# GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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## THE GEOLOGICAL NEWSLETTER

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# TILLAMOOK COUNTY'S DISASTER MANAGER SPEAKS TO GSOC

Synopsis of the December 14, 2007 talk by Tom Manning, CEM Director of Tillamook County

by Carol S. Hasenberg

The dedicated GSOC members who were able to attend last month's Friday night meeting were treated to an inspiring glimpse at one of Oregon's most proactive and knowledgeable public employees – Tom Manning, the emergency manager of Tillamook County. His extensive experience with federal agencies and disaster mitigation makes it possible for one of the most disaster prone counties in Oregon to continually improve its performance in combating flooding, landslides and other natural disasters.

For flooding and landslide hazards Tillamook County rates the highest possible values used by the state of Oregon. The Wilson River, one of five rivers which feed into Tillamook Bay, is one of the most often flooded rivers in the state. Major floods on the Wilson River occurred in 1996, 1998, 2006 and in the recent December 2007 storm. These floods over-spilled the river banks and flooded low-lying land in the Tillamook Basin, including a commercial strip development along Highway 101 north of the town of Tillamook. Damages from the 1996 flood, in which the river level was 19.51 feet above flood stage, were $57 million. By implementing strict building standards for the flood zones in Tillamook County, the damages from the 1998 flood were only $3 million (20.26 feet above flood stage), and from the 2006 flood were $11 million (22.84 feet above flood stage).

The damages predicted in this year's storm were about $40 million, but not much of that was due to flooding. One bridge was washed out (a $3 million item), some railroad tracks and a major fiber optic cable line also washed out. The rest of the damages were due to high winds, which blew continuously for 30 hours.

The new building ordinances to minimize flood damages include a rule that if a structure is damaged at 50 percent or greater level in a flood they have to elevate or move. Some major businesses, such as the Safeway grocery store, have moved to higher ground, and others are following suit.

Despite gains in minimizing flood damage to buildings in the floodplain, some flooding problems are becoming critical which are related to past and present river bank management. Historically, the Army Corps of Engineers built levee systems around the Wilson River within the Tillamook Basin, and to maintain the river in its present course, the levees must be maintained and the river periodically dredged. Unfortunately, the federal government has abandoned the upkeep for this system, and the river just keeps on bringing its load of sediment down from the Coast Range. The Wilson River keeps trying to change its course into nearby Dougherty Slough during flood events, and several attempts to restrain this action have only been partially successful. The county has been doing experiments with set back rock levees for emergency events.

Manning described his efforts to secure federal disaster funds from this latest event and ongoing mitigation projects. Having experience in working at upper management levels in FEMA and as a State Hazard Mitigation Officer for the state of Nevada, he has been able to secure funds from a variety of sources, including a FEMA pre hazard mitigation grant, and all-hazard mitigation grants. Also the county has been able to obtain special legislative appropriations from the state of Oregon, economic development block grants, bonds and local and private funding. It's a very good thing that Tillamook County has such a great advocate and emergency manager.

Tillamook County Emergency Management Department website:
http://www.co.tillamook.or.us/gov/EMGMGNT/default.htm

# GEOLOGY IN THE NEWS

**LANDSAT HIGH RESOLUTION IMAGE OF ANTARCTICA IS AVAILABLE ONLINE**

For those of you interested in the results of polar research projects currently being done, or are planning a project of your own, there is a new high resolution map of Antarctica that is available on the following website:
http://lima.usgs.gov/

The images used in this mosaic were collected by NASA in 1999 and 2000. The resolution is on the order of tens of feet and is 10 times better than previous Landsat mosaics of Antarctica.

**BIG ROCKS FROM THE TYEE FORMATION BLOCK HIGHWAY 38 DURING THE RECENT STORM**

As if flooding and tree blow-downs did not cause enough damage in Oregon's early December 2007 storm, we also had house-sized boulders cascading onto an Oregon highway in Douglas County. Those GSOC members who attended the 2003 President's Field Trip to the southern Oregon coast might remember the Tyee formation cliffs which loomed above Highway 38 as it passes along the Umpqua River west of Elkton. Three massive boulders, the largest of which measured 30 feet in two directions, plus other debris blocked Highway 38 from Tuesday, December 4, to Saturday, December 8, 2007. Several hundred dump trucks were required to remove the debris.

# IN MEMORIAM – CHARLENE HOLZWARTH (1927-2007)

Charlene Marie McMahon was born in Beattie, Kansas. After graduating from Kansas State University, she headed west to Oregon, having an adventurous spirit. She worked as a case worker for Marion County Welfare Department until she married Milbert Holzwarth, a WW II veteran working for the US Forest Service in Hebo, Oregon. Milbert's jobs took them to live in John Day and Eugene before finally settling in Portland. She continued) her education at Portland State University. where she received her teaching certificate. She taught in the Portland elementary schools for 34 years, and after retirement, continued to do voluntary work for them.

After Milbert's death in 1982, she joined the Peace Corps and served two years in Sierra Leone, Africa, teaching English and demonstrating teaching techniques to village elementary school teachers. She oversaw projects to repair four remote schools and traveled throughout the country by motorcycle. She was active in the Grant Park Neighborhood Association, PTA, 4-H youth organizations. Native Plant Society of Oregon, and GSOC.

Charlene and Milbert became active members of GSOC in 1970. Charlene held the position as Historian for many years, until the time of her death in March 2007. She is survived by one daughter and two sons.

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Volume 73, 2007

compiled by Carol Hasenberg


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# Nominating Committee Results

The following slate of officers has been selected by this year's nominating committee:

President ..... Janet Rasmussen
Vice President ..... Carol Hasenberg
Secretary ..... Beverly Vogt
Treasurer ..... Richard Bartels
Director, 3 years ..... Dave Olcott
Director, 2 years ..... Jan Kem
Director, 1 year ..... Larry Purchase
Immediate Past President ..... Clay Kelleher (replacing Richard Bartels)
Past President ..... Bonnie Prange

Nominations are closed for this year's slate of officer's. The slate of officers will be voted on and approved at the February monthly meeting.

The Nominating Committee members are Larry Purchase as chair, Richard Bartels, and Jan Kem. Our thanks to the selected members and members of the Nominating Committee!

Don't forget that annual **DUES PAYMENTS** are due! Think about all those great member benefits for a mere annual fee of $20 for an individual and $30 for a family!

PS – If you joined GSOC in September or later, your 2008 dues are paid, good deal!!!

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**Phone (**_____**)**_____-_____ **Email address**_____

**Geologic Interests and Hobbies**_____

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# FOSSILFEST INFORMATION

## Hatfield Marine Science Center

Newport, Oregon
February 9, 2008

**FOSSILFEST ACTIVITIES**

FOSSIL IDENTIFICATION
Bring in your fossils for expert identification by Dr. William Orr of Univ.of Oregon and “Oregon Fossil Guy" DiTorrice.

FOSSIL SWAP
Tables will be set up for trading those extra fossils you may have. Bring in your specimens for identification and labeling. Bring in your own fossils for trading with fellow bone-bugs (these are rock-hounds who are into fossils). Pick up a fossil or two from the samples' table.

FOSSIL DISPLAYS
Representative fossils from the local Astoria and Nye formations (15-20 million years ago) will be on display. Table displays include fossils collected locally by the ³Oregon Fossil Guy" DiTorrice. A large table-top display showcasing highlights of fossils folks can find on Oregon beaches will be featured in addition to the multi-media presentation. DiTorrice will also display some Florida specimens including skate and ray plates, corals, snail and clam shells, dugong and whale bones, as well as a wide variety of shark teeth. A highlight of the Florida shark teeth display will be a number of large Megaladon teeth between five and seven inches in length!

A returning feature of Oregon State University's FossilFest is a table of donated beach fossil specimens for attendees to select samples to take home, along with printed copies of the OSU SeaGrant Fact Sheet "Fossils You Can Find On Oregon Beaches."

The North America Research Group (NARG) will display fossils from both Oregon and Washington and there will be a special display from Oregon Paleo Lands Institute (OPLI).

ACTIVITIES FOR CHILDREN
The North America Research Group (NARG) will bring several kids activities including digging for shark teeth, making a shark tooth necklace, painting a fossil replica, and an ammonite toss.

**PRESENTATIONS IN THE HENNINGS AUDITORIUM**

"Discovering Beach Fossils From America's Two West Coasts," 11:30 a.m.
This is a multi-media presentation featuring beach fossils from Oregon's Pacific Coast & the Gulf Coast of Florida. Newport fossil enthusiast Guy DiTorrice presents an entertaining and educational program with a focus on comparing and contrasting readily-available and legally-collectible specimens.

"Quality of the non-mammal vertebrates in Oregon's fossil record," 1:30 p.m.
Oregon's superb fossils of mammals often outshine the less common birds, reptiles, fish and amphibians. Despite this in the past few years some spectacular finds of all of the latter forms have come to light. New varieties of large Mesozoic marine reptiles have turned up in Eastern Oregon while fossil fish as a swordfish, birds including eggs, frogs and salamanders have been extracted from Tertiary and Pleistocene intervals of western Oregon. Entering these lesser known vertebrates into our fossil record fills in critical gaps in our knowledge of there lower vertebrate orders. Renewed interest in paleontology has stimulated systematic fossil hunting expeditions into all corners of the state with wonderful results. In addition to adding new taxa to the already diverse lists of prehistoric animals, many of these new animals significantly strengthen some of our theories of the geologic origins of the state. Presented by Dr. William Orr of Univ. of Oregon.

by William Hanshumaker
Public Marine Education Specialist
Extension Sea Grant Faculty
Hatfield Marine Science Center
2030 Marine Science Dr.
Newport, OR. 97365
541.867.0167
541.867.0320 (fax)

**GSOC ACTIVITIES FOR THE FOSSILFEST**

Lodging and Dinner Get-together
For lodging, the Econolodge (514/265-7723) or Days Inn (514/265-5767) motels in Newport are recommended as being conveniently located next to one another on Hwy. 101 and approximately $50 per night. Some GSOC members are already planning to stay at one or the other. Others may want to try the Sylvia Beach Hotel (888/795-8422) for its proximity to the beach and unique bookish charm, priced at $97+. Contact Janet Rasmussen (503/347-8787) for meeting place and time for Saturday dinner at a local restaurant.

NARG Field Trips
NARG is planning some field trips and GSOC members may contact Larry Purchase (360/254-5635) for more information.

**UPCOMING GEOLOGICAL LECTURES AT HATFIELD MARINE SCIENCE CENTER**

Thursday, January 31, 2008, 3:30 pm - 4:30 pm
Dr Laurence Padman, Senior Scientist, Earth and Space Research (ESR), Corvallis, OR, "Polar Ice and Global Sea Level Rise"

Thursday, February 7, 2008, 3:30 pm - 4:30 pm
Chris Goldfinger, COAS, OSU, "Holocene Great Earthquakes along the Cascadia subduction Zone: Riddle of the Sands"

For a complete lecture schedule and other information refer to the HMSC website at http://hmsc.oregonstate.edu/events.html.
and for the FossilFest
http://hmsc.oregonstate.edu/visitor/current.html

# IN MEMORIAM – TWO NORTHWEST GEOLOGISTS

## Paul Lawson (1918-2007)

"LAWSON, Paul Fredrick
Paul Fredrick Lawson passed away on Christmas eve at the age of 89. He was a husband, a father and a man of many interests, but most of all, he was a military man - an Army officer. He fought throughout the entire U.S. engagement in World War II,...[and] received a Silver Star and three Bronze Stars ... for his heroism. ... After retiring, he returned to college, receiving a degree in geology from Portland State University. He taught briefly at Portland State before becoming a geologist for the State of Oregon Bureau of Mining and Land Reclamation, retiring in 1987. He knew every inch of Oregon and most of Washington from his activities as state geologist and from his lifelong interest in rocks and minerals. He also had a passion for Native American history and its preservation. He was an outstanding photographer and took many photographs of Native American rock paintings as a volunteer archeologist. He also greatly enjoyed working as a volunteer at the Fort Vancouver National Historic site for 16 years. Last year, he donated over 1500 rare books and journals on Northwest history and archeology to the Fort, doubling the size of their library. He donated his extensive collection of books on geology, mineralogy, and paleontology to Portland State University's earth sciences department and his large collection of rocks and minerals to the Rice Museum in Portland."

"He was a lifetime member of the American Institute of Mining, Metallurgical and Petroleum Engineers and a member of the Oregon Archeology Society. He was most happy exploring the great beauty of the Pacific Northwest."

Excerpted from *The Oregonian,* 12/28/2007.

## Larry Chitwood, well known Bend geologist, dies at 65

A heart attack recently claimed the life of Portland State University alumnus and US Forest Service geologist Larry Chitwood, while taking a winter hike on Pilot Butte in Bend, Oregon. As a geologist for the Deschutes National Forest, Chitwood was known for his information on Newberry crater volcanic hazards, caving in the Bend area, and monitoring the bulge in the South Sister volcano area. Larry was warmly regarded and respected by his colleagues, and will be missed.

# BOARD MEETING NOTES

January 12, 2008

GSOC members present included Richard 'Bart' Bartels, Janet Rasmussen, Beverly Vogt, Marvel Gillespie, Larry Purchase, Jan Kem, John Newhouse, Bonnie Prange, Tara Schoffstall, Charlie Carter, Dave Olcott, Doug Rasmussen, and Rosemary Kenney.

Upcoming speakers and topics were discussed. Janet Rasmussen reported that Christina Hulbe will be the speaker in February. Information is being collected on upcoming speakers for geothermal energy and a fossil collecting seminar.

The FossilFest will be from 9 to 4 on February 9 in Newport. Presentations will be at 11:00 and 1:30. GSOC will have a table, which will be staffed by GSOC members who are available. Jan and Larry will get supplies and set up the table. Bart will contribute a rock and geological map display. NARG has field trips scheduled for Sunday.

GSOC Field trips for 2008 were discussed. Bart and Bev will lead a three-day camping/geology trip to volcanic features in southeast Oregon in late June or early July. Janet is planning the President's trip to eastern Oregon gold mining country for September 3-10. Several other ideas were discussed.

Banquet plans were discussed. The banquet will be on March 9 at University Place at 3rd and Lincoln. Richard Hill will be speaking on Science and the Media. To encourage larger attendance, the board voted to set the price for the banquet at $24.50, which doesn't quite cover the cost of the dinner and expenses. A banquet ride service will be organized for members who are unable to drive or want to carpool. Members are encouraged to bring a friend, and nonmembers are welcome. Rosemary needs books and maps, which we hope will help defray the extra costs of the dinner. A raffle was discussed but not organized.

The annual GSA meeting will be in Portland on Oct. 2009 at the Convention Center. GSOC board voted to plan spouse events for the meeting.

Rosemary resigned from her positions as historian and hospitality chair. Jan Kem plans to bring newsletters and calendars to the Friday night meetings.

The next Board meeting will follow the Annual Meeting on February 8, and the next Saturday meeting will be on Saturday, April 12. The meeting was adjourned.

Edited from board meeting minutes by Beverly Vogt, GSOC Secretary.

# PSU GEOLOGY COLLOQUIUM

Winter 2008 Seminar Series
2008 Winter Term
Portland State University Geology Department

Wednesdays: 3:30pm, S-17, Cramer Hall
Topic for the colloquium is "Isotopic geochronometers and geochemical tracers".

Schedule is available online at http://www.geol.pdx.edu/.

# Baker County Geology

or

How I Want to Spend My GSOC Field Trip!!

January's Friday Night lecture speaker was Vicki S. McConnell, PhD., R.G., State Geologist. Dr. McConnell first came to Oregon through the Baker City office as a field mapper. Even though she has since moved to the Portland area, she was kind enough to offer her extensive knowledge on the area where we are going for the next President's Field Trip in early September.

Her talk centered on **three main geologic time frames**, which are broken down from oldest to youngest as follows:

**MESOZOIC ACCRETED TERRANES AND ASSOCIATED BATHOLITHS**

These are the oldest units in the Blue Mountains, and geologically the oldest events. In pre-Tertiary times, three major terranes slammed into the west side of the North American craton. Even though these terranes accreted onto the craton in the Mesozoic, they include rocks that are as old as the Paleozoic.

Baker Terrane

This terrane is composed of deep ocean sediments. It is the first suture onto the North American craton, and therefore the oldest event. It was later metamorphosed, and argillites are the type rock for the locality.

Wallowa Terrane

The Wallowa was the second terrane accreted. This terrane is composed of island arc material, with mainly limestones, metavolcanics, and metavolcanic sediments. The shallow marine deposits include the Martin Bridge limestone, which is full of fossils that are complexly folded and somewhat metamorphosed. The best exposures can be found in Hells Canyon.

Olds Ferry Terrane

This youngest terrane is also composed of island arc volcanics, but it also includes evidence of associated fore-arc marine deposits. The age of these rocks range mainly in the Mesozoic.

It is unknown if each terrane collided onto the craton separately, or if they crashed into each other and then accreted as a group. There is also another oddity when following the geology of the terranes from Alaska to California. While Alaska and California line up stratigraphically, the portion in Oregon is either completely missing or rotated. Exposures of the terranes are almost absent in the northeast corner of Oregon, and mainly start farther south in Baker County. The reason for this apparent absence is because farther north of Baker County, these terranes are covered on the surface by the next group, Miocene Volcanics - mainly Columbia River Basalts (CRBs).

**MIOCENE VOLCANICS**

Initially, these Miocene Volcanics were all lumped together as CRBs. However, field work established that certain flows are almost pure rhyolite, which is not typical for CRBs. This lead to the conclusion that at least two separate but concurrent events occurred to pour lava fields throughout the area, with the rhyolitic event being named the Powder River Volcanics.

Columbia River Basalts

These flows are known as LIPs: Large Igneous Provinces. There are not many of these huge outpourings of volcanic materials, considered flood basalts or flood volcanism, found around the world. In fact, at 200,000 sq. km and 25,000 cu. km., the CRB floods in the Oregon Territory are not the largest in the world. The Siberian and Ethiopian floods are much larger, with other floods found in Deccan, Etendeka, Parana, Karoo, and Southeast Greenland. Even the smallest flood of these massive flows eclipses the volume generated by the Hawaiian hotspot. Although the CRB flows occurred between 16-6 mya, impressively, most of the CRB's volume erupted within the first million years. The typical rock type is basaltic andesite.

Powder River Volcanics

When researchers mapped the so-called CRBs around the Baker City valleys, they found that they were not basaltic andesite, but instead rhyolite.

There were other differences as well, although the time frames for both events are the same. While the CRBs erupted with a gradual chemical evolution from basalt to dacite, PRV erupted chaotically, with olivine basalts (pure basalts) and pure rhyolites erupting at the same time.

**PLIO-PLEISTOCENE GLACIATIONS AND PROCESSES**

As time was growing short, Dr. McConnell quickly reviewed some photographs of areas where clear evidence of glacial processes has taken place, such as U-shaped valleys, and different examples of moraines that are still in good shape and easily identifiable. She also discussed the possible event that carved Hells Canyon. In an event similar to the Missoula Floods, Lake Bonneville also had a catastrophic failure. This led to a build up in Lake Idaho, which backed up and catastrophically failed in order to create Hells Canyon. There is some idea that Lake Idaho may also have backed up into Baker Valley.

There is a notable Plio-Pleistocene deposit behind the popular Baker City motel, Always Welcome. The sediments dip softly, sloping to the west. The material is mainly silts and sands, but amazing fossils have been found that may be able to tell what happened to create the unit. The current puzzle is figuring out where the Always Welcome unit fits into the stratigraphy of the surrounding area.

At the end of the talk, Dr. McConnell answered a few questions, including how the mechanism for the mineralization in the area is most likely associated with the intrusion of the Mesozoic batholiths along the suture zones and not black smokers, which one might think considering the Baker terranes were made of deep sea sediments. The lecture attendees are now looking forward to seeing all the Baker County geology next summer on the President's Field Trip. We would like to thank Dr. McConnell for introducing us to it.

Tara Schoffstall

# GSOC Annual Banquet Notes

**Rides to Banquet.**

Would you like a ride to the GSOC banquet March 9? Contact Clay Kelleher at 503-775-6263 (if no answer leave message) or email clayr2236kher@comcast.net. We already have five drivers signed up, including one from Vancouver and one from the Willamette Valley. Also call to add your name to the list of volunteer drivers.

**Donations**

Rosemary Kenney will be accepting donations of books, maps and other geology/natural history related items for the sale at the upcoming Annual Banquet.

Rosemary asks that you do NOT donate the following:

- NO rocks
- NO textbooks older than 5 years

For more information call Rosemary at 503/892-6514.

# Nominating Committee Results

The following slate of officers has been selected by this year's nominating committee:

| | |
|---|---|
| President | Janet Rasmussen |
| Vice President | Carol Hasenberg |
| Secretary | Beverly Vogt |
| Treasurer | Richard Bartels |
| Director, 3 years | Dave Olcott |
| Director, 2 years | Jan Kem |
| Director, 1 year | Larry Purchase |
| Immediate Past President | Clay Kelleher (replacing Richard Bartels) |
| Past President | Bonnie Prange |

Nominations are closed for this year's slate of officer's. The slate of officers will be voted on and approved at the February monthly meeting.

The Nominating Committee members are Larry Purchase as chair, Richard Bartels, and Jan Kem. Our thanks to the selected members and members of the Nominating Committee!

Don't forget that annual **DUES PAYMENTS** are due! Think about all those great member benefits for a mere annual fee of $20 for an individual and $30 for a family!

PS – If you joined GSOC in September or later, your 2008 dues are paid, good deal!!!

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Richard Bartels - 503/292-6939

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Jan Kem (2 years) – 503/246-2275
Larry Purchase (1 year) – 360/254-5635

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Clay Kelleher – 503/775-6263

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Jan Kem - 503/246-2275
**Assistant Business Manager:**
Rosemary Kenney – 503/892-6514

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**GSOC LIBRARY:** Rm. S7, Open 7:30 p.m. prior to meetings.
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**Phone (**_____**)**_____-_____ **Email address**_____

**Geologic Interests and Hobbies**_____

_____

**Please indicate Membership type and include check for appropriate amount:**

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**Make Check Payable to:** **The Geological Society of the Oregon Country**
**PO Box 907**
**Portland, OR 97207-0907**

# President's Field Trip

Getting a head start on the geology of Baker County, in addition to last month's article

The state Department of Geology and Mineral Industries have published a 2007 edition of *Oregon Geology* online, which includes the article "Early Pliocene (Blancan) Always Welcome Inn local fauna, Baker City, Oregon," by Jay Van Tassell, Eric Bergey, Calvin Davis, Misty Davis, Bryan Grimshaw, Jayson Kisselburg, Robert Ledgerwood, Story Miller, Carli Morris, Jesse Steele, Corby Wehymiller, Mark L. Ferns, Gerald R. Smith, H. Gregory McDonald, Jim I. Mead, and Robert A. Martin.

You can also view all previous copies of *Oregon Geology* and *The Ore Bin* by visiting this site http://www.oregongeology.com/sub/quarpub/OrGeo.htm.

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# GSOC ANNUAL MEETING

February 8, 2007

The annual meeting of the Geological Society of the Oregon Country was called to order at 8:00 p.m., February 8, 2007, in Room S17, Cramer Hall, Portland State University. The membership adopted the slate of new officers for the 2008-2009 year as presented by the Nominating Committee.

The board met after the speaker finished and conducted routine annual society business and key redistribution. The next GSOC Board meeting is scheduled for 10 a.m., April 12, at Rosemary Kenney's house.

Beverly F. Vogt, Secretary

# SUPPORT PORTLAND STATE UNIVERSITY'S GEOLOGY DEPARTMENT (and have fun doing it!)

You are invited to join Portland State University's Department of Geology for an evening of **Wine and Soils dinner** and wine tasting to **benefit graduate scholarships in Geology**.

