



# The Geological Newsletter

NEWS OF THE GEOLOGICAL SOCIETY OF  
THE OREGON COUNTRY

January/February 2018  
Volume 84, Number 1

The Geological Society of the Oregon Country  
P.O. Box 907, Portland, OR 97207-0907  
[www.gsoc.org](http://www.gsoc.org)

## Oregon Gems of the Rice Museum

by Carol Hasenberg

Rice Museum curator Leslie Moclock is in charge of the museum's education curriculum. In the course of her educational presentations, she finds that kids always ask deceptively tricky questions like, "Why are minerals the color that they are?" Moclock enjoys this part of her work because answering these questions opens doors to doing research.

*See Rice Gems, Page 4*



*A fascinated crowd appears around Leslie Moclock and her gems at the conclusion of the November 10 lecture.*

**GSOC Friday Night Lectures** are held the second Friday evening of most months, 7:30 p.m., Rm. 53, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon. Join GSOC members at Pizzicato Pizza, 1708 SW 6th Ave., at 6:00 p.m. before the lectures for an informal dinner and conversation. Check the GSOC website ([www.gsoc.org](http://www.gsoc.org)) for more information and updates to the calendar.

**Hourly rates** for parking are available in some parts of PSU parking structures. PSU Parking Structure #2, 1724 SW Broadway across from Cramer Hall is \$5.00 flat rate in the evening. Park in permit (NOT reserved) spaces and pay at the kiosk by entering your vehicle license number. There is also on street pay parking, and many mass transit options. Street parking is \$2.00 an hour, but free after 7:00 pm. More info available [here](#).

## Calendar

### Friday Night Lecture

January 12, 2018, Cramer Hall, Portland State University

GSOC field trip leaders will present our "Year in Review" program with brief slide show summaries of their trips.

*see Year in Review, Page 2*

### Friday Night Lecture

February 9, 2018, Cramer Hall, Portland State University

GSOC Secretary Paul Edison-Lahm will lead this virtual tour of the Johnson Creek Watershed and give tips for exploring Portland's Eastside.

*see Johnson Creek, Page 2*

### GSOC Annual Banquet

March 11, 2018

83<sup>rd</sup> Annual Banquet at 1:00 p.m. at Ernesto's in Beaverton. Speaker Ellen Morris Bishop, geologist, author and award winning photographer, will present "[Mountains out of Molehills: A Brief History of The Wallowas](#)"

*see flyer on Page 9*

### Friday Night Lecture

April 13, 2018, Cramer Hall, PSU

Speaker Tom Pierson, USGS CVO research scientist, will present "Large, Abundant Landslides in the Western Columbia Gorge."

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**Year in Review**

*January 12, 2018, 7:30 to 9:00 pm*

This year's GSOC field trip leaders will present the "Year in Review" program with brief slide show summaries of their trips:

- Rik Smoody: "The Eclipse! And More...," August 18-21
- Larry Purchase: "GSOC Rock Quarry and Gravel Pit Field Trip," June 11-12
- Sheila Alfson, "Mt. St. Helens Helicopter Tour," September 9
- Paul Edison-Lahm, "Downtown PDX Building Stone Tours," June 24, Oct 7

**An Amateur's Guide to the Geology of Johnson Creek and Eastside Portland**

*February 9, 2018, 7:30 to 9:00 pm*

The Johnson Creek Watershed contains volcanoes, Missoula flood deposits, and the oldest rocks in the East Portland Metro. Though this dramatic geologic history is usually obscured by vegetation and development, the creek cuts a slice down through the geologic layer cake to reveal the rock formations underlying Gresham, Southeast Portland, and Milwaukie. Paul Edison-Lahm will lead this virtual tour of the Watershed and give tips for exploring Portland's Eastside.

Paul Edison-Lahm is an amateur geologist, GSOC board member, and coordinator of our annual Downtown Portland Building Stone tours. He lives in Southeast Portland in the Johnson Creek watershed. Paul's presentation was developed in collaboration with geologist and GSOC Vice-President Sheila Alfson, and the Johnson Creek Watershed Council for their September 2017 Science Pub.



## GSOC Board Meeting Notes

December 16, 2017

President Rik Smoody called the meeting to order at the home of Carol Hasenberg. Other board members in attendance constituting quorum were Dawn Juliano, Sheila Alfsen, Marty Muncie, Paul Edison-Lahm, Larry Purchase, and Janet Rasmussen. The minutes of the October 2017, board meeting were approved. The Treasurer's report was approved.

### EVENTS

#### Friday night lectures

Sheila has scheduled speakers for February and April. The January meeting will have the field trip slide shows that were originally going to be shown at the holiday party.

Some ideas for speakers include (1) an annual speaker on Portland Metro area geology, (2) graduate student speakers, (3) an annual DOGAMI speaker on CSZ earthquake issues.

Janet suggests that, prior to the lecture, we have a rotating display of PowerPoint slides describing club history, functions, and upcoming events; and she will provide some slides for this.

Rik will research purchase options for an HD projector and email them to the board.

Greetings committee: a reminder that we should all be reaching out to new faces at Pizzicato and Friday night meetings.

Snack committee: Marty needs more people.

#### Field Trips

Portland Tours: Sheila and Paul will find a date for the next west-side Portland field trip, based loosely on their 2015 Portland Geology by Trimet tour. Paul's Johnson Creek geology lecture may metamorphose eventually into an Eastside Portland field trip.

Paul will also be setting dates for the two annual Downtown Building stone tours with Sheila and Cris Morgante.

Camp Hancock trip: Paul will investigate planning a field trip to Camp Hancock and the John Day Fossil Beds, coordinating with the Rose City Astronomers star party at Hancock.

The Snake River Plain and Albion Mountains: Dave reports via email that 13 folks have pre-registered.

A Eugene trip to the Condon fossil museum is still in the offing.

#### Annual Banquet

Rik confirms that Ellen Morris Bishop will be our banquet speaker. The board decided on the buffet option at Ernesto's Italian restaurant.

### OLD AND NEW BUSINESS

Nominating Committee makes the following nominations for the 2018 slate: President: Paul; Vice-president: Sheila; Secretary: Carol; Treasurer: Dawn; Directors: Megan Scott; Julia Lanning; Larry Purchase.

Communications Report: Paul reports that paid Facebook boosts for two of our Friday lectures got good responses and recommends boosting Friday lectures in the future.

Bylaws Committee: Janet will send out proposed revisions.

Member Database Committee: Rik is working on the spreadsheet.

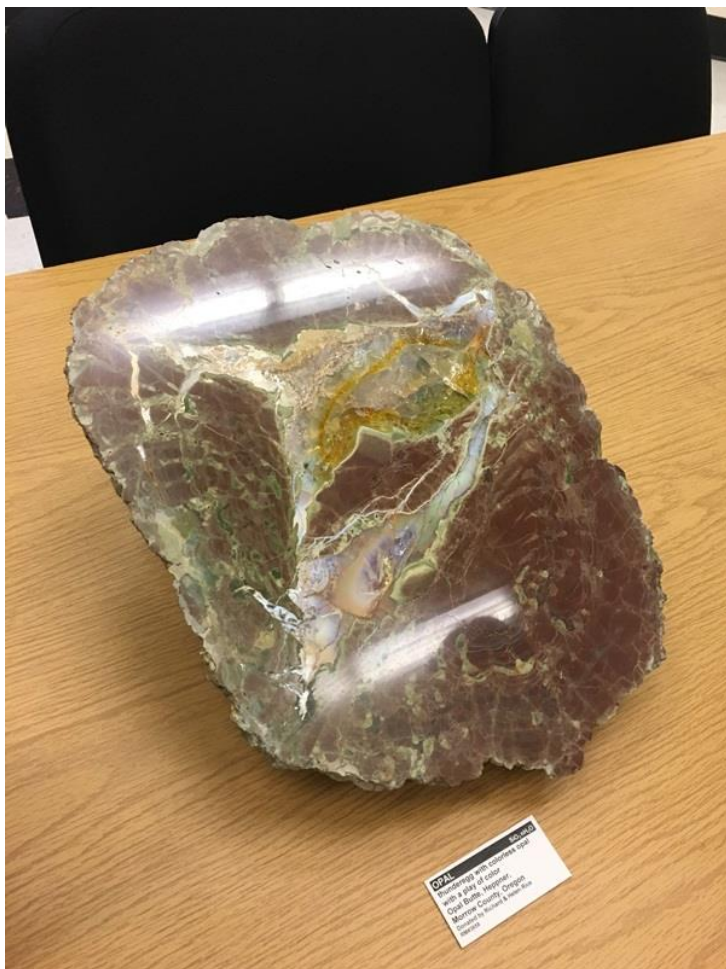
Next board meeting will be at Marty's on Feb. 10, 2018, at 10:00 a.m. — with extra time after reserved for the bylaws committee.

Notes compiled by Carol Hasenberg from Paul's meeting minutes.

## Rice Gems

*Synopsis of the GSOC Friday night lecture given on November 10, 2017, with speaker Leslie Moclock, Curator of the Rice Museum*

*by Carol Hasenberg*



*Moclock brought this huge thunderegg from Opal Butte for the GSOC crowd to ogle.*

Rice Museum curator Leslie Moclock is in charge of the museum's education curriculum. In the course of her educational presentations, she finds that kids always ask deceptively tricky questions like, "Why are minerals the color that they are?" Moclock enjoys this part of her work because answering these questions opens doors to doing research.

Examples of research topics she has pursued include two famous Oregon gemstones, opal (notably from Opal Butte in Morrow County) and sunstones (from Ponderosa and Plush area mines). So she brought an example of each to show the GSOC crowd and proceeded to explain the characteristics of each. The huge Oregon thunderegg shown in the photo contains opal and the interesting faceted and carved gem is sunstone.

Oregon's state gem is the sunstone. Sunstones are large plagioclase feldspar crystals which have developed in porphyritic basalt. Another name for them is labradorite. In Oregon they are found in outcrops of Steens Basalt and possibly Picture Gorge Basalt, Miocene age flood basalts in southeastern Oregon. The stones develop in a

1100 Celsius degree environment and are extruded in the eruption. The areas known for gem quality stones are the Ponderosa mine in Harney County and several mines in Lake County near Plush.

Sunstones are found in a range of colors, mainly red, yellow, green, all due to copper included into the plagioclase matrix. The amount of copper present determines color from yellow to green to red. The copper is a colloidal element interspersed around the actual feldspar crystals. Some sunstones also exhibit aventurescence which is caused by copper platelets embedded in the crystals. This appears as bands of sparkly copperish dots in the stone, which reflect light when viewed at certain angles. This characteristic develops

when the crystals are cooling post eruption. The interspersed copper begins to coalesce into these platelets. In the gem trade it is called "schilling."

The color of a sunstone gem can be dichroic, a type of pleochroism. They can change color depending on the angle at which you view them. This effect is caused by intervalence charge transfer, where electrons are hit with light, and are transferred between one metal ion to another, then go back to their original sites emitting a characteristic wavelength of light. Dichroic sunstones can exhibit these color changes dramatically when they are faceted.

Opals in Oregon are found at Opal Butte in Morrow County and other Oregon sites. The thunder egg Moclock brought for the lecture came from Opal Butte. The thunder egg shell is volcanic rock with a high silica content, and the interior is filled with a variety of silica rich minerals.

All opal is composed of a hydrated amorphous form of silicon dioxide. It is formed at relatively low temperatures by deposition in fissures in rock. Lapidary names of various types of opals include common opal, white and milky in appearance and does not show a play of color; hyalite opal, transparent and jellylike; fire opal, red or orange in color; precious opal, which exhibits a play of colors due to light diffraction in its structure. Precious opals may have a background shade of a variety of colors.

Precious opal is a mineraloid, silica amorphously rolled together into a lattice of tightly packed spheres that function as a diffraction grating. The colors come from the bending of light through the lattice. The color depends on the size of the spheres in the lattice. The scientific designation for this type of opal is Opal-AG (amorphous gel). Hyalite and fire opal, Opal-AN (amorphous network), do not have spheres, their structure is not that organized. Common opal is either Opal-C (cristobalite) or Opal-CT (cristobalite-tridymite). Forming temperatures and time of precipitation are the variables which govern which types form, varying from 170 to 260 degrees Celsius. Moclock finds it interesting that "eyeballing" the gem can give you information about the microscopic structure.



*Moclock shines a light through this dichroic faceted and carved Oregon sunstone gem.*

Opals from Oregon, Nevada and Idaho form in flows of rhyolite lava. Opals can also form in sedimentary processes (Australian opals) related to oil deposits. Oregon opals are deposited in hydrothermal environments, a process which is less well known.

Since opals in Oregon often appear in thundereggs, the silica filled geode-like rocks of the Oregon desert, Moclock also reviewed the process speculated to be the formation of these interesting phenomena: "In a water-rich, high-silica lava flow water droplets flash to steam and crack open a vug. The flow finishes cooling and hardens. Later, the empty vugs fill with agate or other minerals."

#### ADDITIONAL READING

[Inna Gem](#) has some fabulous photos of stunning Oregon opals in its "[Oregon Opals](#)" and "[For Sale](#)" pages.

[Ebay](#) has a rather extensive and beautiful selection of "[Oregon Opal](#)" and "[Oregon Sunstones](#)."

Good information on Oregon sunstones from the [GIA Field Report, GEMS & GEMOLOGY, FALL 2013, VOL. 49, NO. 3](#).

[USGS descriptions of opals](#) and locations in the US.

[Opal Info page from opalauctions.com](#) has lots of information about Australian opals and other international opal types.

For more information and visiting hours for the [Rice Museum visit their website](#).

### WELCOME NEW MEMBERS!

Norm and June McAtee  
Carrie Gordon  
Kent Snyder  
Nicholas Legg  
Nelda and Ronald Skidmore

### NOMINATING COMMITTEE RESULTS

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

President .....	Paul Edison-Lahm
Vice President.....	Sheila Alfsen
Secretary.....	Carol Hasenberg
Treasurer .....	Dawn Juliano
Director, 3 years .....	Megan Scott
Director, 2 years .....	Julia Lanning
Director, 1 year.....	Larry Purchase

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

The Nominating Committee members were Rik Smoody, Sheila Alfsen and Paul Edison-Lahm. Our thanks to the selected members and members of the Nominating Committee!

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compiled by Carol Hasenberg

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## GSOC Eighty-third Annual Banquet

Sunday, March 11, 2018

The Geological Society of the Oregon Country invites you to its 83rd Annual Banquet. Speaker Ellen Morris Bishop will present "Mountains out of Molehills: A Brief History of The Wallawas." The Wallowa Mountains are one of Oregon's iconic "Seven Wonders." Glaciated, craggy, and imposing, they attract hikers, hunters, and solace-seekers. They also appeal to geologists, who have devoted much of the past century to figuring out how this strangely-circular range formed. This talk, illustrated by Bishop's photographs, will explore the geology of the Wallawas and nearby ranges, and trace the evolution of ideas about how the varied mountain ranges of northeast Oregon came to be--and how the Wallawas may have a unique history much more like the Sierras than the nearby Basin and Range.

Ellen Morris Bishop was born into a family of artists, and grew up wandering the glaciated Berkshire Hills of northwestern Connecticut. Geology, with its patterned stones and out-sized stories of glaciers, volcanoes and tholeiitic flood basalts enthralled her from an early age. She holds a PhD in geology from Oregon State University. Her research helped define the history of eastern Oregon's exotic terranes; her books explain the Northwest's geologic history to non-geologists. Bishop's photography reveals her artistic heritage and deep understanding of the Earth and its processes. She has taught at Whitman College and elsewhere, and presently lives and works as a photographer in Wallowa County, Oregon.

The banquet will be held at Ernesto's Italian Restaurant, 8544 SW Apple Way, Portland, OR, located in a strip mall along the Beaverton-Hillsdale Highway between Raleigh Hills Fred Meyer and Jesuit High School. There is ample free parking, and Beaverton-Hillsdale Hwy is served by TriMet bus route 54. Doors to the banquet room open at 1:00 p.m. Dinner at 1:30 p.m. Program will begin at 2:15 p.m.

Dinner will be an Italian Style buffet – including salad, one meat dish, 2 pasta dishes (one meatless) and dessert. Coffee, tea, soda, and fresh bread are also included in the buffet. Please contact Dawn if you have special dietary requirements. (503) 367-7708.

### GSOC 83rd ANNUAL BANQUET RESERVATION FORM – clip at line and mail.

\_\_\_\_\_ Number of tickets at \$33.00 each (includes gratuity). If ordered online, the price is \$34.50 to cover the Stripe processing fees.

Names of persons attending:

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\_\_\_\_\_ Amount enclosed. *Reservations must be received by Friday, March 2, 2018.*

Please mail reservations and checks to GSOC, PO Box 907, Portland, OR 97207-0907



# The Geological Newsletter

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## Geology of Eastside Portland and Johnson Creek

by Paul Edison-Lahm and Carol Hasenberg

Moments after the election of the new GSOC board of directors, President-elect Paul Edison-Lahm addressed a near-record crowd at our February 9th Friday Night Lecture with his presentation "An Amateur's Guide to the Geology of Johnson Creek and Eastside Portland." He explained that since a creek cuts down through vegetation and construction into layers of earth otherwise unseen, the rocks in the creek can tell us the geologic history of the surrounding countryside. Grey basalts and dull orange quartzites, found in the Reed College Lake near his home for example, are clues to earlier epochs of catastrophic volcanism and icy inundation.

