ALASKA GEOLOGY

Newsletter of the Alaska Geological Society, Inc.

Submarine Landslides and Tsunamis at Seward and Valdez Triggered by the 1964 Magnitude 9.2 Alaska Earthquake

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Note: AGS meetings will be at the BP Energy Center for 2008-2009.
Please check the website (www.alaskageology.org) and issues of the AGS newsletter for updates.
This newsletter promotes the September luncheon talk of the Alaska Geological Society, to be held Thursday, Sept. 11th at the BP Energy Center.

Submarine-landslide generated tsunamis caused the greatest loss of life and property in the 1964 magnitude 9.2 Great Alaska earthquake. Almost 90% (106/122) of lives lost in the earthquake are attributed to tsunamis, and about 80% of those deaths (85/106) were caused by submarine landslide generated tsunamis rather than tectonically generated tsunamis. Thus, lessons learned about the origin and generation of these submarine landslide-generated tsunamis can be useful to understanding and mitigating the hazard.

Our work uses newly collected high-resolution bathymetry, high-resolution seismic profiling, and coring data to greatly enhance our understanding of the submarine landslides in two fjords – Port Valdez, near Valdez, Alaska, and Resurrection Bay, near Seward, Alaska. In particular, we can better document the location and extent of the 1964 slides and deposits, image pre-1964 mass failure deposits, and model the tsunamis to better understand their physics. This talk will outline our current understanding of the slides in these two fjords. Geologic studies soon after the 1964 earthquake found that the seafloor was much deeper near the communities of Valdez and Seward than before the earthquake, and thus submarine landslides most likely generated the local tsunamis.

Seward, at the north end of Resurrection Bay, was the only town hit by tsunamis generated from both submarine landslides and tectonic sources. Within 45 seconds of the start of the 1964 earthquake, a 1.2-km-long section of waterfront began sliding into the ocean, and soon after, ~6-8-m high waves inundated the town. Comparison of pre- and post-earthquake bathymetry data allowed us to assess the location and extent of submarine mass failures and sediment transport. To determine the change in the seafloor, we assembled all older soundings from smooth

Alaska Geological Society Luncheon

Date & Time: **Thursday, Oct. 23rd, 11:30 am – 1:00 pm**

Program: **Submarine Landslides and Tsunamis at Seward and Valdez Triggered by the 1964 Magnitude 9.2 Alaska Earthquake**

Speaker: Peter Haeussler, U.S. Geological Survey

Place: **BP Energy Center**

Reservations: **Please make your reservation before noon Tuesday, Oct. 21st, 2008.**

Cost:

Seminar only, no meal:	**Free**
Reserve a box lunch:	**$13**
Nonmember:	**$15**
Reserve a hot lunch:	**$20**
Nonmember:	**$22**

No reservation: add $5 to the above (on an "as-available" basis only)

E-mail reservations: **vp@alaskageology.org**
Or phone (907) 230-1672
(Tom Morahan, AGS VP)

For more information: visit the AGS website:

www.alaskageology.org

sheets for comparison to a new NOAA multibeam dataset. We gridded the sounding data, applied corrections for coseismic subsidence, post-seismic rebound, unrecovered co-seismic subsidence, sea-level rise (tidal datum shift), and measurement errors. The new comparison shows multiple slides and farther sediment transport than previously thought. We estimate the total volume of slide material to be about 211 million m^3. Most of this material was transported to a deep, flat area, which we refer to as "the bathtub", about 6 to 13 km south of Seward. Sub-bottom profiling of the bathtub shows an acoustically transparent unit, which we interpret as a sediment flow deposit resulting from the submarine landslides. We use numerical modeling to recreate the mass failures and tsunami waves of the 1964 earthquake to test the hypothesis that the local tsunamis in Resurrection Bay were produced by a number of different slope failures. We find that numerical results are in good agreement with the observational data, and the model could be employed to evaluate tsunami hazard in other Alaska fjords.

The 1964 earthquake caused major damage to the port facilities and town of Valdez, most of it through the process of submarine-landslide generated tsunamis. Also, one of the highest tsunami wave runups ever documented (>60 m) occurred near Shoup Bay in Port Valdez. Post-earthquake assessments of the stability of the old townsite indicated a high likelihood of future failure, and the town was moved to a new location. Based on a comparison of pre- and post-earthquake bathymetry, an estimate of the net volume of landslide debris deposited in the basin is about 400 million m^3. Landslide features include (1) large blocks (up to 40-m high) near the location of the greatest tsunami-wave runup (~60 m) at the west end of Port Valdez, (2) two debris lobes associated with those blocks, (3) a series of gullies, channels, and talus, near the fjord-head delta at the east end of Port Valdez, and (4) the front of a debris lobe that flowed from the east end of the fjord half-way down the fjord. A seismically transparent unit is found above the debris-flow deposits in the deepest part of the fjord and likely represents very fluid sediment flows that occurred shortly following the deposition of the major debris lobes. Integration of the volume of debris flow deposits (mapped according to their acoustic signature) indicates a gross volume of about 1 km^3, showing that the landslides incorporated significant additional sediment from the fjord floor into the debris flows as they translated. Despite the large volume of sediment failures in the eastern part of the fjord, smaller, but more coherent block failures in the western part appear to be the primary cause of the largest tsunamis impacting the shorelines.