Saturday, March 15th, 2008 from 5:30 to 10:00 pm University Place Ballroom, SW 4th and Lincoln.

Taste 20. Oregon wines from the Columbia to the Rogue and learn about the soils in which their grapes grow.

Costs:

- individual seat: $75
- sponsored table: $750 (for 8, includes acknowledgement in program)

For reservations or more information, call PSU Geology at 503/725-3022.

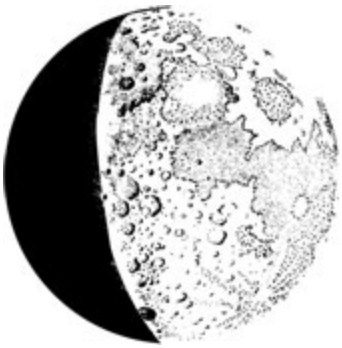
# PSU GEOLOGY COLLOQUIUM

Winter 2008 Seminar Series
2008 Winter Term
Portland State University Geology Department

Wednesdays: 3:30pm, S-17, Cramer Hall

Topic for the colloquium is "Isotopic geochronometers and geochemical tracers".

Schedule is available online at http://www.geol.pdx.edu/.



# SHOOTING FOR THE MOON

This article is dedicated to those house-bound individuals who are waiting for this long dismal winter to end. Meanwhile, you can look out of your window and occasionally, you might notice the moon in the sky. Or, if it is a cloudy night, you can imagine that you can see the moon, and look forward to seeing it again soon (we hope!).

## The Origin of the Moon

Any theory regarding the origin of the moon must account for a few facts (or deductions) that are known about the moon. These are:

- The moon is very large in proportion to the earth. The earth/moon system is unique in the solar system for that reason.
- The orbital plane of the moon about the earth is tilted 5 degrees from that of the earth about the sun. The moon's orbital plane does not coincide with the earth's rotation.
- The angular momentum of the earth-moon system is large. Earth has the shortest day of the inner rocky planets.
- The moon is less dense than the earth, due to the fact that the moon contains a much smaller iron core, proportionally, than that of the earth. The earth is also the most dense planet.
- The density of the moon is similar to that of the earth's mantle, at about 3.3 $gm/cm^3$. The density of the earth is more than 5 $gm/cm^3$.
- The moon contains very little molten iron. This is inferred from the weak magnetic field around the moon.
- The abundance of oxygen isotopes in lunar and terrestrial rock is very nearly identical, although this is not true for other bodies found in the solar system.

- The moon has no water, and few other volatiles.
- Evidence from lunar samples indicates that the moon once had an ocean of magma.

For the last 150 or so years, there has been much speculation about the origin of the moon. Four theories of lunar origin have been advanced over this period, and the Collision Theory is the only one of these that has not been eliminated by the constraints mentioned above. The theories are:

**Fission Theory:** The moon was a blob of material which was spun from a more rapidly rotating earth.

This theory was first formulated in the mid-1800's by George Darwin, the son of Charles Darwin. At the time, people thought it was plausible because it could account for the Pacific Ocean basin or the Atlantic Ocean. However, we now have a better explanation for the ocean basins (plate tectonics), and the angular momentum with which the primordial earth would have had to possess seems unlikely. Although it does account for the similarity in distribution between the oxygen isotopes of earth and moon, this theory is no longer considered as a viable possibility for the moon's origin.

**Co-Accretion Theory:** The moon coalesced at the same time as the earth from the primordial solar system debris.

This theory accounts for neither the low iron content of the moon, nor the lack of water, nor the large angular momentum of the earth-moon system.

**Lunar Capture Theory:** The moon was a separate body orbiting the sun which was captured by the earth's gravity.

This theory does not account for the similarity in distribution between the oxygen isotopes of earth and moon, which imply a close relationship in formation between the two bodies. Also, the moon is too large of a body for the dynamics of this theory to work.

**Collision Theory (or Giant Impact Theory, Big Whack Theory, Big Splat Theory):** The moon was formed when a large body, probably about the size of Mars, collided with the earth. The material which formed the moon basically came from material ejected from the proto-earth's mantle, and the iron cores of the proto-earth and the impacting body fused to make the present core of the earth.

This is the theory that is most commonly accepted today, and researchers are still looking at the dynamics of the moon's orbit, system momentum, masses of the original bodies and other parameters which can account for the current system conditions. It does explain the material makeup of the moon. It also accounts for the fact that the moon once had a magma ocean, from the heat generated by the impact.

Carol Hasenberg

**References and Additional Reading:**

Grego, Peter, The Moon and How to Observe It, Springer-Verlag, London 2005, 274 pages. Available from the Multnomah County Library system. Contains general information about the moon, as well as detailed descriptions of features in particular areas. It discusses the theories of lunar origin as well as the characteristics of the lunar orbit.

Wikipedia, The Geology of the Moon, http://en.wikipedia.org/wiki/Geology_of_the_Moon , last modified 12:33, 7 January 2008. This is an excellent page which has received a lot of work and attention.

Wikipedia, The Giant Impact Hypothesis, http://en.wikipedia.org/wiki/Giant_impact_hypothesis, last modified 17:09, 20 July 2007.

One of the most substantial reference works done on the geology of the moon was the 1987 USGS Professional Paper 1348, "Geologic History of the Moon," by Don Wilhelms. It is no longer in print, but can be downloaded in several Adobe Acrobat (*.pdf) versions from the website http://ser.sese.asu.edu/GHM/.

Canup, R. M.; Asphaug, E., "An impact origin of the Earth-Moon system," American Geophysical Union, Fall Meeting 2001, abstract #U51A-02, December 2001: http://adsabs.harvard.edu/abs/2001AGUFM.U51A..02C. This abstract describes a recent dynamic simulation of the collision theory.

Spudis, Paul D., The Once and Future Moon, Smithsonian Institution University Press, November 1996. This author has several other books about the moon and comes highly recommended.

Next month in *The Geological Newsletter:* "The Lunar Orbit"

# CLIMATE MODEL RESEARCH IN ANTARCTICA

Last February 8 at the GSOC Friday night the audience heard a fascinating account of Antarctic research by Dr. Christine Hulbe of Portland State University (PSU) Geology Department.

Editor's Note: Please refer to a previous article in *The Geological Newsletter*: "International Polar Year (IPY) Kicks Off! - part 2", Carol Hasenberg, Volume 73, No. 6, June 2007, pp. 24-26, for an introduction to land-based ice sheet research.

The end purpose of Hulbe's research is to provide an accurate description of the behavior of the West Antarctic Ice Sheet (WAIS) in order to more accurately portray its behavior in climate change models. To do this she must observe the ice sheet appearance, collect data about the age of various parts of the sheet to determine how fast the ice is moving in various areas, look at the movement of the ice throughout its cross section, and build computer models of the sheet to test her ideas about how it moves.

Dr. Hulbe explained that the reason she is studying the WAIS is that it is a much more efficient mover of ice than its much larger counterpart in "east" Antarctica (the EAIS). To compare the two ice sheets she showed the GSOC audience an enhanced elevation model of the continent. The EAIS is large and convex or pillow-shaped, which shows that it isn't moving ice out to the edges from the center faster than it is accumulating. The WAIS, however, has a definite concave shape, showing that ice is moving quicker than it can accumulate. There are several reasons for this, and Hulbe gave the following reasons:

- The base elevation of the WAIS is below sea level, where the earth's crust is thinner and so geothermal warming is greater on the bottom of the ice sheet.
- Much of the WAIS is underlain by marine sediments which are soft and do not inhibit movement of ice. By contrast, the EAIS is

underlain by a hard continental craton to which the cold ice adheres.

Also the reason that more accurate climate models are needed was demonstrated by Hulbe by showing the audience the results of some recent climate models which predicted that both the Greenland Ice sheet and WAIS should be mostly accumulating more ice rather than shedding it. This, however, is in contradiction to observations that are being made (especially in Greenland). These climate models cannot depict the hydrodynamics of ice flow and this is what is needed to improve them. They also run on a global scale, and are too coarse to predict the outflow of ice as smaller scale factors can greatly influence the movement.

The study area chosen for the project included the Ross Ice Shelf and the area from the shelf inland to the center of the ice sheet. Data for the analysis of WAIS was collected in a number of ways. One way to observe the outflow of ice from the sheet is to see the flow patterns made in the ice of the Ross Ice Shelf. The shelf preserves a 1000-year old record of ice flow off the sheet, in that the oldest ice at the edge of the shelf is 1000 years old. The Hulbe study used a visible light composite image of the sheet made from images collected in space from the MODIS sensor on NASA's Terra platform. When images taken at different times of day were overlain with one another, very detailed flow patterns could be observed in the ice shelf ice. In fact, the land origin could be seen as well as the history of flow of points in the ice shelf. Also, radar interferometry images of the WAIS could show the location of currently active ice streams.

Another means of collecting data was to go to Antarctica and make observations. This Hulbe did with her University of Washington collaborator Ginny Catania. They made visual observations and took seismic imaging data for cross sections of the ice by snowmobile. They studied the cross sectional data for clues about how the ice has move in the present and past. They discovered evidence of where the grounding line has been in the past from interpreting the cross sections. The grounding line, where land based ice meets the ice shelf (floating ice), is important in modeling ice movement.

After collecting all this information Hulbe has gone back to her computer and modeled the behavior of the ice. She has noticed that ice streams in the ice sheet can turn on and off in a matter of a few hundred years, where conventional models show that this happens in millennia. She has revised her assumptions about the flow viscosity and boundary conditions for the ice in order to produce a result using the computer for the ice flow of the last millennium that agrees with the flow seen on the ice shelf. Her hope is to work out a realistic model of past behavior so that future behavior of the WAIS can be most accurately predicted.

Carol Hasenberg

References and Additional Reading:

Note: To read all about the research Dr. Hulbe is doing, you may download an Acrobat file from her website (http://web.pdx.edu/~chulbe/) of the article, "Century-scale discharge stagnation and reactivation of the Ross ice streams, West Antarctica," by C. Hulbe and M. Fahnestock; published 23 May 2007, Journal of Geophysical Research, Vol. 112. The enhanced photo of the Ross Ice Shelf is included in the article.

"Tributaries of West Antarctic Ice Streams Revealed by RADARSAT Interferometry," I. Joughin, L. Gray, R. Bindschadler, S. Price, D. Morse, C. Hulbe, K. Mattar, and C. Werner (1999), Science 286, 283-286.

"Recent Antarctic ice mass loss from radar interferometry and regional climate modelling," Eric Rignot, Jonathan L. Bamber, Michiel R. van den Broeke, Curt Davis, Yonghong Li, Willem Jan van de Berg & Erik van Meijgaard, Nature Geoscience, Published online: January 13, 2008, doi:10.1038/ngeo102, http://www.nature.com/ngeo/journal/vaop/ncurrent/abs/ngeo102.html.

"Antarctic Ice Sheet Melting Speeds Up," A NASA News Release - January 23, 2008,

http://www.jpl.nasa.gov/news/news.cfm?release=2008-010 or http://geology.com/nasa/antarctic-ice-sheet-melting.shtml.

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# GSOC Annual Banquet Wrap-up

**Honors at the Banquet**

Another GSOC Annual Banquet was successfully completed March 9, 2008, at Portland State University's University Place conference center. Attendees included GSOC's distinguished member of longest standing, Dr. Ewart M. Baldwin. GSOC Past President Clay Kelleher was the master of ceremonies for the banquet, and he recognized outgoing treasurer Marvel Gillespie and six year board veteran John Newhouse with GSOC Fellowship Awards for their outstanding service to the society. Clay and other speakers also introduced the new GSOC board members, and recognized the contributions of several other GSOC members who have really helped keep the society on its feet – Beverly Vogt, Carol Hasenberg, Jan Kem, and others.

Outgoing GSOC President Richard "Bart" Bartels compared the success of his two presidential terms in his final address. He believes that the lessons learned in his first term helped out in the second. His words of advice to incoming President Janet Rasmussen included that it was important to have field trip guides who are familiar with the geology of the area for the sake of credibility. Bart was given a gift certificate for his excellent service as president, in lieu of the usual engraved rock hammer (since he has several of these).

In her inaugural address, President Rasmussen told GSOC members that her background as a nurse was no competition for that of the other GSOC board members, which she had just reviewed with the audience. However, GSOC members have come to have enormous respect for Janet's friendliness, energy, scholarship, and competence, and we are sure that her presidency will be quite distinguished.

**"Science and the Media"**

GSOC was very honored to have Richard Hill, the recently retired Science editor and writer for the *Oregonian*, as its guest speaker for the banquet this year. Mr. Hill had a distinguished career at the *Oregonian* starting in 1976, and had been a science writer since 1988. He acknowledged being most proud of the article "Blast from the Past", which preceded scientific publication that the Cascadia Subduction Zone's last great earthquake occurred on January 26, 1700 (at 9 p.m.!). He was also the recipient of the very first David Perlman Award for Excellence in Science Journalism in 2000 given by the American Geophysical Union for "his highly regarded coverage of seismic activity in the northwest".

Hill began the talk describing how he became a science journalist. He told the GSOC audience that he had "backed into" science writing by filling in for the *Oregonian* science writer when she went on vacation, and he found that he enjoyed science writing quite a lot. Science stories are different from political or crime stories because they have content that is much more variable. Also, science articles are interesting for their graphic "splashes" which draw people into reading them.

The meat of Hill's address focused upon a trend in the newspaper publishing industry which is making it very difficult for science journalists and science sections to survive: newspaper circulation is dwindling. Because of this, newspapers and newspaper staff are shrinking all across the nation. At their peak in the 1980's, Hill knew of 95 newspapers with science sections. Now he is aware of only two: The *Oregonian* and the *New York Times*. At a recent Science Writer's conference, he was one of only five newspaper science writers in attendance.

The science section of the *Oregonian* may also be endangered, even though Hill noted that in a recent poll it was cited as one of the most popular sections read – it has more loyal readers than the sports section or the home & garden section. The editorship of the science section has been passed to the lifestyles editor since Hill's departure. The current plan for the section is for it to dwindle to one page of wire news articles.

Hill also noted that many former newspaper science writers are now working for federal or state agencies, or as science writers for universities.

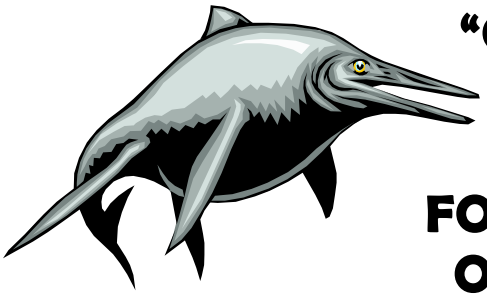
Science in the news media is becoming extinct and Hill thinks that this is an alarming trend, as science is becoming more and more important in people's daily lives. Where can the average person go to get news about science, he wonders? Also, where are the science articles that are important to us locally in the northwest?

Hill ended his talk by encouraging GSOC members as a society or as individuals to participate in the media's decisions by letting institutions like the *Oregonian* know how much we value our science news coverage. Editors do listen to what readers have to say. Also, the *Oregonian* has been setting up a science section in their website and this is to be encouraged as well. He especially encouraged us to let the *Oregonian* editors know that we appreciate local science coverage.

Hill also mentioned some locations where GSOC'ers can obtain local science news. He recommended a website called www.sciencenorthwest.org which is a clearinghouse for local university science news.

Carol Hasenberg

Hill's Perlman Award is described on this site: http://www.agu.org/inside/awards/bios/hill_richardl.html



# "OTHER" FOSSILS IN OREGON

This article is based on the presentation given by Dr. William Orr titled "The Other Oregon Fossils", at the Newport FossilFest on Saturday, February 9, 2008.

When we think of vertebrate fossils in Oregon, we are tempted to consider only the mammal fossils that are found in eastern Oregon in the John Day Fossil Beds National Monument. But there are many other fossils to be found in Oregon, and Dr. Orr gave his delighted audience a brief introduction to those at the FossilFest.

For example, there are many marine fossils to be found in the accreted terranes that underlie most of Oregon's volcanic rocks, which are exposed at the surface in a variety of locations. **Ichthyosaurs**, one of the most successful animal orders ever to exist in terms of biomass, have been found in Oregon, including the huge Shonisaurus. These animals were characterized by their hydrodynamic form, paddle-like flippers, and huge vertically-oriented tail (refer to the clip art near the title). They were pursuit predators which ate like crocodiles with their thin snouts full of sharp teeth. These animals became extinct at the end of the Cretaceous so all the fossils found must be Mesozoic in age.

Another order of oceanic predators, the **plesiosaurs**, are represented in Oregon fossils. These large animals were not as streamlined as their ichthyosaur cousins, so they would lie in wait for their prey and snatch them using their long necks and sharp teeth. The most well-known example of these is the Loch Ness Monster (just kidding, although no doubt fossils of the plesiosaur served as models for this mythical beast). Our local group of paleontological "enthusiasts", the North American Research Group (NARG), found plesiosaur fossils in Oregon of the short-necked variety. (Dr. Orr prefers to use the

word "enthusiasts" for groups like NARG which are using their skills for scientific research, and are more knowledgeable than the word "amateur" might suggest.)

A third group of oceanic predators, the **mosasaurs**, haven't been found yet in Oregon but were common in the Cretaceous and this are probably out there. Other large marine reptiles have been found, including **turtles** and **crocodiles**. The turtle found in the Coaledo formation near Coos Bay is nearly identical to the green turtle you can find swimming in the ocean today – they haven't evolved much in millions of years. The crocodiles mostly come from the Eocene Clarno formation and there have been several finds, including those of Earl Packard in the 1930's, and more recently, NARG.

Moving to land animals, you'd think with all these other Mesozoic fossils you'd find some dinosaurs, but only one **dinosaur** fossil has been found to date in Oregon, near Cape Sebastian. **Pterosaurs**, which were a sort of Mesozoic hang-gliding reptile and the first vertebrate to evolve flight, have also been found. A Jurassic pterosaur the size of a crow was identified by the large flange on the upper arm bone for the attachment of the flight muscles.

Bird fossils are well-represented in Oregon. There are many Ice-Age fossils of birds to be found. A fossil dig in Woodburn, famous for its human remains, has yielded fossils of a large vulture-like bird called the **teratorn** from a 16-foot specimen. The huge bone found resembled a human humerus, but was hollow. The record size of fossil birds of this type comes from Peru, with a wingspan of 22 feet! These are amongst the largest creatures ever to fly.

**Egg** fossils from birds have also been found, and the eggshells are identified by a distinct pattern of breathing holes when viewed under a microscope. (Dr. Orr humorously noted that he has spent 30 years rejecting stream pebbles and concretions that have been mistaken for egg fossils by collectors.) Dr. Orr mentioned a pelican-type of egg which has been found.

**Frogs** are an often found fossil in Oregon, but have not been well researched. Currently the Condon collection contains a number of their distinctive horn-shaped bones, but no researchers are studying them. **Fish** fossils are also common, but not as articulated skeletons, which are quite remarkable. Commonly fish scales are found and can be used to identify a species of fish. These are often used in oil exploration programs. Also, teleost fish have ear bones, or otoliths, to sense pressure which are commonly found. **Shark** teeth, composed of apatite which is nearly insoluble, are also found.

And lastly, Dr. Orr told the audience that the oldest fossils ever found in Oregon come from primitive fish called **conodonts** from the Devonian, nearly 400 million years ago.

Carol Hasenberg

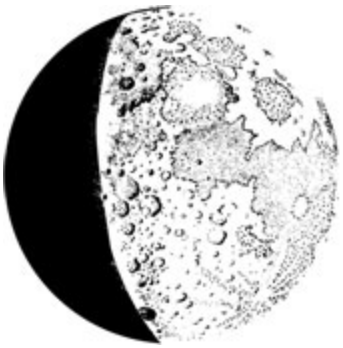
**References and Additional Reading:**

Orr, Elizabeth L. and William N., Oregon Fossils, Kendall/Hunt Publishing Company, 1998, 381 p.

Thompson, Ida, and Dickinson, Townsend P., National Audubon Society Field Guide to North American Fossils (National Audubon Society Field Guide Series), Alfred A. Knopf, Inc.; 8th Printing edition, 1982.

Shonisaurus popularis website:
http://www.oceansofkansas.com/ichthyosaur.html

Wikipedia also has articles on most of the fossils mentioned in this article.



# SHOOTING FOR THE MOON

*Editor's Note: I was very pleased to see that, just as my March 2008 article on the moon's origin came out, the weather obliged us with a number of clear nights with which to observe the moon. I also was pleased to see the moon's path behaving precisely as predicted by the following article on the moon's orbit – that is, the moon's path was highest near the first quarter and lowest near the third quarter last month. Hopefully, you will get a few clear nights this month for your own observations.*

## The Lunar Orbit

In case you've wondered why the moon seems to ride low in the sky at times and is far overhead at other times, this article is for you! It is possible to predict the location of the moon in the sky, and you don't need to be a rocket scientist to follow a few easy rules of thumb about the moon's location.

The basic facts about the moon's orbit which will serve as a background in the discussion are:

- The moon's orbit is slightly eccentric, which means it has a slightly oval shape.
- The plane of the moon's orbit around the earth is close, but not quite on, the same plane as the earth's orbit around the sun. The moon's orbit is tilted 5 degrees to the earth's orbit, and also the orientation of this tilt changes in a cycle which takes 18.6 years to complete.
- The moon's rotation takes one lunar month to complete, so the moon always faces the earth with the same side.

With these in mind, we can investigate the general characteristics of the moon's orbit. Looking at Figure 1 on page 22, we can see that the general height of the moon's path through the sky depends on the time of year and the phase of the moon. In Figure 1, the moon is shown in the position of its orbit (moon phase) for which it will attain the highest position in the sky on the first day of spring, summer, fall and winter in the Northern Hemisphere. This occurs when the earth's axis, or north pole, is tilted toward the moon. If the moon is in another phase at one of these dates (e.g., full moon in summer), then the moon will have a lower path through the sky.

Figure 2 gives a more detailed account of the moon's path near midsummer's day, June 21. If the moon is new at midsummer's day, then it will have a very high position in the sky, as shown on the right in the figure. Figure 2 was drawn with reasonable angular accuracy for a person standing at 46 degrees latitude, and the moon's highest point would be from about 17 to 27 degrees below the zenith. If, instead, the moon is full at midsummer's day, then the situation would be the one shown on the left side of the figure, because the full moon reaches its highest point at 1 a.m. (instead of midnight, due to daylight savings time). The full moon would have a maximum point of about 64 to 74 degrees below the zenith at its highest point.

The variations in the moon's maximum and minimum heights depicted in Figure 2 on page 22 are due to the inclination of the moon's orbit to that of the earth's orbit. Looking again at Figure 2, when the new moon is closest to the zenith, the orbit it will describe, following the dashed orbital plane, will also mean that the corresponding full moon will be lowest on the horizon. This means that over the course of a single month, the moon's path will change about 74-17 = 57 degrees. This condition, called a lunar standstill, occurred in 2006, and will occur again in about 17 years. In about 8 years, the difference between the highest and lowest points in moon's path will be about 64–27 = 37 degrees, shown in the figure as the other dashed line.

In addition to the change in moon path heights, the moon also seems to wobble slightly back and forth during its monthly journey. This phenomenon is

called libration. The moon also changes a bit in apparent size during the month. Both of these phenomena are due to the moon's eccentric orbit around the earth (the orbit is not exactly circular).

For earthbound observers, the moon's orbit is seen as the largest factor in the variation of the earth's tides. The largest tidal variations, called spring tides, occur when the sun, moon, and earth are in a straight line (called syzygy) at either the full or new moon. When the sun and moon are at right angles to one another from the earth, we have minimal variation, or neap tides.