*See Johnson Creek, Page 14*



*Basalt and quartzites in the Reed College Lake.*

## Calendar

### GSOC Annual Banquet

March 11, 2018

83<sup>rd</sup> Annual Banquet at 1:00 p.m. at Ernesto's in Beaverton. Speaker Ellen Morris Bishop, geologist, author and award-winning photographer, will present "Mountains out of Molehills: A Brief History of The Willows"

*see [Banquet Flyer](#)  
[online](#) and the January/February edition  
of *The Geological Newsletter**

### Friday Night Lecture

April 13, 2018, Cramer Hall, Portland  
State University

Speaker Tom Pierson, senior USGS CVO research scientist, will present "Large, Abundant Landslides in the Western Columbia Gorge."

*see [Landslides](#), Page 12*

### Friday Night Lecture

May 11, 2018, Cramer Hall, PSU

Speaker Ray Wells, USGS. Topic will focus on the rotation of the Pacific Northwest.

**GSOC Friday Night Lectures** are held the second Friday evening of most months, 7:30 p.m., Rm. 53, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon. Join GSOC members at Pizzicato Pizza, 1708 SW 6th Ave., at 6:00 p.m. before the lectures for an informal dinner and conversation. Check the GSOC website ([www.gsoc.org](http://www.gsoc.org)) for more information and updates to the calendar.

**Hourly rates** for parking are available in some parts of PSU parking structures. PSU Parking Structure #2, 1724 SW Broadway across from Cramer Hall is \$5.00 flat rate in the evening. Park in permit (NOT reserved) spaces and pay at the kiosk by entering your vehicle license number. There is also on street pay parking, and many mass transit options. Street parking is \$2.00 an hour, but free after 7:00 pm. More info available [here](#).

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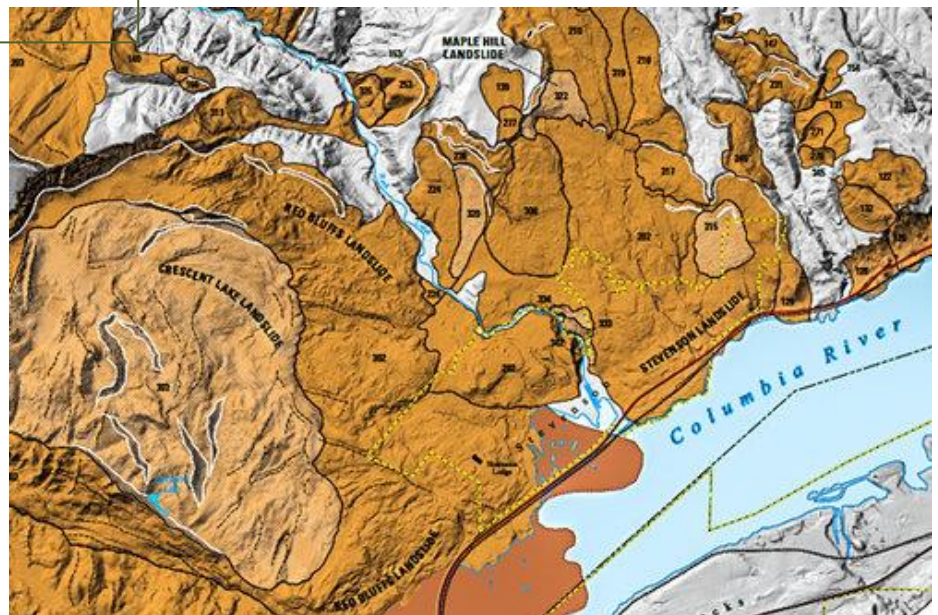
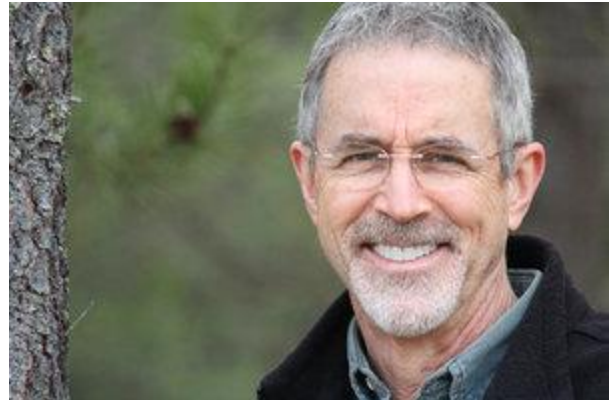
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## Landslides

*April 13, 2018, 7:30 to 9:00 pm*

Recent lidar mapping of large landslides in the western Columbia Gorge in Skamania County, WA, shows that there are many more landslides than previously thought. The mapping area contains at least 215 discrete landslides of various ages — ranging from more than 15,000 years old to currently active.

Tom Pierson is a senior research scientist at the USGS Cascades Volcano Observatory in Vancouver, Washington, where his investigations focus mainly on volcano hazards involving lahars (mudflows), floods, and landslides— processes occurring both during and following volcanic eruptions.



## GSOC Board Meeting Notes

February 10, 2018

GSOC President Rik Smoody called the meeting to order at the home of GSOC Director Martha Muncie. In attendance were GSOC Board members Rik Smoody, Sheila Alfsen, Paul Edison-Lahm, Dawn Juliano, Martha Muncie, Larry Purchase, Carol Hasenberg, Bo Nonn and Janet Rasmussen, constituting quorum. Also in attendance were Director-elect Megan Faust, Dave Olcott, Doug Rasmussen, and Clay Kelleher.

December board meeting minutes were approved.

### EVENTS

#### Friday night lectures

Congrats go to board member Paul for the very informative lecture last night on the Johnson Creek Watershed and surrounding stratigraphy. Paul included a lot of basic info for attendees new to geology. Attendance was counted at 123 persons at the lecture.

Sheila Alfsen reports that lectures are scheduled for the March banquet, April, and May. She is planning to schedule a June lecture and possibly July.

June lecture is rescheduled from June 8 to June 15, and the board meeting will be June 16.

Camp Hancock/President's field trip is planned for September 14-15, so the board may want to reschedule GSOC Friday night meeting that month, which would normally be held September 14.

Rik reports projector purchase is still pending. Name brands Canon, EPSOM, and HP are targeted for reliability.

#### Annual Banquet

Plans are proceeding on the banquet and task assignments have been discussed.

### Field Trips

Camp Hancock/President's Field Trip Sept 14-15: A reconnaissance trip with Paul, Rik, Bo, Sheila, Barbara, and MaryAnn will occur May 12 at with the spring RCA star party. First day will be reconnaissance around the camp itself and another day in Fossil and John Day Monument area. Paul will meet with RCA officers prior to reconnaissance.

The Snake River Plain and Albion Mountains Trip, Jun 2-8, is full. Dave discussed some of the details with the board. Dave is working on coordinating lodging.

Portland Ancient Walls Trips: June 16 is scheduled for the north tour, October 6 is schedule for the south tour. Cris Morgante, Paul and another possible guide are ready to lead these popular trips.

Mt. St. Helens Helicopter Tour: Sheila reports MSH trip has been scheduled for August 18, 2018. This trip will focus on the 1980 eruption and its lasting effects on the landscape. Sheila will give a brief presentation on the eruption before the flight and will prepare participants so they can interpret the landscape from the air.

Other Field Trips: Board discussed the possibilities of an East Portland Field Trip, Salem buildings field trip and trip to the Condon Collection. These trips will occur in 2019 or later.

### OLD AND NEW BUSINESS

The slate of nominees were approved at the Friday night meeting last night. The new board of directors include President Paul Edison-Lahm, Vice President Sheila Alfsen, Secretary Carol Hasenberg, Treasurer Dawn Juliano, Directors Megan Faust, Julia Lanning, and Larry Purchase. Rik Smoody and Bo Nonn are Past Presidents on the board.

## BOARD MEETING NOTES

*continued from Page 13*

Welcome to Megan Faust as a newcomer to the board and also welcome to Julia Lanning, who has previously served. Megan hails from Illinois and received her master's degree in geology at University of Vermont. She teaches geology at PCC and PSU and is also involved with AWG Northwest chapter. She will be acting as liaison to AWG for GSOC.

Bylaws Committee: Board members stayed for a work session marking up some needed revisions to the GSOC bylaws regarding membership definitions, changes to the way GSOC produces the newsletter and a couple of other minor changes. According to procedures outlined in the current bylaws, the proposed changes will be submitted to each of the board members at least seven days prior to the next board meeting. After they have been approved by the board, they will be sent to the membership to be ratified at the February 2019 Annual Business Meeting of the Society.

Member Database Committee: Rik and Dawn are coordinating the editing of the GSOC membership roster on database. This work includes updating club status awards.

Next GSOC Board Meeting will be held 10:00 am, April 14, 2018 at Martha Muncie's house.

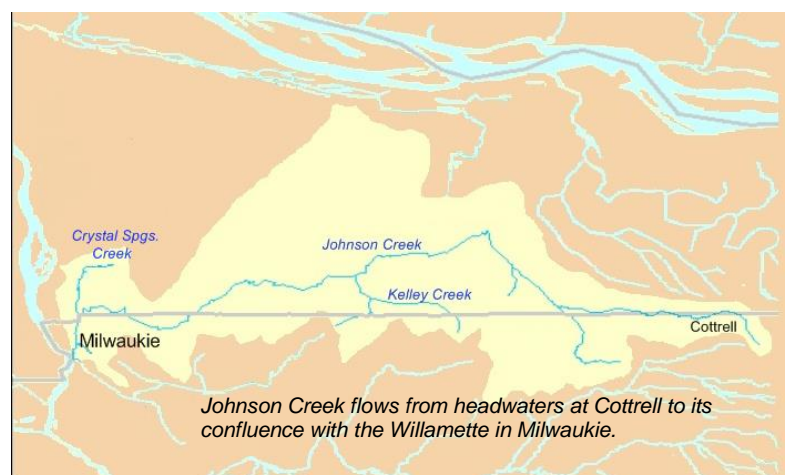
Notes compiled by Carol Hasenberg.

## Johnson Creek

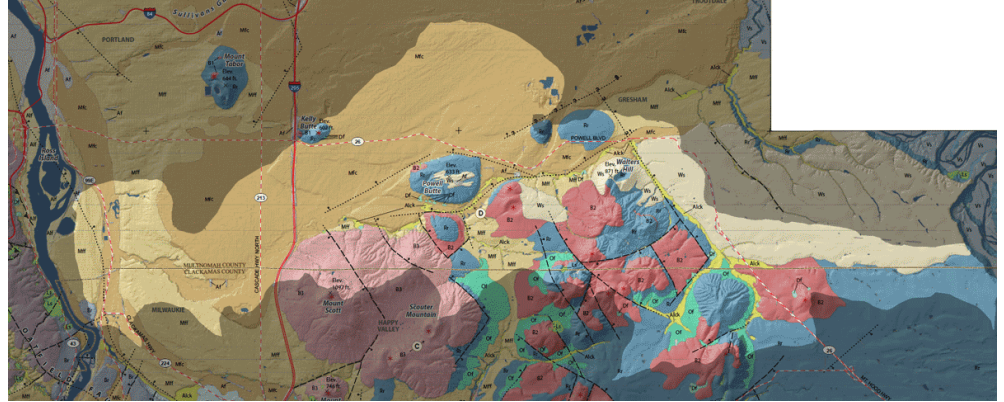
*Synopsis of the GSOC Friday night lecture given on February 9, 2018, with speaker Paul Edison-Lahm, Secretary of GSOC*

The lake is part of the Crystal Springs watershed, which in turn is part of the larger Johnson Creek watershed. Johnson Creek cuts a swath through Eastside Portland along the Multnomah/Clackamas county border, between the Sandy River watershed to the east and the Willamette River to the west. The creek flows west from its headwaters at Cottrell across farmlands; then skirts northwest around the numerous buttes formed by Boring Volcanoes including Mt. Scott; continues west over a plain overlain by Missoula Flood deposits; and finally makes a sharp left-turn southward to its confluence with the Willamette River near the Waverley Country Club.

Rocky outcrops are few among the rolling farmlands near the headwaters, but a clue to the underlying geology comes from the fact that the Sandy River immediately to the northeast has incised deep meanders in the uplifted plain: the curving ravines at Oxbow Park. Edison-Lahm showed a beautiful map of surficial geology (created by Lina Ma and Ian Madin at DOGAMI) projected on a Google Earth view of the Sandy River ravine. This view shows that the headwaters plain is topped by a layer of glacial loess (windblown silt) which overlays ancestral Columbia River gravels — the Troutdale Formation — deposited in the Miocene and Pliocene. The loess is responsible in large part for the great fertility of the headlands. The Troutdale formation, found throughout the Portland basin, is readily identified by the orange quartzite cobbles which originated in the Montana fold belt and were brought here by the ancestral Columbia river.



Moving further downstream, the creek bed now contains vesicular basalt-andesite cobbles from the adjacent Boring volcanic buttes. Edison-Lahm showed a composite photo of Mt. Tabor erupting, reassuring the audience that, even though we are still likely in the era of Boring Volcanism



which has continued intermittently for the past 2.7 million years, it is unlikely that we will have another eruption in the Portland area for a few more millennia yet. There are more than 80 Boring vents in the Portland metro area, including those in the Johnson Creek area such as the Mt. Scott, Powell Butte, Jenne Butte, and Walters Hill. Curiously Mt. Tabor, Powell Butte, and Kelly Butte contain Boring lava vents, and yet are primarily composed of the much older Troutdale formation due to processes that are still the subject of speculation by geologists.

*Image detail from DOGAMI map (Ma, Madin, et. al) showing Johnson Creek Watershed boundary. Moving east to west: cream represents windblown sediments (loess); blue is ancient river rock, predominantly Troutdale formation; pinks are Boring Volcanics; tans are Missoula deposits; and a sliver of grey indicates the Waverley formation basalt.*

The remaining reaches of Johnson Creek flow west past Mt. Scott over Missoula flood sand and gravel deposits. The catastrophic Missoula floods from the ice-dammed Clark Fork River in Montana rushed into the Portland basin at least 40 times during the Pleistocene, covering the landscape to a depth of 150 meters, and leaving behind voluminous sand and gravel deposits. In the northeast sections of the Portland basin, the deposits are coarser-grained as foreset beds of gravels were laid down when flood waters slowed on emerging from the Columbia River gorge. A 1934 photo of the Division Street gravel pit (now Portland Sand and Gravel) shows the cross bedding of the gravel deposits, which demonstrating the direction of the depositional environment. To the south and west, deposits are finer grained where the waters had the chance to pool as temporary "Lake Allison." The slackening waters deposited graded beds of sand, silt, and gravel, called rhythmites. When exposed in cross-section in hillsides close to the Willamette River, these rhythmites show up to 40 successive pulses occurring. The location of these deposits is a critical concern for people living on the Eastside, since the Cascadia quake will be much more destructive for



*Missoula floods covered East Portland to a depth of 150 meters.*



*Waverley Basalt at Johnson Creek/Willamette Confluence.*

people who live on top of the fine rhythmite deposits than those who live on the bedded gravel deposits.

As Johnson Creek descends off the gravel terraces, it joins with Crystal Springs, takes a sharp left turn into an abandoned channel, and flows south. The Eastside channel containing the creek runs five to six miles north-south between Portland's Central Eastside and Milwaukie, along Highway 99E and the Union Pacific tracks. The geologic origins of this channel are something of a mystery. Historically streams have flowed through the channel to the Willamette both to the north and to the south; although perhaps it was also a

backflow channel during the Missoula floods, created when the floodwaters flowed north out of the Portland basin.

Johnson Creek then continues south to its confluence with the Willamette River in Milwaukie immediately south of the Waverley Country Club. Waverley is the type locality for the Waverley Formation basalts, first identified by geologist Terry Tolan. Recent unpublished work by GSOC members Dr. Paul Hammond and our newly elected Director Megan Faust, shows that the Waverley formation may originate from the same mantle plume as the Yellowstone Hot Spot and Columbia River basalts. Hammond's work shows that, when the hotspot track is projected backwards in time, the clockwise rotation of Oregon and the Pacific Northwest can account for the presence of the Waverley formation in the Portland area.

In the course of his research, Edison-Lahm learned of two Native American artifacts that had been discovered just blocks from his home in the Crystal Springs watershed: one a projectile point possibly 8,000-10,000 years old, the other a quartzite implement of uncertain age. Edison-Lahm discussed the political and historical difficulties of ensuring that the last 14,000 years of Native American presence in the watershed be recognized and that the artifacts not be presented out of the context of their current significance to the many modern day tribes in Oregon and Washington.

Finally, Edison-Lahm thanked the many contributors to this project, including the Johnson Creek Watershed Council,

emphasizing that being a successful amateur — in addition to requiring a good map and a hand lens — depends on the successful collaboration between professionals and amateurs.

#### ADDITIONAL READING

[Geology.com](#) site for general information about geology.

Madin, Ian, "[Portland, Oregon, geology by tram, train, and foot](#)", Oregon Geology, Volume 69, Number 1, Fall 2009.

Russell C. Evarts, Jim E. O'Connor, Ray E. Wells, Ian P. Madin, "[The Portland Basin: A \(big\) river runs through it,](#)" GSA Today, Volume 19, Issue 9 (September 2009)

## Seattle Hazards Symposium Report

On Saturday, February 17, 2018, Doug and Janet Rasmussen attended a free public day organized by the Northwest Geological Society ([nwgs.org](#)) of Seattle, Washington. The public day was part of a three-day Geohazards Symposium, "Living with Earth Hazards in Western Washington." A four-hour program with 11 speakers at each session, repeated morning and afternoon. Speakers covered the geology of the state, science reporting, landslide risks, earthquake and tsunami hazards, volcanoes, floods, and government planning and response to emergencies. During the breaks they browsed over tables set up by the sponsors including the United States Geological Survey, Washington Geological Survey, Washington Sea Grant, the Washington Dept. of Natural Resources, and many commercial engineering and construction firms. Computers were set up with volunteers assisting the public to locate their homes or businesses and examine any hazards in their area on a new program.

