Update on the November 30, 2018 Anchorage Earthquake – A Geotechnical Perspective

John Thornley
Senior Geotechnical Engineer, Golder Associates

The M7.0 earthquake that shook on the morning of November 30, 2018 was the largest event to impact south-central Alaska since the 1964 Great Alaska Earthquake. What have we learned in the days and weeks following the event? This presentation is an effort to provide some answers from a geotechnical engineering perspective.

An overview of the variation of shaking across Anchorage will set the stage for the damage observed. Numerous accounts of liquefaction, lateral spreading, settlement, and ground failure will be summarized. Initial thoughts on the impacts of this earthquake to engineering design and future planning will be presented. If time allows, observations from a LiDAR changepoint detection analysis currently underway will be shown as well.

About the Speaker:

John Thornley is a Senior Geotechnical Engineer with Golder Associates in Anchorage. John received his Bachelor’s and Master’s degrees from University of Nevada Reno. While in Reno, John studied geotechnical and earthquake engineering.

John is currently working on a wide range of projects across Alaska, primarily focusing on transportation and building infrastructure. He has been involved in a wide variety of site-response characterizations, including seismic hazard analyses (SHAs), in both thawed and permafrost sites. In addition to working at Golder, he is chair of the Municipality of Anchorage Geotechnical Advisory Commission.

John is currently a PhD candidate at the University of Strathclyde Glasgow under the direction of Dr. John Douglas and is studying the seismic response of the Anchorage basin. In response to the Anchorage Earthquake in November John is acting as the co-lead for the Earthquake Engineering Research Institute (EERI) Field Reconnaissance efforts.

GSA/AGS Joint Luncheon

Date & Time: Thursday, January 10; doors open at 11:30 am, talk from 12:00 – 1:00 pm
Program: Update on the November 30, 2018 Anchorage Earthquake – A Geotechnical Perspective
Speaker: John Thornley, Senior Geotechnical Engineer, Golder Associates
Place: ConocoPhillips Building, Room ATO-1, 700 G Street, Anchorage, AK
Cost: Talk is free; Lunch (Moose’s Tooth pizza) is $15 with an RSVP or $20 at the door
For more information visit GSA’s website: https://www.geophysicalsocietyofalaska.org/luncheon-series.html
From the President’s Desk:

January is named for the Roman god Janus who looked both forward and back. We do a lot that this time of year. I was sorting some of the AGS correspondence, files and newsletters recently. I noticed that we had correspondence that goes back at least as far as 1957 when oil was discovered at Swanson River. That was 34 years after production ceased at Katalla.

Historic geological investigations actually predate the 1900s. Many important works and adventures by likes of Spurr, Brooks, Leffingwell, Martin, Mertie, Buddington, MacKevett and others provided us with the initial geologic framework which has evolved into Alaskan terranes. Grantz, Detterman, Tailleur, and others as part of the US Navy Oil Unit mapped much of the Brooks Range geology. This mapping and the Navy well results demonstrated the existence of resources which brought many of us to Alaska decades later. Gender breaking (?) work by likes of the Florences, i.e., Collins and Robinson; Ruth Schmidt and Helen Foster are an additional chapter of kinds of geologic opportunities here. Arlen Ehm edited the AGS-hosted symposium on the North Slope (1985) that’s still widely referenced. More than a few of us have had the opportunity to work with Gil Mull, Don Richter, the staffs at UAF, UAA, USGS and DGGS, etc. --- and utilized their geologic expertise.

I am not a historian and I have only mentioned a few of the many important folks who have helped steer our various geologic careers in Alaska. I profusely apologize for not being able to have mentioned so many others who have contributed equally, if not more. But I need to get this column finished. Although much fieldwork has been supplanted by the excellent collections at the GMC, labwork, modelling, spreadsheets, ‘scopes, seismic, logs, and LIDAR etc., there’s still adventure to be found in the data. Geology is, was and always will be wherever you find it. We and the varied grounds beneath our feet are this present and future. Let’s hope we all have many more years of geologic interest, commitment and excellence.