Well, that's all the moon facts we can put in our little newsletter. I hope you enjoyed them, and keep your eye on the moon!

Carol Hasenberg

**References and Additional Reading:**

Wikipedia Orbit of the Moon. This site has a great little animation of the moon's libration:
http://en.wikipedia.org/wiki/Orbit_of_the_Moon

NASA JPL HORIZONS Web-Interface
This tool provides a web-based limited interface to JPL's HORIZONS system which can be used to generate ephemerides for solar-system bodies. Full access to HORIZONS features is available via the primary telnet interface. HORIZONS system news shows recent changes and improvements. A web-interface tutorial is available to assist new users. See Figure 3 on page 23 for the maximum heights of the moon's path charted from the data generated by this site.
http://ssd.jpl.nasa.gov/horizons.cgi#top

Wikipedia Lunar Standstill:
http://en.wikipedia.org/wiki/Lunar_standstill

Wikipedia Tide: http://en.wikipedia.org/wiki/Tide

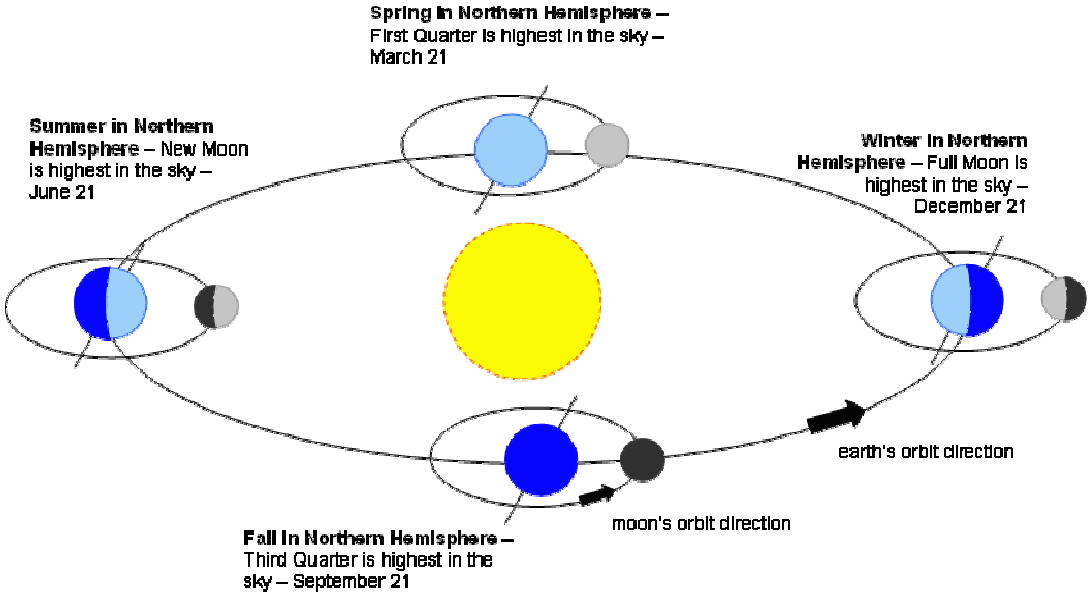



Figure 1. The moon's height in the sky depends on the season of year and the phase of the moon. When the earth's axis is tilted towards the moon at a particular time of year, that phase of the moon rides highest in the sky as shown. For example, near midsummer's day (June 21), a new moon is high in the sky and a full moon is low.

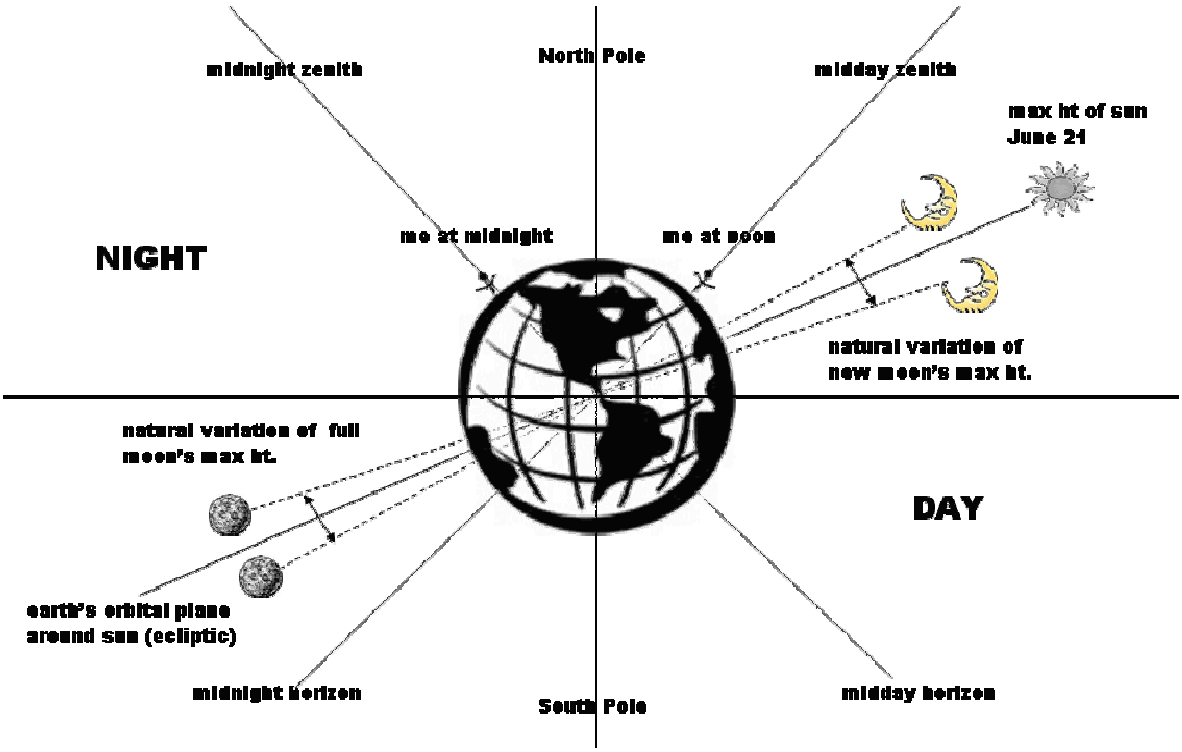



Figure 2. The height of the moon's path near midsummer's day (June 21). Two possible phases are shown, as well as the natural variation of the moon's orbital plane due to the inclination of the moon's orbit to that of the earth's orbit.

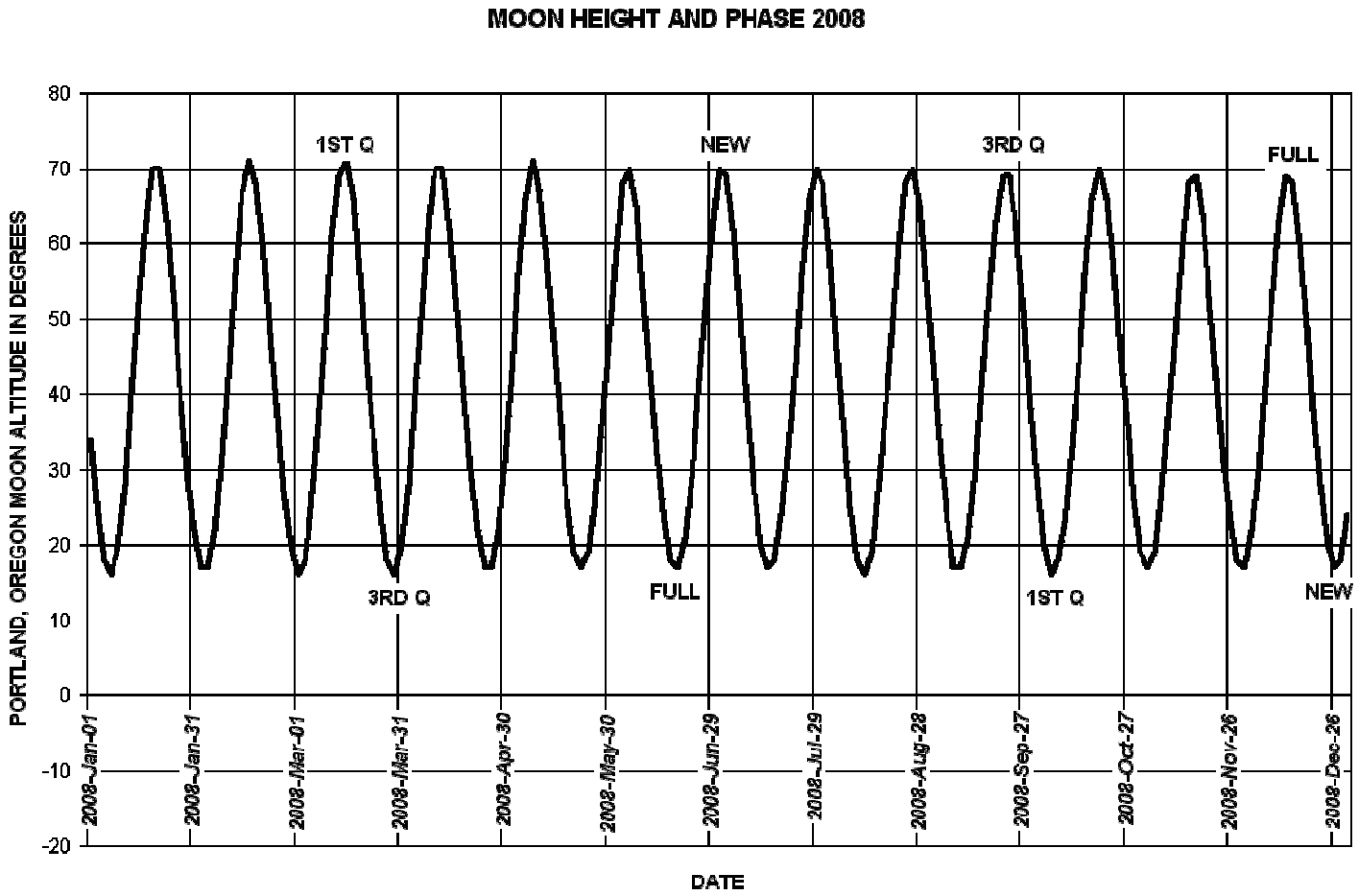



Figure 3. Moon's nightly maximum heights in 2008 calculated from the JPL HORIZONS data for Portland, Oregon. Phases at the highest and lowest paths are labeled. This year there is over 50 degrees of variation between the high and low paths. Each vertical mark represents 30 days.

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**ANNUAL EVENTS:** President's Field Trip—Summer or Fall; Banquet—March; Annual Business Meeting—February.
**FIELD TRIPS:** About 6 per year. Fees: see field trip announcements on the calendar next page.
**GEOLOGY SEMINAR:** Usually held on the third Wednesday of some winter months, 8:00 p.m., Rm. S17, Cramer Hall, PSU. See calendar for details
**GSOC LIBRARY:** Rm. S7, Open 7:30 p.m. prior to meetings.
**PROGRAMS:** Second Friday evening most months, 8:00 p.m., Rm. S17, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon.
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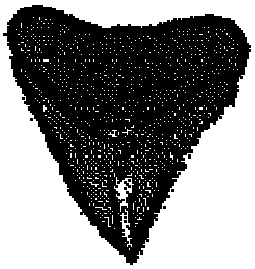


# FOSSILS FROM UNITED STATES' "TWO WEST COASTS"

This article is based on the presentation given by Guy DiTorrice titled "Discovering Beach Fossils From America's Two West Coasts," at the Newport FossilFest on Saturday, February 9, 2008.

The Oregon Fossil Guy, Guy DiTorrice, has had the good fortune to travel several times to Florida in the last few years. Florida is a fossil hunter's paradise, and Guy made this presentation to FossilFest in order to introduce the fossils he has found in Florida and compare them with those he has found in Oregon.

We Oregonians are very fortunate, says DiTorrice, to have public ownership and access to Oregon's fine beaches. Such is not the case in Florida, he has observed. DiTorrice used the trick of backtracking the hurricane evacuation route signs to locate beaches in Florida.

One famous beach in Florida is Venice Beach, the self-proclaimed "Shark Tooth Capital of the World". When DiTorrice visited this area, hoping to find some great shark tooth fossils, he was sorely disappointed. A recent hurricane had stripped the beaches of sand and so truckloads of fresh, clean, non-fossil bearing sand had been placed on the beaches.

Instead of combing the beaches, DiTorrice found that among the best places to look for fossils were construction sites. Florida is just loaded with fossils because of its history of marine sediments and coral reefs. So, there are fossils to be found when digging is done. In fact, Florida paves its roads with fossil shells rather than gravel.

Another terrific place to find fossils in Florida is in the Peace River, which is THE fossil river of the state according to DiTorrice. Canoe is the best way to travel the river, and according to DiTorrice's guides, one needs to keep an eye out for "gators". DiTorrice dived in the river, and quickly learned that you sift through the sand at the bottom verrryyy slowwwllyyy to avoid stirring it up.

DiTorrice made a few quick comparisons between Florida's and Oregon's fossils before delving into specific fossil types. He noted that fossil shark teeth are not plentiful on Oregon's beaches and he wondered why, since shark vertebra are fairly common. He also noted the color differences, and thought that Oregon fossils were quite a bit more colorful than those found in Florida. Most fossils found in Florida will either be bleached white (ocean beaches) or black (rivers). Fossils tend to retain more detail in Florida, but are not as hard (agatized) as those in Oregon.

Fossilized corals are very common in Florida, with its history of coral reefs. Some of these will have some color, and DiTorrice noted that some very nice fossils come from Tampa Bay coral, which forms tubes. By contrast, Oregon coral fossils are rarer; there was a coral island offshore from Oregon in antiquity, so you can find fossilized corals here.

DiTorrice did not dwell on fossil invertebrates, although they are common in Florida. He did mention that scallops were easy to find. One can find whole shells or inside casts of scallops. To identify your fossil scallop, one needs to see the hinge area at the vertex of the shell.

DiTorrice also did not spend much time discussing the ubiquitous shark tooth fossils. He did note that pits are good places to find these. Their value is now approximately $10 to $20 per inch. Shark vertebrae are also found.

Skates, fishes, and crab fossils were also found by DiTorrice in Florida. He found a skate tooth plate on a dive, which was white in color. Fossils exposed to iron blacken.

Mammals are fossils commonly found in Florida. [*Editor's note - For more information and photos of fossil mammals, readers are advised to review several of the web sites listed below. Fossil horses from the Oligocene and Miocene are found in Florida.*] Also, the sea cow or manatee, and its

ancient relatives (order Sirenia) are very common fossil producers. DiTorrice found dugong (a manatee relative) tooth fossils. Dugong vertebrae looked like rockpiles. Sirenian fossils have also been discovered in Oregon. [*Editor's note – refer to the Orr book listed below, pp. 258-260.*] Other fossil mammals commonly found in Florida are seals, dolphins, and whales.

Lastly DiTorrice compared the process of legally collecting fossils between Florida and Oregon. In Florida, the county governments own the beaches, and vertebrate fossil collecting on state-owned land is strictly controlled. [*Editor's note – refer to the Florida Fossil Permit info listed below.*] Collecting fossils of non-vertebrate animals, such as coral and shells, flora, AND shark's teeth are allowed without a permit. According to DiTorrice, all vertebrate fossils collected in Florida must be reported to the state Museum of Natural History, and these are considered state property.

Oregon owns among the last unregulated beaches for fossil collection, according to DiTorrice. However, fossils or other souvenirs found on Oregon beaches may not be sold by the finders without a permit from the Oregon Parks and Recreation Department. Basically, permits are never issued to casual collectors. Also, collecting is not allowed in state parks, waysides and other such areas, and parks and preserves of other agencies. [*Editor's note – refer to the Oregon Beach Fossil rules listed on the Oregon Fossil Guy website.*]

DiTorrice also noted that this winter, with its strong La Nina beach erosion, has been an excellent one for finding fossils in Oregon. The author of this article can attest to that, for directly after the FossilFest activities, she found the bivalve fossil pictured on a nearby Oregon beach.

Carol Hasenberg

**References and Additional Reading:**

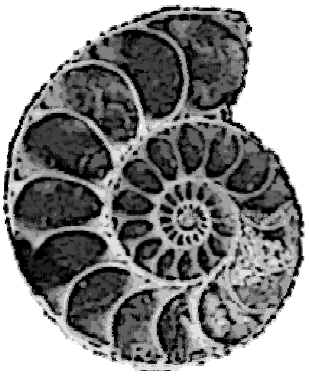

- The Oregon Fossil Guy (Guy DiTorrice's site): http://www.oregonfossilguy.com/
  Guy's version of Oregon Beach Fossil Rules: http://www.oregonfossilguy.com/beach_fossil_rules.php
  For the latest Fossil Guy newsworthy escapade, see http://www.oregoncoasttoday.com/
- Florida Museum Of Natural History, Gainesville, Florida, collections page describes the museum's collections, including flora, vertebrate and invertebrate paleontology: http://www.flmnh.ufl.edu/museum/collections.htm
  Florida Fossil Permit info: http://www.flmnh.ufl.edu/vertpaleo/vppermit.htm
- Geologic Maps of the State of Florida from the Florida Geological Survey: http://sofia.usgs.gov/publications/maps/florida_geology/#sections
- Florida Geological Survey site – history, maps, more!: http://www.dep.state.fl.us/geology/default.htm
- Florida geology and paleontology on the Paleontology Portal site: http://www.paleoportal.org/index.php?globalnav=time_space&sectionnav=state&name=Florida
  Florida's geological history from the ARROW project (Apalachicola Region Resources on the Web): http://www.fnai.org/ARROW/almanac/geology/geology_history.cfm
- Wikipedia Peace River page with map of location: http://en.wikipedia.org/wiki/Peace_River_(Florida)
- Hogtown Creek Fossils - Eocene and Miocene Fossils from the Creeks of Gainesville, Florida – excellent site!: http://www.afn.org/~afn02877/
- "Trapper John's" fossil ID site has tons of pictures and fossil ID's: http://www.trapperjohn411.com/
- Paleocurrents.com Peace River near Arcadia, FL
  Land & Marine Fossils with more tons of fossil pics:

http://www.paleocurrents.com/docs/peace_river_fl.html
- Sirenian evolution (including manatees) from the Brain of the Florida Manatee research group site: http://www.manateebrain.org/07evolution/index.html
- You Tube fans! Check out Venice Florida diving movies from contributor megalodonhunter (Dan Leifheit): http://www.youtube.com/user/megalodonhunter
- Orr, Elizabeth L. and William N., Oregon Fossils, Kendall/Hunt Publishing Company, 1998, 381 p.
- Moore, Ellen James, Fossil Mollusks of Coastal Oregon, Oregon State University Press, 1971, 64 pages.

# MORE FUN WITH FOSSILS

A synopsis of the April 11, 2008 GSOC Friday night presentation.

A full room of fossil enthusiasts greeted two of The North America Research Group's (NARG) members for the kickoff of the seventy fourth speaker series for GSOC. Bill Sullivan, NARG's current president, and ammonite enthusiast Michael Santino kept the crowd rapt with their multimedia presentation on the finding of two reptile fossils from the Jurassic in eastern Oregon and Santino's extensive collection and research on ammonites. Both describe themselves as being retired from professions unrelated to the study of fossils, who now see themselves as free to follow their passions. NARG's mission statement, "To encourage responsible stewardship of earth's paleontological resources; to promote scientific research, communication and public education.", says a lot about their commitment to the science of paleontology.



Santino's powerpoint presentation was dense with information, and included the evolution of cephalopods and ammonoids, ammonoid morphology, a discussion about the variability of ammonoid features, structural differences between ammonoids and other cephalopods, such as gastropods and nautiloids, size variations, sexual dimorphism, ammonoid fossils of Oregon, where ammonoids lived and are now found, and Santino's internet project to create a reference database for ammonoids complete with photographs of all Jurassic and Cretaceous ammonite indicator species (http://www.narg-online.com/ammonites.htm).

In his presentation, Santino explained that cephalopods originated in the early Cambrian and were the most mobile and fierce predators of that time. Ammonites developed from straight shelled cephalopods and were widespread by the Devonian. Ammonoids flourished until the Permian mass extinction, diversified again until the Triassic mass extinction, then diversified a third time until they were finally destroyed at the end of the Cretaceous. Ammonite fossils are found in many parts of the world in strata from ancient continental shelves. Some more "fun facts" from Santino's presentation included:

- Ammonites were named for the Egyptian god Amun.
- Ammonite blood oxygen transport is based on a copper based pigment which gives it a green color like that of a snail (or a Vulcan!).
- No one has never found the fossilized arms of an ammonite, so no one really knows how many they had.
- Ashland, Oregon, has some of the strangest ammonites to be found - you can find these fossils right in town in the Hornbrook formation.
- Since ammonites were so plentiful for so much of earth's history, they are used as indicator species for different periods.
- Fossils of ammonites have been found with plesiosaur bites. They've also have been found with plesiosaur teeth embedded in them.

Bill Sullivan showed the audience two DVD clips of marine fossil reptile excavations. The first was a BLM news trailer - discussing the May 2005 Plesiosaur dig in the Hudspeth Formation near Mitchell, Oregon. The lower jaw of this 25-30' creature dates to the end of the Jurassic age of Dinosaurs 90 -95 Ma. This specimen was

significant because it verified that these creatures ranged throughout the ancient Pacific basin.

The second feature was from the February 14, 2008 OPB airing of "Reptile Fossils" from the Oregon Field Guide. The segment reviewed the Plesiosaur extraction and then discussed the importance of the Jurassic crocodile excavated Oct. 2005 from private property in the Snowshoe Formation, near Supplee, Oregon. The crocodile specimen dates to about 165 Ma. National Geographic rated #2 in the "Top 10 Dinosaur and Fossil Finds of 2007" (see link below in Editor's notes). This fossil specimen may have traveled over 60 million years on a tectonic journey of 8000Km before accreting to Oregon shores. The program, and the NARG presenters, stressed the fact that responsible fossil collectors will make sure that important finds are excavated with professional help and given over to scientific study. In early July, NARG will host a group of juniors from the Oregon Museum of Science and Industry camp at Camp Hancock, where the youngsters will be able to help in the 2008 NARG Oregon Dinosaur Hunt near Mitchell, OR. Should be fun!

Carol Hasenberg

**References and Additional Reading:**


- North America Research Group website: http://www.narg-online.com/ Description of NARG's First Annual Oregon Dinosaur Hunt in June, 2007: http://www.narg-online.com/trip_rpt_032.htm Collecting regulations in the Northwest: http://www.narg-online.com/searchandrescue_regulations.htm.
- You, too, can watch the OPB/Oregon Field Guide airing of the February 14, 2008 "Reptile Fossils" on your computer at http://www.opb.org/programs/ofg/videos/view/50-Reptile-Fossils. The schedule for other episodes can be found at http://www.opb.org/programs/ofg/episodes/.
- Bishop, Ellen Morris, In Search of Ancient Oregon: A Geological and Natural History , published 2006 by Timber Press Inc., ISBN:0881927899, Originally published: 2003, 288 pages.


[*Editor's Notes:*

- If you follow the National Geographic Top Ten Fossil Finds link at: http://news.nationalgeographic.com/news/2007/12/071226-top-dinosaurs.html and go to the #3 find, you'll be led towards May's speaker topic of fossils in amber. Check out the link from the frog in amber fossil web page to the bee in amber and you'll have a reference to May's speaker: http://news.nationalgeographic.com/news/2006/10/061025-oldest-bee.html
- I also found these very interesting websites while doing a little googling for ammonites in the Hornbrook Formation from the University of California Museum of Paleontology: Geologic history of the northern Sierra Nevada, including links to a 2006 paleobotany field trip: http://www.ucmp.berkeley.edu/science/profiles/erwin_0609geology.php ]

## USGS-CVO OPEN HOUSE MAY 3

USGS-CVO will be holding an open house on Saturday May 3, 2008. CVO holds open houses only sporadically, and the next one might not be until the year 2011, so volcano enthusiasts with interest should make a point of coming to the event this year. You can link to our website, where information and directions to CVO can be found. http://vulcan.wr.usgs.gov/.