The Rasmussens missed the first day in which additional speakers presented more technical information on the same topics. Those who paid for the first day, which was not free, were eligible to attend a field trip organized on Sunday to examine local geology.

NWGS President Jim Miller advised that their organization is meeting to discuss whether to produce a similar event for next year. They have hosted meetings before in 2007 and 2013.

### AWG FIELD TRIP ANNOUNCED

The [Pacific Northwest Chapter of the Association for Women Geoscientists \(AWG\)](#) will host a field trip to the Klamath Mountains, Oregon Caves and Josephine Ophiolite this September 8-10, 2018.

This trip will focus on the Klamath accreted terranes, comprised of a classic ophiolite sequence and varied metamorphic rocks. The leaders are AWG-PNW member and geology instructor Sheila Alfsen and retired education director at Oregon Caves National Monument Roger Brandt. Please see the trip flyer for more details.

The AWG website will soon post a link to a registration form. [Click here](#) for more information on the trip.

### WELCOME NEW MEMBERS!

Nicholas T Legg  
 Nelda and Ronald Skidmore  
 Thomas Kaldenbach  
 Terrance and Dennea Hedding  
 Trish Rolin  
 Jonathan and Dana Tree  
 Kathleen Kerner  
 Rafael Suarez and Akiko Sulisufaj  
 Andrea Bowen  
 Bruce Thiel  
 Hank Schottland and Elka Grisham  
 William Burgel and Charlotte Finn  
 JoLynn Lords  
 Sally Kenney  
 MaryAnn Amann  
 Bruce Howard  
 Madison Ball  
 Melanie Klym  
 Lucas Fleetham  
 Pam Hepper  
 Herb Dirksen  
 Charlie Carr  
 Sue and Glorie Gary  
 Tim Taylor







# The Geological Newsletter

NEWS OF THE GEOLOGICAL SOCIETY OF  
THE OREGON COUNTRY

May/June 2018  
Volume 84, Number 3

The Geological Society of the Oregon Country  
P.O. Box 907, Portland, OR 97207-0907  
[www.gsoc.org](http://www.gsoc.org)

## From Bowlby to Zumwalt – Exploring the Geology of the Wallowa area, Oregon

by Carol Hasenberg

Dr. Ellen Morris Bishop – geologist, writer, and photographer – drove from her ranch near Enterprise, Oregon, to speak to an enthusiastic GSOC audience at the 83rd Annual Banquet on Sunday, March 11, 2018. The purpose of her talk was to introduce GSOCers to the geology of Oregon's Wallowa Mountains and Hells Canyon (WMHC).

*See Wallowa Geology, Page 22*



Wallowa Lake at the base of the Wallowa Mountains near Enterprise, Oregon.  
Photo by Ellen Morris Bishop.

## Calendar

### Friday Night Lecture

May 11, 2018, Cramer Hall, PSU

Speaker Ray Wells, USGS Research Geologist Emeritus, will present "Rotating Crustal Blocks of the Pacific NW"

*see Crustal Blocks, pg 20*

### Friday Night Lecture

June 15, 2018, Cramer Hall, Portland State University

Speaker Jeffrey Templeton, Professor of Geology at Western Oregon University, will present "A New Look at "Old" Tuffs at Newberry Volcano."

*see Newberry Tuffs, Page 28*

### Snake River Plain and Albion Mountains Field Trip

June 2, 2018 – June 8, 2018

### Downtown Ancient Walls North Tour

June 16, 2018 – 1-3 p.m.

### Willamette East Bank Geological Bike Tour

Jun 23, 2018

See [GSOC website](http://www.gsoc.org) for current information on GSOC field trips

**GSOC Friday Night Lectures** are held the second Friday evening of most months, 7:30 p.m., Rm. 53, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon. Join GSOC members at Pizzicato Pizza, 1708 SW 6th Ave., at 6:00 p.m. before the lectures for an informal dinner and conversation. Check the GSOC website ([www.gsoc.org](http://www.gsoc.org)) for more information and updates to the calendar.

**Hourly rates** for parking are available in some parts of PSU parking structures. PSU Parking Structure #2, 1724 SW Broadway across from Cramer Hall is \$5.00 flat rate in the evening. Park in permit (NOT reserved) spaces and pay at the kiosk by entering your vehicle license number. There is also on street pay parking, and many mass transit options. Street parking is \$2.00 an hour, but free after 7:00 pm. More info available [here](#).

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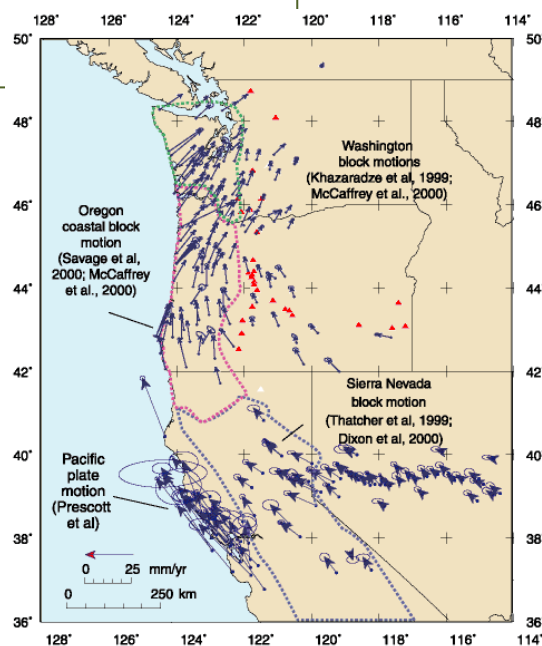
## Crustal Blocks

May 11, 2018, 7:30 to 9:00 pm

Dr. Wells has been a research geologist with the USGS for 40 years, where he has used field geology, paleomagnetism, and GPS to understand the tectonic evolution and seismic hazards of active continental margins. Dr. Wells is a recipient of the Distinguished Service Award of the Department of the Interior and the 2017 recipient of GSA's Florence Bascom Geologic Mapping Award. Ray is a Research Geologist Emeritus stationed at the USGS Oregon Water Science Center and is a Research Associate with the Geology Department at Portland State University.



Paleomagnetists – scientists who track the motions of continents from ancient magnetic field directions frozen into rocks – have long known that Oregon has been slowly rotating clockwise over geologic time. The rate of motion measured by GPS over the last decade is the same as measured by paleomagnetists for time spans of millions of years and indicates that the present rate is useful for understanding the rate of earthquake production. Little did we know that the curiosity-driven paleomagnetists would be so important to understanding the earthquake hazard in the Pacific Northwest!



To get ready for this talk, you can review the info on the USGS website entitled [“Tectonic plate motions, crustal blocks, and shallow earthquakes in Cascadia”](#) in current research topics.

## GSOC Board Meeting Notes

April 14, 2018

Board members in attendance: Paul Edison-Lahm, Bo Nonn, Rik Smoody, Sheila Alfsen & Julia Lanning, not enough for quorum. Also in attendance were Martha Muncie and Dave Olcott.

### EVENTS

#### Friday night lectures

Vice President Sheila Alfsen report, upcoming speakers:

- May: Ray Wells, USGS
- June: Jeff Templeton - Cinder cones near Newberry
- July: Not yet settled but will probably be a PSU grad student or students.
- August: Picnic at Rice Museum
- Sept: Bill Orr- Extinctions
- Oct: Jim O'Connor - Bonneville Flood

Board discussed the dispensation of speaker honoraria.

#### Field Trips and Other Events

Springwater Bike Tour reconnaissance: today will be the first reconnaissance for this tour in an effort to make this an annual event. Trial run of the tour is scheduled for June 23.

April 20: Dick MacKay Portland Tour, 11:00 a.m. Dick McKay, New Hampshire, requested GSOC to give him a geology tour of Portland. Paul, Bo, Sheila and Julia will participate.

May 12-14- Camp Hancock reconnaissance. Cost per person for the one night at the spring Rose City Astronomers star party is \$55. Club to reimburse participants Paul, Bo, Rik, Barbara, Sheila, Larry and Mary Ann.

June 2-8- Snake River Field Trip - Board discussed details of guide costs and mailing.

May 20: Reconnaissance for Johnson Creek Watershed tour. This tour is being planned for September 29 by Paul and Sheila with the assistance of Johnson Creek Watershed Council chair Melanie Klym and PSU Adjunct geology professor Matthew Brunengo. Board members are invited to the next reconnaissance on May 20.

June 16 - Downtown Ancient Walls North Tour is open for registration.

August 12 - Annual Picnic will be at the Rice Museum. Julian has suggested we give a \$500 donation to the Museum in exchange for the use of their grounds for a picnic and a one year membership for all GSOC members. The board is leaning towards accepting this offer because (1) this was a great deal for GSOC members in the coming year and (2) was the best way to strengthen our important relationship with Rice Museum.

August 18 - Mt St. Helens helicopter tour. \$269/person. Sheila is in process of confirming details with helicopter folks. Nathan Reynolds, ecologist with the Cowlitz Tribe, will be giving a presentation about the Lawetlat'la/Mt. St. Helens federal Traditional Cultural Property designation for those on ground awaiting their ride. Sixteen GSOCers will need to commit for this to happen.

September 14th & 15th. Camp Hancock field trip. We will be coordinating with the newly formed Central Oregon Geoscience Society (COGS) for a picnic at the Condon museum on the second day of our trip. The prospect of forming a sister club relationship with COGS might be explored in the future.

## BOARD MEETING NOTES

*continued from Page 21*

Sept. 29: Johnson Creek Tour (see above). Paul and Sheila will be planning this with Johnson Creek Watershed Council chair Melanie Klym and PSU Adjunct geology professor Matthew Brunengo.

Oct. 6 - Downtown Ancient Walls South Tour

March 2019 Annual Banquet: Board discussed scouting for a new venue for the Annual Banquet

### Other Old and New Business

Treasurer's Report submitted by Dawn in abstentia and reviewed by board.

Change in Bylaws passed unanimously by the Board. Note that Secretary Carol Hasenberg and Treasurer Dawn Juliano voted in absentia prior to the meeting to confirm this vote, thus quorum was confirmed. The changes will be presented for a vote to those members in attendance at the next annual business meeting of the society (February 2019).

Database updating report by Rik. He's working on read only spreadsheet of full membership available to all members. Since members are entitled to a list of membership, Rik will provide a secure way to extract this data for members.

Next GSOC Board Meeting will be held 10:00 am, June 16, 2018 at Julia Lanning's house.

Notes compiled by Carol Hasenberg based on minutes by Julia Lanning.

## Wallowa Geology

*Synopsis of the GSOC 83<sup>rd</sup> Annual Banquet lecture given on March 11, 2018, with speaker Dr. Ellen Morris Bishop*

### The Short Geologic History of the Wallowa Mountains and Hells Canyon

Bishop began by showing the location of WMHC on a terrain enhanced road map of Oregon, then a satellite view, and finally a geologic overview as depicted by the Oregon Department of Geology and Mineral Industries' (DOGAMI's) [online interactive map](#). Studying the DOGAMI map one sees that the bulk of the Wallowa Mountains consists of outcrops of the "Wallowa Terrane" and "Nevadan Intrusives", which can both be viewed as a result of the docking of ancient island complexes to the North American continent by the mechanism of plate subduction.

The rocks of the Wallowa Terrane, ranging from 295 million years (Ma) to 160 Ma in age, outcrop in the eastern and southern regions of the Wallowa Mountains and in the depths of Hells Canyon. They are themselves the island complex materials which docked to the North American continent. The Wallowa Batholith, labeled "Nevadan Intrusives" on the map, is the result of an upwelling of mantle plume, facilitated by the breaking off of the subducting oceanic plate which occurred as a result of the docking of the Wallowa Terrane. The mantle plume injected magma into the continental crust into what is now the western region of the Wallowa Mountains, where it cooled below the surface of the continent, and later became exposed by uplifting and erosion. These rocks are about 130 Ma in age. Another fact about the docking of the Wallowa Terrane is that it caused the buildup of very high mountains, similar to the Himalayas today.

Surrounding, capping, and cutting through these ancient rocks are the Columbia River Basalts (CRB) from the Miocene Epoch. These started erupting about 17 Ma through vents in the Wallowas and nearby regions. The CRB flows completely inundated the area that is now the Wallowa Mountains because the tall mountains from the docking epoch had eroded and the terrain was relatively flat.

The removal of the dense continental basement with the eruption of the CRB and the peeling of the remnants of the subducted Farallon tectonic plate beneath the Wallowas

increased the buoyancy of the region, and the uplift which resulted in the Wallowa Mountains began. There has been more than 6000 feet of uplift in the last 14 Ma. These mountains were subject to local glaciation during the Pleistocene and Holocene Ice Ages, with some classic moraines deposited at their termini. Also, a single Ice Age flood pulse from Pleistocene Lake Bonneville tore through Hells Canyon, widening it and depositing some impressive gravel bars.

Bishop told the GSOC audience that folks from Wallowa County like to think of their county in terms of superlatives. The Wapshilla Ridge Unit of the Grande Ronde Flow of CRB originated in Wallowa County and is the most voluminous flow of basalt of the CRB. Likewise, the flood pulse from Lake Bonneville which widened Hells Canyon had a volume greater than that of any individual Missoula flood volume. Hell's Canyon is North America's deepest gorge.

At this point Bishop invited folks who were so inclined to get out there and enjoy the beautiful spring day, saying that this was the history of the area in a nutshell and the rest was just details. Nobody took her up on that!

**The Wallowa Terrane – a more in-depth view**

After going through a general description of the Wallowas' geology, complete with an illustration of the stratigraphic column, Bishop then proceeded to talk about details of the area and illustrate these with some of her own professional photography. She began with various sections of the Wallowa Terrane, a stratigraphic sequence of gneiss and mylonite, greenstone, marble/limestone, sandstone and shale ranging in age from 295 to 160 Ma.

The Wallowa Terrane's oldest rocks are exposed only in Hells Canyon at Kirkwood Ranch. These heavily folded rocks of the Cougar Creek Complex are alternating bands of andesite and rhyolite and are 280 Ma. They were

EROSION	GLACIAL DEPOSITS, EROSION 1 million – 19,000 years	Where: Moraines, Hells Canyon
UPLIFT	Wallowa Fault 15 my-present	Where: Alder Slope, Wallowa Valley
ERUPTIONS!	COLUMBIA RIVER BASALTS 17-14 my	Where: Twin Peaks, Sawtooth, Hells Canyon, Wallowa River Canyon, Zumwalt.
ERODE MTNS INTO FLAT PLAIN	River Gravels 50 ma??	Where: Jim White Ridge
COLLISION	GRANITIC INTRUSIONS 130-100 my	Where: Lakes Basin, Aneroid, Cornucopia, Sand Pass,
VOLCANIC ISLANDS	SANDSTONES & SHALES 240-160 million years	Where: Upper Chief Joseph Mountain; Ice Lake; Hurwal Divide; Cusick Mtn, Eagle Creek, Hells Canyon, Pittsburgh Landing
	MARBLE/LIMESTONE 240-180 million years	Where: Sacajawea, Lower Eagle Creek, Summit Point, Spring Creek (HC)
	GREENSTONE Metamorphosed basalt, 270-230 my.	Where: Mt. Bonneville, Lower Wallowa River and Lower Hurricane Creek, Hells Canyon
	GNEISS and MYLONITE 295-270 my	Where: Kirkwood area, Hells Canyon

Stratigraphy schematic of the Wallowa Mountains and Hells Canyon area. Photo by Ellen Morris Bishop.



Hells Canyon looking southwest to the Zumwalt Prairie and Wallowa Mountains beyond. Photo by Ellen Morris Bishop.



*Alternating bands of andesite and rhyolite from the Cougar Creek Complex. Photo by Ellen Morris Bishop.*

*The walls of Eagle Creek Canyon are papered with alternating bands limestone and sandstone from the Martin Bridge and Hurwal Formations. Photo by Ellen Morris Bishop.*



Permian volcanic rocks which have not been altered beyond recognition.

A slide of the volcanic island of Mt. Bromo on Java was shown as a modern example of the environment which created the Triassic basaltic greenstones found at the base of Mt. Bonneville, dating 230 Ma. Exposures include the Wild Sheep Creek Formation, which forms some of the most rugged and forbidding scenes in the depths of Hells Canyon. Some of these rocks are breccias from explosive volcanoes. Pillow basalts are exposed in places and Bishop showed a slide of pillows that were carried down the Snake River. Some greenstones are also found in the northern base of the Wallowa Mountains.

The Martin Bridge Formation consists of sedimentary limestones and marbles which are remnants of reefs and sediments from the Late Triassic. A well-known Ichthyosaur fossil was found in Eagle Creek by a high school student. A separate source from this lecture describes this formation as being “deposited in a narrow, carbonate-dominated basin during a lull in volcanic activity.”<sup>1</sup>

Sacajawea Peak, the highest peak in the Wallowas, is made from limestone and marble of the Martin Bridge Formation. Bishop explained that younger intruding granitic rock accomplished the transformation of limestone to marble in the Martin Bridge. Bishop showed a slide of an aerial view which contained both Martin Bridge Limestone and the Early Jurassic Hurwal Formation. Another slide of Eagle Creek showed dramatic banding between the Martin Bridge and Hurwal layers.