The 1964 mass failures in Port Valdez were not unique. We identified 5 additional sets of debris flow deposits, beneath parallel-layered reflectors, which we interpret as paleo-tsunami deposits. Assuming that the first set of debris flow deposits, imaged beneath the 1964 lobes, was deposited at the time of the penultimate megathrust earthquake (dated at 913-808 yrs b.p., Carver and Plafker, in press), we calculated a sediment accumulation rate of about 2 cm/yr for the inter-lobe deposits. This rate is comparable to that determined for post-1964 deposits using ^{137}Cs peaks in gravity cores from Port Valdez. Deposits attributed to submarine failures triggered by the 1964 and penultimate events have a similar distribution across the entire fjord. However, earlier events are not present in western Port Valdez, suggesting that failures related to the Shoup Glacier moraine did not occur until more recently. In addition, the oldest debris flow lobes tend to be thinner and have thinner sedimentary sequences between the lobes than the younger flows. This may be the result of more typical shorter recurrence intervals between megathrust earthquakes and perhaps differences in sediment input at the fjord head.

Speaker's Biography

Peter Haeussler received his B.S. degree from Michigan State University, his Ph.D. from the University of California Santa Cruz, and he did a post-doc with Dwight Bradley at the USGS in Anchorage before becoming a permanent employee. He has worked on various aspects of the tectonics and neotectonics of southern and southeastern Alaska. Haeussler is now head of the USGS' Alaska earthquake hazards project, where recent work has focused on understanding the paleoseismology and earthquake hazards of the Denali fault system.

The Alaska Geological Society

LUNCHEON SCHEDULE 2007 - 2008

Updates on the web at:
http://www.alaskageology.org

September 2008	Thurs., Sept. 11th Tom Homza An Introduction to the Petroleum Geology of Part of the 'Western Beaufort Sea
October 2008	Thursday, Oct. 23rd Peter Haeussler, USGS, Submarine Slope Failures Near Seward and Valdez, Alaska, During the 1964 Earthquake, and Implications for Local Tsunami Generation
November 2008	Thursday, Nov. 13th , Kirk Sherwood, MMS, Chukchi Sea, Alaska – Exploration History and Petroleum Potential
December 2008	Thursday, Dec. 11th , David Houseknecht, USGS, Brookian Sequence, Arctic Alaska
January 2009	Thursday, Jan. 15th, Tina Neal, USGS / AVO, 2008 Eruption of Okmok Volcano
February 2009	Thursday, Feb. 19st, Open
March 2009	Thursday, March 19th, Open
April 2009	Wednesday, April 22nd, Steve Jones, BP, Liberty Field Development
May 2009	Thursday, May 21st, Open

Please contact Tom Morahan, Program Chair, if you have suggestions for luncheon talks on the open dates.

The USGS Seminar Series

Thursday, October 16th, Noon - 1 PM.

Alaska Science Center [on the campus of Alaska Pacific University]
Glenn Olds Hall Conference Room
4210 University Drive 99508
call 786-7000 for directions

Seminar topic:

Josiah Edward Spurr - Explorations along the Yukon and Kuskokwim

by Stephen J Spurr (professor of economics at Wayne State University, Michigan)
[abstract]

Josiah Edward Spurr began his career with the Minnesota Geological Survey, producing the first geologic map of the great Mesabi Iron Range in Minnesota. On the strength of this work, he obtained a position with the U.S. Geological Survey in 1894, working for two years in the Utah and crossed the Alaska Range, traveled down the length of the Kuskokwim River, then headed southeast via an overland route to Shelikof Strait, terminating their voyage with the first scientific observations of Katmai volcano and the area that later became the "Valley of Ten Thousand Smokes." He detailed his party's findings in *A Reconnaissance in Southwestern Alaska in 1898*.

Spurr continued to work for the USGS until 1906, mapping many of the important mining districts in the American West and becoming a prominent researcher in the field of economic geology. In addition to his USGS publications, he also wrote *Geology Applied to Mining* (1904); founded the journal *Economic Geology* (1905), the first subject-specific geologic journal; and published *The Ore Magmas* (1923), a series of essays on ore deposition.