Carolyn L. Driedger
Hydrologist/Outreach Coordinator

# BOARD MEETING NOTES

April 12, 2008

The meeting was called to order by President Janet Rasmussen at the home of Rosemary Kenney, and GSOC members present included Janet Rasmussen, Beverly Vogt, Richard Bartels, Larry Purchase, Jan Kem, Bonnie Prange, Tara Schoffstall, Dave Olcott, Doug Rasmussen, Rosemary Kenney, Clay Kelleher, and Taylor Hunt.

GSOC members have an invitation to go to the PSU Annual Scholarship Reception on April 22, and several members have promised to attend.

Field trips for 2008 were discussed. Ken Cameron will lead a trip to McCormick and Baxter superfund site on May 31. Bart and Bev will to lead a three-day camping/geology trip to volcanic features in southeast OR in June 27, 28, and 29. Bonnie will lead a trip to Washington quarries in August—possibly August 2. The President's trip to eastern Oregon gold mining country is scheduled for September 3-10. Taylor Hunt wants to lead a trip to the Coast Range, and we suggested he do might do that in early October, but he was asked to first prepare an itinerary for our next meeting.

Taylor invited GSOC to participate in the Regional Gem and Mineral Show, October 3, 4, and 5. GSOC wants to participate and will do a booth. Board members also noted that they would like to have the August Annual Picnic at Beacon Rock State Park if possible.

The annual GSA meeting will be in Portland on Oct. 18-21, 2009, at the Convention Center. GSOC will work with OMSI to facilitate the spouse events during the meeting. Bart is GSOC's liason to the GSA PDX 2009 Planning Committee.

We thanked Rosemary for her willingness to host the board meetings and for her wonderful hospitality. The board also voted to buy Carol Hasenberg an AGI Glossary of Geology for her to use as she prepares the Geological Newsletter. She is the longest serving editor of the newsletter (she is now starting her ninth year as editor), and as a sign of our gratitude and in recognition of the wonderful job she has done, we are giving it to her to keep personally.

The next Board meeting will be on Saturday morning, tentatively at 8 a.m., on June 14.

Beverly Vogt
GSOC Secretary

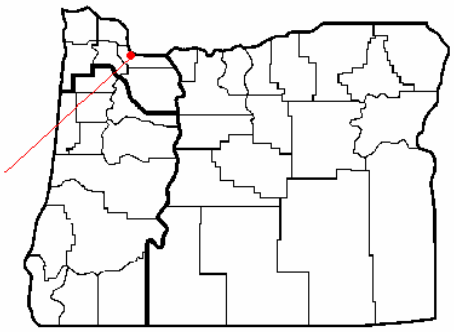
# Upcoming May GSOC Field Trip – McCormick & Baxter Superfund Site

[*Editor's Note: For logistical infomation about the trip, refer to this month's GSOC calendar.*]

The McCormick and Baxter site, located on the east bank of the Willamette River on the upstream side of the St. Johns railroad bridge, started operation around 1944. It used creosote and other preservatives to make railroad ties and telephone poles until it ceased operations in 1991. Due to a combination of on-site disposal of used material, overflow from the creosoting process, and spills, contamination has migrated to depths of at least 80 feet and worked its way into the sediments under the Willamette. It's the job of the environmental geologist to figure out the best way to clean up this type of site. **In Oregon, environmental geology now employs more geologists than any other area of work.** On this field trip we will see how the investigation was implemented, what techniques were used, and what the final result was. Since there is such a good view of the scarp of the Portland Hills fault from the site, we will also discuss that topic for a while.

Ken Cameron

## McCORMICK & BAXTER



**Oregon DEQ Fact Sheet Reprint**
**Project Overview**
The McCormick & Baxter site is located on the northeast shore of the Willamette River in north Portland. The legal address is 6900 North Edgewater Ave., Portland, Oregon 97203, and

DEQ's Environmental Cleanup Site Information (ECSI) number for this site is 74. The site includes 41 acres of land and 23 acres of sediments beneath the Willamette River.

McCormick & Baxter Creosoting Company operated between 1944 and 1991, treating wood products with creosote, pentachlorophenol, and inorganic (arsenic, copper, chromium, and zinc) preservative solutions. Historically, process wastewaters were discharged directly to the Willamette River, and other process wastes were dumped in several areas of the site. Significant concentrations of wood-treating chemicals have been found in soil and groundwater at the site and in river sediments adjacent to the site.

The United States Environmental Protection Agency (EPA) listed the site on the National Priorities List (NPL) in June 1994 based on information collected by DEQ between September 1990 and September 1992. The EPA also designated the Oregon Department of Environmental Quality (DEQ) as the lead agency for implementing the selected remedy while funding for remedial design and construction is being provided by EPA.

The DEQ implemented a number of interim removal measures between 1992 and 1994, including plant demolition, sludge and soil removals, and extraction of creosote from the groundwater aquifers.

The Record of Decision (ROD) was issued by EPA and DEQ in April 1996 after considering public comments on the Proposed Cleanup Plan. The Remedy addressed contaminated groundwater, sediment and soil.

A component of the groundwater remedy, initiated in 1994, consisted of an automated creosote extraction and groundwater treatment system. However, due to poor product recovery and high operating costs, the automated system was discontinued in late 2000. Creosote is currently being recovered by passive and manual methods. Approximately 6,000 gallons have been recovered since 1995. A contingency groundwater remedy was implemented in the summer of 2003, with the construction of a combination steel sheet pile and soil Bentonite slurry wall surrounding 18 acres. The purpose of the barrier wall is to prevent migration of creosote to the Willamette River.

The sediment remedy was implemented in 2004 and primarily consisted of a sand cap placed over 23 acres of contaminated sediment. An oil adsorptive material known as organophyllic clay was used in the creosote seep areas. To protect the cap from erosion, the sand and organophyllic clay were armored with a combination of rock and articulated concrete blocks. The sediment remedy also included the regrading and capping of the riverbank with two feet of topsoil. Revegetation of the capped riverbank with native trees and shrubs will occur in February 2006 after the soil has been stabilized with the native grasses planted in November 2004. Capping of a one acre portion of the contaminated sediments along a high pressure sewer main was completed in September 2005.

Implementation of the soil remedy began in March 1999 with the removal of 33,000 tons of highly contaminated soil and debris. The soil remedy was completed in September 2005 following installation of a combination impermeable/earthen cap – the impermeable portion covering the area within the subsurface barrier wall.

**Environmental Concerns and Ongoing Work**

The primary risks associated with the site are from potential exposure to wood-treating compounds in soil, river sediments and surface water near the site and the Oregon Department of Human Services maintains a health advisory for crayfish harvesting within 1,000 feet of the site (see Oregon Sport Fishing Regulations. DEQ is currently evaluating the effectiveness of the cleanup remedies.

By: Kevin Parrett (503) 229-6748
DEQ Environmental Cleanup Division
2020 SW Fourth Ave., Suite 400
Portland, OR 97201
Phone: (503) 229-5263, Fax: (503) 229-6945
www.deq.state.or.us/nwr/mccormick.htm

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**FIELD TRIPS:** About 6 per year. Fees: see field trip announcements on the calendar next page.
**GEOLOGY SEMINAR:** Usually held on the third Wednesday of some winter months, 8:00 p.m., Rm. S17, Cramer Hall, PSU. See calendar for details
**GSOC LIBRARY:** Rm. S7, Open 7:30 p.m. prior to meetings.
**PROGRAMS:** Second Friday evening most months, 8:00 p.m., Rm. S17, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon.
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# A LIFE'S WORK IN AMBER:

## Unpeeling the amber onion

This article is based on the May 9, 2008 lecture given by George Poinar to GSOC and also the four Poinar books owned by the author, listed in the reference section at the end of the article. The May 9 lecture by Poinar was an excellent introduction to many facets of Poinar's work, but it is difficult to distill the work of a lifetime into a single hour, or indeed a short article in this newsletter. For those who are interested in learning more, this article includes a discussion of the content of the books, most of which are coauthored by his wife and research partner Roberta and are both very well written and lavishly illustrated.

Amber, which is the fossilized resin produced by trees, is known to most people as a semi-precious gem that has been traded since ancient times. The study of the amber trade is a field all in itself, although Poinar's work goes well beyond the cultural aspects of amber. Above all, Poinar is an scientist and is interested in what fossil amber can tell us about the past. However, he has traveled the world in search of the sources of amber, and in doing so he has also learned a great deal about the amber trade. In the lecture, he gave several illustrations of this. One was a discussion of historical amber trade routes in Europe. These were physically found by modern people who found caches of amber in their fields, presumably left there by travelers wanting to hide the amber from others. Another story was that in northern Burma young boys dig in the jungle for amber and cart it out of the area on elephants. Poinar also described the working conditions in the amber mines in the Dominican Republic. These miners toil daily by candlelight in unbraced, cramped holes that go deep into the hills to the amber veins, and are compensated by the weight and quality of the amber they are able to bring out. Fatal mine accidents do occur. It's not an easy life for the miners, yet Poinar found them friendly and helpful.

The Poinars' book The Amber Forest (Poinar, 1999), which is all about Dominican amber from source to scientific conclusions, further discusses the amber trade from the this area. The book The Quest for Life in Amber (Poinar, 1994) describes many aspects of the amber trade, because it is the story of George and Roberta Poinars' world-wide quest for amber, their travels to various well-known and mysterious amber production sites, the people they met while on the quest, and the research conducted by the Poinar team, including son Hendrik who pioneered many techniques in DNA extraction from amber.

Poinar also discussed the origin, fossilization, and characteristics of the substance amber in the lecture. Amber comes from resins produced by trees, but not all trees can produce amber. Kauri pines and their relatives of the family *Araucariaceae* are the most well known producers of amber, and are responsible for all the Cretaceous amber studied by Poinar, as well as the Eocene/Oligocene amber from the Baltic region. This family of trees also contains the modern species of the kauri pine from New Zealand, the Norfolk Island pine, and the monkey puzzle tree. Dominican amber from the Oligocene/Miocene comes from *Hymenaea protera*, an extinct species of algarrobo tree (genus *Hymenaea*) found in the Caribbean and South America.

The process which the resin goes through to become amber occurs over a span of several million years, and is not completely understood. Most amber is found in deposits that also contain soft (bituminous) coal, so the heat and pressure of burial is undoubtedly required in the process. Also most researchers believe that amber has always at some point been buried under the sea, so the catalytic presence of salt water may be a factor. Whatever the process may be, the resulting amber is hard, burns away rather than melting, and does not react to the solvents acetone or alcohol. Pulverized amber will dissolve in linseed oil or turpentine. The chemical signature of each type of amber is specific, not only to the type of tree of origin, but also varies to a specific location where it is found.

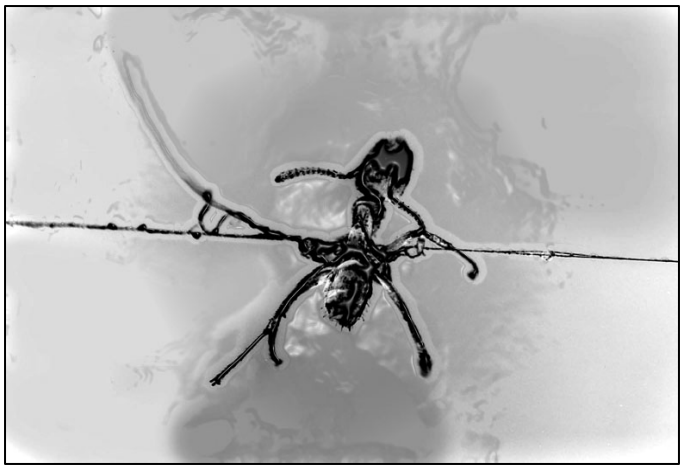
Resin in the process of becoming amber goes through an intermediate step called copal. Copal, on the order of hundreds of thousands of years in age, is hard enough to retain its shape, and is usually lighter in color than true amber. Copal will

melt and dissolve in alcohol or acetone. Copal often has insect or plant inclusions, and these can be identified as being recent in age.

Amber is one of the most commonly faked gemstones. Normally Baltic amber is "clarified" in the industrial processing of the gem, and although this modifies the gem's visual properties, it is still considered to be amber. However, amber can be reconstituted or "pressed", and some fake "fossils" have been introduced in this process. Also, fakes can be made by hollowing out a portion of a piece and inserting a "fossil" encased in resin in the hollow. Plastic is also frequently substituted for amber and may contain "fossils". The presence of these fakes are one of the difficulties researchers must overcome in working with amber.

Now we can turn to the heart of the Poinars' work with amber, and that is what can be learned from the fossils found in amber. The research done by the Poinar team has taken a couple of directions due to the background and interests of the Poinars themselves. George studied "insects, nematodes, and microorganisms" at the University of California at Berkeley (Poinar, 1994) and has done work for the World Health Organization as a parasitologist in addition to his studies on amber. Roberta, on the other hand, "had already established her reputation as a leading electron microscopist at Berkeley" when she and George began working together (Poinar, 1994). So they have studied amber fossils on both the macro- and microscopic levels. This is fortuitous, as each kind of research can provide material which can reinforce and confirm findings from the other.

On the most superficial level, the Poinar team collects data from their research. On the macroscopic level, they look at the fossils of insects, plants, and associated objects encased in the amber and determine as much data as they can about these inclusions. This is where Poinar's background as an entomologist and parasitologist is valuable. As an example for an insect fossil, the Poinars would gather data by asking questions like: What kind of insect (plant, etc.) is it? What can be determined or inferred about its behavior at the time of death? What did it eat? What kind of parasites, symbionts or diseases did it contain? What kind of other fossils are associated with it? What modern insects does it resemble and how close is the resemblance? As the basic questions are answered questions occur that have to do with the insect's life and environment: What did the insect eat? What kinds of plants and animals did (or would) it associate with? In what environmental conditions would this animal be found? What part of the environment would it inhabit? By going through this process for many fossils, a complete picture of the world in which they inhabited begins to emerge.



Most of the slides that Poinar showed the audience on May 9 were of meticulously prepared fossil specimens photographed in their amber prisons. The Poinars have perfected the methods of preparing fossil specimens (most of which are arthropods) in amber for photography, and their books are illustrated with these amazing photographs. The "double jeopardy" slide (clip art version above) of the ant trapped in a spider web strand and entombed in amber, which Poinar lent GSOC for the lecture publicity poster, is a good example. He also showed the GSOC audience slides of bees, an ancient insect intermediate between bees and wasps, aphids, ticks, palm bugs, a pair of water striders, predatory ant bugs, singing caterpillars, etc. Some of the slides illustrated behavior the subjects were engaged in before, during, or after entombment. For example, the water strider male was still guarding the female he had mated after 30 million years! Other slides showed objects or organisms associated with the specimens – jaguar hairs found on a bamboo spikelet, parasitic mites holding onto their prey, a

nematode seeking to flee its host which had become entombed.

Other fossils found (or not found) in amber suggest profound insights into the evolution of life on earth. The development of pollinating insects, illustrated by the primitive bee mentioned previously can give scientists clues about the rise of angiosperm plants (Poinar, 2008). Looking at the various time spans of the survival of animals and plants at the species, genus, family and higher levels can give researchers information about how they might survive in the future. The nature of past climates can be inferred from the species found in the amber when compared to related species that exist today. Also, the ranges for these past species compared to the present ranges can say a lot about what the climatic changes have been over time.

An important part of the evidence used in confirming these concepts is done at a cellular or even a molecular level, and this is where the microfossil research is important. The Poinars began working on this type of research in the mid 1970's, when they began to study fossil nematodes in Mexican amber (Poinar, 1994). They were able to determine that tissue from the ancient creatures was preserved by studying these with an electron microscope. They were also able to find bacterial cells in the nematode tissues. A few years later, they tried growing ancient bacterial cells from cultures made from tissues in amber, but were not able to eliminate the possibility that their cultures were contaminated. In 1980 Roberta made sections of a fly embedded in Baltic amber and was able to view the cell organelles in the electron microscope.

Also the 1980's saw great strides the development of DNA research. Two attempts to isolate DNA from amber fossils were made in the 1980's by pioneering researchers with limited success and funds dried up for the project. One problem was that the sample sizes from the amber fossils was small and the DNA strands weren't complete. A new sequencing technique called PCR was developed in the mid 1980's which could greatly amplify the presence of DNA fragments in a small sample. Then in 1991 their son Hendrik started working on the amber project under Dr. Raul Cano of California Polytechnic State University. He developed a method of cracking open a sample of amber by freezing it in liquid nitrogen so that the tissue material from the fossil inside could be quickly scraped out and transferred to the extraction solution. He used the method to extract DNA from stingless bees encased in Dominican amber, and the lab results compared favorably with the DNA found in modern Panamanian bees. At the time, this was the oldest known DNA to have been studied, and the results were published in two papers in April and September of 1992. Shortly after their final results were published, a team of researchers at the American Museum of Natural History published the results of a successful extraction of DNA from termites in Dominican amber. In 1992 Hendrik successfully sequenced DNA from *Hymenaea protera* in Dominican amber (the algorrobo tree), which was a bit more difficult of a task. Now the researchers had a powerful tool which could be used to identify and compare genetic material and relationships between samples across the ages.

Since that time, the Poinars have done much research to uncover the worlds revealed by the fossils in amber. In addition to their scientific papers, they have published the results of two of the amber ecosystems they have investigated into books. The Amber Forest (Poinar, 1999) was written about the ecosystem revealed by amber from the Dominican Republic. This amber is in the range of 15-45 million years in age. According to the book, "The animals and plants conserved in amber from the Dominican Republic represent one of the world's most complete fossil records of terrestrial life in a tropical region" (Poinar, 1999). A personal favorite of the author of this article, the book first introduces the settings in which the fossils were made and are found, and some of the methods used in conducting the research. Next, a large portion of the book describes each type of plant and animal remains found in the amber. Each of these is illustrated with a black and white plate of a representative fossil, a exquisite color version of the same plate in the color printing section, and a drawing of the micro-ecosystem with the fossils together in them. The final sections discuss the implications of the fossil finds, the limitations and biases in the fossil record, and the conclusions

drawn from the research. Most notably, the Poinars are concerned with questions about past changes to the climate of the Greater Antilles (where the Dominican Republic is located), the survivability of species there due to isolation and climate change, extinction of species from natural vs. manmade causes, and the biodiversity of life then and now in the Greater Antilles.

The smaller paperback Lebanese Amber book (Poinar and Milki, 2001) from the Oregon State University Press features the study of 130-135 million year old amber from Lebanon and neighboring areas. The material is presented in a similar fashion to The Amber Forest (Poinar, 1999). The Early Cretaceous Lebanese amber is special because "the fossils reported here are quite significant in illustrating patterns of origination, evolution, distribution, and extinction" from this critical period of time(Poinar and Milki, 2001). The fossil amber contains, amongst other things, the oldest feather tissue found and the remains of the four "oldest generic lineages known for any terrestrial multicellular animal" (Poinar and Milki, 2001). The age of this amber makes it possible to study the emergence of angiosperms (flowering plants) primarily through the evolution of insects which pollinate them. The researchers also looked at the percentages of fossil arthropod types (parasitic, predatory, plant-eating, and generic) in Lebanese and other sources and ages of amber for trends in populations. The study of the survivability of insect genera found in the Lebanese amber and other amber source have caused the Poinars to ponder questions about the survivability of genera during times of environmental change, the biodiversity of terrestrial genera then and now, and the workings of the "punctuated equilibria" model of evolution.

For the latest book, What Bugged The Dinosaurs? (Poinar, 2008), the Poinars' background in parasitology triggered a desire to investigate the history of infectious diseases. Two major vector-borne human diseases of our time, malaria and leishmaniasis, have been discovered by Poinar in amber fossils. The most remarkable discovery of multiple *Leishmania* stages in a sand fly in 100 million year old Burmese amber is described in detail in the book. Although some forms of modern sand flies infect mammals with the disease, there are also modern forms which infect reptiles, and this sand fly resembled those. The same sand fly specimen contained vertebrate blood cells in its gut, and by several steps of reasoning related in the book, the Poinars thought that the most likely victims of these parasites were reptiles or dinosaurs. They were able to find more infected sand fly specimens, in fact a large percentage of the specimens they examined had the disease! This success encouraged them to look for more disease agents in amber. They found viruses, fungal pathogens, and mite and nematode parasites in Cretaceous amber. Poinar showed GSOC slides of some of these on May 9. From the results of their research to date they discuss the survivability of smaller life forms in contrast with larger forms (like dinosaurs and humans). They are convinced that pathogens were a significant component in the extinction of the dinosaurs, even if the primary causes may have been abiotic. They also pose a number of questions for future biologists to investigate; and indeed the book is dedicated to "the inquiring minds of future generations."

Carol Hasenberg

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Poinar, George O., Jr., and Milki, Raif, Lebanese Amber: The Oldest Insect Ecosystem in Fossilized Resin, Oregon State University Press, 2001.

Poinar, George O. Jr. & Roberta, What Bugged The Dinosaurs? Insects, Disease And Death In The Cretaceous, Princeton University Press, 2008.

**Additional Reading**

The Poinar book which precedes the others owned by the author is:
Poinar, George, Life in Amber ,Stanford University Press, 1992.

The younger set may want to check out this introductory booklet:
Poinar, George O. Jr., Discovering the Mysteries of Amber, GEOFIN s.r.l. – Italy, 1997.

Some other articles about the Poinars' work available online:

- From the National Geographic News website, "Photo in the News: Oldest-Ever Bee Found in Amber," October 25, 2006: http://news.nationalgeographic.com/news/2006/10/061025-oldest-bee.html
- From the BioEd Online website, "Amber collectors hit on oldest mushroom find: 100-million-year-old fungus brings hints of Cretaceous ecology," by Virginia Gewin, Nature News, June 11, 2007: http://www.bioedonline.org/news/news.cfm?art=3374
- From the FOX News.com website, "Frog in Amber May Be 25 Million Years Old," Associated Press, Friday, February 16, 2007: http://www.foxnews.com/story/0,2933,252459,00.html
- Liebert Online (electronic access to peer-reviewed journals published by Mary Ann Liebert, Inc.), "Vector-Borne and Zoonotic Diseases: Evidence of Vector-Borne Disease of Early Cretaceous Reptiles," by George Poinar Jr., Department of Zoology, Oregon State University, Corvallis, Oregon., and Roberta Poinar, The Amber Institute, Corvallis, Oregon. abstract and introduction available online: http://www.liebertonline.com/doi/abs/10.1089/vbz.2004.4.281
- There are several other links to the work of George and Roberta Poinar and their son Hendrik (whose research work is in DNA sequencing from amber and other fossils) in the National Geographic website. Go to http://news.nationalgeographic.com/news/ and up in the headliner, type Poinar in the search window to see these items.

Books on amber from the American Museum of Natural History:

- Grimaldi, David, and Engel, Michael S., Evolution of the Insects, Cambridge University Press, 2005.
- Grimaldi, David A., Amber: Window to the Past, Harry Abrams, Inc., 1996.

