to plan a flurry of observations of the now rapidly flowing glacier. Time-lapse cameras, sound stations, a water gauge, and two continuously operating GPS stations were deployed to capture the detailed motion of the surge. UAF graduate students were deployed to install seismometers and measure flow using ground-based radar. The NPS repeatedly flew aerial surveys to create a time series of elevational changes of the glacier surface. Elevation change analyses from SfM indicate over 100 meters of drop in the upper reaches of the glacier and over 150 meters of build up near the toe. Ice velocity measured using satellite image pairs by UAF researchers and the continuously operating GPS stations showed that the ice was flowing up to over 20 meters per day which is up to 125 times faster than the between surge flow rates that ranged from 0.16-0.25 meters per day over the last 60 years. Of particular interest to glaciologists was capturing the gradual and non-linear slow-down of the surge using the continuously operating GPS stations. In this presentation, you'll learn about the exciting opportunity this surge provided for better understanding surge processes and the impacts the surge has had on the traditional northern climbing route up the Muldrow Glacier.

AGS Meeting

Date & Time:	Wednesday, March 22; Doors open 11:30 am, announcements 11:45 am, talk 12:00 – 1:00 pm
Program:	Denali's Muldrow Glacier Surge 2021-2022
Speaker:	Chad Hults, National Park Service, Anchorage, AK
Place:	Live presentation at the Energy Center and virtually online; 1014 Energy Court, Anchorage, AK
Reservations:	Reservations are not required
Login:	For instructions on how to log in see AGS website: http://www.alaskageology.org/events.html
How to Join:	Join with Google Meet: meet.google.com/nao-drkn-rzz
	or join by phone: (US) +1 385-246-2960, PIN: 698 665 822#

Link to National Park Service article on Denali's Muldrow Glacier: https://www.nps.gov/articles/dena-muldrow.htm


Chad Hults installing time lapse cameras near Anderson Pass on March 28, 2021.



Velocity model of the Muldrow Glacier by Mark Fahnestock (UAF) using orthomosaics NPS produced from air-photo flights on March 13 and March 17 2021

About the Speaker:

Chad is the NPS Alaska Regional Geologist supporting parks on various projects including mining, geohazards, and glacier change. Prior to this, he worked for the USGS helping produce the geologic map of Alaska. The NPS Geoscientist-in-the-Parks internship program brought him to Alaska in 2001 after studying plate tectonics at Western Washington University. In 2002 he first stepped on the Muldrow Glacier to help with pre-surge baseline studies.

Pathfinders in Alaska Geology Wall of Fame

The geology of Alaska is exceptionally diverse and complicated. Mapping and understanding Alaska geology are further challenged by remoteness, rugged terrain, severe weather and limited infrastructure. A Pathfinders in Alaska Geology award has been established to recognize outstanding geoscientists that have risen above these difficulties and contributed significantly to synthesizing and understanding the geology, hazards, and resources of the state. These geoscientists will be honored with a photograph and citation on the Alaska Geological Society website and on a dedicated wall in the Geologic Materials Center in Anchorage, Alaska.

David Brew
Alfred Brooks
William Brosgé
A.F. Buddington
Stephen Capps
Robert Coats
Robert "Buck" Detterman
Arthur Grantz
David Hopkins
Ernest Leffingwell
Edward Mackevett
Thomas Marshall
George Martin
Walter C. Mendenhall
John Mertie
Donald Miller
Fred Moffit
Charles "Gil" Mull
Warren Nokleberg
William Patton
Troy Péwé
Louis Prindle
Donald Richter
Frank Schrader
Philip Smith
Josiah Spurr
David Stone
Irv Tailleur
Wesley Wallace
Florence Weber

It is with great honor, pleasure, and humility that the Alaska Geological Society's Pathfinders Committee announces the inaugural class of "Pathfinders in Alaska Geology". This award was established to recognize true trailblazers in the geosciences in Alaska; men and women who made enormous contributions to the general understanding of the geology of the Last Frontier.

The thirty individuals listed at left are inducted as the first Pathfinders class; they will be honored with a permanent display at the Alaska Geologic Materials Center in Anchorage. There also will be an annual dedication ceremony for newly inducted Pathfinders at the Alaska Geological Society's Annual Technical Conference. This year's conference will be held at the University of Alaska-Anchorage on April 22nd, 2023.

The composition of this first class was determined after several months of research and deliberation by a committee of 9 long-time Alaskan geologists. Following the 2023 AGS Technical Conference, the nomination process for future inductees will be posted and open to the public.

Congratulations to the inaugural class – we thank you for your efforts.