Spurr's Alaskan expeditions were made, of course, without benefit of airplanes, helicopters, boat engines, satellite phones, GPS units, or any of the other conveniences that modern field geologists employ. Along the way, he encountered Indians (who declined to serve as guides, explaining that his itinerary was much too dangerous), Aleuts, traders, missionaries, prospectors, whiskey smugglers, and con artists. He mapped the geology and bestowed names on numerous creeks, rivers, lakes, glaciers, mountains, and mountain ranges. Over the years, the favor was returned: named after him are Mt. Spurr, an active volcano near Anchorage; the mineral, spurrite; and the Spurr lunar crater.Colorado mining districts. In the summer of 1896, Spurr and two assistants were sent to map the gold districts of the Yukon River from Fortymile to Nulato; his 300-page report, *Geology of the Yukon Gold District*, was the definitive work on that region for many years. In 1898, Spurr returned north with topographer WS Post to map southwestern Alaska. Starting in Cook Inlet, their party

NEW READING

John Sweet's book "**DISCOVERY at PRUDHOE BAY**" is now available
Check Hancock House Publishers or Amazon

John, one of the speakers at our 2008 Tech Conference, will be glad to sign the book and pay for the return postage if you send the book to him. Alternatively, John would be more than happy to sign a stamp to place in the book.

The Alaska Geological Society, Inc.
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On the web at: http://www.alaskageology.org

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.

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MEMBERSHIP INFORMATION

AGS annual memberships expire November 1. The annual membership fee is $15/year. 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 coordinator Mark Olson with changes or updates (e-mail: mark.a.olson at conocophillips.com; phone: 907-263-4250)

All AGS publications are now available for on-line purchase on our website. Check to see the complete catalogue.
http://www.alaskageology.org/publications/

ADVERTISING RATES

Advertisements may be purchased at the following rates:
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1mo rate=(9mo rate/9)+$40 (rounded up).

Contact Tim Ryherd (907) 269-8771 for advertising information.

Meeting Information:
These links were all active as of 03/08/08. Please send updates to the editor: Greg Wilson 263-4748, or e-mail to Gregory.c.wilson at conocophillips.com

The **American Geological Institute** provides a comprehensive list of national and international geoscience meetings at: **http://calendar.agiweb.org**

Local Meetings:

American Water Resources Association—Alaska Section
http://www.awra.org/state/alaska/index.html

Alaska Geological Society
http://www.alaskageology.org
Lunch meetings are held monthly September through May in Anchorage. For more information, contact Art Banet, 334-5316.

Alaska Miners Association
http://www.alaskaminers.org/
The Anchorage branch of the AMA holds weekly meetings at 7 AM every Friday at the Denny's on Northern Lights and Denali. They hold regular luncheon meetings in association with SME. For more information, contact the AMA office at 563-9229.

American Institute of Professional Geologists
http://www.aipg.org
AIPG holds regular quarterly evening Section meetings in Anchorage and Fairbanks. For more information contact Mark Lockwood, President, at Shannon & Wilson, Inc., in Fairbanks, 907-460-7239.

Chugach Gem & Mineral Society
http://www.chugachgms.org
CG&MS holds all meetings at the First United Methodist Church on 9th Avenue. Contact their hotline at 566-3403 for information on regular monthly business meetings, monthly potlucks, and guidebook sales, including the new Alaska Rockhound Guidebook.

Geophysical Society of Alaska
http://gsa.seg.org/
Luncheon meetings are held monthly September through May at the ConocoPhillips Tower. For more information, contact Monte Mabry, 265-1653

Society of Petroleum Engineers
http://alaska.spe.org/
For more information, contact Jack Hartz at 375-8239.

UAS Environmental Science Program
http://www.uas.alaska.edu/envs

National Association of Geology Teachers (NAGT)
http://www.nagt.org/

From the President's Desk ….

In September 2007, I had the opportunity to travel to St. Petersburg to visit the very first geological research institute (known now as VSEGEI) established in Russia. During 2007, this institute celebrated their 125th year of existence (1882-2007). By Imperial Decree of Tsar Alexander III, the Geological Committee or GeolCom (Геолком) was established on January 31, 1882. Several name changes later, it is now known as the A.P. Karpinsky All Russian Geological Research Institute or VSEGEI (the English transliteration of the acronym ВСЕГЕИ or Всероссийский Научно - Исследовательский Геологический Институт им А.П. Карпинского). In order for me to visit the institute, my host, Professor Tatiana Koren (graptolite expert and stratigrapher) was required to fill out 10 pages of paperwork, but she gladly did this and it was a pleasure for me to visit the institute with my colleague Boris Nikitenko (Novosibirsk Institute of Petroleum Geology and Geophysics).