NOVA site Jewel of the Earth, , Original PBS TV program broadcast date was February 14, 2006. Site contains information about the show, many photographs, and links to obtain a DVD or podcast from the show
http://www.pbs.org/wgbh/nova/jewel/

EBAY's article "Authenticating Genuine Amber" by ambersilver:
http://reviews.ebay.com/Authenticating-Genuine-Amber_W0QQugidZ10000000003687644?ssPageName=BUYGD:CAT:-1:LISTINGS:2

# Paleomagnetism Primer

from Wikipedia, the free encyclopedia
http://en.wikipedia.org/wiki/Paleomagnetism

**"Paleomagnetism** refers to the study of the record of the Earth's magnetic field preserved in various magnetic minerals through time. The study of paleomagnetism has demonstrated that the Earth's magnetic field varies substantially in both orientation and intensity through time.

Paleomagnetists study the ancient magnetic field by measuring the orientation of magnetic minerals in rocks and sediments, acquired at the time of their formation (remnant magnetization), then using methods similar to geomagnetism to determine what configuration of the Earth's magnetic field may have resulted in the observed orientation.

**Fields of paleomagnetism**
Paleomagnetism is studied on a number of scales:

Secular Variation Studies look at small scale changes in the direction and intensity of the Earth's

magentic field. The magnetic north pole is constantly shifting relative to the axis of rotation of the Earth. Magnetism is a vector and so magentic field variation is made up of palaeodirectional measurements of magnetic declination and magentic inclination and palaeointensity measurements.

Reversal Magnetostratigraphy examines the periodical polarity reversion of the Earth's magnetic field. The reversals have occurred at irregular intervals throughout the Earth's history. The age and pattern of these reversals is known from the study of sea floor spreading zones and the dating of volcanic rocks.

**Principles of remnant magnetization**

The study of paleomagnetism is possible because iron-bearing minerals such as magnetite may record past directions of the Earth's magnetic field. Paleomagnetic signatures in rocks can be recorded by three different mechanisms:

Thermal remanent magnetization - First, iron-titanium oxide minerals in basalt and other igneous rocks may preserve the direction of the Earth's magnetic field when the rocks cool through the Curie temperatures of those minerals. The Curie temperature of magnetite, a spinel-group iron oxide, is about 580°C, whereas most basalt and gabbro are completely crystallized at temperatures above 900°C. Hence, the mineral grains are not rotated physically to align with the Earth's field, but rather they may record the orientation of that field. The record so preserved is called a thermal remanent magnetization (TRM). Because complex oxidation reactions may occur as igneous rocks cool after crystallization, the orientations of the Earth's magnetic field are not always accurately recorded, nor is the record necessarily maintained. Nonetheless, the record has been preserved well enough in basalts of the ocean crust to have been critical in the development of theories of sea floor spreading related to plate tectonics. TRM can also be recorded in pottery kilns, hearths, and burned adobe buildings. The discipline based on the study of thermoremanent magnetisation in archaeological materials is called archaeomagnetic dating.

Detrital remanent magnetization - In a completely different process, magnetic grains in sediments may align with the magnetic field during or soon after deposition; this is known as detrital remanent magnetization (DRM). If the magnetization is acquired as the grains are deposited, the result is a depositional detrial remanent magnetization (dDRM); if it is acquired soon after deposition, it is a post-depositional detrital remanent magnetization (pDRM).

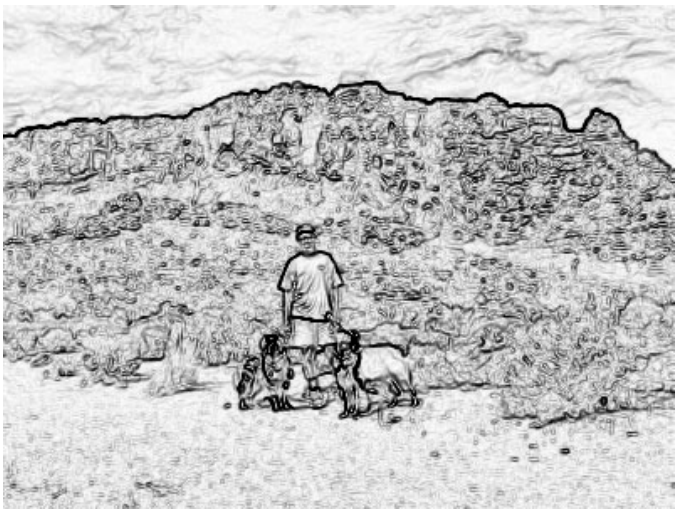
Chemical remanent magnetization - In a third process, magnetic grains may be deposited from a circulating solution, or be formed during chemical reactions, and may record the direction of the magnetic field at the time of mineral formation. The field is said to be recorded by chemical remanent magnetization (CRM). The mineral recording the field commonly is hematite, another iron oxide. Redbeds, clastic sedimentary rocks (such as sandstones) that are red primarily because of hematite formation during or after sedimentary diagenesis, may have useful CRM signatures, and magnetostratigraphy can be based on such signatures.

**Examples [of Paleomagnetic studies]**

Paleomagnetic evidence, both reversals and polar wandering data, was instrumental in verifying the theories of continental drift and plate tectonics in the 1960s and 70s. Some applications of paleomagnetic evidence to reconstructing histories of terranes have continued to arouse controversies. Paleomagnetic evidence also is used in constraining possible ages for rocks and processes and in reconstructions of the deformational histories of parts of the crust.

Reversal magnetostratigraphy is often used to estimate the age of fossil and hominin bearing sites.

Paleomagnetic studies are combined with geochronological methods to determine absolute ages for rocks in which the magnetic record is preserved. For igneous rocks such as basalt, commonly used methods include potassium-argon and argon-argon geochronology."



# GSOC June Field Trip to Oregon Lake County Outback Country

Richard Bartels and Beverly Vogt are leading a field trip to Oregon's beautiful Lake Country volcanic and Basin and Range country from June 27 through June 29. We will meet Friday morning, June 27, at 9 a.m., in LaPine and head southeast along Highway 31 and adjacent side roads ultimately to as far southeast as Paisley and the intersection of Highways 395 and 31. Along the way we will see some of the most unusual and remote volcanic features in Oregon. We will learn about the Eocene to present-day geologic history of the area.

Some of the volcanic features we plan to explore include Hole-in-the-Ground, Fort Rock, Crack-in-the-Ground, Christmas Valley, and the Table Rock complex. Then, as we move on to the spectacular Basin and Range, we will learn about Egli Rim and the Silver Lake graben, Winter Ridge and Summer Lake, and Abert Rim and Lake Abert. We will learn about pluvial Fort Rock and Chewaucan Lakes and their shorelines, erosional features, deltas, and caves. If enough snow melts by the end of June, we also plan to drive up to the top of Winter Ridge to Fremont Point, which Captain John C. Fremont visited in 1843. From this point, we will be able to look out over the spectacular scenery of the area. The distances are get to this country are great, but the rewards are many.

When we meet in LaPine, be sure you have a full tank of gas. We plan to camp Friday night at Green Mountain BLM campground near the fire lookout on the road to Crack-in-the-Ground and Saturday night near Paisley. There are motels in the area too, but you should make a reservation ahead of time. There will be a nominal charge for the field trip guide. The campgrounds do not have water, so carry enough water for your camping needs. Bring enough food to make lunches each day, plus your breakfasts and dinners. There are a few gas stations, cafes, and stores in the area. If you have any questions or plan to go on this trip, contact Richard Bartels, phone 503-292-6939, email bartbartels@comcast.net, no later than June 21. If no one answers, leave a message on his voice mail.

In case you are undecided about whether you want to go or not to see this unusual and spectacular country, here is a description of the area written by Jonathan Nicholas and quoted in Oregon's Outback Scenic Byway Discovery Guide:
"Between the Cascade Mountains and the Continental Guide, there exists a land of magic and mystery, a place where rivers run every which way but never to the sea. This is the Great Basin Country, a star-spangled landscape of marsh and mountains, of reflection and rim rock, of seamless vistas and sage-scented dreams."

# GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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Janet Rasmussen – 541/753-0774
**Vice-President:**
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**Calendar:**
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**Business Manager:**
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## ACTIVITIES:

**ANNUAL EVENTS:** President's Field Trip—Summer or Fall; Banquet—March; Annual Business Meeting—February.
**FIELD TRIPS:** About 6 per year. Fees: see field trip announcements on the calendar next page.
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**GSOC LIBRARY:** Rm. S7, Open 7:30 p.m. prior to meetings.
**PROGRAMS:** Second Friday evening most months, 8:00 p.m., Rm. S17, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon.
**MEMBERSHIP:** Per year from January 1: Individual--$20.00, Family--$30.00, Junior (under 18)/Student--$10.00.
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**TRIP LOGS:** Write to the same address for names and price list.
**WEBSITE:** www.gsoc.org. Email address: gsoc@spiritone.com.

**APPLICATION FOR MEMBERSHIP-**
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**Name**_____ **Spouse**_____

**Children under age 18**_____

**Address** _____ **City** _____ **State** ___ **Zip**_____-_____

**Phone (**_____**)**_____-_____ **Email address**_____

**Geologic Interests and Hobbies**_____

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**Please indicate Membership type and include check for appropriate amount:**

**Individual $20.00** _____ **Family $30.00** _____ **Student $10.00** _____

**Make Check Payable to:** **The Geological Society of the Oregon Country**
**PO Box 907**
**Portland, OR 97207-0907**

# BOARD MEETING NOTES

June 14, 2008

The meeting was called to order by President Janet Rasmussen at the home of Rosemary Kenney. Board and GSOC members present included Janet Rasmussen, Beverly Vogt, Richard Bartels, Jan Kem, Dave Olcott, Doug Rasmussen, Rosemary Kenney, Clay Kelleher, Carol Hasenberg, and John Newhouse.

Total membership is approximately 150 people. Following a discussion of how to get new members, the board approved a motion that **to take part in GSOC field trips, each participant has to be a GSOC member or guest of a member**. To facilitate this rule, preliminary field trip announcements via newspaper, GSOC website, calendar and newsletter, or during meetings will not mention specific fees or meeting places and should request that participants contact a designated person via phone or email to reserve a place on the trip. At that time, the contact person can tell them where the meeting place for the trip is and should warn them that to go on the trip they have to be a member or guest of a member, but could join for $20, payable at the start of the trip. A week ahead of the actual trip, GSOC could post the meeting place on the website with the caveat that people have to pre-register for the trip. Specific circumstances may require some slight adjustments to actual implementation of this new rule.

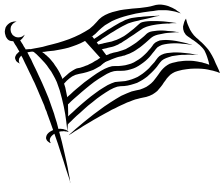
The annual picnic is set for August 10 at Beacon Rock State Park in the Columbia River Gorge. GSOC will supply the paper plates, napkins, paper cups, and utensils. There will be no barbecue, just pot luck food. Attendees bring their own beverages. The board will meet at 10 at the picnic site, and we will eat around noon.

Upcoming field trips were discussed. Dave Olcott and Larry Purchase are leading a two-day trip to eastern Oregon, on August 8 and 9. It will be a car caravan, with multiple stops including Columbia Ridge Landfill and Klondike and Biglow Canyon Wind Farms on the first day and agriculture of northern Sherman County on the second day. Friday night will be in the The Dalles including the Mint, now a winery, and attendees are to make their own camping or motel accommodations. The President's trip to eastern Oregon gold mining country is scheduled for September 3-9. See related articles elsewhere in this newsletter.

GSOC would like to thank Rosemary Kenney once again for being such a longtime and gracious hostess.

Next GSOC board meeting is 10 a.m., August 10, at the annual picnic at Beacon Rock.

Beverly Vogt, Secretary



# 2008 GSOC PRESIDENT'S FIELD TRIP: THE BLUE MOUNTAINS

September 3-9, 2008
Mark your calendars now for the President's Field Trip. This year we'll travel east to Baker County. It will be a two-part trip.

The first two nights will be spent at the **historic Chloride Mine**, about 18 miles due west of Haines in the heart of the Elkhorn Mountains. There are several small cabins and tent cabins, and plenty of room for camping. Doug Rasmussen will lead a four-mile round trip hike for those interested, and others may explore the mine site or pan for gold. We'll leave from there early Friday morning to begin our exploration of Baker County museums, including the new Oregon Trail Interpretive Center.

Friday, Saturday, and Sunday nights will be spent at the **Always Welcome Inn** (1-800-307-5206, and ask for the special GSOC nightly rate of $60 + tax) in Baker City. For those who prefer to camp, there are tent sites at Oregon Trails West RV Park, at Exit 302, (1-888-523-3236), for $18 + tax, which includes showers. Please make your own arrangements at the earliest opportunity. At the Always Welcome Inn, an outcrop behind the motel

has yielded many interesting plant and animal fossils. Jay Van Tassell, a researcher from Eastern Oregon University, will tell us about these and we'll have an opportunity to find some ourselves. Saturday, we'll visit the nearby Virtue Mine, then on to Sumpter to see the restored gold dredge and take a ride on the Sumpter Valley Railroad (a narrow gauge steam engine) through the dredge spoils in the Sumpter Valley. On Sunday, DOGAMI geologist Mark Ferns will lead a trip to see more of the geology south of Baker City. At some point, we should be joined by Howard Brooks, retired DOGAMI geologist, who has written a new book, A Pictorial History of Gold Mining in the Blue Mountains of Eastern Oregon.

Monday morning we will leave town before the Cycle Oregon riders begin to arrive, and head to Granite for a tour of that interesting mining town. We'll then follow a field guide of geology stops between Granite and Ukiah. On to Pendleton, to stay at a motel (don't have a recommendation yet). For those who don't mind an additional 3 hour drive to Portland, you could continue on home.

For questions, please call Janet Rasmussen at 541/753-0774 or email at jkayerocks@yahoo.com. This trip will be limited to 30 participants. Please tell Janet if you would be interested in traveling by van, and if enough people do, we could look into the shared cost of rental. NOTE: You must be a GSOC member or guest of a member to attend GSOC field trips. You may join GSOC at any time, for $20.

# GEOTHERMAL ENERGY: BUILDING A FULL HEAD OF STEAM

synopsis of GSOC Friday night lecture by Alex Sifford
June 13, 2008

by Carol Hasenberg

[*Author's Note: As Click and Clack would say, this talk is one of our "Alternative Energy series". As I reviewed the titles of GSOC Friday night lectures over the last 10 years conveniently supplied to me by GSOC Past President and current Treasurer Richard "Bart" Bartels, I noticed that only one of these talks were about geology and energy production! Considering the history of energy production in our country, and the importance of this topic to our economy, this struck me as rather odd. I decided that at least one talk this year should be devoted to energy production in the twenty-first century.*]

Considering that Oregon is such a prime place to house such projects, the 1990's was a dormant time for geothermal energy. One can find scattered examples of geothermal energy usage in Oregon - several buildings in Portland use geothermal for heating, Vale has mushroom production facility using geothermal energy, Bend has seen prospectors for geothermal power, and the Oregon Institute of Technology's (OIT) Klamath Falls campus has been using geothermal heat for a long time. But according to long-time geothermal observer Alex Sifford, all that is going to change. Right now there is a lot of geothermal prospecting going on, and with oil prices going through the ceiling, things are going to happen.

As if to illustrate his point it was noted that two articles about geothermal energy have appeared in the Oregonian in the month preceding the talk (see references for details). One of the articles discusses the current exploratory drilling going on near the Newberry volcanic complex in central Oregon, and the other discusses the first graduate in OIT's four-year degree program in renewable energy systems.

Sifford gave the GSOC audience a run-down on ways of harnessing geothermal energy. All of these methods require water as a reservoir and transport

medium for the heat contained in the earth below. Hot rock alone is not useful without this "plumbing". Water below the surface of the earth is under pressure and is in liquid form. Depending on its temperature, it will either stay in liquid form or "flash" to steam when it reaches the surface.

In the direct method, heat is directly obtained from water pumped to the surface. On the smallest scale, this water can be used to heat a single building. The water is circulated through a heat coil and directly heats the building. Warm or hot groundwater can also be directly used to grow greenhouse crops (agriculture) or aquatic animals, such as fish (aquaculture). Sifford showed the audience slides of facilities in Idaho and Colorado which produce, amongst other products, alligators! Of course, the oldest direct human use of geothermal energy is bathing and washing in hot springs.

Two of the problems of direct usage of heated groundwater are oxygen corrosion and, in some cases, heavy metal contamination. To minimize these hazards, the groundwater can also be used to heat a secondary circulation system or heat pump. The water does not have to be hotter than 50 degrees Fahrenheit to heat a building. Most district geothermal heating systems are done by circulating a secondary fluid (domestic water) heated by the geothermal water into the district buildings. On the positive side, because the heating energy is not generated by fossil fuels, direct geothermal heating has a much lower carbon footprint than heating based on fossil fuels.

Geothermal energy can also be used to generate electricity. The conventional method uses geothermally heated steam to run a turbine which produces the electricity. To do this economically, the geothermally heated water must be really hot – temperatures above 400 degrees Fahrenheit are desirable. The site of the first geothermal electricity plant was Larderello, Italy, in 1898. Nowadays there are plants in the Western US, Italy, and other parts of the world.

Ways of improving efficiency and environmental impacts of the geothermal electricity production process are being developed. A chiller run in reverse will generate electricity, and the water need not be over 165 degrees Fahrenheit. Also, in a binary power system, the geothermally heated water is used to heat a secondary fluid (refrigerant) which boils at a much lower temperature than water. There are zero resource emissions from binary plants.

The economic nature of geothermal energy production is that the costs are mostly up front, with benefits later. Sifford gave an example that a 20 megawatt geothermal power plant costs $70 M to build where as a comparable coal power plant costs $40 M. It also can take as mcuh as nine years to get a plant online. The early years are spent doing geological investigations and feasibility studies. Geothermal prospecting is also a risky business, because one needs not only to find heat but water to use geothermal energy. That being said, sometimes geothermal energy is found "by accident" while drilling for cold water or other purposes, and geothermal prospectors can use records and samples from other drilling to obtain information. On the bright side, geothermal plants are desirable as "base load" power plants. They can run all the time; they are not seasonal or sporadic in their production.

Environmentally, geothermal plants are desirable for several reasons. Not only is the carbon footprint smaller but air pollution is greatly reduced. Two great photographs of Reykjavik, Iceland, were shown to the GSOC audience – one taken in 1932, when fossil fuels were used for heating, and the other taken recently, with 95% geothermal heating. Although in the past some geothermal heating plants have had problems with out-gassing of natural heavy metal contaminants in the pumped water, this problem has been solved by making the geothermal water circulate in a closed system. After the water heats the secondary fluid, it is pumped back into the ground. In some cases scrubber processes also are used. In the future valuable minerals can also be recovered from the water.

Geothermal power plants are often located in natural areas, and are typically designed to complement their surroundings. For example, buildings are given a profile which stays below the

tree line, and painted in muted natural colors. Cooling towers also have a low profile.

Sifford spoke of a lot of recent activity in the geothermal industry in Oregon. The Oregon Renewable Energy Act, requiring the state to have a certain percentage of electrical power from renewable sources by the year 2025, has spurred geothermal development. Other western states are doing likewise. Besides the previously mentioned power plant envisioned for the Newberry volcano area by Davenport Power, there are projects happening at Neal Hot Springs west of Vale by U.S. Geothermal, Nevada Geothermal Power's Crump Geyser in the Warner Valley of Lake County, and a possible electrical power plant at Oregon Institute of Technology in addition to the heating there.

Besides being a relatively clean, renewable power source, geothermal energy will employ geologists, engineers, lawyers, environmental specialists, managers and plant operators in the state. Off-grid home owners may find geothermal heat pumps a realistic option as well. Tax incentives are available for both businesses and home owners. Geothermal energy may be a warm prospect for the future of Oregon.

**References and Additional Reading**

Hill, Gail Kinsey, "Is energy solution just waiting under volcano?", *The Oregonian*, Thursday, May 29, 2008, pp. A1 and A9.

Hill, Gail Kinsey, "Engineer has a renewed purpose", *The Oregonian*, Monday, June 9, 2008, pp. A1 and A6.

"Nevada Geothermal Power Acquires Fourth Geothermal Project Crump Geyser, Oregon," *Business Wire*, August 9, 2005: http://findarticles.com/p/articles/mi_m0EIN/is_2005_August_9/ai_n14873775

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Oregon Department of Geology and Mineral Industries, *Oregon Geology*, Volume 65, Number 1, Spring 2003. This issue was all about geothermal energy and can be downloaded from the DOGAMI website at: http://www.oregongeology.com/sub/quarpub/OrGeo.htm

USGS/Cascades Volcano Observatory website, Geothermal and Hydrothermal Activity: http://vulcan.wr.usgs.gov/Glossary/ThermalActivity/framework.html

ONLINE GEOTHERMAL REFERENCES:

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Advanced introduction (U.S. DOE)..... www.eere.energy.gov/geothermal
Geo-powering the west (GPW)..... www.eere.energy.gov/geothermal/gpw
Low-temp uses, data & technology (GHC) .....http://geoheat.oit.edu
U.S. Geothermal facts & figures (GEA) .....www.geo-energy.org
Geothermal database, USA & worldwide (GRC) .....www.geothermal.org
International geothermal (IGA) .....http://iga_igg.cnr.it/index.php
Geothermal development info .....www.geothermal-biz.com
Heat flow info (SMU)..... www.smu.edu/geothermal
Geothermal heat pumps (GHPC) .....www.geoexchange.org
GHP technology & case studies (IGSHPA) ..... www.igshpa.okstate.edu
Geothermal slide show..... www.geothermal.marin.org/GEOpresentation
Intro to geothermal energy ..... http://doegeothermal.inel.gov/
Low-temperature uses ..... http://www.oit.osshe.edu/~geoheatl/
Geothermal heat pumps .....http://www.igshpa.okstate.edu/

International geothermal ..... http://www.demon.co.uk/geosci/igahome
More about geothermal ..... http://www.eren.doe.gov/geothermal/
Lots more info & links ..... http://www.geothermal.org
Neat things for students ..... http://www.eisweb.com/geo/

# UPCOMING GSOC EVENTS

**Waste, Wind and Water GSOC Field Trip**
Tapping Resources East of The Cascades
Friday and Saturday, August 8th and 9th, 2008

GSOC Directors Larry Purchase and Dave Olcott will be leading a 1½ day field trip examining three operations in northern Gilliam, Sherman, and Wasco Counties. Specifically, we will visit Columbia Ridge Landfill, Klondike and Biglow Canyon Wind Farms, and ground-water supporting cherry production south of The Dalles. Where appropriate, geologic connections and constraints of each operation will be evaluated. Since both wheat and cherries will be under harvest throughout much of our route of travel, we will make a couple educational stops focusing on these crops.

Transportation will be by private cars, so start coordinating your car-pooling arrangements. We will spend Friday night in The Dalles and start Saturday's trip at a designated location at 9:00 am. Richard Bartels will lead a time of geologic reflection and contemplation at The Mint urban winery (http://www.eringlenn.com/) on Friday evening.

Cost of this trip is $10, and participation will be limited to the first twenty GSOC members and their guests who sign up with Dave Olcott. If you plan on participating in this trip or have any questions, please contact Dave Olcott at (503) 695-5219, email daveolcott46@yahoo.com, by August 1st.

Needs and Things to Do if you plan to go:

- Appropriate Clothing – may be warm/hot (and it may not)
- Water, Sunscreen, Sunglasses
- Sack Lunch and Snacks for Friday and Saturday
- Make Carpool Arrangements
- Make Lodging Reservations in The Dalles or Camping Plans for August 8th
- Join GSOC if you are not a member and want to go on the trip

**GSOC Annual Picnic**
Sunday, August 10, 2008

At this year's annual picnic, GSOC plans to have a Board Meeting at 10:00 am, followed by the picnic at noon. This year the picnic will be at Beacon Rock State Park, Washington. Drive east on Hwy. 14 from Vancouver, Washington for 35 miles. We have reserved the upper picnic area (signs will be posted) until 6:30 p.m. The picnic area is covered, with electricity and water available. There is no day use or parking fee charged; however, GSOC will assess $5 per person to cover facility rental and other costs.