Art Banet, AGS President 2018-19

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My Pet Rock

Kenneth P. Helmold
Alaska Division of Oil & Gas

Medium-grained (0.27 mm) Nanushuk sandstone from the USGS Wainwright #1 Test Well. Rock framework consists largely of chert (c) and monocrystalline quartz (q) grains, with minor K-feldspar (kf) grains. Intergranular pores (φ) are common, with only local kaolinite (ka) cement. Reservoir quality is very good with measured porosity of 26.7% and Klinkenberg permeability of 753 md. Present burial depth is 1128 ft; maximum burial depth (Dmax) is 3890 ft.

For more information see: http://dggs.alaska.gov/pubs/id/29652

Send me a photo of your pet rock at: ken.helmold@alaska.gov
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HALOBIA CORDILLERANA SMITH, 1927

Robert B. Blodgett1 and Kenneth J. Bird2

1Blodgett & Associates, LLC, 2821 Kingfisher Drive, Anchorage, Alaska 99502, RobertBBlodgett@gmail.com
2Consultant, 966 El Cajon Way, Palo Alto, California, 94303, birddog966@comcast.net

The Upper Triassic (Carnian-middle Norian) bivalve genus Halobia is one of the most biostratigraphically useful bivalves in the Triassic, and virtually every field geologist working in Triassic strata of Alaska have encountered it, often in great abundance. The genus is characterized in having very thin shells; hence, they and ecologically similar bivalves (such as Monotis) are commonly referred to as “flat clams” and are found most commonly in organic-rich shaly rocks.

In the previous issue of this Newsletter (December 2018) we had an article reporting the occurrence of Monotis (Eomonotis) obtusicostata Westermann, 1966) from the Merak-1 well of Great Bear Petroleum along the Dalton Highway approximately 20 miles south of Deadhorse (Blodgett and Bird, 2018). We are currently in process of carefully analyzing the cored Shublik Formation interval of this well both for fossil faunal and lithologic features. In the middle Norian interval of the examined cores we not only find an amazing array of several species of the flat clam Monotis (Eomonotis), but also numerous specimens of the genus Halobia, all the latter which appear to belong to the species Halobia cordillerana Smith, 1927 (Fig. 1).

Halobia cordillerana was established by the paleontologist James Perrin Smith in 1927, who noted its presence at several localities in strata now referred to lower part of the Glenn Shale of east-central Alaska (part of stable cratonic North America), as well as in the Alexander terrane of southeast Alaska and the Hosselkus Limestone of northern California. The holotype specimen (reillustrated here in Fig. 2) is from exposures of the Glenn Shale on the south bank of Yukon River about 1 mile above the mouth of the Nation River. The species ranges from the early to the mid-Norian (McRoberts, 2010 and 2011), but here it is constrained to the middle Norian (Late Triassic) due its co-occurrence with the subgenus Monotis (Eomonotis). This widespread species has been reported previously from Alaska (Smith, 1927; Silberling, 1963; Dutro and Silberling, 1988), as well as British Columbia (McRoberts, 2011) and Northeast Russia (Kiparisova et al., 1966; Bychkov et al., 1976). Another specimen of this species is shown (Fig. 3) from the South Meade Test Well #1, as well as numerous specimens from British Columbia (Fig. 4).

REFERENCES


Figure 1. *Halobia cordillerana* Smith, 1927 from a depth of 10743.29' in the Merak-1 well on the North Slope. Specimen coated with ammonium chloride. Scale bar marked in cm and mm. Co-occurs in a core interval with *Monotis (Eomonotis) pinensis* Westermann, 1962 and *Monotis (Eomonotis) obtusicostata* Westermann, 1968, clearly indicating a middle Norian age.

Figure 2. Holotype specimen (right valve) of *Halobia cordillerana* Smith from USGS Mesozoic locality 8897, in beds of the lower part of the Glenn Shale exposed on the south bank of Yukon River about 1 mile above Nation River (from Smith, 1927, Pl. XCIIX, fig. 2). The same specimen was illustrated earlier under the name of *Halobia* sp. cf. *Halobia superba* Mojsisovics in Martin, 1916 (Fig. 1).