Jade inlay map of Russia near entrance to museum

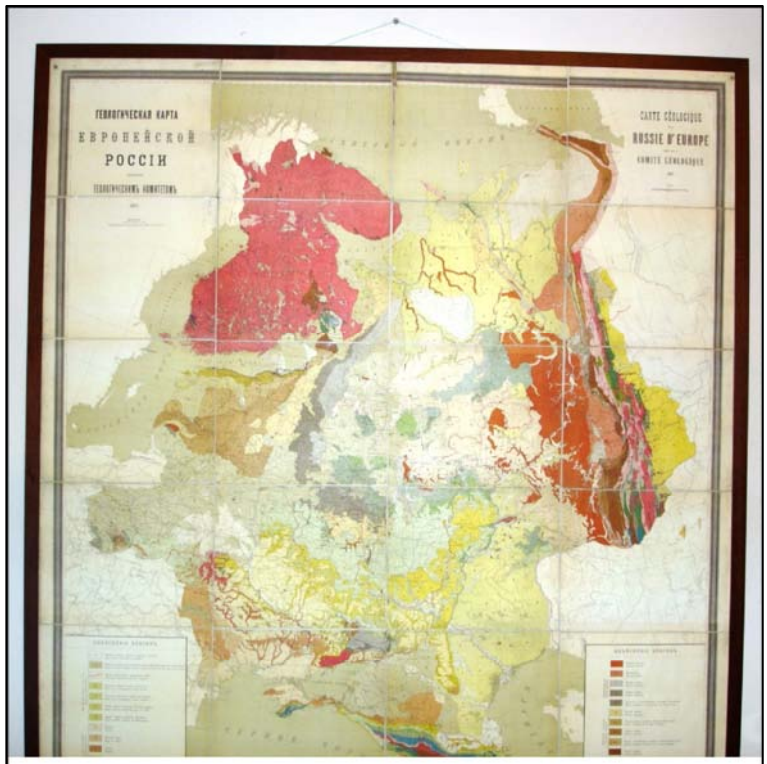
Geologists and paleontologists at the institute are involved in geologic mapping, stratigraphic and oil and gas studies of sedimentary basins, and metallogenic research throughout Russia. The institute occupies an entire city block and includes a large library (over 1 million books), a Center of Isotopic Research (including a Shrimp II ion microprobe), and a museum with exhibits of more than 80,000 samples of minerals, rocks, and fossil flora and fauna. Visitors to the museum exhibit halls are greeted by a large jade inlay map of Russia and treated to a red carpet tour of the outstanding displays of rocks, minerals and fossils.

One of the highlights of my visit to the institute was the opportunity to see the office of Alexander Petrovich Karpinsky, preserved with its original furniture. A.P Karpinsky became famous for his prolific research in paleontology, mineralogy, and petrology in the Urals

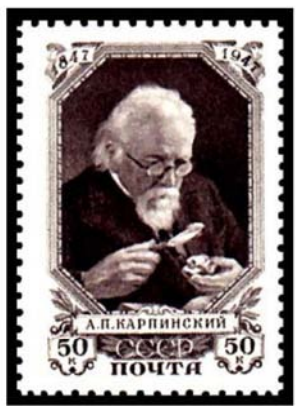
and served as GeolCom director from 1885 through 1902 and honorary director from 1905 until his death in 1936. He also completed the first Russian-made geologic map of European Russia that I observed hanging on the wall in this office. Dr. Karpinsky was instrumental in preserving scientific equipment and many invaluable records during the 1917 Revolution. He also secured an important role for the institute under the communist regime. Today there is a medal named in his honor that is awarded for outstanding geologic research in Russia.

I left my visit to the institute with a profound and better understanding of how the profession of Geology is celebrated (even venerated) throughout Russia by the government and its people. For example, they even have a Geologists' Day in Russia (first Sunday in April), and poems are written to celebrate geologists and their works. There was even a popular board game during Soviet time named "Geology", similar to our Monopoly, in which the players discovered important mineral and oil resources for the country. This love of Geology is reflected in the attention to geologic detail throughout the institute in both its museum and research branches.

- *Jim*



First Russian-made geologic map of European Russia (Western Russia) published in 1897 by GeolCom (now VSEGEI)



50 Kopek postage stamp honoring Karpinsky and Karpinsky medal awarded for outstanding contributions to geology.

2006 - 2007 Alaska Geological Society Board

Note: e-mail addresses now contain “at” instead of “@” Please change to @ when typing.

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