GSOC will supply the paper plates, napkins, paper cups, and utensils. We will not be grilling this year, but just having a potluck meal. Attendees bring their own beverages. If your last name begins with A through G bring a dessert; H through P bring a main dish; Q through Z bring a side dish or salad. Alcoholic drinks (except kegs) are permitted; bring your own if desired.

Some members would like to hike to the top of Beacon Rock, or perhaps to the waterfall in the woods above the picnic area. We encourage anyone with musical abilities to bring their instrument for entertainment and sing-alongs.

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# Geologic Evolution of the Blue Mountains Province, Eastern Oregon and Western Idaho

A summary of GSOC Friday night lecture by Todd LaMaskin, July 11, 2008

By Beverly Vogt, GSOC secretary

Todd LaMaskin, a doctoral candidate from the University of Oregon, discussed the Mesozoic geologic history of the Blue Mountains of northeastern Oregon, the site of our President's Field Trip this coming September. He set the stage for the Mesozoic events by reviewing the ages of cratonic rocks to the east of our area and describing modern-day areas of southeast Asia and the southwest Pacific that are analogous to what was happening as our part of the North American continent was being assembled. He described the various terranes found in the Blue Mountains, presented their lithology, and summarized earlier workers' attempts to explain how this area had become what it is today. He then presented his model of how he believes the terranes were created and assembled, based on plate tectonic processes, mudrock (shale) geochemistry and stratigraphy, detrital zircon age populations in sandstones, and regional stratigraphic relationships in the Izee Basin. He finished this truly ambitious presentation with some wonderful oblique air photos taken by Ellen Bishop, with various rock units outlined on the photos. The following greatly oversimplified summary is based on my notes and was supplemented by information from Dorsey and LaMaskin (2007), LaMaskin's website (http://www.uoregon.edu/~tlamaski/), and the website of his advisor, Dr. Rebecca Dorsey (http://www.uoregon.edu/~rdorsey/rjd.html).

LaMaskin started by defining some terms he used during his discussion. The term "terrane" is applied to a fault-bounded crustal block that has a different geologic history than adjacent rocks and that is often described as "allochthonous" or "exotic"—for example, an assemblage of rocks such an old volcanic island arc that formed somewhere else and moved to its present location. "Stitching plutons" are igneous bodies of roughly the same age that intrude tectonic terranes after they were assembled--they do not really "sew" the terranes together but help record when terranes were assembled. An "overlap assemblage" is composed of sediments deposited on top of terranes and derived from adjacent areas surrounding the basin. And finally, a "provenance link" is a deposit of sediments that is on top of a terrane and that can be shown to have been derived from a different source.

Back to the rocks—the ages of rocks in the terranes that together form the stable portion of North America called the "craton" range from >2.5 b.y. (billion years) to 1.6 b.y. Later, during the Mesozoic, smaller microplates or packages of rocks were added to the western margin—something like adding Japan or the Indonesian Islands to our continent. LaMaskin suggested that North America during the Mesozoic looked somewhat like present-day southeast Asia, upside down and backwards, with a sequence of components including (from east to west): continental margin (craton), ocean basin, back-arc basin, and offshore island arc. He also reminded us that the Idaho Batholith was not in existence when the Blue Mountains were being assembled.

The rocks of the Blue Mountains of northeast Oregon are generally grouped into the following terranes: (1) the Wallowa terrane, a volcanic arc composed of Permian to Triassic volcanic, plutonic, and volcaniclastic rocks; (2) the Baker terrane, a subduction zone complex or mélange including sheared Permian to Triassic argillite and chert; mélange-type blocks of Devonian to Triassic limestone; and serpentinized ocean crust and forearc fragments with blueschist facies all deformed in a long-lived subduction zone; (3) Olds Ferry terrane, a volcanic arc containing Permian to Triassic volcanic, plutonic, and volcaniclastic rocks; and (4) the Izee terrane, consisting of Jurassic sedimentary rocks overlying the other three terranes. The question that many gifted and dedicated geologists working in this area have grappled with for years is how these terranes were assembled into their present-day configuration. LaMaskin called the problem the "Blue Mountains Conundrum" and showed a picture of a big elephant with geologists each feeling a different part of the elephant and

trying to understand what the whole elephant looked like.

Before the work currently being done by LaMaskin and his advisor, Dr. Rebecca Dorsey, most models explaining the present-day configuration of the Blue Mountains fell into one of two categories: (1) the Wallowa and Olds Ferry terranes were a composite single-arc complex in which the subduction zone shifted directions in Late Triassic time (Pessagno and Blome, 1986; White and others, 1992; Vallier, 1995); and (2) the Wallowa and Olds Ferry terranes were two totally separated magmatic arcs that moved toward each other as the ocean basin separating them closed during the Triassic and Jurassic, with the two terranes ultimately colliding in the Late Jurassic (Dickinson and Thayer, 1978; Dickinson, 1979; Avé Lallemant and others, 1980, 1985; Mortimer, 1986; Follo, 1992; and Avé Lallemant, 1995). In both models, the Izee terrane sediments accumulated in a forearc or inter-arc basin between the Wallowa and Olds Ferry terranes.

Dorsey and LaMaskin felt that the above models do not fully explain what they are seeing in their studies of the Blue Mountains. They believe that any model should be able to explain (1) simultaneous deposition of Late Triassic submarine conglomerates and chaotically deposited submarine sediments in basins developing at the same time on opposite margins of the emerging Baker terrane thrust belt; (2) a major angular unconformity on which similar-type Jurassic rocks overlap all older rocks; and (3) the subsidence of the Baker, Wallowa, and Olds Ferry terranes to depths of about 10 km during the Jurassic (Dorsey and LaMaskin, 2007). Based on their work, Dorsey and LaMaskin (2007) proposed dividing the Blue Mountains rocks into two mega-sequences: (1) Late Triassic to Early Jurassic rocks including both the volcanic and volcaniclastic rocks of the Wallowa and Olds Ferry Terranes plus rocks derived from the Baker terrane; and (2) Early to early-Late Jurassic marine sediments deposited above an angular unconformity into a single large marine basin—first above the Olds Ferry Terrane, then the Baker terrane, and finally the Wallowa terrane.

Dorsey and LaMaskin (2007) have proposed a new model for the Blue Mountains province that includes the following sequence of events (see Figure 1 on page 47): (1) during the Middle Triassic, magmatism occurs in both the Wallowa and Olds Ferry island arcs as the ocean separating them closes; (2) the accretionary wedges of the Wallowa and Olds Ferry island arcs collide during the Late Triassic, a thrust belt develops in the Baker terrane, and marine basins develop on both sides of the thrust belt; (3) the two joined terranes collide with the edge of North America during the Early to Late Jurassic, and a large sedimentary collisional basin subsequently grows in the Blue Mountains Province, possibly as a flexural response to thrust loading in the Cordilleran thrust belt to the east; and (4) during the late Jurassic and Early Cretaceous, a new subduction zone forms to the west, causing additional thrusting and accretion of the basin and terranes to the western margin of North America, uplift, and emplacement of plutons. They also propose that the term "Izee terrane" be abandoned because the Jurassic portion of these sediments overlies and links the other three terranes. The above-described sequence of events is believed to have occurred at the latitude of northwest Nevada, with the Blue Mountains ultimately moving about 400 km to the north along the western Idaho shear zone to their present location after the Jurassic ( Wyld and Wright, 2001). Various parts of this sequence of events are being observed today in places like the Molucca Sea, Papua New Guinea, and southeast Alaska.

LaMaskin discussed ways he is testing this new model with his geochemical studies of the sediments and ages of detrital zircons. The geochemical studies suggest the Wallowa terrane is more typical of intraoceanic chemistry, while the Olds Ferry sedimentary rocks have a more continental-fringing signature. The Jurassic overlying sedimentary rocks also have a more continental-type geochemical signature. As for zircons, the absence of Precambrian zircons in the Wallowa terrane suggest it was formed far away from the continent, while the Olds Ferry terrane has many Precambrian zircons, showing its proximity to the continent during its formation.

LaMaskin's fascinating and all too brief discussion of what he is learning about the Blue Mountains provided a tantalizing introduction to some very complex geology. It also provided us the

opportunity to see how geologic understanding of complex areas evolves over time as more is learned and as new analytical techniques and better instruments are developed. The earlier geologists led the way, and later workers have the opportunity to build on what has been learned before. The President's Field Trip will give us an opportunity to have a closer look at this fascinating area.

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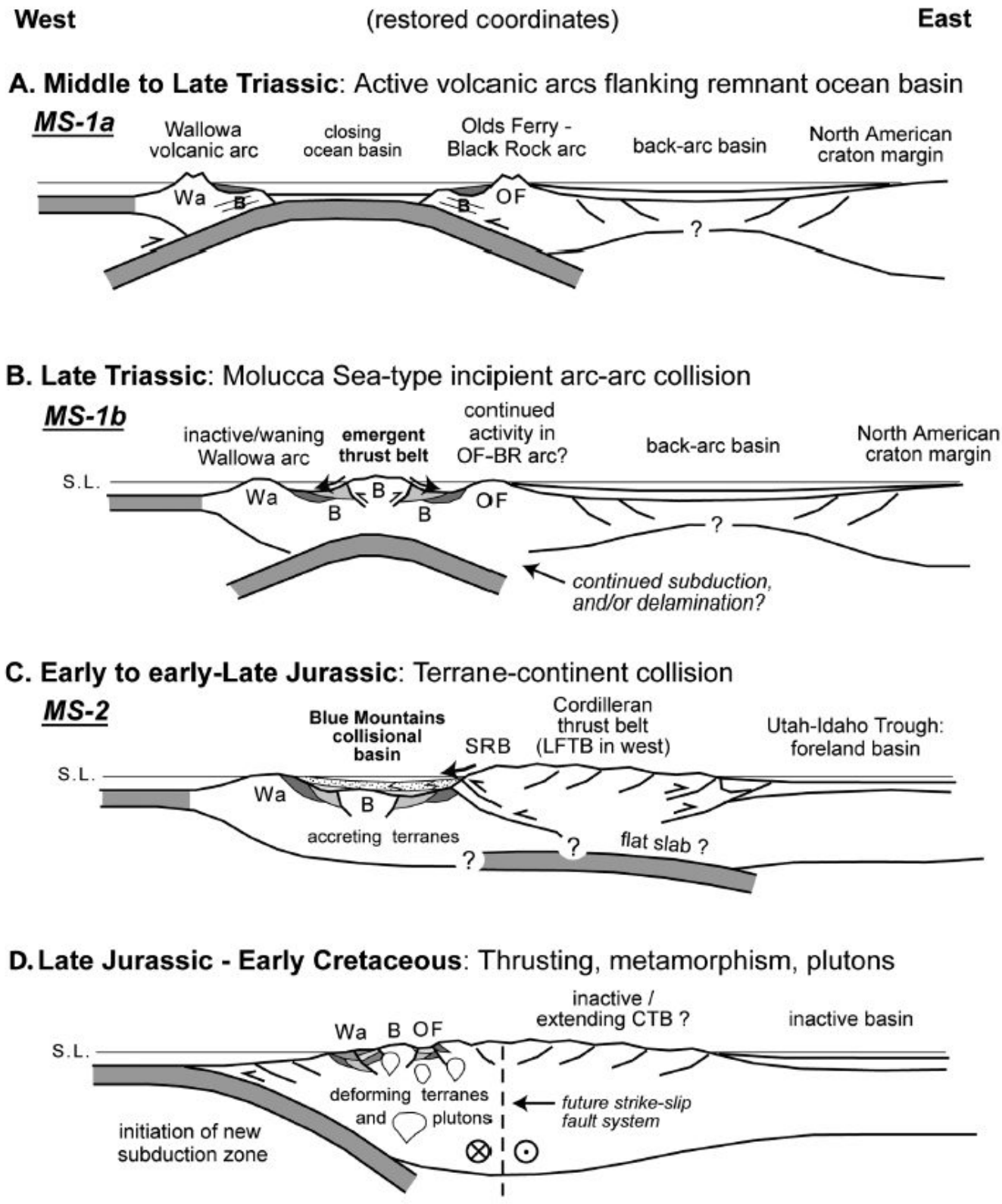


Figure 1. Proposed tectonic model for evolution of the Blue Mountains region and central Nevada during Middle Triassic through Early Cretaceous time (modified from Dorsey and LaMaskin, 2007).

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## 2008 GSOC PRESIDENT'S FIELD TRIP: THE BLUE MOUNTAINS

September 3-9, 2008

Mark your calendars now for the President's Field Trip. This year we'll travel east to Baker County. It will be a two-part trip. See registration form in last month's *Geological Newsletter* for complete details. For more information contact Janet Rasmussen 541/753-0774 or email at jkayerocks@yahoo.com, or Bev Vogt or Richard Bartels at 503/292-6939.

NOTE: You must be a GSOC member or guest of a member to attend GSOC field trips. You may join GSOC at any time. GSOC membership application form is on title page of this newsletter.

# BOARD MEETING NOTES

August 10, 2008

The meeting was called to order by President Janet Rasmussen at Beacon Rock State Park. Board and GSOC members present included Janet Rasmussen, Beverly Vogt, Richard Bartels, Dave Olcott, Doug Rasmussen, Clay Kelleher, Bonnie Prange, Larry Purchase, and Trish Reading.

The Lake County field trip in June had 20 participants. The August field trip to the wind farms and Columbia Ridge Landfill and other interesting areas was cancelled because not enough people signed up. It was decided that the trip should be rescheduled for next year (possibly next June), with more advance time and publicity so more people could plan to attend. Also, it was suggested that setting up the trip so people could attend for only one day instead of both days might make it easier for some people to attend.

Janet summarized plans for her president's trip in September. Wed. and Thurs. (Sept. 3rd and 4th) will be camping at Janet's place, with sightseeing and hiking there. Friday will feature eastern Oregon mining history, as related by long-time DOGAMI geologist and mining historian Howard Brooks, plus the Oregon Trail museum and other local museums and interesting places in Baker City. Late Friday afternoon we will meet with Jay Van Tassel, EOU geology professor, to look for fossils behind the Always Welcome Inn where we are staying while in Baker City. Saturday we will see the Sumpter mining dredge and explore that interesting mining area. Sunday will be a tour of North Powder River and Snake River led by Mark Ferns, another long-time local DOGAMI geologist. Monday will be a tour of Granite led by GSOC members Bo and Marija Janko and a trip between Granite and Ukiah, which will be the end of the trip. Some of us plan to eat dinner and stay in Pendleton that night before returning to Portland.

Bart is still working with the group that is coordinating activities related to the GSA national meeting next year in Portland. He will check to see about possible reduction in cost to attend the meeting for volunteers who are helping with the meeting.

Trish Reading presented information from Jan Kem about ways we can print the newsletter more economically. The president appointed a committee consisting of Jan Kem, Carol Hasenberg, Clay Kelleher, Bart Bartels, and Bev Vogt to investigate this issue and report back at the next board meeting.

GSOC will have two eight-foot tables at the regional gem show September 26th –28th at the Expo Center. The tables will be against the wall and will have access to an electric outlet. Bart and Larry will work on the display with whomever else wants to help. Trish, Jan, Bev, Bart, Larry and Clay volunteered to man the tables during the exhibit.

Next meeting is 10 a.m., October 11, location to be confirmed.

Beverly Vogt, Secretary

# GSOC HISTORY SERIES

Dear GSOC Members,

This month we have reprinted another fine article written about Edwin T. Hodge, the founder of our society. We hope you enjoy it.

Carol Hasenberg, Editor

MEMORIAL TO EDWIN THOMAS HODGE (1887-1970)

by JOHN ELIOT ALLEN
Department of Earth Sciences, Portland State University, Portland, Oregon

Edwin Thomas Hodge, born in Atlanta, Illinois, on July 12, 1887, died at his home in Portland, Oregon, on November 7, 1970. He was the only son of an itinerant minister, who had abandoned his family when Edwin was 4 years old. His early years were full of hardship that spurred him on in his later ambitions and successes. He attended school in Minneapolis and completed high school in three years. One of his early talents was his ability to memorize; he tells in a memoir how he read and committed to memory whole sections of Darwin's Origin of Species and Hudson's Laws of Physical Phenomena while he was still in grade school. He early developed a high degree of competence in gymnastics, and during high school and college taught night "settlement" classes in gymnastics and boxing to contribute to the family finances. He worked his way through the North American Normal School for Gymnastics in Milwaukee and, after receiving a degree in 1907, took his first academic job as director of high school physical education at Ashland, Wisconsin. In one year he was able to save enough money to go to the University of Minnesota, receiving a B.A. in 1913 and, with the assistance of a fellowship, a M.A. in Biology (pre-Med.) in 1914. While at the University of Minnesota, he met Lydia L. Herrick whom he married in 1912. She was an accomplished artist and a gracious woman who enriched Edwin's life. Here he also met W. H. Emmons, who helped him decide that climbing mountains was better than working in a laboratory, and who recommended him to the graduate school at Columbia University, where he studied as a University Scholar. He received his Ph.D. in 1916 for a study of the geology of south-central Puerto Rico, made during one year as a William Bayard Cutting Traveling Fellow.

Hodge began his field career under Emmons in 1911 as assistant geologist for the Minnesota Geological Survey in the Mesabi Range. In 1912, he acted as geologic aid studying coal in Montana for the U. S. Geological Survey. He was geologist for the Wisconsin Geological Survey in a magnetic study of iron ore in 1913, and assistant chief geologist for the Pennsylvania Geological Survey in 1914. As geologist for the New York City Board of Appraisal he examined bridge and tunnel projects in 1916. Between 1917 and 1925 he acted as consultant to several mining companies in Alaska, Yukon, and British Columbia. In 1919 he helped organize the International Mining Convention and acted as secretary and in other capacities during 1920 and 1921. He was also executive secretary to the General Meeting of the Canadian Institute of Mining Engineers, and president of the British Columbia Chamber of Mines in 1919. During the decade 1910 -1920 he reports that he studied under or worked during the summer with such well-known geologists as J. P. Berkey, Reginald A. Daly, W. H. Emmons, Amadeus Grabau, L. C. Graton, Frank Grout, J. D. Irving, D. W. Johnson, J. F. Kemp, Waldemar Lindgren, G. P. Merrill, and F. E. Wright.

In 1917 he went to the University of British Columbia as assistant professor, to organize and direct the Department of Geology. In 1920 he moved to the University of Oregon as professor of economic geology. Here, with Warren Du Pre Smith and Earl Packard, this small department during the next 10 years graduated such eminent geologists as Eugene Callaghan, Ian Campbell, Harold N. Fisk, Donald M. Fraser, Claire Holdredge, Henry V. W. Howe, Siemon W. Muller, Howard A. Powers, Hubert G. Schenck, T. P. Thayer, Harry E. Wheeler, D. W. Wilkinson, and

others. Can any other three-man department match such a record?

Thomas Condon, Oregon's pioneer geologist, had been appointed to the Chair of Natural Science in 1876 and had held it during the following 30 years. Condon saw the ulrural values of geology and the importance of transmitting them to the general public, as well as to the students.

After Condon's death in 1908 there was a hiatus until 1914, when Warren Du Pre Smith came from his tour in the Philippines to become head of the new department, When he added Hodge to the staff in 1920 he brought in a man who would stress the importance of basic field work in the solution of geological problems, one who had gone into geology originally because of his interest, as he once stated, "in climbing the mountains," and one who was later to conduct with his students, some of the most extensive field surveys that had been accomplished in the state up to that time.

In 1932, in a reorganization of the State System of Higher Education, the geology department was transferred to Oregon State College at Corvallis. From here he commuted once a week by train to Portland to teach an adult geology class. With this group as a nucleus, he founded and was twice president of the Geological Society of the Oregon Country, a laymen's group that now numbers over 200 members, with a *Newsletter* which has been published monthly since 1935. He served as editor for the first three years, contributed 17 articles, and gave 28 addresses to the society. Hodge also participated in the formation of the Oregon Museum of Science and Industry in 1946, and was its advocate as far back as 1938. As late as 1964, after his retirement in 1951, he taught for a semester at Texas Technological Institute.

Following Condon's tradition of public service, Hodge's public lectures and popular articles in the Newsletter and elsewhere must have numbered in the hundreds. He records that he spoke before, held offices and was active in mountaineering, mining, political, social, improvement, sanitary, church and lodge societies and associations. In addition to his activity with laymen's groups, his professional record includes membership in The Geological Society of America, American Association of Petroleum Geologists, Canadian Institute of Mining Engineers, New York Academy of Science, American Institute of Mining and Metallurgical Engineers, American Geographical Society, Seismological Society of America, American Association of University Professors, Sigma Xi, American Mineralogical Society, and American Ceramic Society.

In 1930 he completed, by summer plane table work with students, a topographic base map covering 8,600 square miles of north-central Oregon. In 1931 he published the first geologic map of the area. By 1942 the work had been expanded to cover 12,000 square miles and was published as an Oregon State College monograph.

In the summer of 1931, eleven students under his direction mapped Mount Hood and the Columbia River Gorge in 15 weeks, with areas north and south encompassing 2,000 square miles, resulting in three master's theses and a report in the GSA *Bulletin* in 1938. Some of us later calculated that our combined traverses in heavily forested wilderness country totaled over 15,000 miles! Incidentally, on the basis of this survey, Hodge later (1932 to 1942) served as consultant to the U. S. Army Engineers; and the accomplishment in which he took greatest pride was the location of the site and geological supervision of the foundation work on Bonneville Dam, the first of the great dams across the Columbia River.

As a teacher, Hodge is remembered by his students for the rigor of his expectations in their work - some of us might even say the harshness of his requirements. He was generally referred to behind his back as "E. T. God." Later, we found out in other graduate schools that our background far exceeded that of most of our competitors. Hodge also had a talent which added immeasurably to his effectiveness as a teacher and public lecturer - with colored chalk he could ambidextrously draw blackboard diagrams of geomorphic landscapes, stratigraphic and structural sections, and optic wave front views, exceeded only in my experience by those of William Morris Davis.

Hodge was always keenly interested in innovative theories, and since he was firm and emphatic in his opinions, he became involved in several lively controversies. In 1930 he presented a full-term seminar on continental drift, which so indoctrinated many of us, that in recent years we have had no problems adjusting to the swing of the pendulum toward this concept. He also gave a seminar on the then questionable Spokane Flood hypothesis of Bretz, and later published an alternate hypothesis. As early as 1925, after making topographic base maps of the Three Sisters area, he mapped and proposed that an ancient Mount Multnomah had been destroyed to leave a caldera ring of peaks. Since Oregon already was familiar with Mount Mazama, ancestor of Crater Lake, this caught the public fancy, and even after Mount Multnomah had been demolished by Howel William's study, the general public (and press) continued to refer to it.

Generations of students worked with him in the compilation of data for his *Quantitative Mineralogical and Chemical Classification of Igneous Rocks* (1927), which ingeniously placed 679 described igneous rock names on one sheet in a circular diagram (known to his students as "The Target") where they were classified on the basis of the percentage of feldspars and feldspathoids, orthoclase-plagioclase ratios, and degree of saturation. Chemical composition was given by contours.

Perhaps Hodge's most monumental publication was the editorial compilation for the Corps of Engineers from 1932 to 1935, of 16 volumes on the available raw materials for Pacific Northwest industries, with numerous sections and appendices totaling over 1,500 pages. This "5-foot shelf" has been an invaluable basic reference for the mineral industry for 35 years, in spite of its limited distribution.