NEW DEVONIAN BRACHIOPODS AND A NEW DEVONIAN FORMATION FROM THE SHELLABARGER PASS AREA, DENALI NATIONAL PARK & PRESERVE, SOUTH-CENTRAL ALASKA

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The Shellabarger Pass area is situated in the Talkeetna C-6 quadrangle in the western part of Denali National Park & Preserve (DENA) of south-central Alaska (Fig. 1). The region preserves a stratigraphic record of rocks belonging to both the Dillinger and Mystic sequences of the Farewell terrane (Decker et al., 2004). Due to the remote nature of and limited access to Shellabarger Pass, limited geologic research has been undertaken in this portion of DENA. The geologic maps of the Talkeenta quadrangle by Reed et al. (1977, 1980) did not formally name any Paleozoic or Mesozoic stratigraphic units in the area of Shellabarger Pass. In this short note we outline recent research on the distinctive fauna of the recently established Emsian-age (Late Early Devonian) Shellabarger Limestone (Blodgett et al., 2022). The brachiopod fauna is very diverse and has been the subject of several focused studies (Blodgett and Brease, 1997; Blodgett, 1998; Blodgett and Boucot, 1999; Garcia-Alcalde and Blodgett, 2001; Blodgett et al. 2002, 2021, 2022; Baranov and Blodgett, 2022. Most interesting is distinctly Eurasian character of the brachiopod fauna, suggesting a probably origin by rifting from the Siberian craton during Late Devonian-early Carboniferous time like many of the other accretionary terranes of Alaska (see Blodgett et al., 2002 and 2010). Other elements of the fauna are found here as well (notably rugose corals, trilobites), but none (with the exception of the sponges by Rigby et al., 2009) have been studied in detail.

The Shellabarger Limestone was recently established (Blodgett et al., 2022) as a new litho-stratigraphic unit in the Shellabarger Pass region, Talkeetna C-6 1:63,360 scale quadrangle (Denali National Park & Preserve), south-central Alaska. The north-south trending stratigraphic section was measured along the eastern side of a small hillock situated near the center of the NE¼, SW¼, NE¼, sec. 15, T28N, R18W, Talkeetna C-6 1:63,360 scale quadrangle, latitude 62°31'21"N., longitude 152°35'32" W. (Fig. 2), at an elevation slightly above 700 m (2,400 feet). Photographs of the type section are provided in Figs. 3 and 4. The formation is the only Paleozoic age lithostratigraphic unit described and named date within Denali National Park & Preserve. Only three other units have stratotypes within this park unit: Cantwell Formation, Teklanika Formation and Mount Galen Volcanics, these latter units range in age from Cretaceous to Cenozoic (Henderson et al., 2022).

The Shellabarger Limestone type section, consisting of 38.7 m (127 ft) of lime mudstone and wackestone, was measured in a then unnamed late Emsian-age limestone unit (Fig. 2). See Blodgett and Boucot (1999) and Blodgett et al. (2002) for a description of the locality. In addition, the new formation has equivalent strata which appear to be present to the west and northwest in the Lime Hills 1:250,000 scale Quadrangle. This lithologic unit locally forms the base of the Mystic sequence of the Alaska Range (Blodgett and Gilbert, 1992; Gilbert and Bundtzen, 1984, Savage and Blodgett, 1995). Typically, the unit appears to be ~50 m (164 ft) thick through much of the central Alaska Range from Shellabarger Pass and to the west into Lime Hills C-5, C-6, D-4, and D-5, 1:63,360 scale quadrangles (Blodgett and Gilbert, 1992; Bundtzen et al., 1994; Blodgett et al., 2002). The Emsian limestone is closely associated with underlying strata of the Dillinger sequence in the Lime Hills D-4, 1-63,360 scale quadrangle, composed of deep-water turbiditic sandstone, siltstone, shale, and sparse limestones; however, a direct contact with the overlying Mystic sequence has not been observed (Blodgett and Gilbert, 1992). The youngest fauna in the local underlying Dillinger sequence is found in a limestone containing a predominately pelagic fauna consisting of abundant dacryoconarid tentaculitids, orthoconic natutiloids, and undetermined bivalves. A single species of conodont, *Pandorinellina optima*, was found, indicative of a Lochkovian (but not earliest Lochkovian) to Pragian age (Blodgett and Gilbert, 1992).

Among the brachiopod taxa of the Shellabarger Limestone, the gypiduloids are the most conspicuous, including *Carinagypa robecki* Blodgett et al., 2021 (Fig. 5), *Ivdelinia (Ivdelinia) tweeti* Blodgett et al., 2022 (Fig. 6), and the clorindid *Clorinda cappsi* Blodgett et al., 2022 (Fig. 7). Rhynchonellid brachiopods appear to be limited a single species, *Sibirirhynchia alata* (Khodalevich, 1951) (see Fig. 8) noted by Baranov and Blodgett (2022) to also be known from the Urals, the Siberian craton (Kuznetsk Basin), and Northeast Russia. Atrypid brachiopods, like the gypiduloids, are also extremely abundant in the Shellabarger Limestone. Illustrated examples here include *Atrypa* sp, *Variatrypa* sp., *Spinatrypa* (*Spinatrypa*) sp. and *Spinatrypina* sp. (all shown in Fig. 9). In addition, another common atrypid is the flattish and rather handsome *Carinatina* sp. (Fig. 10). Two eospiriferinid taxa are also present in the fauna: *Janius* cf. *J. vetulus* (Eichwald, 1860) (Fig. 11) and *Myriospirifer breasei* Garcia-Alcalde and Blodgett, 2001 (Fig. 12). Other brachiopod genera found in the Shellabarger Limestone, but not illustrated here, include *Opsicondion*, *Teichertina*, *Schizophoria*, *Undatrypa* and possibly *Warrenella*. It is most worthy to note that this fauna is typically Eurasian (close to described fauna from Taimyr, the Siberian Craton, the Urals, and Northeast Russia). In terms of Lower Devonian brachiopod biogeographic units the Shellabarger fauna is distinctly part of the Uralian Region of the Old World Realm (Boucot and Blodgett, 2001, p. 342; see Fig. 13). As noted therein “In this vast Region *Karpinskia*, *Ivdelinia*, *Sibirirhynchia*, certain endemic uncinuloids and gypiduloid, *Janius* and other eospiriferinids are characteristic forms. The abundance of these brachiopods clearly distinguish this unit from the otherwise similar Cordillerian Region, where these taxa are notably absent or are very rare in comparison.” None of these illustrated Shellabarger species have yet been recognized in age equivalent strata of the Ogilvie Formation or the Salmontrout