Figure 3. *Halobia cordillerana* Smith (coated with ammonium chloride) from the South Meade Test Well #1, 9057.5 ft. depth. Scale bar in both cm and mm.

Figure 4. Numerous specimens of *Halobia cordillerana* Smith from the Norian of British Columbia (from McRoberts, 2011, Fig. 21).
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<th>Date</th>
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<td>April 20</td>
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<td>AGS</td>
<td>AGS Spring Technical Conference ABSTRACTS DUE MARCH 15!</td>
<td>BP Energy Center, Anchorage</td>
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<td>UAA</td>
<td>Susan Wilson, 3rd Rock Consulting LLC “Ground Temperature monitoring”.</td>
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<td>Joe Chmielowski State of Alaska DOG “Pikka-Horseshoe, Willow and Smith Bay (Unraveling Three New Discoveries with Publicly Available Data)</td>
<td>BP Energy Center, Anchorage</td>
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<td>GSA</td>
<td>Dr. William Symes, Rice University 2018 SEG Distinguished Lecturer.</td>
<td>ConocoPhillips, Anchorage</td>
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<td>AGS</td>
<td>Dr. Erin Shea, University of Alaska, Anchorage “The end game of arc magmatism: Using geochronology and geochemistry to understand how arcs shut off”</td>
<td>BP Energy Center, Anchorage</td>
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<td>GSA/AGS</td>
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<td>Airman’s Banquet Hall, Anchorage</td>
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<td>Sept 18</td>
<td>11:45 am</td>
<td>AGS</td>
<td>Hannah Dietterich, USGS “Eruption response and preliminary observations of the 2018 eruption of Kilauea volcano, Hawaii”</td>
<td>BP Energy Center, Anchorage</td>
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<td>AGS</td>
<td>Chad Hults, National Parks “Service 3D modeling and detailed digital elevation mapping in Alaska National Parks”</td>
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<td>Nov 20</td>
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<td>AGS</td>
<td>John Lyons, USGS, “Can you hear me now? Monitoring and studying active volcanoes with low frequency sound in Alaska, Hawaii, and beyond”</td>
<td>BP Energy Center, Anchorage</td>
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<td>Dec 13</td>
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<td>AGS</td>
<td>Paul Decker, State of Alaska DOG, “Brookian topset stratigraphic plays: Petroleum systems elements”</td>
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<td>Jan 10</td>
<td>11:45 am</td>
<td>GSA/AGS</td>
<td>John Thornley, Golder Associates, “Update on the November 30, 2018 Anchorage Earthquake – A Geotechnical Perspective”</td>
<td>ConocoPhillips, Anchorage, ATO-1</td>
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<td>AGS/AMA</td>
<td>Rick Van Nieuwenhuyse (President and CEO of Trilogy Metals Inc), Arctic and Bornite Exploration Projects</td>
<td>BP Energy Center, Anchorage</td>
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<td>March 14</td>
<td>11:45 am</td>
<td>AGS</td>
<td>Rob Witter, USGS, “Ground Failures Induced by Seismic Shaking During the 2018 Anchorage, Alaska M7 Earthquake”</td>
<td>BP Energy Center, Anchorage</td>
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<td>April 23</td>
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<td>AGS/GSA/SPE</td>
<td>Joint AGS/GSA/SPE presentation, Shuvajit Bhattacharya (UAA Geophysics), Machine Learning Using Alaskan Geophysical Data</td>
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<td>In discussion: geological/technical presentation from Pebble Partnership or Greg Wilson (ConocoPhillips), TBD</td>
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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.

NEW! UAA Geological Science Department Weekly seminars: [https://www.uaa.alaska.edu/academics/college-of-arts-and-sciences/departments/geology/seminar.csh.html](https://www.uaa.alaska.edu/academics/college-of-arts-and-sciences/departments/geology/seminar.csh.html)
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