Hodge's many early articles in the *Portland Oregonian* and later, in the *Newsletter* of the Geological Society of the Oregon Country, document his concern with public appreciation of the cultural values of geology. His early training in economic geology led directly to his deep involvement with the interplay between economics, political factors, and the available mineral resources of the region. His students who assisted him in mapping large areas of the state well remember how he could sit on a high point and derive multiple hypotheses on the geological implications of the landscape for miles around.

After his retirement in 1951, he spent 1952 in South West Africa and 1953 in Angola as a consultant, investigating iron and manganese possibilities for a steel corporation. Following the death of his wife in 1960, he lost interest in geology for a time, but during the late 1960's this revived, and he became active again, mainly with the Geological Society of the Oregon Country, which, in a real sense, is his outstanding monument.

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# NOTES FROM THE 2008 GSOC PRESIDENT'S FIELD TRIP: MINING HISTORY AND MORE IN OREGON'S BLUE MOUNTAINS

by Carol Hasenberg

Now that the field trip is over and we're all looking forward to the fall and winter, it's a good time to settle down with a nice cuppa and review some of the events and notes we took on the trip. Also, do check out the "Field Trip Revues" section of the GSOC website, www.gsoc.org, for more information, maps and slide shows from the trip.

The author attended Part 2 of the trip on September 5, 6, 7 and 8. A brief trip synopsis of Part 2 is as follows:

- Day 1, September 5, Baker City Museums, Howard Brooks (retired, DOGAMI) lecture and fossil hunting with EOU's Jay Van Tassel
- Day 2, September 6, Sumpter gold mining history, dredge, and railroad
- Day 3, September 7, Geological tour of the Snake River Canyon by Geologist Mark Ferns of DOGAMI
- Day 4, September 8, town of Granite history, Fremont Power Station tour, and Tower Mountain caldera

The weather was extremely cooperative for this geological tour – clear blue skies, temperatures in the 80's during the day and 50's during the night – it was Oregon at its finest.

Day 1 Notes:

After browsing through the displays at the Oregon Trail Interpretive Center just outside Baker City, the GSOC group assembled in the Center's auditorium for a talk by Howard Brooks, a retired geologist from the State Department of Geology and Mineral Industries (DOGAMI).

According to Brooks, northeast Oregon mines have produced 3.5 million ounces of gold. The discovery of gold in 1861 in northeast Oregon was the impetus of early European-American settlements in the area. The gold mining industry was a major part of the area's economy during the latter part of the 19th century. Gold camps or towns were located in Sumpter, Granite, Baker City, Auburn, Clarksville, Malheur City, Bourne, Cornucopia, and Canyon City.

Transportation to and from the mines was a key economic factor in the mining of gold. Supplies were obtained from the Willamette Valley and California and arrived by way of steam boat on the Columbia River. They were taken to the mines by pack strings in the early days before roads, then freight teams and finally railroads. The Sumpter Valley Railroad was built in 1896.

There are basically two types of gold mining: **placer** mining and **lode** mining, with many variations and scales. Refer to Fig. 1. Placer mining is the recovery of eroded gold from stream beds and other depositional environments. Lode mining is extraction of the gold from the gold-bearing veins. At its simplest scale, panning for gold is the quintessential image of placer mining. The old mine shaft is the image that readily comes to mind of lode mining.

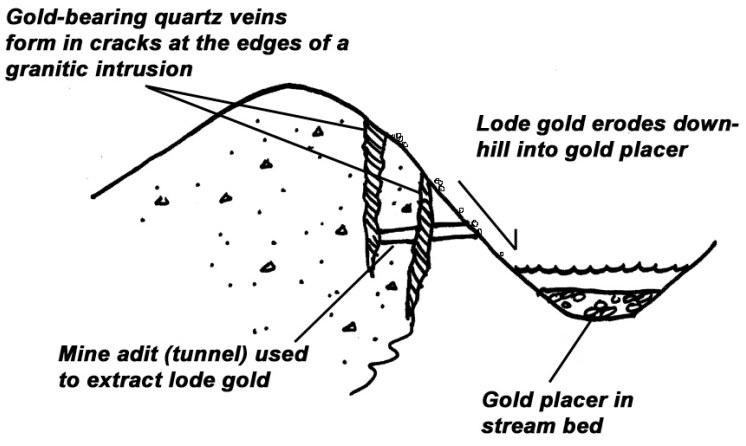


Figure 1. A pictorial representation of gold mining variations.

Brooks described various versions of each type of mining done historically in northeast Oregon. Lode mining in Oregon was generally carried out in mine adits (horizontal tunnels). Early mining employed the technology of sledge hammer and drill bit by candlelight. Single jacking was done by one worker wielding both of these tools and double jacking was done by two workers, one swinging the sledge while the other held the bit. Needless to say this was very dangerous work. The jackleg drill, invented in the 1890's, made mining much safer.

Once the ore was extracted from the vein, various devices were used to crush the ore – arrastra stones, which were powered by water, and stamp mills were two commonly used methods. Later in the day, the GSOC group saw examples of these plus steel ball mills in the Baker Heritage Museum. Gold pieces were extracted by gravity or in a mercury amalgam.

Brooks then described various types of placer mining which took place in northeast Oregon. Early prospectors panned for gold, then worked placer deposits with sluice boxes. Hydraulic mining was used in waterless deposits. A system of ditches and pipes were used to bring water to these areas. According to Brooks, the pressure of water coming out of the hose end could kill a man. The most efficient method of placer gold mining was the dredge, which was used in the waning days of the gold rush. Basically a dredge sifted through all the material in a placer gold deposit, removed the gold, and left behind piles of spoils. Three dredges worked the Sumpter Valley from 1913-1954 and produced 296,000 ounces of gold.

The towns associated with the gold rush experienced a cycle of boom and bust, and now many of them are ghost towns. Baker City, the hub at the center of the mining district, had the finest hotel between Seattle and Salt Lake City in its heyday. Although this claim could be disputed today, Baker City is still a thriving town because its economic base was more diverse than simply mining. Sumpter burned in 1917 and never recovered its glory. Today it is a sleepy town on the Elkhorn Mountains Scenic Byway. Granite, just up the road from Sumpter, is just a small village. Bourne, which boasted 750 people in 1905, is nearly completely erased due to a 1937 flood.

European-Americans were not the only people who came to Oregon for the gold rush. Chinese workers came to work in the gold fields even though they had to endure xenophobic regulations and exploitation by the whites. Chinese workers in the town of Granite, who lived in their own separate area, provided town services and were permitted to work through the dredge spoils, creating the rocky features that are now called the "Chinese Walls." Some other legacies of the Chinese gold rush workers can still be seen in the area, including the Chinese cemetery in Baker City.

Brooks ended the talk on a little wistful note that current state mining regulations are very strict, which has effectively discouraged much gold mining in Oregon today. Although it is important to protect the environment and some past mining practices have been very toxic or destructive, he recognizes the need for mining because the minerals are very important for today's technological needs.

After visiting the museums and a short tour of the town on Day 1, the GSOC group went on a little fossil hunting expedition behind the Always Welcome Inn, with geologist Jay Van Tassell, who described himself jokingly as the "Geology Department" at Eastern Oregon University. Jay had a couple posters about the fossils, as well as some example fossils from the area. The group oohed and ahhed at the beaver jaw that a previous researcher had found, then set about to try its luck at finding fossils. Jay gave some instructions on fossil appearance and sifting technique, and made sure that no one made off with anything of scientific value.

The fossil beds behind the Always Welcome Inn are a series of early Pliocene fluvial/ pluvial sedimentary layers dating about 4.8-4.3 million years in age and yielding fossils of small mammals, amphibians, reptiles, fish, birds and plants of the era. Fossils of this age are relatively rare and that is why the researchers are grateful to the inn for access to the site. There are a couple of free

publications describing the fossils in more depth in the additional reading listed below.

Day 2 Notes:
On Day 2 the GSOC group drove to Sumpter and were given a tour of one of the gold dredges that worked the valley from 1913-1954. The dredges were built in the "same pond" in which they now sit, according to Ranger Miller, who led the group through the dredge. Miller also went on to describe how the dredge worked by swinging back and forth around the pivot point of the "spud anchor" at its back end and cable lines on both sides. It could thus process all the sediment in its path. It progressed along the valley floor at a rate of 10 acres per month.

After the tour of the dredge, the GSOC group took gold panning lessons from the rangers at the Sumpter Valley Dredge State Heritage Area. Some tried their new panning skill in the nearby Cracker Creek (without any luck I might add) while the others went on a fruitless search for the ghost town of Bourne. Then the group reassembled for a short ride on the Sumpter Valley Railway.

Day 3 Notes:
This was the true rock-bustin', dust-eatin', hot-as-an-oven geologic tour that GSOC'ers have come to love. Because the geology of the Blue Mountains has been previously covered in the February 2008 and August 2008 issues of *The Geological Newsletter*, they will not be covered in these notes; the reader is referred to these issues for reference. Only specific observations or descriptions of the tour will be noted. The field trip leader was DOGAMI Regional Geologist Mark Ferns, who did an excellent job of acquainting the GSOC group with the area.

Since the tour would pass through sections of the Olds Ferry/Izee Terrane and the Baker Terrane, Ferns described these to the group at Stop #1. The Weatherby Formation is composed of shallow marine sediments, and the Huntington Formation is composed of volcanic arc rocks of the Olds Ferry/Izee Terrane, which was believed to be a forearc basin environment during the Permian, Triassic, and Jurassic. The Baker Terrane was formed in deep water during the Pennsylvanian to Jurassic. Also, the terrane rocks in this area contain many basalt dikes which are now understood by geologists to be the southern end of the Chief Joseph dike swarms of the Miocene, through which the Columbia River Basalt was erupted.

Ferns also mentioned that historically the terranes of northeast Oregon were named for their mineral associations. Neither the Huntington or Weatherby formations contain gold—copper, zinc, and silver are the minerals found in these formations. Gold, copper, and zinc are to be found in the Wallowa terrane to the north, and gold can also be found in the Baker Terrane to the north.

The route of the geological tour was to take I-84 south from Baker City to the US 30 exit at Huntington. The group traveled north for a couple of miles to pick up Stop #1, then headed south through Huntington. In Huntington the group turned off US 30 onto the Snake River Road which followed the Burnt River to the Snake River Canyon. Shortly after arriving at the canyon, the route becomes a well-maintained gravel road for about 30 or 35 miles along the canyon, where the group made most of their stops. Eventually, the road climbs out of the canyon, passes over the hills, then falls back down to the valley containing Richland, Oregon. SR 86 from Richland to Baker, part of the Hells Canyon Scenic Byway (see www.oregon.com/byways/ ) is paved. The GSOC group packed into as few vehicles as they could manage for the tour. Ferns traveled with each group for portions of the trip.

Ferns was a very knowledgeable, patient leader. He gave the GSOC group hints about what they were observing and asked them to make conclusions from their observations. Some of the questions were:

- In the porphyry dike of Stop #1, did the feldspar crystals form in the dike or prior to their arrival in the dike?
- Granitic intrusions usually form a fine-grained rind at their intrusive boundary due to rapid cooling. At Stop #2, which came first, the granite intrusion or the basalt intrusion?

- Can stone be spherical from a non-water related process? At Stop #6, there were spherically-weathered sections of the basalt dike.

Although there was much more information than this author could note in the tour it is certain that the GSOC group came away with a much better appreciation for the work geologists have done to map and understand the development of this region's geology.

Day 4 Notes:

The final day of the field trip dawned beautifully over the Elkhorn Ridge to the west, and the GSOC group set out for Granite, Oregon, some few miles northwest of Sumpter. GSOC members Bo and Marija Janko own a summer home in Granite and GSOC member Arthur Springer has also spent summers in this community, so they all had information about the town to relate.

Bo and Marija were the group's tour guides to the Janko residence and the town of Granite. They bought their house in 1978. It was built as a stage coach station in 1895-1898. Bo and Marija have taken loving care of it, filling it with suitable old furniture and appliances, including old iron beds, wood burning stoves and old radios. The old linoleum area rugs are in very nice shape. Marija has also been weaving for several years and has been working on hangings that recreate some of the Croatian folk patterns of her heritage in naturally dyed wool.

Bo and Marija took the GSOC'ers on a tour of the town of Granite. The group saw the old dance hall next door to the Janko's place as well as old grocery store, city hall, and pharmacy farther down the street. Bo pointed out the old log cabin which was the home of Olds Ford, the "last resident of Granite." They told us how the sheriff of Granite had been murdered some years before by two women in the town. According to Bo the town attracts its share of misfits and paranoid individuals. At the end of the tour the group visited the town cemetery, where the tombs of the murdered sheriff "Ringo" and the man who kicked off the Granite gold rush, AG Tabor, could be found.

After the tour of Granite, the GSOC group headed a few miles south of town to the old Fremont Power Station. The old powerhouse is now a museum, and caretaker Mitch Fielding gave the group an excellent tour of the facility, which included technical explanations of the works and even a ghost story of the place. Apparently the ghost of Sergeant Major, the former manager of the powerhouse, who had earlier died nearby of a heart attack, moved his favorite hat outside of the structure to the doorstoop one day. That hat hangs on the wall of the powerhouse now in memorial. The power provided by the station was used by local mines and the Sumpter valley dredges. The concrete masonry station was built in 1908 and closed in 1967. The structure lost its original roof in 1999 from excessive snow loading. Olive Lake, 8 miles from the station, provided the water that ran the turbine to generate the power.

For the remainder of the trip, the group used the "Ukiah to Granite Geology Field Trip Guide" brochure published jointly by the USDA, DOGAMI, and the Umatilla National Forest. The group stopped at stops 9, 5, 4, and 3 from the brochure. Stop 9 was the "Chinese Walls" which Brooks described to the group on Day 1. Stops 4 and 5 were in the Tower Mountain Caldera area, a rhyolite volcano which is about 25 million years old. A fellow rock hound stopped by while we were examining a road cut to tell us about his petrified wood finds in the area.

The last stop was an overlook looking west to the North Fork of the John Day canyon. What a beautiful view, and a very nice place to say goodbye to another GSOC adventure.

**References and Additional Reading:**

Howard Brooks, A Pictorial History of Gold Mining in the Blue Mountains of Eastern Oregon, Baker County Historical Society; Trade Paperback, 200 pp., $20

Howard C. Brooks and Len Ramp, *Gold and Silver in Oregon*, Oregon Department of Geology and Mineral Industries, Bulletin 61, 1968, 337 pp.

Can be ordered from DOGAMI at http://www.oregongeology.org/pubs/search.php.

Howard C. Brooks, *Quicksilver in Oregon*, Oregon Department of Geology and Mineral Industries, Bulletin 61, 1963, 223 pp.

The full catalogue of Oregon Geology/Ore Bin articles represented by Howard C. Brooks, Mark L. Ferns, and J. Van Tassell is simply too numerous to record here, and can be searched and viewed at the oregongeology.org website listed above. Some notable examples which concern our trip are as follows:

M. L. Ferns and H. C. Brooks, "Serpentinite-matrix melanges in parts of the Blue Mountains of northeast Oregon", Oregon Geology/Ore.Bin vol. 45, no. 7/8, July/August 1983, p. 82.
Thesis abstract is contained in full issue PDF.

J. Van Tassell; M. L. Ferns; G. R. Smith; H. G. McDonald; J. I. Mead; R. A. Martin, "Early Pliocene (Blancan) Always Welcome Inn local fauna, Baker City, Oregon," Oregon Geology/ Ore.Bin vol. 68, no. 1, 2007, p. 3.
Article is contained in full issue PDF.

Howard C. Brooks and Mark L. Ferns also produced a number of other publications for DOGAMI, including many geological maps. Once again, the list is lengthy, but in reference to this trip you may be interested in GMS-019, GMS-022, GMS-025, GMS-028, GMS-029, GMS-031, GMS-035, and GMS-041, which are geological and gold deposits/mineral resources maps of various quadrangles in Baker and Grant counties.

*A Guide to the Fossils at the Always Welcome Inn, Baker City, Oregon*, the website by Kate Asplund, Eric Bergey, Misty Davis, Brooke Garton, Bryan Grimshaw, Allison Kuenzli, Story Miller, Carli Morris, Kelsey Swanson, Corby Weyhmiller, and Jay Van Tassell, Science Department, Eastern Oregon University, La Grande, Oregon, http://www.eou.edu/geology/AlwaysWelcomeInnFossils.html and its parent website, *Eastern Oregon Geology*, http://www.eou.edu/geology/easternoregongeology.html

For more information about historic Sumpter see the following websites:
Sumpter Valley Railway: http://www.svry.com/
Historic Sumpter:
http://www.historicsumpter.com/sumpter-oregon-sumpter-valley-ry.html
Sumpter Valley Dredge State Heritage Area:
http://www.oregonstateparks.org/park_239.php
Friends of the Dredge, Inc.:
http://www.friendsofthedredge.com/
Elkhorn Mountains Scenic Byway
http://www.oregon.com/byways/

Volcano World's "Columbia River Flood Basalt Province, Idaho, Washington, Oregon, USA" has a map showing the extent of the Chief Joseph Dike Swarm:
http://volcano.oregonstate.edu/vwdocs/volc_images/north_america/crb.html
and also visit the USGS page on the subject:
http://vulcan.wr.usgs.gov/Volcanoes/PacificNW/AGU-T106/columbia_river_basalt_group.html

DOGAMI Field Trips: Granite to Ukiah, Grant County, Oregon website:
http://www.oregongeology.com/sub/fieldtrips/ukiah-granite/default.htm
and brochure of the trip from the US Forest Service:
http://www.fs.fed.us/r6/uma/maps/UG2.pdf

This net-published paper discusses the age of the Tower Mountain Caldera:
John D. Kauffman, John H. Bush, Reed S. Lewis, "Oligocene Alkaline Volcanic Rocks Along the Eastern Margin of the Columbia Plateau, Northern Idaho", Idaho Geological Survey-University of Idaho Technical Report 06-7, ISBN 1-55756-513-8, http://www.idahogeology.org/PDF/Technical_Reports_(T)/TechRpt06-7_B.pdf

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**FIELD TRIPS:** About 6 per year. Fees: see field trip announcements on the calendar next page.
**GEOLOGY SEMINAR:** Usually held on the third Wednesday of some winter months, 8:00 p.m., Rm. S17, Cramer Hall, PSU. See calendar for details
**GSOC LIBRARY:** Rm. S7, Open 7:30 p.m. prior to meetings.
**PROGRAMS:** Second Friday evening most months, 8:00 p.m., Rm. S17, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon.
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## WELCOME

We welcome the following new members to the Geological Society of the Oregon Country:

**Dawn Juliano**
**Betty Lou Pratt**
**Howard Brooks**
**Mark Ferns**
**Jay Van Tassell**

# BOARD MEETING NOTES

October 11, 2008

The meeting was called to order by President Janet Rasmussen at the home of Past President Rosemary Kenney. Board and GSOC members present included Janet Rasmussen, Beverly Vogt, Richard 'Bart' Bartels, Jan Kem, Larry Purchase, Tara Schoffstall, Doug Rasmussen, Rosemary Kenney, John Newhouse, and Bonnie Prange.

The President appointed the Nominating Committee: Jan Kem, Chair; Carol Hasenberg; and Larry Purchase. Larry has volunteered to serve as Vice President, Bev agreed to continue as Secretary, and Bart agreed to stay on as Treasurer. The schedule for the nomination process is that the Committee reports its nominees at the November meeting; additional nominations may be made from the floor at the November and December meetings, after which the nominations are closed; the names of the nominees are printed in the January newsletter; and the election is held during the February meeting.

The Gem and Mineral Show was discussed. Although fewer people attended this year, we felt we made some good contacts, and it was worth doing again next year. Janet said she was asked if we would be willing to work on the seminar for next year. She is willing to organize such an event with GSOC members' help.

Jan discussed ways to reduce the cost of the newsletter. We agreed that is should be printed on 11 x 17 sheets, folded, not stapled, and fastened by tape by the printer. He would like to start using this method next month to reduce the cost and will work directly with Carol to facilitate the change. He will also look into the implications of the potential change in requirements by the Port Office for taping of the newsletter.

Rosemary showed us the Crooked River Caldera brochure that is available from DOGAMI and suggested we also distribute them. Larry said he would contact DOGAMI about putting their brochure on our web site. Rosemary also reported that the PSU Geology Department asked her if we would like to fill in the missing copies of the GSA Bulletin in our library with copies from PSU's collection before they discard them.

Rosemary discussed the history of locations, times, and frequency of board meetings and said she originally offered her house for the meetings because of its central location. She said she is happy to continue hosting our meetings, and we are happy we can meet at her house. We thank Rosemary for her willingness to have us—plus providing us with coffee and treats each time.

The adequacy of the GSOC Friday night meeting room was also discussed. There also was a suggestion to promote new members more aggressively at the meetings, perhaps by setting up a table by the door, having a brightly colored box in which to put membership applications and checks, and making an announcement at the meeting.

Next GSOC board meeting will be 10 a.m., December 13, at Rosemary Kenney's house.

Beverly Vogt, Secretary

# WATER WITCHING: FOLKLORE, FREEDOM OF SPEECH, OR PUBLIC PRACTICE OF GEOLOGY?

By Todd Jarvis

You know the competition is getting stronger when your competitor makes it into the Wall Street Journal. The August 3, 2007 edition ran the piece entitled "In Race to Find Water, It's Science vs. 'Witchers'", where a California "dowser" charges $200 an hour, plus $10 for each gallon per minute produced in a well he has located, sometimes making $7,500 in a day's work! The article reports a rush is one because Western states such as California and Arizona are experiencing a well-drilling boom, as a surge of new properties are being developed outside the boundaries of a municipal water system.

The same type of rush may occur in Oregon despite the "fixing" of Ballot Measure 37 with Ballot Measure 49; the August 22, 2008 edition of The Oregonian reports that there is some talk of trying to repeal Measure 49. Prior to the passage of Measure 49 there were an estimated 124,000 houses proposed for development under Measure 37; the vast majority of these dwellings would have been serviced by individual wells and septic tanks.

While Oregon is famous for its diverse water landscapes, Oregonians have a rich history in dowsing and locating water and water channels. In the article "Witching for Water in Oregon" published in a 1952 edition of Western Folklore, Claude Stephens describes the diverse skills and tools used by water witches dating back to the early 1900s. In one of the most complete studies of the psychology and anthropology of water witching Water Witching, U.S.A. first published in the late 1950s, cognitive psychologist and retired University of Oregon professor, Ray Hyman, and anthropologist Evan Vogt show that nearly every tool imaginable has been used to "divine" water, from pitchforks, car keys hung as a pendulum from bibles, and pliers from a toolbox, to the classic "forked" stick. Stephens also reported an interesting array of equipment used in the hunt for Oregon groundwater, including one water locator's toolbox "a compass, several copper rods, the forked witch stick, a radio tube, a small bottle of water, several stakes, a block of wood, and a gold watch and chain." Stephens also describes the method of a witch from Boring, who used a rawhide covered buggy whip.

Many drillers in Oregon also offer their services as "water finders". Harold White is a well driller located in Creswell, Oregon who unlike many of his American counterparts, learned how to find water channels from his father. According to a 1956 article in the Omaha World-Herald, Harold's father was apparently one of the many dowsers contacted by Vogt and Hyman for Water Witching, U.S.A. Harold has been drilling wells and dowsing for water for over 40 years. Like his father, Harold prefers to be called a "water channel surveyor" as opposed to a witch or dowser because he believes he senses the electricity generated by water moving underground. Harold has built upon the skills learned from his father and indicates he can "see" different types of "energy" emanating from the ground surface, and that he does not need to use the conventional tools of the dowser such as bent rods or a forked stick to detect this energy. Interestingly enough, Stephens reported the same type of sensation for a water witch working out of Eugene from the early 1900s to 1950s. While Harold's brother is a geologist educated at the University of Oregon, the two respect the skills of the other – if Harold has a question on geology, he relies on his brother; if his brother has need to find water, he relies on Harold.