The Early Jurassic Hurwal Formation represents a deepening of the water which formed the reef platform of the Martin Bridge Formation. It includes sandstones and mudstones and volcanically derived sediments. Bishop showed slides of rocks from this age containing thinly bedded limestones and sandstones, the remnants of eroding volcanoes alternating with reef growth and found in Hurricane Creek. At the Black Marble

Quarry near Enterprise, the quarry walls contain fossils of giant clams 5 to 10 inches long, which had chambered “wings,” allowing it to float in goeey muddy water.

Another group of sediments, the Middle Jurassic Coon Hollow Formation at Pittsburgh Landing contains temperate fern fossils, indicative of a shoreline setting.

### The Wallowa Batholith

At the core of the Wallowas, Bishop reiterated that collision uplift created very high mountains, and plutons formed from magma upwelling into the collision zone. Four different similarly aged granodiorite plutons can be found in the area, 100 Ma to 125 Ma. Bands in granitic rocks occur at the edge of the plutons. Eagle Cap peak is about 100 Ma and is formed of intrusive granite.

Of the geology between the Wallowa Batholith intrusion and the Columbia River Basalt floods, remains are skimpy and studies of them are skimpier. In 1991 John Eliot Allen wrote an article designed to stimulate interest in the subject in *Oregon Geology*. He described Pre-CRB river gravels containing giant quartzite boulders in the area on the Jim White Ridge Placer Mine.

### Columbia River Basalts (CRB)

By the time the CRB started erupting the big mountains were gone, and the topography was relatively gentle. In a shot from the Buckhorn overlook, Bishop showed the audience that the CRB goes on forever, flow after flow after flow. The view represents the whole sequence of CRB flows. Bishop showed several photos of dikes in the Wallowas which produced the flood basalts - at Hurricane Creek, Wanapum dikes where Lewiston Highway crosses Grande Ronde river, and an aerial view showing extent of some of these dikes, 25 to 30 miles long.

Bishop also showed slides of the enormous 40 foot-wide dike near Maxwell Lake, which produced the Wapshilla Ridge Member of the Grande Ronde Basalt 16.2 Ma. Bishop avers that this is the most voluminous basalt flow on the planet. The flow volume totaled 9000 cubic miles, at a rate of 10 cubic miles per



*Banded granodiorite in the Wallowa batholith. Photo by Ellen Morris Bishop.*

*Bowlby Stone on the Bowlby Building in Enterprise was created in the Wapshilla Ridge flow. Photo by Ellen Morris Bishop.*





*Glacial moraines and erratic boulders from the shores of Wallowa Lake. Photo by Ellen Morris Bishop.*



*Gravel bar dumped in Hells Canyon by the flood created by Ice Age Lake Bonneville. Photo by Ellen Morris Bishop.*



day. In a slide of Multnomah falls, Bishop pointed out the Wapshilla Ridge flow as the second from the top. Outcrops of this flow also occur as far as the Oregon coast, including Saddle Mountain in the Coast Range and Humbug Mountain on the coast.

Bishop briefly spoke of Findley Buttes in Zumwalt Prairie north of Enterprise. They are located in the Zumwalt Prairie Preserve, owned by The Nature Conservancy. They are little shield volcanoes that are remnants of the Wapshilla Ridge eruption. The Bowlby Building in Enterprise was built in 1899 out of tuff related to the Wapshilla Ridge eruption.

Interesting climatic variations occurred during this time. Carbon dioxide produced by the CRB eruptions warmed the atmosphere by the greenhouse effect until the Wapshilla Ridge flow; then, an abundant discharge of sulfur dioxide and particulates cooled things down.

Nowadays the remnants of the CRB eruptions just top the Wallowa Peaks, due to uplift of this area by 6000 feet in the last 14 Ma., and the eroding forces of glaciers, especially during the Ice Ages. The top of Twin Peaks is tipped with Imnaha Basalt, the oldest of the CRB flows. How and why did the Wallowas rise? The latest accepted theories say they had their dense root removed at the time of the CRB eruptions by delamination of the subducting Farallon plate. Researchers at UO are working on confirming the timing of the uplift and the flood basalts to confirm their theories on these processes.

### **The Ice Ages**

After all the discussions about the accreted terranes, batholith formation, flood basalts, and uplift there was barely time for Bishop to explore the effects of the Ice Age valley glaciers which shaped the terrain of the Wallowas today. Bishop showed a lidar view of Wallowa Lake, with its classic moraines forming its shapely crescent 19,000 years ago. She also showed a slide of the large gravel bar formed in Hells Canyon by the massive flood produced by Pleistocene Lake Bonneville in a one-time event.

At the end of this memorable talk Bishop reminded the audience that all these geologic splendors are within a day's drive from Portland, and she invited GSOCers to come on out and explore!

### References and Additional Reading

Ellen Morris Bishop, Living with Thunder, Oregon State University Press, 2014. *Editor's note: I did a lot of fact-checking of my lecture notes with this most recently written volume by Bishop. A lot of the photos from Bishop's slide show are also to be found in this book.*

John Eliot Allen, "The case of the inverted auriferous paleotorrent-exotic quartzite gravels on Wallowa Mountain peaks," Oregon Geology, Volume 53, Number 5, September 1991. This is the Allen article referred to in this article.

George D. Stanley Jr., Christopher A. McRoberts, Michael T. Whalen, "Stratigraphy of the Triassic Martin Bridge Formation, Wallowa terrane: Stratigraphy and depositional setting," The Geological Society of America, Special Paper 442, 2008. Very detailed article about the MBF which is very prominent in the Wallowas.

<sup>1</sup>T. L. Vallier (Edited By) and H.C. Brooks, "Geology of the Blue Mountains region of Oregon, Idaho, and Washington; stratigraphy, physiography, and mineral resources of the Blue Mountains region," USGS Professional Paper 1439, 1994. <https://pubs.er.usgs.gov/publication/pp1439>

Geology of the Wallowa Mountains Oregon, simplified geology map of the Wallowas by Andy Buddington, Earth Sciences Instructor at Spokane Community College.

Geologic units in Wallowa County, Oregon, web page on the USGS website.

Accreted Terranes & the Western Idaho Suture Zone, a web page in Digital Geology of Idaho website, By Keegan Schmidt, Lewis & Clark State College and Paul Link, Idaho State University. Lots of interesting photos of the topics in this lecture.

## Announcing the Central Oregon Geoscience Society

The Central Oregon Geoscience Society (COGS) has formed as a central-Oregon based, non-profit organization promoting a greater awareness and understanding of the geological sciences through technical presentations, field trips and educational outreach to schools. They plan to have eight presentations per year, as well as field trips in the late spring through early fall. Presentations are held at Deschutes Brewery Tap Room (upstairs), 1044 NW Bond Street in Bend. Join them at 6:00 PM for food/beverages and presentation at 7:00 PM.

COGS held its inaugural presentation on March 27 with Bart Wills, U.S. Forest Service, speaking on "Geothermal Exploration at Newberry Volcano." The next presentation will be on April 24th with Adam Kent, Oregon State University, speaking on "Mount Hood: Confessions of an interesting Boring Volcano."

Bob Jensen will lead COGS's inaugural field trip in April exploring the geology of the upper and lower loop trails in Riley Ranch Nature Reserve. This trip will allow a look into the Deschutes River channel where over five million years of Central Oregon's geologic past are exposed. The wide variety of volcanic and erosional features within the Riley Ranch Nature Reserve makes it one of the most geologically interesting park in the Bend Park & Recreation District system.

Keep abreast of their upcoming plans via their website [CoGeoSoc.org](http://CoGeoSoc.org).

## Helicopter Tour of Mt. St. Helens August 18th, 2017 10:00a.m., \$269/per person



The 1980 eruption of Mt. St. Helens in Washington was the worst US volcanic disaster in recorded history.

Once again, Sheila Alfsen will host a tour by helicopter of Mt. St. Helens and the surrounding devastation area. This year the tour is planned for Aug. 18, 2018.

The trip will be conducted at the North Fork Survivors Gift shop, located at 9745 Spirit Lake Hwy, Toutle, WA, 98649. (360-274-6789). Helicopters are flown by Hillsboro Aviation. The price includes a presentation in the gift shop theater of the 1980 eruption and its aftermath, and a 40-minute flight over the devastated area and close up to the crater where you can see the effects on the landscape.

Additionally, Nathan Reynolds, Ethnologist and Habitat Program Manager for the Cowlitz Indian Tribe, will be giving a presentation about the federal designation of Lawetlat'la/Mt. St. Helens as a Traditional Cultural Property of the Cowlitz Tribe and Yakima Nation.

Pricing depends on a sign-up of a quota of 16 participants, so please advise us of your intent if interested as soon as possible.

## Newberry Tuffs

*June 15, 2018, 7:30 to 9:00 pm*

A New Look at "Old" Tuffs at Newberry Volcano: Evaluating the Influence of Cascadia Subduction and the High Lava Plains on Magmatism at a Geologic Crossroads in Central Oregon.

Speaker Jeffrey Templeton is a Professor of Geology at Western Oregon University, where he has taught for over 23 years. He earned his Ph.D. in Geology from Oregon State University in 1998. He teaches a diverse



array of courses at WOU ranging from introductory Earth System Science and Physical Geology courses to upper division courses in Petrology, Volcanology, and Structural Geology. His research interests include igneous petrology, volcanology, and undergraduate geoscience education.



## Retired, age 65 or older, with time on your hands? Learn some geology —or anything else!

by *GSOC Past President, Bo Nonn*

Why not audit a class at PSU? It's free, practically, and you get to hear the same great professors who've addressed our Friday night meetings. I've been auditing mostly geology since I retired, over 30 to date, from entry-level to heavy-duty senior/graduate level. You can arrange with the instructor on how deeply you want to get involved, from just sitting in on the lectures all the way to labs, quizzes, term papers and exams.

If you're interested, here's what to do:

1. First time auditors must apply to be an auditor and pay a one-time registration fee of \$25. The Senior Adult Learning Center (SALC) office accepts only check or money order for the one-time application fee.
2. Log on to [pdx.edu](http://pdx.edu). Click on Quick Menu and then Find a Class. Theoretically any class can be audited if there's room and if the teacher agrees.
3. Pick up an SALC registration form at the Senior Adult Learning Centers office on the PSU campus.
4. Fill in the classes of your choice, up to 8 credits.
5. On the first meeting day of your selected class, go up to the teacher after the class to get a signature.
6. When you have all the signatures, turn in the registration form and in a few days you'll have a pseudo-student number and access to online class materials.

If you want to start slowly, look into one of the G200 1 to 3-day field trip classes.

Feel free to e-mail Bo at [bononn14@Q.com](mailto:bononn14@Q.com) and if you'd like a second opinion, check with Marty Muncie — she's been doing them all along!

Senior Adult Learning Center  
Room 470, Urban Center Building, 506 SW Mill Street  
Phone: 503-725-4739  
E-mail: [salc@pdx.edu](mailto:salc@pdx.edu)

### WELCOME NEW MEMBERS!

Garret Romaine  
John and Catherine Thompson  
Jake Turner  
Larry Kotan  
Chris Bennett  
Janet Johnson





# The Geological Newsletter

NEWS OF THE GEOLOGICAL SOCIETY OF  
THE OREGON COUNTRY

July/August 2018  
Volume 84, Number 4

The Geological Society of the Oregon Country  
P.O. Box 907, Portland, OR 97207-0907  
[www.gsoc.org](http://www.gsoc.org)

## A Sharper Image of the Landslides of Skamania County

by Carol Hasenberg

Tom Pierson has been a research scientist at the USGS Cascades Volcano Observatory (USGS CVO) since 1981. His field-based research focuses primarily on the hydrological response to volcanic eruptions—lahars, debris avalanches, and floods. Pierson spoke to GSOC in February 2014 about the debris flows following the eruption of the Chaiten Volcano in Chile. Pierson's April 2018 topic hit a lot closer to home, although the Pacific Northwest also has plenty of volcano hazards.

*See Landslides, Page 34*



*View upslope to the headscarp of the Red Bluffs landslide, seen from the surface of the Crescent Lake landslide, taken in 2012. Photographer Tom Pierson, USGS CVO.*

## Calendar

### Friday Night Lecture

July 13, 2018, Cramer Hall, Portland  
State University

Speaker Emily Cahoon, PSU PhD candidate, will present "A Tail Between Two Cities: the Yellowstone Plume (Head and Tail) Between John Day and Burns, Oregon."

*see Yellowstone Plume, Page 32*

### GSOC Annual Picnic

At the Rice Museum in Hillsboro, August  
12, 2018, 12 – 2:30 pm

*see page 41, or the GSOC website, for  
more information*

### Mount Saint Helens Helicopter Tour

August 18, 2018, 10 am

*see page 41, or the GSOC website, for  
more information*

### Camp Hancock/President's Field Trip and RCA Star Party

September 14-16, 2018

Trip is open for registration until the limit of  
25 participants is reached.

*see the [GSOC website](http://www.gsoc.org) for more info*

**GSOC Friday Night Lectures** are held the second Friday evening of most months, 7:30 p.m., Rm. 53, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon. Join GSOC members at Pizzicato Pizza, 1708 SW 6th Ave., at 6:00 p.m. before the lectures for an informal dinner and conversation. Check the GSOC website ([www.gsoc.org](http://www.gsoc.org)) for more information and updates to the calendar.

**Hourly rates** for parking are available in some parts of PSU parking structures. PSU Parking Structure #2, 1724 SW Broadway across from Cramer Hall is \$5.00 flat rate in the evening. Park in permit (NOT reserved) spaces and pay at the kiosk by entering your vehicle license number. There is also on street pay parking, and many mass transit options. Street parking is \$2.00 an hour, but free after 7:00 pm. More info available [here](#).

**2018 - 2019 ADMINISTRATION:**

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 503/939-6003  
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## Yellowstone Plume

*July 13, 2018, 7:30 to 9:00 pm*

Emily Cahoon's talk will focus on volcanic deposits around the John Day Valley and further south to Burns, Oregon. This includes the Clarno Formation, John Day Formation, and lots of mid-Miocene lavas and tuffs. Also, there are unstudied Oligocene to mid-Miocene basaltic lavas and dikes exposed south and east of known Picture Gorge Basalt (PGB) localities. These help to reevaluate PGB distribution and to better understand evolution, mantle components, and possible petrogenetic connections among PGB, Steens Basalt, and the Strawberry Volcanics. Broadly, we will explore the proposed connections between the John Day Formation, the Columbia River Basalts, and the Yellowstone plume.

Emily Cahoon is a 3rd year PhD Candidate at Portland State University. She received her BS from the University of Delaware in geological sciences and continued studying geology at Washington State University where she earned her MS investigating volcanoclastic deposits of the Clarno Formation in eastern Oregon. Her current research interests broadly cover the petrogenesis and geochemistry of basaltic magmas. Specifically, her dissertation examines the Picture Gorge Basalt (CRBG) via trace element and isotopic signatures to assist in geochemical modeling and interpretation of magmatic components during Oligocene

and Miocene time in central and eastern Oregon.



## GSOC Board Meeting Notes

June 16, 2018

Board members Paul Edison-Lahm, Rik Smoody, Carol Hasenberg, Dawn Juliano, Julia Lanning, Larry Purchase, Megan Faust in attendance constituting quorum. Dave Olcott also attended the meeting.

### EVENTS

#### Friday night lectures

Vice President Sheila Alfsen report, upcoming speakers:

- July: Emily Cahoon – Yellowstone Hot Spot
- August: Picnic, Nick Famoso - Fossils
- Sept: Bill Orr- Extinctions
- Oct: Jim O'Connor - Bonneville Flood
- Nov: - Bill Burgel - TBA

Bill Burgel, a recently joined member of the club, has offered to speak this fall. Board discussed possible topics that he had proposed.

Board approved purchase of Epsom Pro EX9220 for \$750 after reviewing Rik's research on the subject.

For event promotions for this year the board approved \$180 per year for Meetup outreach, and \$50/typical event in Facebook ads, and \$100 in Facebook ads for the annual banquet. The Facebook ads have been correlated with higher attendance numbers with lectures.

#### Field Trips and Other Events

August 12 - Annual Picnic will be at the Rice Museum. We plan to give a \$500 donation to the Museum in exchange for the use of their grounds for a picnic and a one year membership for all GSOC members. Fee for the picnic of \$10 helps pay for this, plus attendees get a talk from Dr. Nick Famoso, USNPS Chief of Paleontology at John Day Fossil Beds National Monument.

Club has agreed to pay Nick's hotel and his meals for dinner, breakfast, and the picnic lunch. Picnic is pot luck with board members suggested to bring protein dishes. We will have the donations box available for speaker costs. We would like to stress that no alcohol is allowed on the grounds, and participants are to clean up cigarette butts. The club will not be able to use Rice Museum BBQs or grills.

August 18 - Mt St. Helens helicopter tour. \$269/person. One more participant was needed to complete the required participation in fee structure as of the board meeting.

September 14 - 16. Paul reviewed itinerary and budget. Board discussed options for determining how to prioritize participants for the trip, as this trip seems to be of particular interest, and space is limited. Paul as field trip leader has discretion on prioritization and registration methods. Board discussed whether to allow additional participants on this trip or to arrange future trips. Board discussed having an optional dinner and overnight stay in Mitchell (?) area to be paid for by participants. Lodging suggestions Skyhook Motel in Dayville (cheap) or Oregon Hotel in Mitchell (nicer). Budget \$250 per participant approved.