Limestone of east-central Alaska, which represented the northwestern extremity of cratonic North America (part of the Cordilleran Region of the Old World Realm) during Devonian time.

It is our objective to finish completion of the taxonomic study of the brachiopod fauna of the Shellabarger Limestone, with special attention being given to the paleobiogeographic affinities of the overall fauna. We have initiated a detailed taxonomic analysis and description of the brachiopod fauna from the unnamed overlying Frasnian (Early Late Devonian) stratal units in Shellabarger Pass, again with same objectives.

Blodgett expresses his thanks to the Committee for Research and Exploration of the National Geographic Society for providing funds in 1996 which permitted five days of fieldwork in the Shellabarger Pass area of south-central Alaska in late July of the same year. He also thanks Phil F. Brease (deceased) and Pam Sousanes of the U.S. National Park Service, Denali National Park & Preserve, for their able assistance with field work. Carl Bentley, helicopter pilot for Era Helicopters, capably got us into and out of the remote and beautiful area of the central Alaska Range. The Alaska Division of Geological & Geophysical Surveys of Alaska is also acknowledged for providing several brief reconnaissance helicopter trips into the Shellabarger Pass area to Blodgett in the early 1980s.

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Figure 1. Index map of Alaska showing location of Shellabarger Pass (from Blodgett et al., 2021).

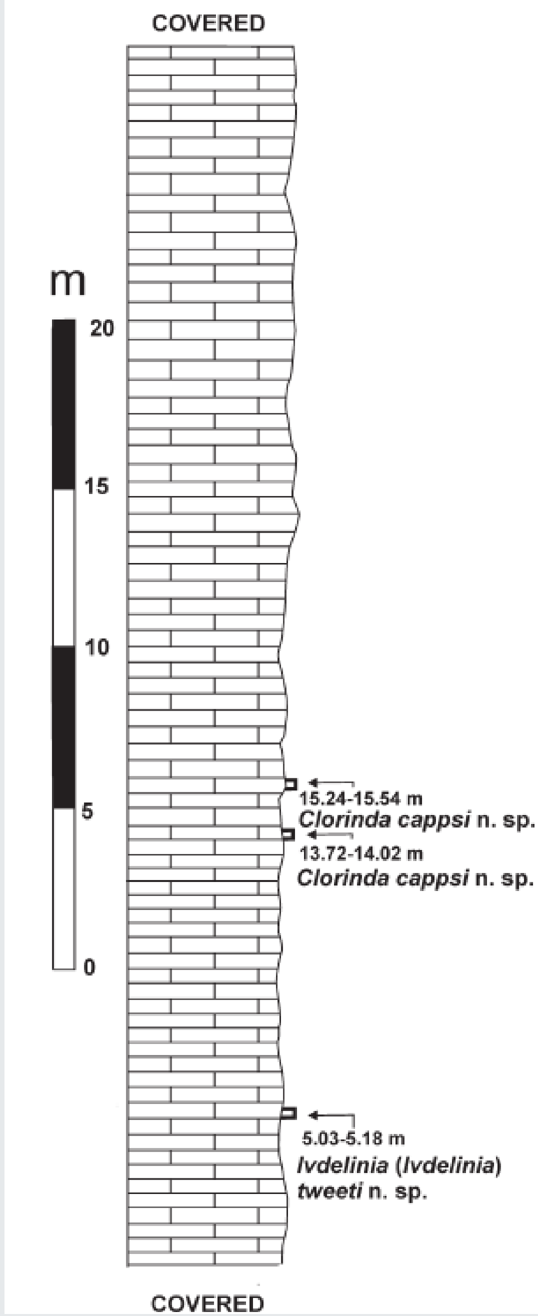

Figure 2. Measured type section of the Shellabarger Limestone. Situated at a single isolated limestone outcrop, it constitutes the oldest Devonian interval within the Dl unit of Reed and Nelson (1977, 1980). It forms the oldest stratigraphic interval within the Mystic sequence of Gilbert and Bundtzen (1984). This outcrop is situated on the eastern side of a small hillock situated near the center of the NE¼, SW¼, NE¼, sec. 15, T28N, R18W, Talkeetna C-6 1:63,360 scale quadrangle, latitude 62°31'21"N., longitude 152°35'32" W. The measured section of the outcrop indicates a minimum thickness of 38.7 m (127 ft) of lime mudstone and wackestone for the unit (Blodgett et al., 2021). The location of two of the here described brachiopod are indicated on the stratigraphic column of the type section (from Blodgett et al., 2022).