So who is right – the hydrogeologists or the water witch? According to Hyman and Vogt's Water Witching U.S.A., there were approximately 25,000 practicing water witches in the late 1950s. Francis Chapelle, a hydrologist with the U.S. Geological Survey estimated that this number had grown to approximately 60,000 in his book The Hidden Sea published in 2000. For comparison, Chapelle estimated approximately 4,000 professional hydrologists were practicing in the US. University of Oregon Professor Ray Hyman reports that the many tests of a dowser's ability under controlled

and double-blind conditions have failed to find any evidence that dowsing works. Many of the natural resource agencies with the State of Oregon proclaim that the USGS and the NGWA do not promote water witching due to a lack of science.

Whether water witches can offer their services as "professionals" remains debatable as the California Board of Geologists and Geophysicists in California won a permanent injunction against a water witch in 2004. In the Wall Street Journal article, George Dunfield, chief of the professional-standards unit with the California Board indicates that water witchers are protected by the First Amendment of the US Constitution regarding free speech - a subject that the Oregon State Board of Geologists Examiners learned about the hard way just a few years ago when dealing with an unlicensed geologist. Dunfield says there have been a growing number of complaints recently from people who say they paid witchers to find water and were led to dry wells. No complaints have been received by the OSBGE regarding water witches to-date.

So why should geologists care about witching? In the National Driller's Journal, editorials published in 1999 called water dowsing "bad news" for groundwater, yet offered that "Obviously it is an issue we must be cognizant of to be effective in our business, and to be better communicators with dowsers and our clients". Historical notes published in a 2002 issue of Ground Water indicate that "While hydrogeologists have a better track record at finding water, we must also win the client's favor and trust" implying that many people needing wells are more likely to believe in the success of a site located by a water witch than by a geologist. To underscore this conundrum, the water witch portrayed in the Wall Street Journal article was tasked with finding water for a Napa Valley golf course and estate homes project. He was apparently being paired against a hydrogeologist on the project. This particular witch believes that "finding water is becoming all too easy". Perhaps it is time to level the playing field in Oregon and start licensing and regulating the practice of water witches. But which state board should they fall under? The State Board of Geologists Examiners? The Board of Examiners for Engineering and Land Surveying? The Well Construction and Compliance Section under the Oregon Water Resources Department? My sources at the American Society of Dowsers indicate that efforts are underway to develop a national certification program for water dowsers much like the certification programs available to well drillers and geologists!

Todd Jarvis, CEG, CWRE is the Associate Director at the Institute for Water and Watersheds at Oregon State University. He can be reached at 541-737-4032 or todd.jarvis@oregonstate.edu

# The Beauty of Basalt

Synopsis of the October 10, 2008 GSOC Friday night lecture with speaker Terry Toedtemeier

by Carol S. Hasenberg

The first GSOC Friday night lecture since July saw an enthusiastic crowd for Portland Art Museum's photography curator Terry Toedtemeier, who also holds a degree from Oregon State University in earth science. Toedtemeier discussed briefly his recent projects developing an exhibit, 'Wild Beauty', of historical photographs of the Columbia River Gorge which is open until January 11 at the Portland Art Museum, based on the photographs researched for a book he recently co-authored with John Laursen. Both the book, Wild Beauty: Photographs of the Columbia River Gorge, 1867–1957 (The Northwest Photography Series), and the photographs displayed at the museum are breathtakingly beautiful, and historically rich.

Now that these projects are nearing completion, Toedtemeier has been feeling a desire to get back to his own photography work. Basalt, that is. The root of his fascination for basalt came from doing a lot of childhood camping on the Oregon coast. He became very adept through his youth of discovering the incredible worlds of rock and sea life revealed by minus tides. (For coastal newbies, minus tides are the very low 'spring tides' that occur around the new and full phases of the moon. Sadly, you'll also need to wait until at least March for the next one that occurs in daylight.)

From this and his studies of geology, Toedtemeier has had an interest in tracing the flows of the Columbia River Basalt from eastern Oregon to the coast. These exposures of massive Miocene basalt flows comprise many of the headlands along the Oregon coast as far south as Seal Rock. He showed the enrapt audience pictures he has taken which possess such an expression of movement, not only from the water which coursed through the scenes, but from the rock which had crystallized from its own fluid movement and had been further fashioned by the water.

Toedtemeier showed the audience a photograph of the tortuously twisted rock at Ecola State Park, looking like it had emerged from Bruce's Candy Kitchen saltwater taffy emporium in nearby Cannon Beach. The rock there was created by warping sedimentary rock and injecting basalt into the mix. Another special place which he photographed was Cape Falcon in Oswald West State Park. There a basalt sill is exposed at low tides, which is treacherous to reach due to a fin of the formation which must be passed. Toedtemeier has also photographed several minus tide caves in the Oceanside/Cape Meares area, and he showed photos of Lost Boy Cave and others. Although he prefers photographing basalt, a nice sandstone such as that found at Cape Kiwanda makes a good subject too. And of course the "other" Haystack Rock in Pacific City is an end chunk of a massive lava flow, and everything else has been eroded away.

Getting back to the idea of tracing the flows of the Columbia River Basalt, Toedtemeier showed some aerial photos of lava flows spanning the width of the state, from "scorpions and sagebrush down to starfish and anemones". He has been compiling photos of basalt which show a record of the travels of the lava. The scientific discovery that each flow can be traced by its chemical signature makes it possible to map out the paths of each flow. Toedtemeier has thought of producing a book showing the photos of the journey of the lava. He showed the audience aerial shots of the lower John Day River; the deeply incised meanders were fascinating to him. Going further and further east, he showed photos taken near Spray, Oregon, Steens Mountain, and Abert Rim.

Toedtemeier has also taken photos of basalt other than Oregon's Miocene-age basalt. A shot of the Jordan Crater lava field looking toward Cow Lakes shows a classic Hawaiian style pahoehoe lava. And speaking of which, he hired a pilot while on the Big Island of Hawaii to take pictures of Kilauea's Pu'u O'o vent, basalt flow 'skylights' and other features. Toedtemeier also showed photos of the younger basalts of the Snake River Plain in Idaho.

Wrapping up the evening, Toedtemeier fielded several questions about the rocks he loves and the photos he produces. He explained how a dike of basalt on the Oregon coast is a location where the lava was flowing down into the water, not up as is usual for feeder dikes coming from a chamber of magma. He said that although he currently uses analog photography equipment, and digitizes the photos on a drum scanner, there are several digital camera products on the market now which can make very finely detailed images. Toedtemeier's lecture was fascinating, and we look forward to seeing more of his work in the future.

**References and Additional Reading**

Portland Art Museum: www.pam.org

Terry Toedtemeier(Editor), John Laursen (Editor), Wild Beauty: Photographs of the Columbia River Gorge, 1867–1957 (The Northwest Photography Series), Oregon State University Press, October 2008, pp. 360.

A couple of sites describe Toedtemeier's photographic career and show his photos:
PDX Contemporary Art gallery:
http://www.pdxcontemporaryart.com/toedtemeier
(be sure to click on "show more images")
The Flintridge Foundation:
http://www.flintridgefoundation.org/visualarts/recipients20012002_terrytoedtemeier.html

"Columbia River Basalt Group stratigraphy in western Oregon" by M. H. Beeson; M. R. Moran, *Oregon Geology* article vol. 41, no. 1, 1979, p. 11-14 is available in acrobat format from the DOGAMI website: http://www.oregongeology.org/pubs. The

site also contains numerous other articles on Columbia River Basalt.

Virtual Oceanside History discusses some hidden tidal features near Oceanside, Oregon: http://www.virtual-oceanside.com/history.asp

Interested in more about Oregon caves? This site contains a list and info about each cave listed: http://www.oregongrotto.com/cavehistory.shtml

Wikipedia "Tides" page has it all including references: http://en.wikipedia.org/wiki/Tide

View the tide calendar at your favorite beach using this free site: http://www.rebeccashapley.com/tides/#

## Nominating Committee Results

The following slate of officers has been selected by this year's nominating committee:

President ..... Carol Hasenberg
Vice President ..... Larry Purchase
Secretary ..... Beverly Vogt
Treasurer ..... Richard Bartels
Director, 3 years ..... Anne O'Neill
Director, 2 years ..... Dave Olcott
Director, 1 year ..... Jan Kem

Nominations will also be open at the December club meeting on Friday, December 12, 2008. Consent of the nominees must be secured prior to their nomination. Nominations will be closed after the December meeting. Final nominations will be published in the January newsletter. The slate of officers will be voted on and approved at the February monthly meeting.

The Nominating Committee members are **Jan Kem, chair, Larry Purchase** and **Carol Hasenberg**. Our thanks to the selected members and members of the Nominating Committee!

# GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

**2008-2009 ADMINISTRATION**
**BOARD OF DIRECTORS**

**President:**
Janet Rasmussen – 541/753-0774
**Vice-President:**
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**Treasurer**
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Larry Purchase (1 year) – 360/254-5635

**Past Presidents:**
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Clay Kelleher – 503/775-6263

## THE GEOLOGICAL NEWSLETTER

**Editor:**
Carol Hasenberg – 503/234-0969
**Calendar:**
Beverly Vogt – 503/292-6939

**Business Manager:**
Jan Kem - 503/246-2275
**Assistant Business Manager:**
Rosemary Kenney – 503/892-6514

## ACTIVITIES:

**ANNUAL EVENTS:** President's Field Trip—Summer or Fall; Banquet—March; Annual Business Meeting—February.
**FIELD TRIPS:** About 6 per year. Fees: see field trip announcements on the calendar next page.
**GEOLOGY SEMINAR:** Usually held on the third Wednesday of some winter months, 8:00 p.m., Rm. S17, Cramer Hall, PSU. See calendar for details
**GSOC LIBRARY:** Rm. S7, Open 7:30 p.m. prior to meetings.
**PROGRAMS:** Second Friday evening most months, 8:00 p.m., Rm. S17, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon.
**MEMBERSHIP:** Per year from January 1: Individual--$20.00, Family--$30.00, Junior (under 18)/Student--$10.00.
**PUBLICATIONS: THE GEOLOGICAL NEWSLETTER (ISSN 0270 5451),** published monthly and mailed to each member. Subscriptions available to libraries and organizations at $15.00 per year. Individual Subscriptions $13.00 per year. Single Copies: $1.00. Order from:

**Geological Society of the Oregon Country, P.O. Box 907, Portland, Oregon 97207**

**TRIP LOGS:** Write to the same address for names and price list.
**WEBSITE:** www.gsoc.org. Email address: Our club email has been eliminated. Please request individual member email addresses.

**APPLICATION FOR MEMBERSHIP-**
**THE GEOLOGICAL SOCIETY OF THE OREGON COUNTRY**

**Name**_____ **Spouse**_____

**Children under age 18**_____

**Address** _____ **City** _____ **State** ___ **Zip**_____-_____

**Phone (**_____**)**_____-_____ **Email address**_____

**Geologic Interests and Hobbies**_____

_____

**Please indicate Membership type and include check for appropriate amount:**

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**Make Check Payable to:** **The Geological Society of the Oregon Country**
**PO Box 907**
**Portland, OR 97207-0907**

# ENVIRONMENTAL GEOLOGY AT WORK IN PORTLAND

synopsis of GSOC Friday night lecture by Heidi Blischke

*Editor's Note:*
*Last month's Friday night lecture topic was prompted by a statement made to us by Ken Cameron, a GSOC member and an employee of the State Department of Environmental Quality, that "In Oregon, environmental geology now employs more geologists than any other area of work" (see May 2008 issue of The Geological Newsletter). Well, that was a wake-up call in my capacity of GSOC Vice President in getting some speakers for our group. So with Cameron's assistance, we invited hydrogeologist Heidi Blischke from consulting firm GSI Water Solutions, Inc. to speak to us. Blischke has been working on the McCormick and Baxter Superfund Site, amongst other projects, since its beginnings in the early 1990's, and had many great slides of the project to show us. We want to thank her for the interesting lecture, which is described in the article which follows.*

The McCormick and Baxter Superfund Site was the location of a wood preserving company that operated in the mid-twentieth century and went bankrupt in 1991. It is located along the east bank of the Willamette River in north Portland not far from the University of Portland. The site was left by the company with a lot of chemical waste in the soil – Penta, Cellon, creosote, and metals such as arsenic, copper, zinc, and chromium. These had been leaching into the adjacent Willamette River. The chemicals had come from spillage from the treatment retorts, leaking waste disposal ponds and spillage and construction in the dock area. Prior to remediation one could see debris, oily scum on the water, and abandoned structures on the site.

Nowadays the site, which is a superfund site within a superfund site, is managed as an orphan site by the Oregon Department of Environmental Quality (DEQ). Many companies and organizations have been involved in the cleanup of the site, which was identified by the US Environmental Protection Agency in the 1990's. GSOC speaker Heidi Blischke has been involved in the cleanup since the early 1990's when she worked for CH2MHill. Blischke also has worked periodically on the project for later employers Oregon DEQ and GSI Water Solution, Inc.

In a cross section of the site Blischke showed the GSOC audience that the site and the river are underlain by river sediments for a couple hundred feet. The soil below the site is polluted to a depth of about 100 feet. Prior to remediation, many samples and borings had to be made to determine the extent and type of pollutants. A number of remediation methods were considered and the final remediation method was selected. This consisted of three major steps:

- Above the water table the soil was treated with incineration, was necessary due to the arsenic content of the soil. Six thousand gallons of creosote was extracted in this step, which is only a "drop in the bucket" compared to the bulk of the pollutants below.
- The most toxic areas of the site were surrounded by impermeable walls and capped with an impermeable membrane. Along the river the walls were 88 foot deep steel sheet pilings and inland the walls were composed of a Bentonite slurry.
- The polluted areas below the river were weighted with a two foot thick blanket of sand with an armor coating of rock or articulated concrete block. This was deemed sufficient in most areas since the pollutants below were in a static state (i.e. not moving because they adhered to the sediments in which they were located)

The remediation also included cleaning the site of the debris, abandoned structures and pilings from the old dock.

After the initial remediation was finished and the site was monitored for compliance to the water quality standards, areas of bubbles which burst with an oily sheen were noticed in some of the locations where the sand blankets had been put. Also, some areas outside the barrier wall had enough of a mass of creosote that would allow it to move into the river. In these areas an additional measure was

taken. Organoclay blankets, which soak up the oil (from the creosote) and repel water, were emplaced here and covered with the armor coating.

At the completion of the major remediation steps, the site was rehabilitated by construction of fish habitable areas and inland planting. Wood debris was emplaced at the river's edge to create fish habitat. The area above the capped zone was overlain by topsoil and planted with grass. Trees and other wetland plantings were introduced outside this zone.

Since the remediation was completed in 2004, the site has been carefully monitored and it has consistently met the water quality standards. Some additional bubbly areas have been noted, and some discussion has been made about these and the biological processes which are producing them. The remediation should last for at least 1000 years and other techniques may in the future be applied to these sites.

Carol S. Hasenberg

## UPCOMING SEMINARS BY OTHER ORGANIZATIONS

**Portland State University**
Dept. of Geology
Fall Seminar Series, 2008
Wednesday, Dec. 3, 2008 "Structural Geology of the Canadian Rockies" by speaker Gil LaFreniere, Professor Emeritus, Willamette
University (CH 69)
Seminars to be held in Cramer Hall S17 & CH69; 3:30 - 4:30 PM

**Oregon Archaeological Society:**
December 2008 Speaker
Dec 2, 2008, "A New Look at Old Cordilleran Traditions in Lithic Technology in the Pacific Northwest" by speaker Terry Ozbun, M.A. R.P.A., SeniorArchaeologist and Lithic Technology Specialist, Archaeological Investigations Northwest, Inc.
General Meeting is at 7 pm, Speaker at 8pm at Oregon Museum of Science and Industry, free of charge.

# What Do Geoscientists DO?

*Editor's Note: The following information is excerpted 11/22/08 from "Careers in the Geosciences," online brochure produced by the American Geological Institute, http://www.agiweb/workforce/brochure.html. Our thanks to Beverly Vogt for researching this material.*

"Geoscientists are stewards or caretakers of Earth's resources and environment. They work to understand natural processes on Earth and other planets. Investigating the Earth, its soils, oceans, and atmosphere; forecasting the weather; developing land-use plans; exploring other planets and the solar system; determining environmental impacts; and finding new sources of useful Earth materials are just a few of the ways geoscientists contribute to our understanding of Earth processes and history. Geoscientists provide essential information for solving problems and establishing governmental policies for resource management; environmental protection; and public health, safety, and welfare."

"Geoscientists gather and interpret data about the Earth and other planets. They use their knowledge to increase our understanding of Earth processes and to improve the quality of human life. Their work and career paths vary widely because the geosciences are so broad and diverse. The National Science Foundation considers geology, geophysics, hydrology, oceanography, marine science, atmospheric science, planetary science, meteorology, environmental science, and soil science as the major geoscience disciplines. The following list gives a glimpse of what geoscientists do in these disciplines and a variety of subdisciplines:

**Atmospheric scientists** study weather processes; the global dynamics of climate; solar radiation and its effects; and the role of atmospheric chemistry in ozone depletion, climate change, and pollution.

**Economic geologists** explore for and develop metallic and nonmetallic resources; they study mineral deposits and find environmentally safe

ways to dispose of waste materials from mining activities.

**Engineering geologists** apply geological data, techniques, and principles to the study of rock and soil surficial materials and ground water; they investigate geologic factors that affect structures such as bridges, buildings, airports, and dams.

**Environmental geologists** study the interaction between the geosphere, hydrosphere, atmosphere, biosphere, and human activities. They work to solve problems associated with pollution, waste management, urbanization, and natural hazards, such as flooding and erosion.

**Geochemists** use physical and inorganic chemistry to investigate the nature and distribution of major and trace elements in ground water and Earth materials; they use organic chemistry to study the composition of fossil fuel (coal, oil, and gas) deposits.

**Geochronologists** use the rates of decay of certain radioactive elements in rocks to determine their age and the time sequence of events in the history of the Earth.

**Geologists** study the materials, processes, products, physical nature, and history of the Earth.

**Geomorphologists** study Earth's landforms and landscapes in relation to the geologic and climatic processes and human activities, which form them.

**Geophysicists** apply the principles of physics to studies of the Earth's interior and investigate Earth's magnetic, electric, and gravitational fields.

**Glacial geologists** study the physical properties and movement of glaciers and ice sheets.

**Hydrogeologists** study the occurrence, movement, abundance, distribution, and quality of subsurface waters and related geologic aspects of surface waters.

**Hydrologists** are concerned with water from the moment of precipitation until it evaporates into the atmosphere or is discharged into the ocean; for example, they study river systems to predict the impacts of flooding.

**Marine geologists** investigate the ocean-floor and ocean-continent boundaries; they study ocean basins, continental shelves, and the coastal environments on continental borders.

**Meteorologists** study the atmosphere and atmospheric phenomena, including the weather.

**Mineralogists** study mineral formation, composition, and properties.

**Oceanographers** investigate the physical, chemical, biological, and geologic dynamics of oceans.

**Paleoecologists** study the function and distribution of ancient organisms and their relationships to their environment.

**Paleontologists** study fossils to understand past life forms and their changes through time and to reconstruct past environments.

**Petroleum geologists** are involved in exploration for and production of oil and natural gas resources.

**Petrologists** determine the origin and natural history of rocks by analyzing mineral composition and grain relationships.

**Planetary geologists** study planets and their moons in order to understand the evolution of the solar system.

**Sedimentologists** study the nature, origin, distribution, and alteration of sediments, such as sand, silt, and mud. Oil, gas, coal and many mineral deposits occur in such sediments.

**Seismologists** study earthquakes and analyze the behavior of earthquake waves to interpret the structure of the Earth.

**Soil scientists** study soils and their properties to determine how to sustain agricultural productivity and to detect and remediate contaiminated soils.

**Stratigraphers** investigate the time and space relationships of rocks, on a local, regional, and global scale throughout geologic time -- especially the fossil and mineral content of layered rocks.

**Structural geologists** analyze Earth's forces by studying deformation, fracturing, and folding of the Earth's crust.

**Volcanologists** investigate volcanoes and volcanic phenomena to understand these natural hazards and predict eruptions.

A strong interest in science and a good education are the most important elements in becoming a geoscientist. The geosciences draw on biology, chemistry, mathematics, physics, and engineering. High school courses related to these subjects plus a geology or earth-science course, or an integrated science curriculum, will help prepare you for college. Also, get a solid grounding in English, because geoscientists need to be able to write and speak clearly.

In choosing a college or university, look at the course listings for departments of geology, geoscience, earth-systems science, or environmental science to identify the geoscience programs that best match your interests. As in any profession, the applicants with the best qualifications get the best jobs. Most professional positions in the geosciences require a master's degree. A Ph.D. is needed for advancement in college teaching and in most high-level research positions."

# Geological Time Chart

Rusty on your geological time chart? Here's the latest version from the USGS web site:

Phanerozoic Eon (544 ma to present)
- Cenozoic Era (65 ma to present)
  - Quaternary Period (1.8 ma to present)
    - Holocene Epoch (8,000 years ago to present)
    - Pleistocene Epoch (1.8 ma to 8,000 years ago)
  - Tertiary Period (65 to 1.8 ma)
    - Pliocene Epoch (5.3 to 1.8 ma)
    - Miocene Epoch (23.8 to 5.3 ma)
    - Oligocene Epoch (33.7 to 23.8 ma)
    - Eocene Epoch (55.5 to 33.7 ma)
    - Paleocene Epoch (65 to 55.5 ma)
- Mesozoic Era (248 to 65 ma)
  - Cretaceous Period (145 to 65 ma)
  - Jurassic Period (213 to 145 ma)
  - Triassic Period (248 to 213 ma)
- Paleozoic Era (544 to 248 ma)
  - Permian Period (286 to 248 ma)
  - Carboniferous Period (360 to 286 ma)
    - Pennsylvanian Period (325 to 286 ma)
    - Mississippian Period (360 to 325 ma)
  - Devonian Period (410 to 360 ma)
  - Silurian Period (440 to 410 ma)
  - Ordovician Period (505 to 440 ma)
  - Cambrian Period (544 to 505 ma)

Precambrian Time (4500 to 544 ma)
- Proterozoic Era (2500 to 544 ma)
  - Vendian Period (544 to 650 ma)
- Archaean Era (3800 to 2500 ma)
- Hadean Time (4500 to 3800 ma)

For more info on geological time, visit the USGS web site at:
http://pubs.usgs.gov/gip/geotime/

or, University of California Museum of Paleontology:
http://www.ucmp.berkeley.edu/exhibits/geologictime.php

or, Geological Society of America time scale:
http://www.geosociety.org/science/timescale/timescl.htm

or, Geology.com pictorial time scale:
http://geography.about.com/gi/dynamic/offsite.htm?site=http%3A%2F%2Fwww.geology.com%2Ftime.htm

or,
Do you keep forgetting the geo time chart? This funny site can help:
Easiest way to remember geologic time scale? Yahoo! answers posting (as voted by the readers):
http://answers.yahoo.com/question/index?qid=20071106202755AAoH88Q

And finally, for those who are interested in etymology of the time scale divisions, the USGS glossary has an excellent chart with the definitions:
http://vulcan.wr.usgs.gov/Glossary/geo_time_scale.html

## Nominating Committee Results

The following slate of officers has been selected by this year's nominating committee:

President.....Carol Hasenberg
Vice President.....Larry Purchase
Secretary.....Beverly Vogt
Treasurer.....Richard Bartels
Director, 3 years.....Anne O'Neill
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