Sept. 29: Johnson Creek Tour Van tour is still in planning stages, to be discussed next meeting.

#### Oct. 6 - Downtown Ancient Walls South Tour

March 2019 Annual Banquet: Board discussed scouting for a new venue for the Annual Banquet, but meanwhile has booked the Monarch Hotel.

Wallowa trip – Board discussed the possibility of a Wallowa trip to be tentatively scheduled for late 2019. Committee has formed of Julia Lanning, Carol Hasenberg, Kimberly McCree, and Evelyn Bennett.



## BOARD MEETING NOTES

*continued from Page 33*

### Other Old and New Business

Treasurer's Report submitted by Dawn and approved by board.

Database updating report by Rik. He's completed a read only spreadsheet of full membership which will be made available to all members. It will be password protected and members will receive the password in an email soon.

GSOC Mugs - Dawn reports that we have sold or given as gifts all of the GSOC mugs ordered in 2011! Board authorized research into ordering more mugs.

Next GSOC Board Meeting will be on August 12, 2018, 10:00 a.m. prior to the picnic at the Rice Museum.

Notes compiled by GSOC Secretary Carol Hasenberg.

## Landslides, cont from pg. 31

*Synopsis of the GSOC Friday night lecture given on April 13, 2018, with speaker Tom Pierson, USGS CVO*

Pierson's involvement in Skamania County, Washington, landslide risk assessment began in February 2007 when he and other CVO colleagues got a call from the Skamania County emergency personnel about a large landslide in Rock Creek just west of the town of Stevenson in the Columbia River Gorge.

Pierson showed some slides of this landslide in motion. In a couple of days after the call, the landslide had become much larger, moving downslope at about a foot a minute. It ended up engulfing a lot of trees and threatening some houses. The landslide was aggravated by a lot of rain earlier in the season. This is a general rule of landslides – they respond to an accumulation of rainfall. In response to this disastrous event, a team from the CVO set about the task of examining the landslide hazards in Skamania County.

At this point Pierson laid out the geological framework for the Columbia Gorge landscape and landslides. A visitor to the gorge cannot help but notice that the **land abutting the Oregon side of the river is very steep and that on the Washington side has more gently sloped, hummocky terrain**. In fact, in some places on the Washington side one can see layers of rock dipping towards the river at a moderate angle.

What really distinguishes the geology of the gorge is that there is a large, heavy, rigid sequence of Columbia River Gorge Basalt rocks sitting atop layers of weaker, variably weathered volcanoclastic rocks of the ancestral Cascade mountains. The area has been experiencing uplift for millions of years, causing layers to dip from 2 to 10 degrees toward the southeast, and also has been downcut by the Columbia River, which predates the Cascade Range. Add to that the abundant rainfall of the area, and you have terrain that is highly prone to sliding.

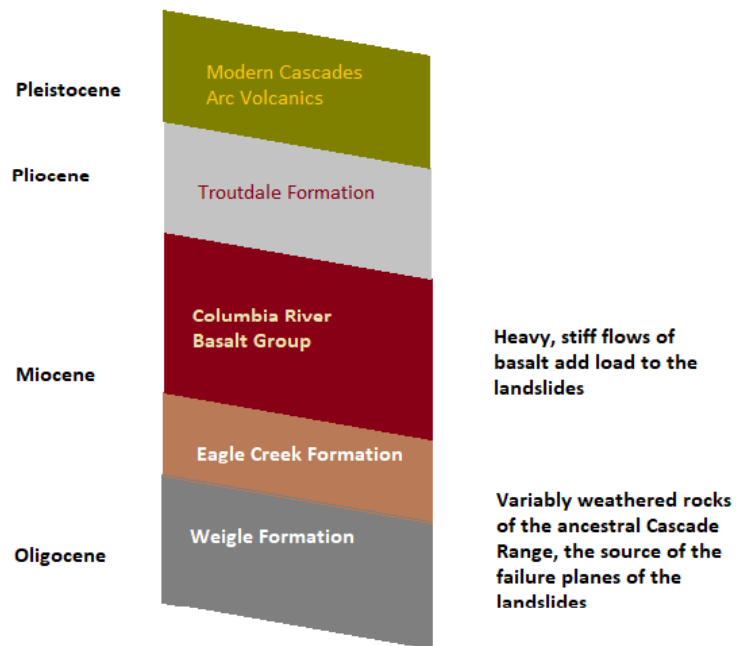
The **dip of the stratigraphic layers also accounts for the difference in the landscape between the north and south margins of the Columbia River**. This talk was predominantly about the north margin in the state of Washington, where the gentle slopes leading down to the river are in fact the remnants of ancient landslides, many of which are still active. The southern Oregon side is

mostly steep cliffs of Columbia River Basalt and is prone to debris flows and rockfalls.

But any discussion about landslides must include a discussion of modern tools and techniques to find and analyze them. **LiDAR (Light Detection and Ranging) is a method of surveying terrain using a laser mounted on an airplane** with the sophisticated computer algorithms to analyze the data. Bursts of laser light are emitted and then the return times are collected and analyzed. The technique can be used to map the canopy and buildings, or these can be filtered out to reveal the ground surface beneath to high accuracy. What this means is that geologists have a clearer picture of the ground surface than they did in the past century using photogrammetry (airphoto analysis), and the landslides really pop out due to their shape and can be easily identified. In effect, for landslide analysis LiDAR removes the trees from the image with resolution of objects in feet or smaller. In the context of this study, **LiDAR was used in mapping the landslides** and the resolution was 6 feet.

Another, related technique is called InSAR (Interferometric Synthetic Aperture Radar) is satellite-based and uses radar emissions rather than laser light. InSAR data is much cheaper to acquire than that of LiDAR and the measurements are repeated every time the satellite passes over the terrain to be analyzed, every few weeks. Measurements between passes can be compared and changes in position over time can be monitored. This technique is highly effective in monitoring landslides, volcano inflation or deflation, ground subsidence and other such conditions. In this study, **InSAR was used to determine movement** on the landslides in multiple satellite flybys.

There were other techniques used in the studies of these landslides for dating, documenting movement and other information. Dating of landslides was done by dendrochronology (tree ring dating), lichenometry (measuring lichen growth on rocks), radio-carbon dating, and historic records. Besides InSAR, GPS and historic



*Stratigraphy schematic of the Columbia River Gorge. The layers are shown at a 10 degree tilt.*



*Sequential photos showing the progression of the Piper Road Landslide on Rock Creek. Upper photo was taken on February 6, 2007, and the lower photo taken on February 16, 2007, shot from the same location. Photos by Tom Pierson, USGS CVO.*

records helped to document the movement of active landslides.

Due to the research initiated by Skamania County, the area of **found landslides in the study area increased dramatically**. At least 215 landslides were identified, covering 64% of the land area -- an increase of 56% over previous studies. At least 12 slides are active. Parts of old slides have been shown to have reactivated. About two-thirds of the slides have translational motion, in other words they move downslope in a horizontal direction, rather than rotating along a curved failure plane.

About **one quarter of the slides are less than 1000 years old** and categorized as recent in the study. They all show rather sharp and clear mapping features in the LiDAR images, whereas older slides have smoother, more amorphous features. The well-known Bonneville slide near Stevenson, Washington, occurred sometime between years 1421-1447 AD, dated using dendrochronology and radio-carbon dating. The Bonneville slide is part of a major set of landslides, the Cascade Landslide Complex, originating from a set of scarps strung between Table Mountain to the west and Greenleaf Peak to the east. Another major slide in this complex, the Red Bluffs slide, has had a preliminary dating window that brackets the date of the last great Cascade Subduction Zone earthquake, 1700 AD, and it is possible that this slide was triggered by the earthquake.

An active landslide of **particular interest is the Crescent Lake Landslide** in the Cascade Landslide Complex, located a little to the east and overlapping the Bonneville slide. An ominous finding using InSAR was a new slump block developing above this slide on the 500-foot-high head scarp. There is a back tilt to the top of the slump block at the head scarp, so it may indicate back rotation motion in the block. But it is not known for sure if that is this type of motion or a block translational glide. The slide has moved about 30 cm in 4 years. They are currently monitoring this slide with GPS. Some movement studies on this slide have correlated the movement of the slide with periods of prolonged rainfall, a not infrequent occurrence during

winters in the Columbia River Gorge. The same researcher was able to calculate the relative thickness of the landslide itself, which showed that this landslide is overlapping the old Bonneville slide.

In the calculation of risk to society from these landslides, one considers population, infrastructure, transportation and other ways the slides can impact human activities. Although the population is not great, there is lot of infrastructure in this area. The small town of Stevenson is built upon the toe of slides from the Cascade Complex. There is also the Bonneville dam, a railway, highways, electrical transmission, and a 26-inch gas pipeline running across the toes of these slides.

One important question asked by the researchers is how will all these slides react to a magnitude 9 Cascadia Subduction Zone quake? Predictions are so hard to make it's difficult to assess risk, but the knowledge that there is a risk can be used to guide future development.

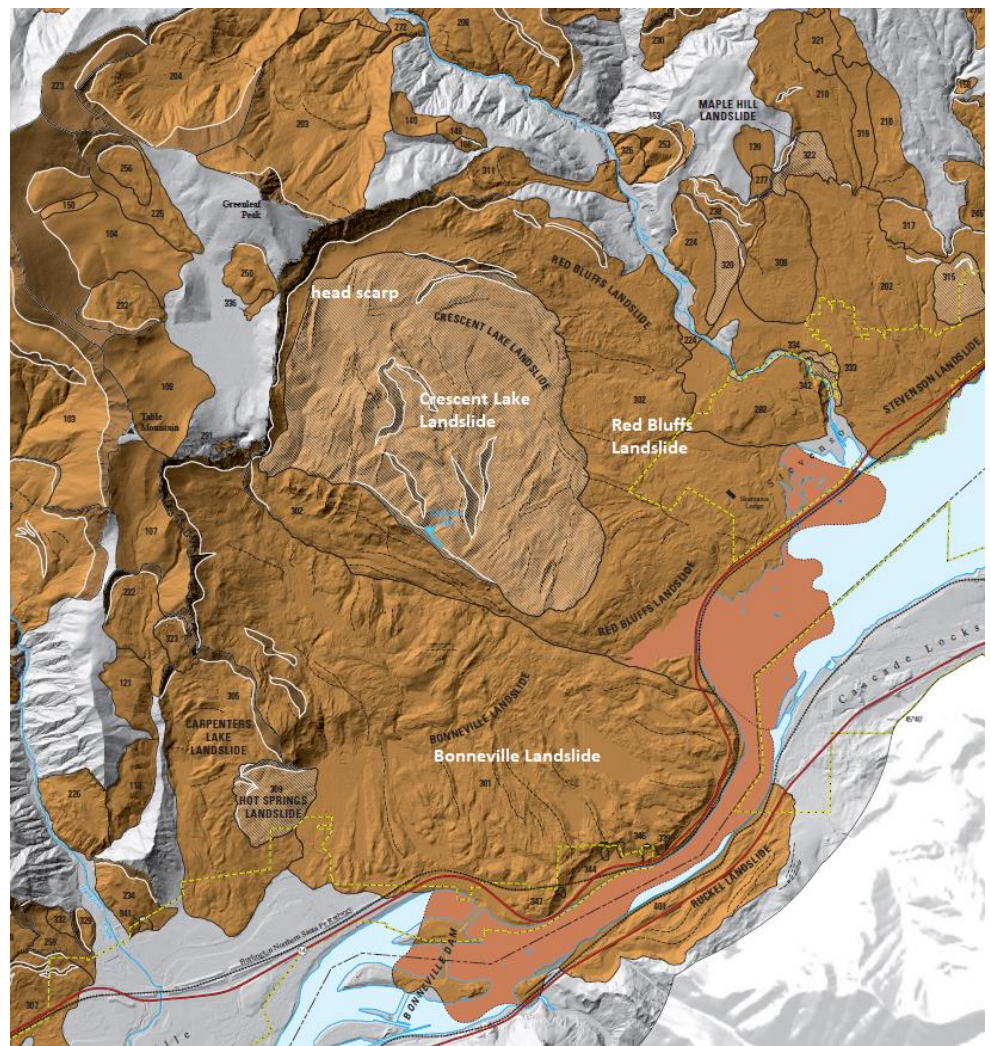
*The landslides comprising the Cascade Landslide Complex. From the USGS publication "Landslides in the western Columbia Gorge, Skamania County, Washington," SIM 3358.*

### Additional Reading

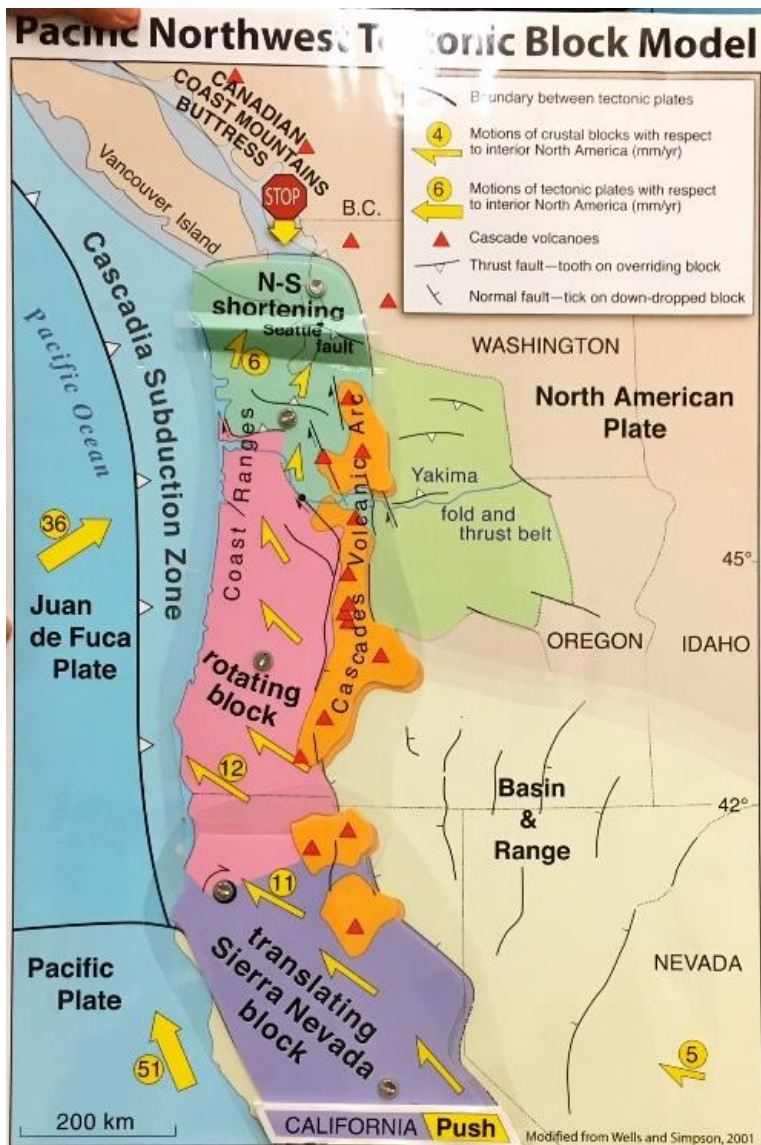
["Imagery Reveals More Landslides in Western Columbia Gorge,"](#) USGS web page, November 4, 2016

Thomas C. Pierson, Russell C. Evarts, and Joseph A. Bard, ["Landslides in the Western Columbia Gorge, Skamania County, Washington,"](#) USGS Pamphlet to accompany Scientific Investigations Map 3358, 2016. This pamphlet gives background info on and summarizes the results of the study and also gives an excellent primer to landslide types and failure mechanisms.

Thomas C. Pierson, Russell C. Evarts, and Joseph A. Bard, ["Landslides in the Western Columbia Gorge, Skamania County, Washington,"](#) USGS Scientific Investigations Map 3358, 2016.



## Rotating Crustal Blocks Form a Simplified Picture of Pacific NW Plate Motion



Display board used by Ray Wells to give the audience a tactile experience of the tectonic motion of the Pacific coast of North America.

*Synopsis of the GSOC Friday night lecture given on May 11, 2018, with speaker Ray Wells, retired USGS*

May's GSOC Friday night lecture from retired USGS research geologist Ray Wells gave the listeners a big picture of the tectonic motion of the Pacific NW and explained much about the distribution and function of shallow crustal earthquakes and their associated faults in the region. This picture had sharpened over Wells' 40-year career at USGS, as our understanding of plate tectonics evolved and new techniques contributed to the store of information and provided corroboration for earlier findings.