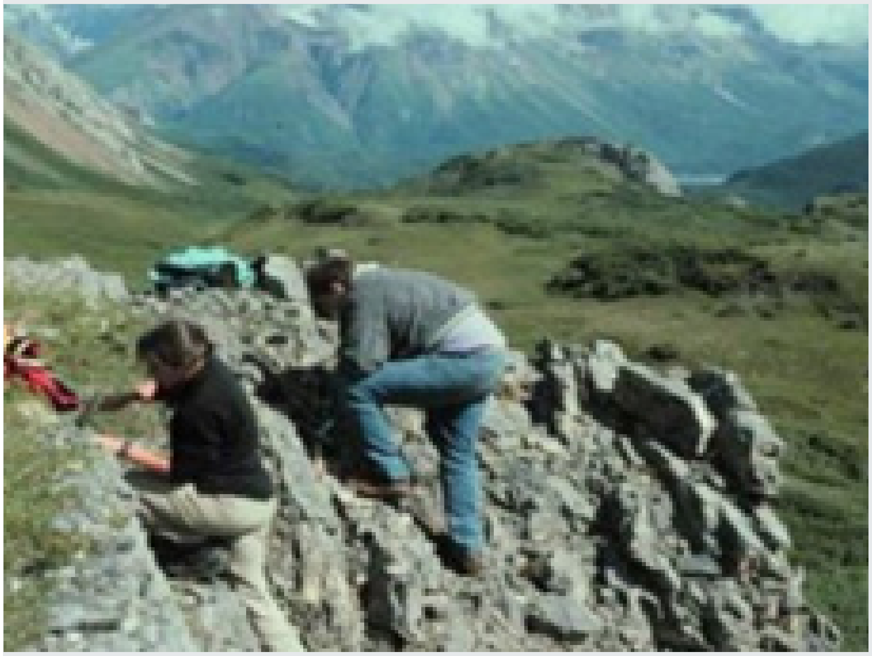

Figure 3. Outcrop of the upper part of the type section of the Shellabarger Limestone (Emsian, =Late Early Devonian) in Shellabarger Pass (view looking east-northeast). The two people in the photo are Pam Sousanes (NPS) (left) and one of the authors, Robert B. Blodgett (on right). [from Blodgett et al., 2022]

Figure 4. Another slightly differing view of the same outcrop in the previous figure, view looking east-northeast. View well demonstrates the rugged mountainous terrain surrounding Shellabarger Pass. The geologist in the view is the late Phil F. Brease (deceased, former NPS geologist, who was an extremely great supporter of paleontology within the park). [from Blodgett et al., 2022]

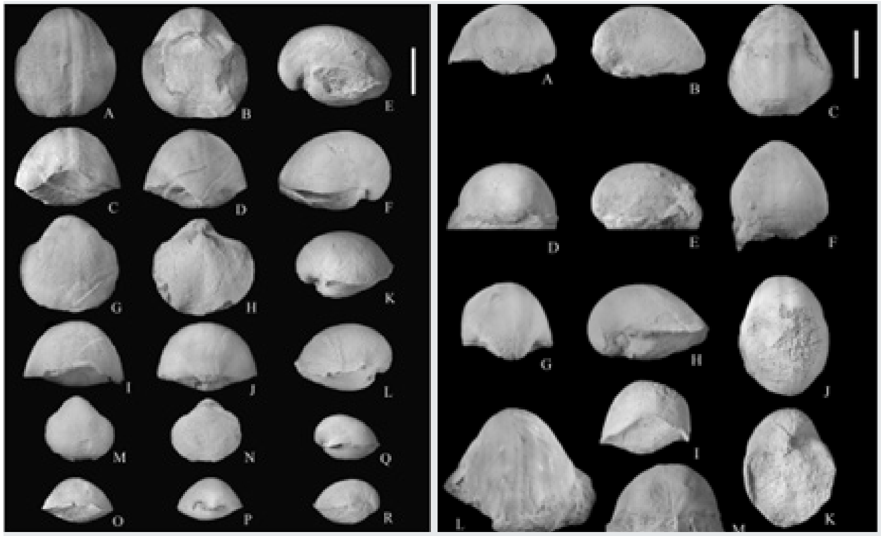

Figure 5. Two plates of the gypidulid Carinagypa robecki Blodgett, Santucci, Baranov, and Hodges, 2021. Scale bar = 10 mm.

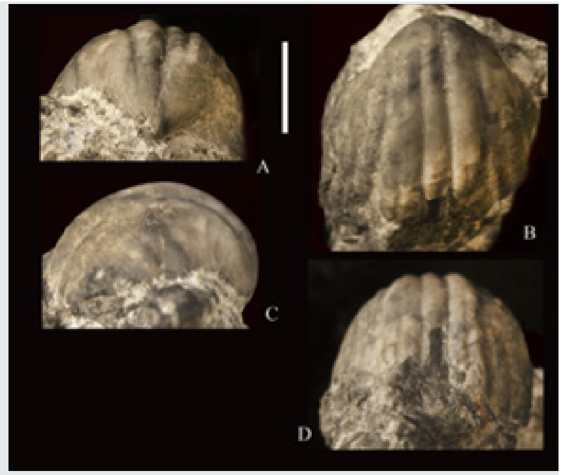

Figure 6. The gypidulid Ivdelinia (Ivdelinia) tweeti Blodgett, Baranov, and Santucci, 2022. Scale bar = 10 mm. Plate on left from Blodgett et al. (2022), and that on right is from Blodgett and Boucot, 1999).