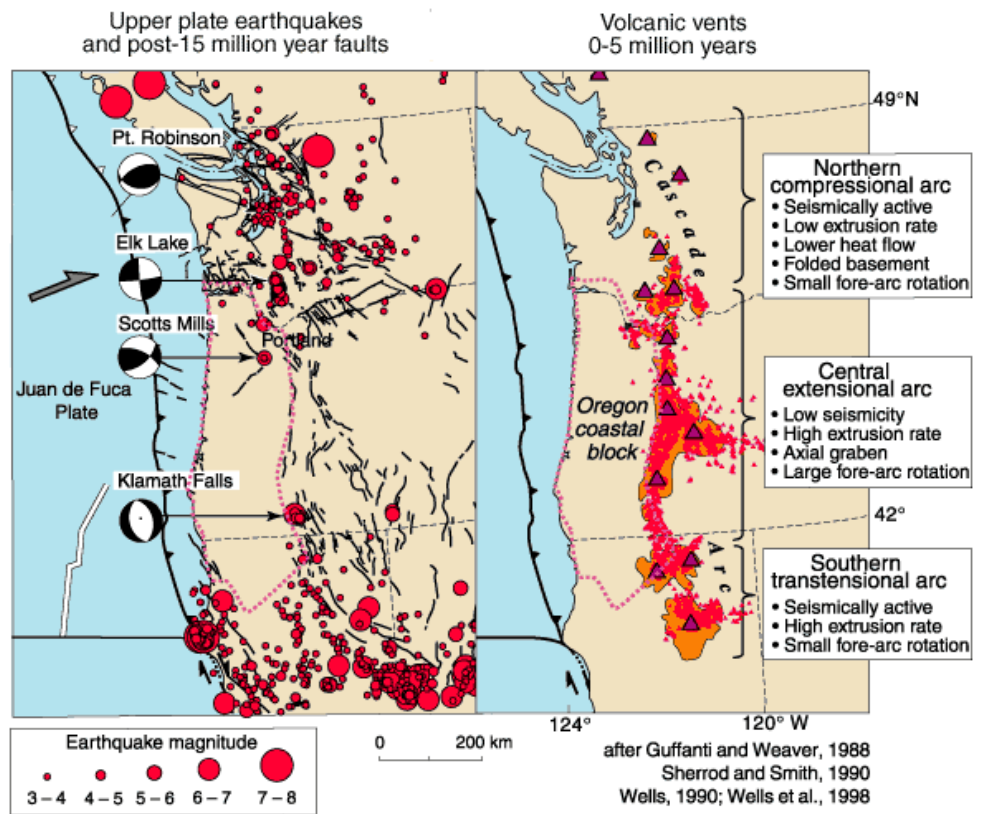
On the largest scale, the Pacific NW is the scene of a collision between the North American tectonic plate and the Pacific plate, with the Pacific plate motion NNW in relation to North America. Sandwiched between the two are a couple of small oceanic plates, the Juan de Fuca and the Gorda Plates, which are the remnants of an ancient great oceanic plate dubbed the Farallon Plate. The boundaries of these plates have been determined by mapping of the ocean floor and mapping the earthquakes whose hypocenters are located within the oceanic plates.

The interface between the Gorda and Juan de Fuca Plates and North America is a great thrust fault, the Cascadia Subduction Zone, which periodically ruptures and causes great earthquakes in the Pacific NW. In addition there are periodic deep earthquakes in the subducting oceanic plate that are in response to this activity.

The topic of Wells' lecture, however, **focused upon crustal earthquakes that occur near the surface in the North American Plate**, and are a response of the plate margin to the forces which are acting upon it in this tectonic environment. A lot can be learned from studying maps of crustal earthquakes and volcanoes of the Pacific NW. One

sees a lot of crustal earthquakes in the Puget Sound area, activity all the way south to Portland, then there is little activity through Oregon and the Klamath Mountains but lots of activity south of that. Also, there is a lot of volcanic activity in Oregon in the straight line formed by the Cascade Mountains, but north of Oregon the Cascades volcanoes are more isolated ('big ice cream cones'). What this suggested to research geologists was that western Oregon and the Klamath Mountains of northern California are in effect a 'mini-plate' that moves pretty much as a solid block. Wells called this the Oregon Coast Block. It is bounded by the ocean on the west and the Cascade Mountains on the east.

Much data gathered over the last several decades supports the idea that the **Oregon Coast Block (OC)** is moving as a block and is rotating clockwise at a fairly steady rate, and has done so during the Tertiary and Quaternary geologic eras -- 70° rotation for the last 60 million years and 18° for the last 15 million years. These measurements are obtained from paleomagnetic studies, which takes measurements of the magnetic orientation which is set in volcanic rock when it cools from magma, in alignment with the magnetic polarity of the earth. More recently, measurements from GPS stations have corroborated the paleomagnetic data.



The movement measurements of the coastal areas from northern California to lower British Columbia show that there are regions of distinct characteristics which fit rather neatly into a **block model of motion**. The blocks from south to north are the Sierra Nevada block, the Oregon Coast block, the Washington Coast block, and the Canadian Coast Mountains Buttress. The motion of the Pacific Plate is dragging the Sierra Nevada block NNW, and in turn this block is pushing the Oregon Block northward. But the Washington Coast block has nowhere to go, as it is constrained by the Canadian Coastal Mountains Buttress,

*Crustal earthquakes vs. volcanism in the Pacific NW. From USGS web page "Tectonic plate motions, crustal blocks, and shallow earthquakes in Cascadia," see link below article.*

so it is getting squeezed from Oregon to the South and Canada to the north, and this resistance is also rotating the Oregon block clockwise.

And these motions are expressed in the Washington Coast Block as E-W trending thrust faults, which are absorbing the shortening of this part of the coast. A major example is the Seattle Fault, which is responsible for a much greater earthquake risk than that of western Oregon. And that brings us to a more general discussion of earthquake hazards in the Pacific NW as a result of all this crustal motion. In addition to the threat of a great earthquake the whole length or a major part of the subduction zone and the intra plate earthquakes with a deep focus (1949 Olympia and 2001 Nisqually earthquakes are examples), there are also hazards from shallow crustal faults in the North American plate. The **greatest risk areas are western Washington, especially the Seattle area, all the way south to the Portland basin**, where several crustal faults converge. There are also numerous faults in the Yakima Fold and Thrust belt to the east. Crustal faults do exist in western Oregon, but there are fewer of them.

#### Additional Reading

[“Tectonic Earthquakes of the Pacific Northwest,”](#) a video available on YouTube and produced by a joint venture of [IRIS](#) (Incorporated Research Institutions for Seismology), USGS, and funded by a grant from the National Science Foundation, 2015. Dr. Wells was the science advisor for this project and it contains an animated version of the concepts discussed in the lecture.

R.E. Wells, R.J. Blakely, R.W. Simpson, C.S. Weaver, R. Haugerud, and K. Wheeler [“Tectonic plate motions, crustal blocks, and shallow earthquakes in Cascadia”](#), in current research topics from the Pacific Northwest Geologic Mapping and Urban Hazards section of the USGS web site, 2016.

### WELCOME NEW MEMBERS!

Deborah Sather	Joel Wilson
James Bell	Chris Wiley
Sarah Rehwalt	Lisa Goode
Robin Smith	Nancy Floyd
Jack & Susan Carlson	
Patricia Sexton & Cecile Bennett	
Alvin & Jane Chase	
Roger Hall	
Susan Granados & Chuck White	

## GSOC Annual Picnic

*August 12, 2018, 12 to 2:30 pm, Rice Museum, Hillsboro, cost \$10 per member attending*

This year's GSOC picnic will be held at the Rice Northwest Museum of Rocks and Minerals, 26385 NW Groveland Drive, Hillsboro, OR. It is located 25 minutes from downtown Portland, Oregon, on Highway 26 west at the Helvetia Road/Brookwood Parkway Exit.

If you are coming, bring \$10 a head in cash or checks made out to GSOC, a picnic chair, your favorite non-alcoholic beverage and a side dish or dessert. GSOC will provide paper plates, flatware, and cups. GSOC board members are to bring protein dishes. We will not have access to stoves or barbecues. Eating will commence as soon as possible after 12pm. Your payment will go towards a GSOC club membership to the Rice Museum for this day and the upcoming year.

There will be a great speaker at this year's banquet! [Dr. Nicholas Famoso](#), USNPS Chief of Paleontology of the John Day Fossil Beds National Monument and native Oregonian, will discuss fossils in the monument and at the Rice Museum. Additional small donations will be accepted to help pay for Nick's overnight lodging and meals.



## Helicopter Tour of Mt. St. Helens August 18th, 2017 10:00 am, \$269/per person



The 1980 eruption of Mt. St. Helens in Washington was the worst US volcanic disaster in recorded history.

Once again, Sheila Alfsen will host a tour by helicopter of Mt. St. Helens and the surrounding devastation area. This year the tour is planned for Aug. 18, 2018.

The trip will be conducted at the North Fork Survivors Gift shop, located at 9745 Spirit Lake Hwy, Toutle, WA, 98649. (360-274-6789). Helicopters are flown by Hillsboro Aviation. The price includes a presentation in the gift shop theater of the 1980 eruption and its aftermath, and a 40-minute flight over the devastated area and close up to the crater where you can see the effects on the landscape.

Additionally, Nathan Reynolds, Ethno-ecologist and Habitat Program Manager for the Cowlitz Indian Tribe, will be giving a presentation about the federal designation of Lawetlat'la/Mt. St. Helens as a Traditional Cultural Property of the Cowlitz Tribe and Yakima Nation.

Pricing depends on a sign-up of a quota of 16 participants, so please advise us of your intent if interested as soon as possible.







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September/October 2018  
Volume 84, Number 5

The Geological Society of the Oregon Country  
P.O. Box 907, Portland, OR 97207-0907  
[www.gsoc.org](http://www.gsoc.org)

## Clarno and John Day Lava: Extent and Origins

by Carol Hasenberg and Emily Cahoon

PSU PhD Candidate Emily Cahoon spoke to GSOC at the July Friday night meeting about her research into the origin of the Clarno and John Day magmatism. Her research is part of an ongoing push in the geoscience community to determine the origin of the magmas to erupt in Oregon. This is a tricky question when the magma originates somewhere in the earth's mantle, is filtered by partial melting of intervening subducting plates and/or continental crust, erupts onto the earth's surface, and is then pushed and pulled, rotated away from its original location, covered up in some places and eroded away in other places.

*See Clarno and John Day, Page 34*



*Cahoon reviews some of the finer points of her research after the lecture.*

## Calendar

### Friday Night Lecture

September 21, 2018, Cramer Hall,  
Portland State University

Speaker Bill Burgel, MS Structural Geology, retired with 48 years in the railroad industry, will present "Real-Time Seismic Notification Systems."

*see Seismic Notification, Page 44*

### Friday Night Lecture

October 12, 2018, Cramer Hall, Portland  
State University

Speaker Dr. Jim O'Connor, USGS hydrogeologist, will present "The Other Flood — Ice-age Bonneville Flood on the Snake River."

*see Bonneville Flood, Page 44*

### GSOC President's Field Trip: Camp Hancock with the Rose City Astronomers

September 14-16, 2018

This Camp Hancock portion of this trip is full!

### Johnson Creek Van Tour

September 29, 2018

This trip is now open for registration! Fee is \$15.

See [GSOC website](http://www.gsoc.org) for current information  
on GSOC field trips

**GSOC Friday Night Lectures** are held the second Friday evening of most months, 7:30 p.m., Rm. 53, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon. Join GSOC members at Pizzicato Pizza, 1708 SW 6th Ave., at 6:00 p.m. before the lectures for an informal dinner and conversation. Check the GSOC website ([www.gsoc.org](http://www.gsoc.org)) for more information and updates to the calendar.

**Hourly rates** for parking are available in some parts of PSU parking structures. PSU Parking Structure #2, 1724 SW Broadway across from Cramer Hall is \$5.00 flat rate in the evening. Park in permit (NOT reserved) spaces and pay at the kiosk by entering your vehicle license number. There is also on street pay parking, and many mass transit options. Street parking is \$2.00 an hour, but free after 7:00 pm. More info available [here](#).

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**Bonneville Flood**

*October 12, 2018, 7:30 to 9:00 pm, Cramer Hall*

The Bonneville Flood was one of the largest floods on Earth. First discovered by G.K. Gilbert in the 1870s during his inspection of the outlet at Red Rock Pass, Idaho, it was rediscovered in the 1950s by Harold Malde and coworkers, leading to mapping and assessment of spectacular flood features along Marsh Creek, Portneuf River, and Snake River for over 1100 kms between the outlet and Lewiston, Idaho. From the rapid 115 m drop of Lake Bonneville from the Bonneville level to the Provo level, the flood was nearly 200 m deep in places and flowed at a maximum rate of about 1 million cubic meters per second — about 100 times greater than any historical Snake River flood. Along its route the Bonneville Flood carved canyons and cataract complexes and built massive boulder bars. These flood features have been a rich source for understanding megaflood processes, and offer more with new and developing techniques for hydrodynamic modeling and landscape analysis.

Jim O'Connor majored in Geological Science at University of Washington and earned M.S. and Ph.D. degrees at University of Arizona. Since 1991, he has worked at the U.S. Geological Survey, intent on improving understanding of the processes and events that shape the remarkable and diverse landscapes of the Pacific Northwest.

**Seismic Notification**

*September 21, 2018, 7:30 to 9:00 pm, Cramer Hall*

Bill Burgel, a recently joined GSOC member, has a BS in Engineering from the University of Michigan, 1971, with minor in Geologic Oceanography; and an MS in 1986 Structural Geology from Idaho State University; and 48 years in the railroad industry.

The presentation will focus on efforts to provide extremely quick and accurate information of a seismic event especially Magnitude 5.0 and higher to businesses and communities so that they can react to minimize the extent of earthquake damage and/or loss of life.



## GSOC Board Meeting Notes

August 12, 2018

Board members Paul Edison-Lahm, Sheila Alfsen, Rik Smoody, Dawn Juliano, Larry Purchase, Bo Nonn and Megan Faust in attendance constituting quorum. Marty Muncie and Dave Olcott also attended the meeting.

### EVENTS

#### Friday night lectures

Vice President Sheila Alfsen reported the following upcoming speakers:

- Today's Picnic, Nick Famoso- Fossils
- Sept: Bill Orr- Extinctions
- Oct: Jim O'Connor - Bonneville Flood
- Nov: Bill Burgel – Earthquake Early Warning Systems
- Dec: Holiday Party
- March 2019 banquet: Ian Madin of DOGAMI

Paul brought in the newly purchased Epsom Pro EX9220 projector. Sheila will use it for the Mt. St. Helen's field trip on Saturday August 12, and the AWG field trip in September. Thanks to Rik for doing the research and purchasing of the projector!

#### Field Trips and Other Events

The East Bank Bike Tour (June 23) went very well. The next annual tour will be scheduled for the same Saturday as the annual Portland Naked Bike Ride in June 2019.

August 12 - Annual Picnic (August 12) was at the Rice Museum in Hillsboro. We gave \$500 to the Museum for the use of their grounds today and a one-year membership for all GSOC members. A \$10 Fee was assessed for the picnic to pay for the membership, plus attendees got to hear an excellent talk from Dr. Nick Famoso, USNPS Chief of Paleontology at John Day Fossil Beds National Monument. GSOC also paid for Famoso's Aug 11th stay at the Larkspur Landing in Hillsboro. Attendance was outstanding.

August 18 - Mt St. Helens helicopter tour. 23 people participated in the helicopter rides, presentations on the 1980 eruption by Sheila Alfsen and the cultural history of the volcano by Nathan Reynolds of the Cowlitz tribe, picnicking and exploring the area of the Toutle River. The weather and smoke conditions were favorable for great visibility and a wonderful tour! Plans are in the works for another tour next year.

September 14 - 16 President's Camp Hancock field trip is full. Nick Famoso, Bill Orr and Karyn Patridge will be speakers. Carol is assisting with carpooling, Barbara with accommodating participants' needs. Bo & Sheila are assisting with logistics, and Julia is our photographer. Rik suggested that people hike the trails during the daylight, so they know what to expect on the night hikes for star gazing. Some participants are planning to overnight in Mitchell on Sunday and stay until Monday.

The Rose City Astronomers had new member orientation on Monday, August 20th, at the OMSI planetarium to give an overview of what to see and do at a star party. Several GSOC members who are participating in the Camp Hancock trip attended.

Sept. 29: Johnson Creek Van Tour is still in the planning.

Oct. 6 - Downtown Ancient Walls South Tour

June 2019 Wallowa trip – Board discussed the possibility of a Wallowa trip to be tentatively scheduled for June 2019. Committee consists of Julia Lanning, Carol Hasenberg, Kimberly McCreedy, and Evelyn Bennett.

Possible other 2019 trips: Salem/ U. of Oregon Condon Collection/ Mary's Peak/ Coast Range/ Clackamas River tour.

Annual Banquet: The board discussed some possible alternates to the Monarch; however, they would raise the ticket price to \$40 or more. The Monarch Hotel is still tentatively booked for March 10, 2019.

## BOARD MEETING NOTES

*continued from Page 45*

The board still plans to continue the search for a more ideal banquet venue.

GSA Cordillera 2019: GSA Cordillera 2019: Convention will be in Portland in May 2019. We are investigating the possibilities of GSOC members attending and GSOC having an exhibit.

### Other Old and New Business

Treasurer's Report submitted by Dawn and approved by board.

GSOC Mugs – Oops! Not all the GSOC mugs have been sold as reported last issue. The club will be selling them at \$5 each at the picnic and other events.

Membership Roster: Board approved modifying the general membership roster to include names, phone and e-mails, but not street addresses. The general membership roster is available only to paid members with a password.

Earthquake Preparedness Committee: The ad hoc Earthquake Preparedness Committee met for the first time this month with Sheila, Paul, and Bill Burgel. Sheila will be adding this topic to the speaker's bureau as part of the GSOC outreach program. The committee will also be reaching out to community partners, including the local Neighborhood Emergency Teams, and will meet again prior to our next Friday lecture at 5:00 p.m. Friday, September 21.

Next GSOC Board Meeting will be on October 13, 2018, 10:00 a.m. Location TBA.

Notes compiled by GSOC Secretary Carol Hasenberg from minutes taken by Dawn Juliano.

## Clarno and John Day, cont from pg. 43

*Synopsis of the GSOC Friday night lecture given on July 13, 2018, with speaker Emily Cahoon, PSU PhD Candidate*

A lot of evidential weight is put on the chemical composition of the basalt magma and its derivatives in more silicic forms as fractionation and assimilation occur. There are basically two types of basaltic magmas that erupt on land – tholeiitic basalt and calc-alkaline basalt. Of the two, tholeiitic basalt is richer in iron and more closely resembles the Mid-Oceanic Ridge Basalt (MORB), the basalt which is more purely derived from the earth's mantle. Calc-alkaline basalts are generally associated with volcanic arcs and subduction zones.

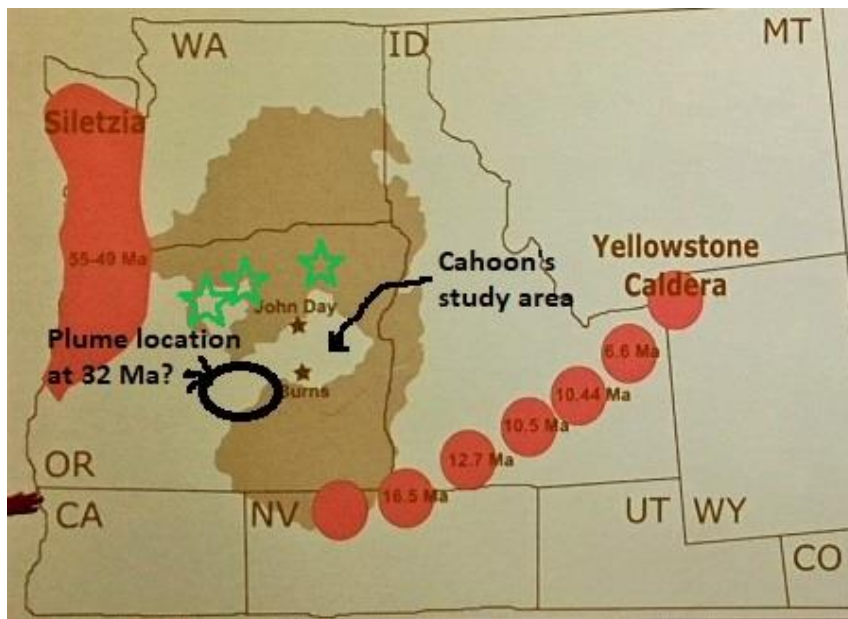
The 800-pound gorilla in the room during a discussion of the source of volcanism in Oregon is the Yellowstone Hot Spot (YHS) and its assumed mantle plume origin. This gorilla has been rather hard to catch. That is, the proof that a mantle plume really exists and is causing the Yellowstone volcano and its track across time from Oregon to Wyoming. Nevertheless, it has left its signature in the basalts from the Columbia River Basalt Group (CRBG) in Oregon through the Snake River Plain in Idaho. An alternate explanation for at least some of the tholeiitic basalts may be delamination of the bottom layer of the continental crust, or interaction of the ancient Farallon slab below western North America...but for now the jury is still out. Newer techniques of mantle imaging may soon shed some light on this area.

But let's get back to the history of the Oregon landmass and why we are concerned with the volcanism of the Eocene and Oligocene epochs. Ray Wells of the USGS (and a recent speaker for GSOC) presented a paper to the geoscience community on the origins and character of the Siletzia terrane which docked onto the Oregon coast about 50 million years ago and is composed of tholeiitic basalt. Wells makes a case for this large mass of land originating at the spreading center just off the coast of Oregon and its large mass pointing towards its production beginning at 55 million years ago as the extrapolated track of the YHS intersected with the spreading center.

Between the production of Siletzia (55-49 Ma) and what we normally mark as the initial outburst of the YHS, the eruption of the CRBG in eastern Oregon (17 Ma), there is

an itsy-bitsy time gap of about 30 million years. If a long-lived mantle plume is responsible for all these other events, what was it doing during this gap of time? This is where Cahoon's research begins.

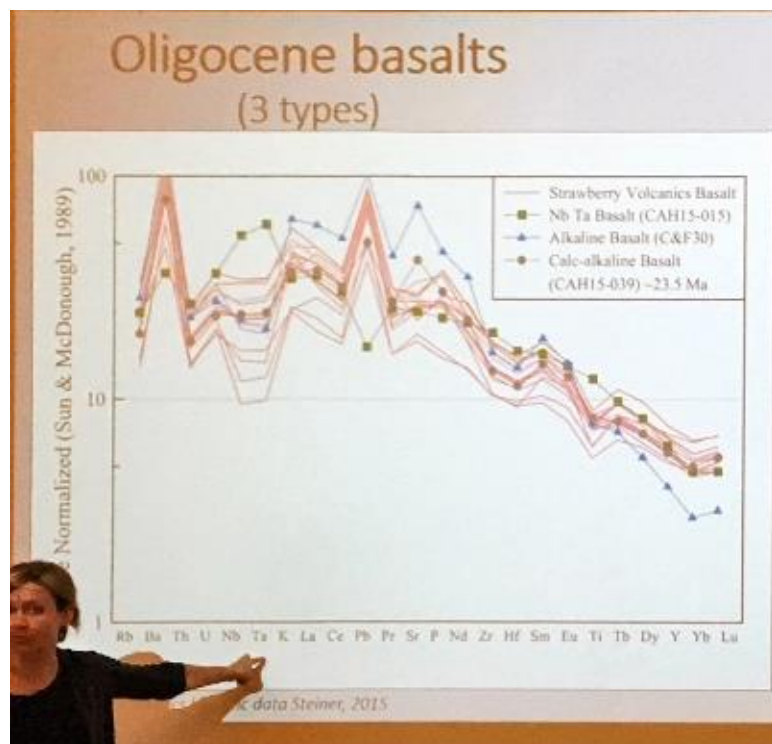
Actually, there was quite a lot of volcanism in central and eastern Oregon during the Eocene and Oligocene. The Crooked River, Wildcat Mountain, and Tower Mountain Calderas have recently been mapped and identified as the eruptive sources that produced the Clarno and John Day Formations. However, these calderas are located somewhat to the north of where the hot spot track should have been. Were these calderas produced by the hot spot and were there other calderas to the south that have been eroded or covered by subsequent volcanism?



Cahoon's methodology has been to target and collect a variety of samples of basaltic lavas of the age in question from John Day to Burns, Oregon. This is a region where there are no identified volcanic products of John Day or Clarno age. The objective is to get a better idea of the nature and extent of volcanism ~10 million years before initiation of the CRBG. Samples are analyzed for major and trace elements, radiogenic isotopes, and select samples are dated at an Ar-Ar geochronology lab. Through her own and her advisor Dr. Martin Streck's research, they have identified a significant amount of lavas that are ~23-28 Ma. She is particularly interested in comparing these samples' geochemistry in order to say something more definitive about the evolutionary path of the magma and if it is related to the YHS. Additionally, she is analyzing samples for their oxygen isotopic content to quantitatively say something about how much crustal material "contaminated" the basaltic magma before it erupted. Volcanism associated with the YHS tends to have anomalously low oxygen isotope ratios, ie, low values of the "heavy oxygen" isotope  $O_{18}$ .

Cahoon also studies the Picture Gorge Basalt (a subunit of the CRBG), and has discovered that these lava flows cover a much larger area than previously recognized. The Picture Gorge Basalt, which has had its mantle source questioned, may also contain critical evidence to aid in the evaluation of the plume during the mid-Miocene.

Map showing current locations of Siletzia (Seligman, et.al., 2014), the Yellowstone Hot Spot Track, CRBG coverage in brown, the conjectured location of the YHS in 32 Ma. (Wells et.al., 2014), and area of Cahoon's work. Known calderas of the Clarno and John Day Formations are shown as green stars.



Cahoon explains the geochemical analysis results for the Strawberry Mountain volcanics in comparison to standard basalt types.

Other samples include basalts associated with the Strawberry Volcanics, a suite of volcanic rocks that are coeval in time with the CRBG. Geochemically, many of these samples are similar to the older (Eocene/ Oligocene) basalts Cahoon has identified.

#### Additional Reading:

Ray Wells, David Bukry, Richard Friedman, Doug Pyle, Robert Duncan, Peter Haeussler and Joe Wooden, "[Geologic history of Siletzia, a large igneous province in the Oregon and Washington Coast Range: Correlation to the geomagnetic polarity time scale and implications for a long-lived Yellowstone hotspot,](#)" *Geosphere* (2014) 10 (4): 692-719.

McClaghry, J.D., Ferns, M.L., Streck, M.J., Patridge, K.A. and Gordon, C.L., "Paleogene calderas of central and eastern Oregon:

eruptive sources of widespread tuffs in the John Day and Clarno Formations. Volcanoes to vineyards: geologic field trips through the dynamic landscape of the Pacific northwest," *Geological Society of America Field Guide* 15, pp.407-434, 2009.

Jason D. McClaghry, Mark L. Ferns, Caroline L. Gordon, and Karyn A. Patridge, "[Field trip guide to the Oligocene Crooked River caldera: Central Oregon's Supervolcano, Crook, Deschutes, and Jefferson Counties, Oregon,](#)" *Oregon Geology*, Volume 69, Number 1, Fall 2009.

Reidel, S.P., Camp, V.E., Tolan, T.L., Martin, B.S., Ross, M.E., Wolff, J.A. and Wells, R.E., "The Columbia River flood basalt province: Stratigraphy, areal extent, volume, and physical volcanology. The Columbia River flood basalt province," *Geological Society of America Special Paper* 497, pp.1-43, 2013.

Bindeman, I., "Oxygen isotopes in mantle and crustal magmas as revealed by single crystal analysis," *Reviews in Mineralogy and Geochemistry*, 69(1), pp.445-478, 2008.

## WELCOME NEW MEMBERS!

Sarah Starr	David Selby
Gabrielle Clifford	Samuel Giese
William Brown	Ann McKinney
Henry Johnson	Mike Hiner
Dana Willis	John Lillie
Laura & Kevin Foster	
Carole & Mike Miles	
Ron Sonnevil & Dorothy Dutton	
Jon & Barbara Stroud	

## GSOC Annual Picnic Wrap-up

August 12, 2018, 12 to 2:30 pm, Rice Museum, Hillsboro

By Larry Purchase

This year's GSOC annual picnic was at the Rice Northwest Museum of Rocks and Minerals in Hillsboro. It was attended by about 70 club members and was a very great success! The money collected at the picnic was used to purchase a one-year membership for all GSOC members and to secure a guest speaker, [Dr. Nicholas Famoso](#), USNPS Chief of Paleontology of the John Day Fossil Beds National Monument, who will also be a guest field trip leader at Camp Hancock in September.

One outstanding happening at the picnic was that Rosemary Kenney, GSOC member for 54 years, presented 45 fossil items to Famoso for donation to the John Day Fossil Bed's collection. The presentation followed the conclusion of Nick's lecture at the picnic. Some of the major items were also displayed the day before in a case at the NARG Fossil Fest, also at the Rice Museum.

Rosemary collected the items with her husband Albert, both active fossil and rock collectors in 1966. In 1974, the area became an Oregon state park, and in 1975, a national monument. Most of her collection is from the Turtle Cove Member (29 Ma) of the John Day Formation in the [Foree area](#), located three miles north of the monument's museum. The climate was cool and dry, and the habitat was primarily woodland. It was inundated with ash and pumice from abundant volcanic eruptions.

Some of the major items in the collection include:

1. Two professionally prepared skulls, in excellent condition, mentioned by Nick as a sheep/camel/pig-like browsing Oreodont, [Eporeodon occidentalis](#).
2. Tooth of a clawed Oreodont that allowed it to climb trees for food, [Agriochoerus antiquus](#).
3. Two-horned Rhino tooth, [Diceratherium](#).
4. Teeth of a small Antelope. [Leptomeryx evans](#).
5. Six nuts from the 44 mya. Clarno formation, Hancock Nut Beds.
6. Teeth from a 3-toed, 2-1/2 foot tall horse, [Miohippus](#).









# The Geological Newsletter

NEWS OF THE GEOLOGICAL SOCIETY OF  
THE OREGON COUNTRY

November/December 2018  
Volume 84, Number 6

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## Camp Hancock and John Day Basin Field Trip – A Fond Memory

by Carol Hasenberg

This past President's field trip organized by GSOC President Paul Edison-Lahm was representative of the best that GSOC has to offer its members – world class geology, knowledgeable speakers, activities for active and less robust participants, fellowship within our group and other science-oriented society members, ground-breaking club history (past and present), breathtaking scenery, great weather, and just plain fun! Special thanks to Paul for his hard work!

*See Camp Hancock Field Trip, Page 54*



*The paleosols of Red Hill demonstrate the subtropical character of the climate in which they were formed. Photo by CSH.*

## Calendar

### Friday Night Lecture

November 9, 2018, Cramer Hall,  
Portland State University

Speaker Dr. William Orr, emeritus professor of geology, University of Oregon, will present "Extinctions."

*see Extinctions, Page 52*

### GSOC Volunteer Recognition Event

Saturday, November 17, 2018, 2-4 pm at  
the Lucky Lab Brew Pub, 915 SE  
Hawthorne Blvd, Portland

The GSOC Board of Directors invite GSOC Members and volunteers to this event to honor the many people who make this club work! Snacks will be provided. Please [RSVP by Wednesday, November 17 on the GSOC website.](#)

### See GSOC website for current information GSOC 10th Annual Holiday Party

Friday December 14, 6:00 pm – 9:00 pm,  
614 NE 114th Ave., Portland

GSOC Members and their guests are invited to the 10th GSOC Annual Holiday Party.

There will be no December Friday night meeting due to the Holiday Party.

*see Plans for GSOC Holiday Party, pg 52*

**GSOC Friday Night Lectures** are held the second Friday evening of most months, 7:30 p.m., Rm. 53, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon. Join GSOC members at Pizzicato Pizza, 1708 SW 6th Ave., at 6:00 p.m. before the lectures for an informal dinner and conversation. Check the GSOC website ([www.gsoc.org](http://www.gsoc.org)) for more information and updates to the calendar.

**Hourly rates** for parking are available in some parts of PSU parking structures. PSU Parking Structure #2, 1724 SW Broadway across from Cramer Hall is \$5.00 flat rate in the evening. Park in permit (NOT reserved) spaces and pay at the kiosk by entering your vehicle license number. There is also on street pay parking, and many mass transit options. Street parking is \$2.00 an hour, but free after 7:00 pm. More info available [here](#).

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**Plans for GSOC Holiday Party**

*December 14, 2018, annual event from the GSOC Calendar*

GSOC Annual Holiday Party is scheduled for Friday, December 14, at 614 NE 114th Ave., Portland. GSOC Board Members will provide main dishes with protein of various sorts. Other members please bring vegetable, side dishes or desserts for 6 to share, plus beverage of their choice. Music program to be announced.

Schedule of Holiday Party activities:

-6:00 pm: Set-up for party

-6:30 pm: Dinner buffet

-7:15 pm: Welcome presentation. Nominations for GSOC Board members for the 2018-2019 year will be open.

-7:30 pm: Dessert and musical program. A slide show of the field trips will be displayed during the meal and afterwards.

-8:30 pm: Cleanup

**Extinctions**

*November 9, 2018, 7:30 to 9:00 pm, Cramer Hall*

Although we perceive them as catastrophes, mass extinctions are one of the most powerful tools geologists employ as time markers. The presentation will address the major phanerozoic extinctions as well as their probable causes. Included will be a summary of the ever changing cause and effect of the Cretaceous/Tertiary event.



*Dr. William Orr discusses the lahar deposits which created the Clarno Palisades at the 2018 GSOC President's Field Trip to Camp Hancock and the John Day Fossil Beds National Monument.*

## GSOC Board Meeting Notes

October 13, 2018

In attendance board members Paul Edison-Lahm, Sheila Alfsen, Dawn Juliano, Carol Hasenberg, Rik Smoody, Larry Purchase, Julia Lanning. Also Wenonah Purchase, Barbara Smoody, Dave Olcott. Minutes of the August 2018 board meeting were approved.

The GSOC 2018 Nominating Committee was formed with members Dawn Juliano, Paul Edison-Lahm, Larry Purchase.

Board positions for next year have been examined and most positions have been requested for nomination by current board members. Open positions are Vice President and Secretary.

### EVENTS

#### Friday night lectures

Vice President Sheila Alfsen reported the following upcoming speakers:

- Nov: Bill Orr- Extinctions
- Dec: Holiday Party
- Jan 2019: Field trip recaps
- Feb 2019: Mike Cummings
- March 2019 banquet: Ian Madin of DOGAMI
- May 2019: Seth Moran from USGS will be talking about Hawaiian eruptions

#### Field Trips and Other Events

##### RECAPS

August 18: Mt. St. Helens Helicopter Tour (Sheila), trip went well, nice presentations and flights. Maybe redo in 2 years.

Sept. 14-16: Camp Hancock Trip, great trip! Paul and everyone else had fun. Made connections with OMSI, NPS, RCA, COGS on the trip.

Sept. 29: Johnson Creek Tour (Paul), Melanie Klym and Matt Brunengo were great and both want to redo trip next September. Melanie obtained a sponsorship from Geoengineers for the transport.

October 6: Downtown South Tour Cris Morgante did a great job!

#### FUTURE TRIPS

Wallowas Trip (Carol, Julia, Evelyn, Kim) mid- to late June 2019, 4 days plus travel to and fro, total 6 days. Trip committee submitted a preliminary draft in August which the committee will flesh out in the next 2 months.