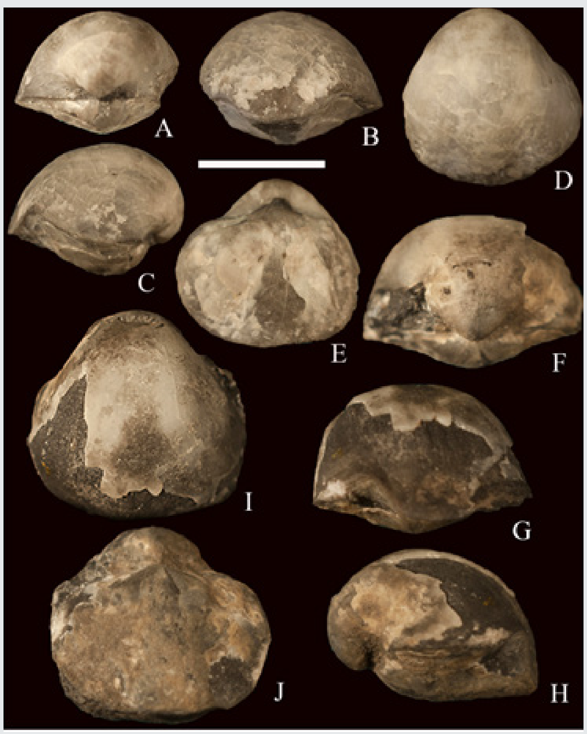

Figure 7. The clorindid brachiopod Clorinda cappsi Blodgett, Baranov, and Santucci, 2022. (from Blodgett et al., 2022). Scale bar = 10 mm.

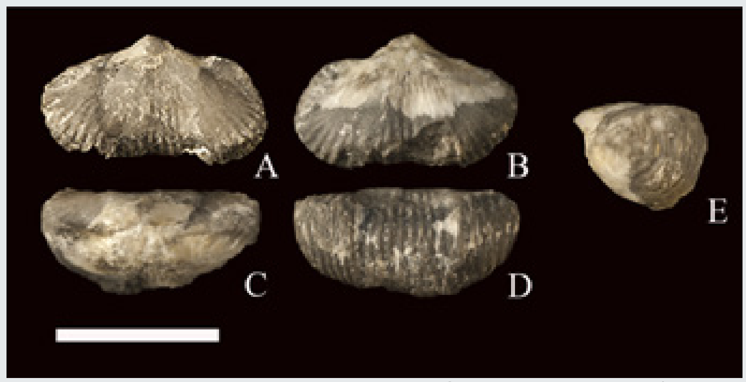

Figure 8. The rhynchonellid brachiopod Sibirirhynchia alata (Khodalevich, 1951). Scale bar = 10 mm. (from Baranov and Blodgett, 2022). This species is also known from the Urals, Siberian craton (Kuznetsk Basin), and Northeast Russia.

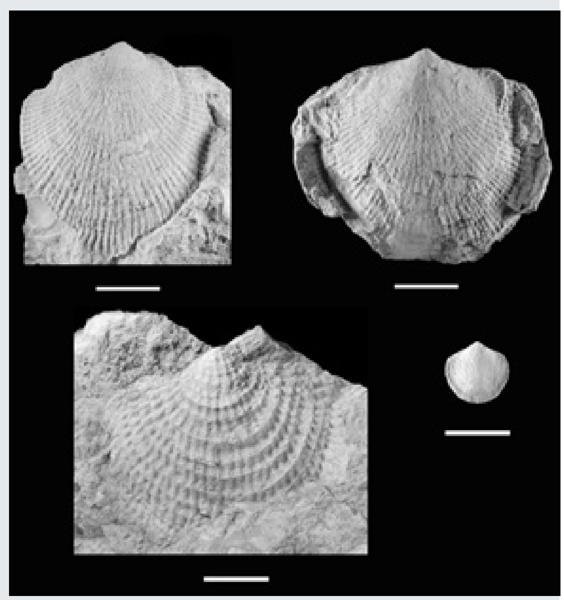

Figure 9. Ventral valves of four genera of atrypid brachiopods (left to right in two rows): *Atrypa* sp., *Variatypa* sp., *Spinatrypa* (Spinatrypa) and *Spinatrypina* sp. Scale bar = 10 mm.

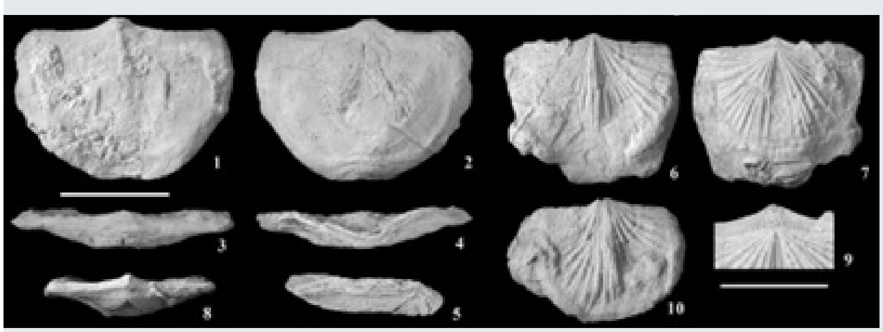

Figure 10. Several specimens of the atrypid *Carinatina* sp. (to be formally studied). Scale bar = 10 mm.

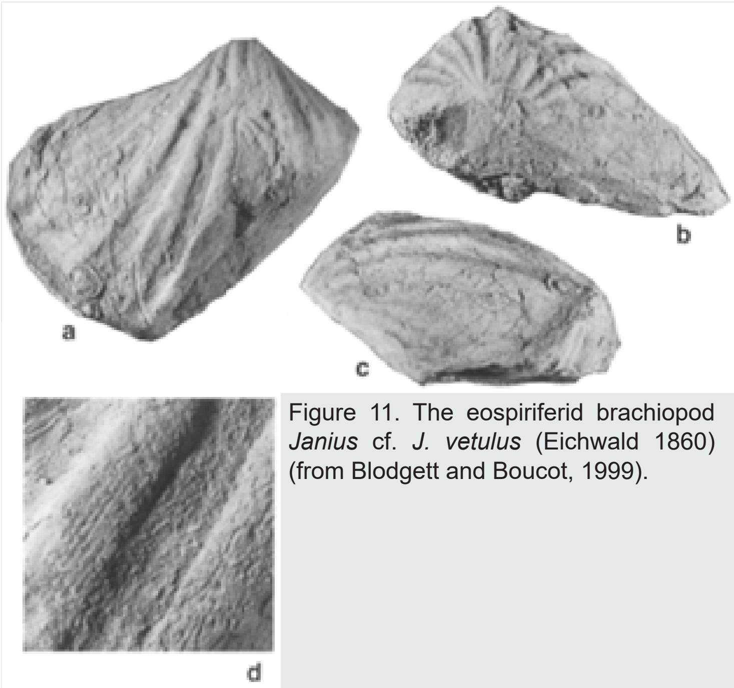

Figure 11. The eospiriferid brachiopod *Janius* cf. *J. vetulus* (Eichwald 1860) (from Blodgett and Boucot, 1999).

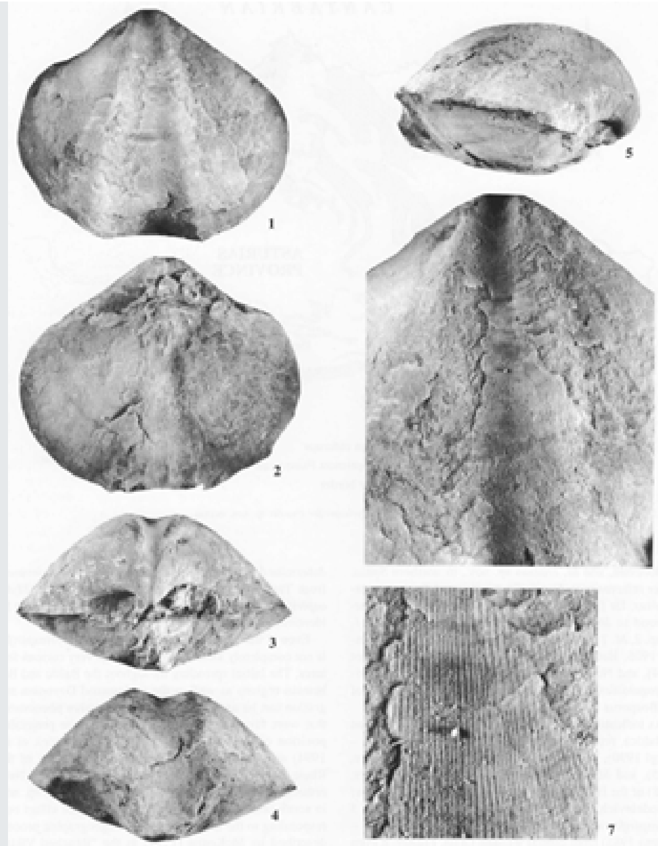

Figure 12. The eospiriferinid brachiopod *Myriospirifer breasei* Garcia-Alcalde and Blodgett, 2001 (from Garcia-Alcalde and Blodgett, 2001).

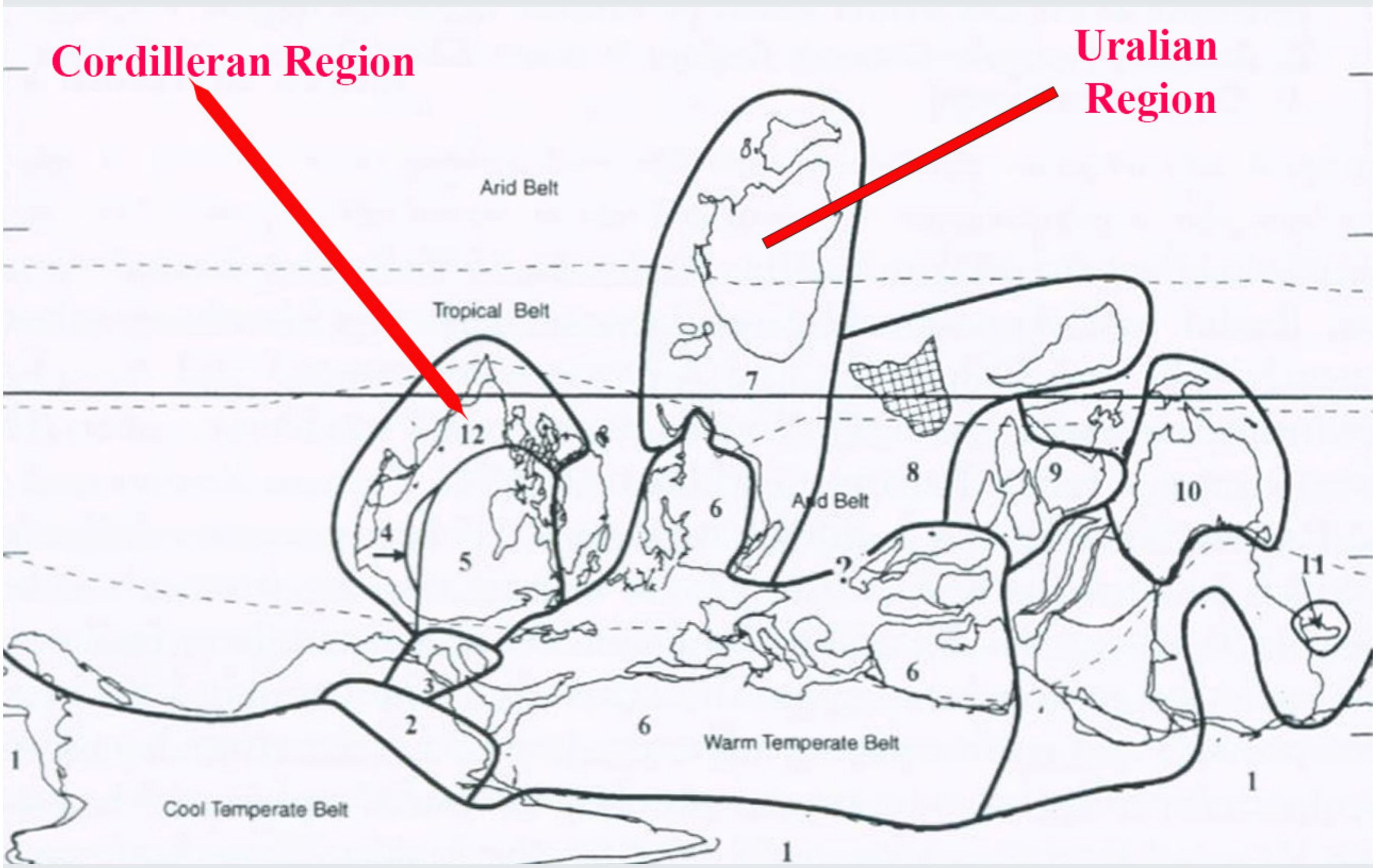

Figure 13. Early Devonian biogeographic units (from Boucot and Blodgett, 2001, Fig. 34.2). 1: Malvinokaffiric Realm; 2-5, Eastern Americas Realm (2: Amazon Subprovince; 3: Colombian Subprovince; 4: Nevadan Subprovince; 5: Appohimchi Subprovice); 6-12, Old World Realm (6: Rhenish Bohemian Region; 7: Uralian Region; 8: Balkhash-Mongolo-Okhotsk Region; 9: South China Region; 10: Tasman Region; 11: New Zealand Region; 12: Cordilleran Region). The Uralian Region appears to be the site of origin of many of Alaska's accretionary terranes (i.e. Arctic Alaska, Farewell, Alexander, and Woodchopper terranes).

Alaska Geological Society

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The Alaska Geological Society is an organization which seeks to promote interest in and understanding of Geology and the related Earth Sciences, and to provide a common organization for those individuals interested in geology and the related earth sciences.

This newsletter is the monthly (September-May) publication of the Alaska Geological Society, Inc. 300± newsletters delivered eletronically per month.

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MEMBERSHIP INFORMATION

AGS annual memberships expire November 1. The annual membership fee is $25/year ($5 for students). Lifetime menbership is $250. You may download a membership application from the AGS website and return it at a luncheon meeting, or mail it to the address above.

Contact membership coordintor Kirk Sherwood with changes or updates (e-mail: membership@alaskageology.org; phone: 907-240-2546)

All AGS publications are now available for on-line purchase on our website.

Complete catalogue at: http://www.alaskageology.org/publications1.html

ADVERTISING RATES

Advertisements may be purchased at the following rate: $200 for 9 monthly issues (September - May) of AGS newsletter (any size up to full page) and companion ad on AGS website for full year (beginning each September).

Contact Jennifer Crews at jennifer.r.crews@conocophillips.com to place ad.

Pick.Click.Give.

It's PFD Application Time!

Did you know that you can support the society through Pick.Click.Give? When you fill out your PFD application, just select Alaska Geological Society, Inc. in the list of non-profits and you can help AGS to promote the uniqueness of Alaskan Geology and provide for education, geologic research, and networking to all who are interested a well as provide scholarships to students across a wide range of geologic topics.

https://www.pickclickgive.org/index.cfm/pfdorgs.info/Alaska-Geological-Society-Inc

- **From the PFD home page http://pfd.alaska.gov/Application, select the green "Add or Change Your Pick.Click.Give. Donation" button**
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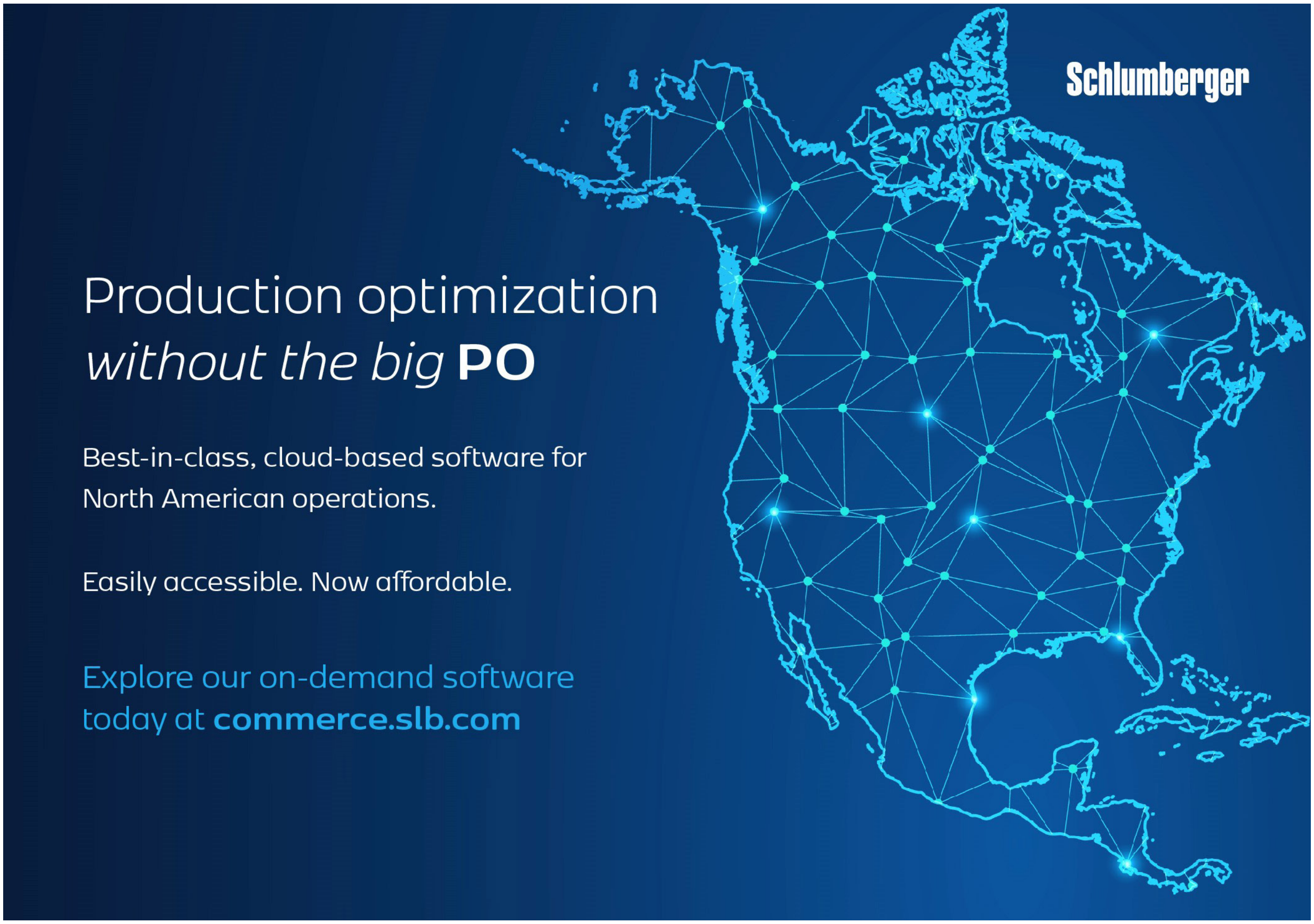
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Alaska Geological Calendar of Events

Date	Time	Organization	Event	Location
Mar 22, 2023	11:45 am	AGS	Chad Hults, National Park Service. "Rapid interagency response and science discoveries for the 2021-2022 Muldrow Glacier surge, Denali National Park"	Virtual Google Meet & Viewing at BP Energy Center
Apr. 22, 2023	8:30 am - 4:30 pm	AGS	AGS Technical Conference, "Theme Responsible Resource Independence"	ConocoPhillips Science Building, UAA
May 2023; Date to be determined	11:45 am	AGS	Speaker to be determined	BP Energy Center & Google Meet &

AMA: Alaska Miners Association; **AGS**: Alaska Geological Society: **GSA**: Geophysical Society of Alaska

AAEP: Alaska Association of Environmental Professionals; **SPE** Society of Petroleum Engineers;

UAA University of Alaska Anchorage.

Membership Note

Membership renewal is November 1; annual dues are:

Full member - $25

Student member - $5

Lifetime membership - $250

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