Mary's Peak/Coast Range (Sheila, Clay, Melanie Klym), June or July 2019, probably a day trip from PDX. New interesting roadwork projects have opened up new geology. Wildflowers fantastic in early June.

Clackamas River Basin (Paul) will not do this in 2019, will be planning it for a later year.

Volunteer Recognition Event (Paul) Lucky Lab on Hawthorne, Saturday November 17, 2-4 pm. GSOC will provide venue, audio visual, and snacks. Agenda will include fellowship, recognition of volunteer work, announcement of available board/volunteer positions, announcement of opportunities to help with field trips. Speeches will be brief.

Earthquake Preparedness & Chinese Delegation (Sheila). For the GSOC presentation to delegates from the state Dept of China, Sheila has planned a focus which is academic in character. Scott Burns will be joining her, a room at PSU has been secured, and several others plan to help, including Larry Kotan and Bill Burgel.

Annual Banquet: Tabled for next meeting.

GSA Cordillera 2019: Tabled for next meeting.

## BOARD MEETING NOTES

*continued from Page 53*

### Other Old and New Business

Treasurer's Report submitted by Dawn and approved by board.

Field Trip Budget Guidelines written by Secretary Carol were adopted. This is a document to clarify the club's positions on field trip financial planning and provide information for future field trip planners.

COGS Sister Club relationship: On the Camp Hancock trip we had a congenial meeting, and we would like to develop a joint field trip every year.

Next GSOC Board Meeting will be on December 15, 2018, 10:00 a.m. Location Carol's house.

Notes compiled by GSOC Secretary Carol Hasenberg.

## Camp Hancock Field Trip, *cont. from pg. 51*

### Day 1: Friday Sept. 14, 2018

*John Day National Monument (JDNM) Clarno Unit: Palisades Fossil Trail Hike with Dr. Bill Orr and Meet Up with Central Oregon Geoscience Society*

Early afternoon Friday 9/14/18, GSOC field trip participants assembled in the picnic area beside the Clarno Palisades. They took a short hike with fellow participant Dr. William Orr to examine the structure of the Palisades and the fossils found within the rock.

Orr explained that the Clarno Palisades are composed of cool lahar flows that did not destroy the integrity of the plants and animal bodies they overran. The layers have little "attitude" which means they have not been tilted during or after emplacement. They are 45-50 Ma in age. Although the porosity (% holes) in this rock is 4-5%, the permeability is very low because the holes aren't connected.

Orr underlined two important facts about this deposit: (1) The lahar deposit shows us that fossils can be preserved in "volcanic rocks," (2) but these are sedimentary rocks, aren't they? They are essentially the equivalent of a landslide deposit.

Oregon was the "Pittsburgh of the West" because it had low grade iron ore in some of the soils of the area. Grillwork famous in the city of San Francisco prior to the earthquake and fire was from iron from Oregon.

*Bo Nonn contemplates the Palisades while Sheila listens to Bill Orr's discussion. Photo by CSH*



After the short hike and interpretation in the Clarno Palisades, the GSOC participants rendezvoused back to the picnic area to meeting with the Central Oregon Geoscience Society members who were just finishing their hike in the JDNM Clarno Unit. Trip leaders Bob Timmer and Derek Loeb met with GSOC President Paul Edison-Lahm and Paul presented them and their participants gifts of GSOC mugs filled with trail mix that GSOC had put together to welcome our recently formed sister club COGS.

### Camp Hancock: GSOC Joins Rose City Astronomers (RCA) at Camp Hancock for Astronomical Observing

After relocating down the road at historic Camp Hancock, participants moved into their bunks and prepared to spend the evening with the Rose City Astronomers at their biennial Hancock Star Party. This was an exciting event not only for its foray into the sister science of astronomy, but also historically, as the founder of Camp Hancock, Lon Hancock, was a GSOC Past President and GSOC was involved in the foundation of OMSI.

**Yara Green** of RCA spoke to the GSOCers after dinner, explaining the viewing protocols and taking a tour of the sights we would be likely viewing that evening. And a few facts about astronomy and the structure of the cosmos.

That evening GSOC participants went to the “star ambassador site” near the Camp Hancock parking area to view with the RCA Star Ambassadors **Kelsey Yocum, Bhavesh Parekh, Mark Lowenthal, John DeLacy, David Novotny and Jennifer Laster**. Kelsey Yocum gave a quick tour through the sky with a powerful laser pointer.

Carol Hasenberg’s account of the star party was this: “The night was very beautiful, and stars were out full force. The moon was a waxing crescent and moonset was 10:22 pm. Our star host started by using a powerful hand laser to show us around the sky. The most prominent constellations and other objects visible were the Big Dipper, Cassiopeia, the Summer Triangle, and Sagittarius, and the planets Mars, Saturn and Jupiter.

“She then showed us quite a few features in her telescope, including the moon, Jupiter, Saturn, Mars, M31 the Andromeda Galaxy in the constellation Andromeda, M13 the Great Globular Cluster in Hercules, which was one of



*Bob Timmer and Paul Edison-Lahm perform the ceremonial handshake observed by Derek Loeb and Megan Faust during the GSOC/COGS get-together. Photo by CSH*



*RCA members prepare their scopes for evening viewing. Photo by Megan Faust*



Welcome to Camp Hancock! Photo by Patty Hyatt



RCA Star Ambassador Kelsey Yocum enjoys some geology at the Hancock Tree. Photo by Paul Edison-Lahm

several globular star clusters, several open clusters of stars, and M57, the Ring Nebula in Lyra, one of several nebulae. We also saw M27 the Dumbbell Nebula in Vulpecula.

“We got to see several meteors while we were waiting our turns on the scopes. It was a stellar night!”

Barbara Smoody’s account of the star party was this: “Additional features I saw were Titan (a moon of Saturn), four of Jupiter’s moons, Neptune (blue!), Uranus (blue!), various fuzzy objects (Messier bodies) and the Swan nebula (?). I also a glittering star which name begins with a “C” (Capella?), and we looked at it thru 13 inch scope to see the spectrum of its white light refracting through the Earth’s atmosphere.”

## Day 2: Saturday Sept. 15

*Hiking Around Camp Hancock Trails with Dr. Orr and Dr. Nick Famoso*

There were two hikes planned on the “geoloop” trail of the Clarno Unit of JDNM for Saturday. These were on an unofficial national monument trail, so special permission and a guide were required. One hike was NNW to the famous Clarno Nut Beds on the slopes of Red Hill, which demonstrates the red paleosols that developed in the subtropical climate of the Eocene. This hike was led by NPS Paleontologist Nick Famoso. The other hike, led by Bill Orr, was a longer trek NE to Hancock Canyon and the Hancock Tree, a preserved tree trunk belonging to a species related to today’s katsura tree of Asia.

Forty people went on the hikes, and since there were only 22 GSOC participants (in addition to Dr. Orr), then the rest of the hikers were RCA people. We applaud their enthusiasm for the geosciences!

Notes on Nick Famoso’s Red Hill Hike: first of all, we needed to get the rules straight – leave all fossils and archaeology objects in situ! If you find a noteworthy fossil lying on the ground, get its GPS coordinates and photo and tell some of the park personnel.

Famoso was familiar with Camp Hancock as he spent six years as a camp worker in his younger days. The John Day Fossil Beds National Monument (JDNM) was not created by Presidential decree; it was created through an act of Congress. The nut beds and mammal quarry were not part of the original park but were added at a later date.

On the way up to the nut beds, the hikers walked through other outcrops of the lahar deposits of the Clarno, similar to the Clarno Palisades elsewhere in the park.

The nut beds are high up against the backdrop of Red Hill, whose dark red surface showcases the paleosols created by the weathering in the subtropical environment of the Eocene era 40-44 Ma. Many of the nuts, subtropical flora, insects and vertebrate fossils were found in the boulders that have fallen off the nut bed outcrop.

The top of a hill in the distance is crowned by the John Day Member A Ignimbrite (welded tuff). Two ridges over from the nut beds one finds the mammal quarry. As the deposit from a point bar in a stream, this area collected the unarticulated bones of many animals and contains very few plants. Age is 40 Ma and it is located at the very top of the Clarno Formation.

*Additional Reading:* John Day Fossil Beds National Monument website, "[Geologic Framework of the Clarno Area.](#)"

## Lon's Lab with Bill Orr

### #1 Fossil ID Session in Lon's Lab:

Bill Orr did not actually ID any fossils in this learning session, I imagine because most of us would not have known the difference anyway and would have been lost in all the Latin names. Instead, he discussed fossils in a "teaching collection" such as the one found in Lon Hancock's laboratory.

In setting up a fossil teaching collection, Orr said that it is important to bear in mind that fossils can break if you drop them, so don't put your museum specimens in the lab. It's not necessary to have a perfect specimen to give you important info about the animal and its environment.

It's also not necessary to have a whole skeleton of the animal. For example, fish fossils are rarely found as articulated skeletons. But you don't need an entire skeleton as fish can easily be identified by their scales, so you just need one scale. These **parataxons** can represent an entire organism and many such bits (teeth, scales, ossicles, etc.) are used in paleontology.

Repeating patterns are often found on both plants and animals and can be used to identify species. Some examples are trilobite segments, ammonite suture patterns, leaf veining patterns, etc.



*Dr. Famoso discusses the lahar deposits. Photo by Paul Edison-Lahm*



*This model of the stratigraphy of the JDNM was found in Lon's Lab. Photo by CSH*



This brings us to the concept of **guide fossils**, which are the stock in trade for paleontologists. Guide fossils are those remains of ubiquitous creatures that can be used to determine the relative age of any strata. To qualify as a guide fossil, the animal type must be found just about everywhere in the type of strata you're in, so it must be able to get around easily (ie., it flies or swims), it must have big populations and it must be able to evolve rapidly so your time frame can be pinpointed. It must also be easily identified from closely related populations. Orr used the example of rodents – they evolve quickly and all you need to identify the species is the cheek teeth. Plant fossils in general do not make good guide fossils because they evolve slowly.

Many of these guide fossils are tiny microfossils. Identifying them is not as difficult as you might suppose and can often be done in the field with a 10x lens. They might first have to be extracted from the parent rock by some means (boiling, processing with acid, etc.).

*Additional Reading:* "Thomas Condon's Fossils," synopsis by the Friday Night Lecture by Bill Orr in *The Geological Newsletter*, July/August 2017, Volume 83, Number 4.

*Additional Reading:* "Thomas Condon's Fossils," synopsis by the Friday Night Lecture by Bill Orr

in *The Geological Newsletter*, July/August 2017, Volume 83, Number 4.

## #2 Evening Lecture "Tertiary Fossil Beds in Northeastern Oregon"

Bill began the evening lecture by describing the geophysical Blue Mountain province of Oregon as being one of rich geology. The Blue Mountain area contains the remains of a number of exotic terranes which were brought to Oregon with the tectonic ocean crust conveyor belt. Forty years ago, geologists became aware of the fact that there were exotic Asiatic fossils in Oregon, and thus the idea behind the terranes was formed.

Younger Tertiary rocks are then draped over top of these exotic terranes. There is a rich record of these Tertiary deposits starting from about 50 Ma in age with the Clarno Formation of the Eocene Epoch, John Day Formation in the Oligocene, Picture Gorge Basalt and the Mascall Formation in the Miocene, and the Rattlesnake Formation in the late Miocene.

*The Mammal Quarry. Photo by Barbara Stroud*



Fortunately for the nearly continuous record of the flora and fauna of the day, a lot of volcanic ash was erupted in the area during this time, and this is an optimum preservation medium. Many articulated skeletons were found of a wide-ranging diversity of species, both large and small. In addition to animals there were many plant fossils representative of the total environment.

The environmental record of the fossils shows that there were two major climatic changes in the area. The first is that of a cooling trend at the boundary of the Eocene and the Oligocene, and this corresponds to a world-wide cooling trend in the fossil record. In addition, a further cooling and drying trend is noted which corresponds to the rise of the Cascade Mountains in Oregon, creating a rain shadow over the land to the east of this barrier.

Orr went on to describe a few of the paleontologists who have studied the fossil record of the area. Alonzo "Lon" Hancock, whose laboratory was being used for the lecture, was a high school teacher and amateur paleontologist whose tireless efforts were directed to bring to light the fossil record of the Clarno Epoch upon which Camp Hancock is sited. Ironically, he was best known nationally for his photo in Time Magazine displaying a Miocene elephant. His OMSI fossil camps produced many paleontologists who went on to have great careers. (Editor's Note: There is a biography of Lon Hancock, a GSOC Past President, in the Past President section of the GSOC website history section.)

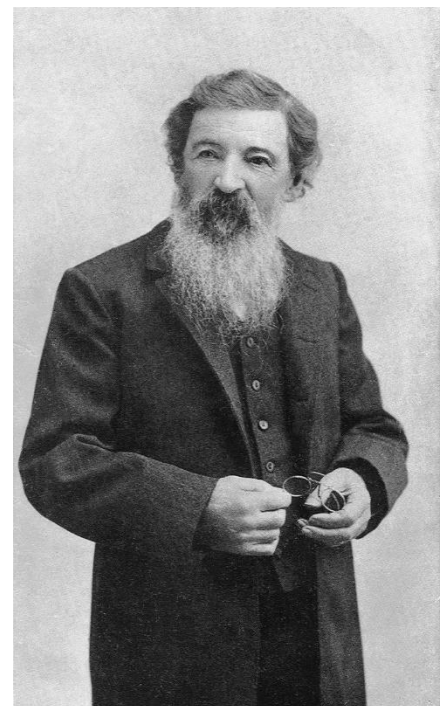
The first paleontologist in the area was Thomas Condon, a missionary minister who eventually went on to become the first Oregon State Geologist and professor of Geology at the University of Oregon. Prominent paleontologists of the nineteenth century, Othniel Marsh and Edward Drinker Cope were intrigued by the fossils Condon was finding and sent delegations out to collect and publish findings. John Merriam from UC Berkeley began introducing contextual methods of fossil collecting at the close of the nineteenth century.

Earl Packard replaced Condon at the University of Oregon. A group of four paleontologists including Merriam and Chester Stock, dubbed "The Associates," studied fossils in the area and began to lobby for the protection of the fossil beds. But the area did not receive official status until 1975.

Orr described the geology of the fossil beds and the "greatest hits" of creatures found there. The Clarno Epoch



*Lon Hancock, GSOC President of 1945. GSOC Archive photo.*



*Thomas Condon.*



*Entelodon by Charles R. Knight*

had a warm, humid climate and produced animals that would be comfortable in a subtropical forest. Hemipsalodon was a super predator that looked much like a hyena. This creature feasted on early members of the horse family, oreodonts, and other mammals of the time.

Orr did not dwell on the fauna of the Clarno, although the remains of vertebrates found at the nearby Mammal Quarry were from that time. He then described the John Day Formation, which began with the Big Basin Member, in which soil layers developed on top of volcanic ash, and the colors that developed as the soils weathered mark rainfall variations that occurred as the climate changed over the

years. The most dramatic exposures of these are at the Painted Hills Unit of the monument. Big Basin exposures are rich in plant remains.

The Turtle Cove Member, with its greenish layers of volcanic ash, is punctuated by a marker bed of welded tuff, known as the Picture Gorge Ignimbrite. Although this layer contains no fossils as it fried everything in its path, the surrounding layers of the Turtle Cove Member are most

productive in fossils. A common super predator of the day is the Entelodont *Archaeotherium caninus*, nicknamed the “terminator pig”. A favorite of Orr’s were the Chalicotheres, cousins of horses and rhinos, which had clawed feet and a long tall neck. Hypertragulids were deer-like creatures with canines. They were very common. Another common mammal was the browser Oreodonts. Hundreds of these were collected by Thomas Condon.

The environment that produced the Turtle Cove mammals was that of a tropical savannah like we see in East Africa today. A primate lived in this area with the difficult-to-

pronounce moniker of Ekgmowechashala, taken from the Sioux language for “cat with the face of a man.” Both camels and rhinos lived and evolved in this environment. Small rodents – many and with huge populations – evolved rapidly and have been easy to identify (by their cheek teeth), have been used as guide fossils as described in Orr’s afternoon lecture.



*The group is dwarfed by the spectacular Turtle Cove Formation in the Blue Basin hike on Sunday. Photo by CSH*

Originally and for many years, geologists had assumed it was the Cascades Mountains that produced the vast ash deposits that became the John Day Formation, but in the twenty-first century it was a team of geologists from DOGAMI led by Mark Ferns and Jason McClaughry that found three monster calderas further east and published their finds in 2006. These are the Wildcat Mountain Caldera, erupting in the Eocene, the giant Crooked River Caldera in which the town of Prineville is centered, and the Tower Mountain Caldera.

One of the most famous groups of fossils found by Thomas Condon depict the evolution of the horse. He found three “missing links” in horse evolution, including *Merychippus* of the Miocene.

After the vast eruptions of the Picture Gorge Basalt, fossils continued to be laid down in younger falls of ash, although not at a rate as in the Clarno and John Day Formations. The Mascall Formation of 15 Ma was studied by geologist Chester Stock, who also worked at the La Brea tar pits in California. Its tan to buff layers contain a good diversity of fossils.

The Rattlesnake Formation, which contains the famous Rattlesnake Tuff, contains rather familiar types of mammals from about 7 Ma. Horses, camels, and rhinos were preserved by a series of eruptions whose sources are younger as they go westward.

### Day 3: Sunday Sept. 16

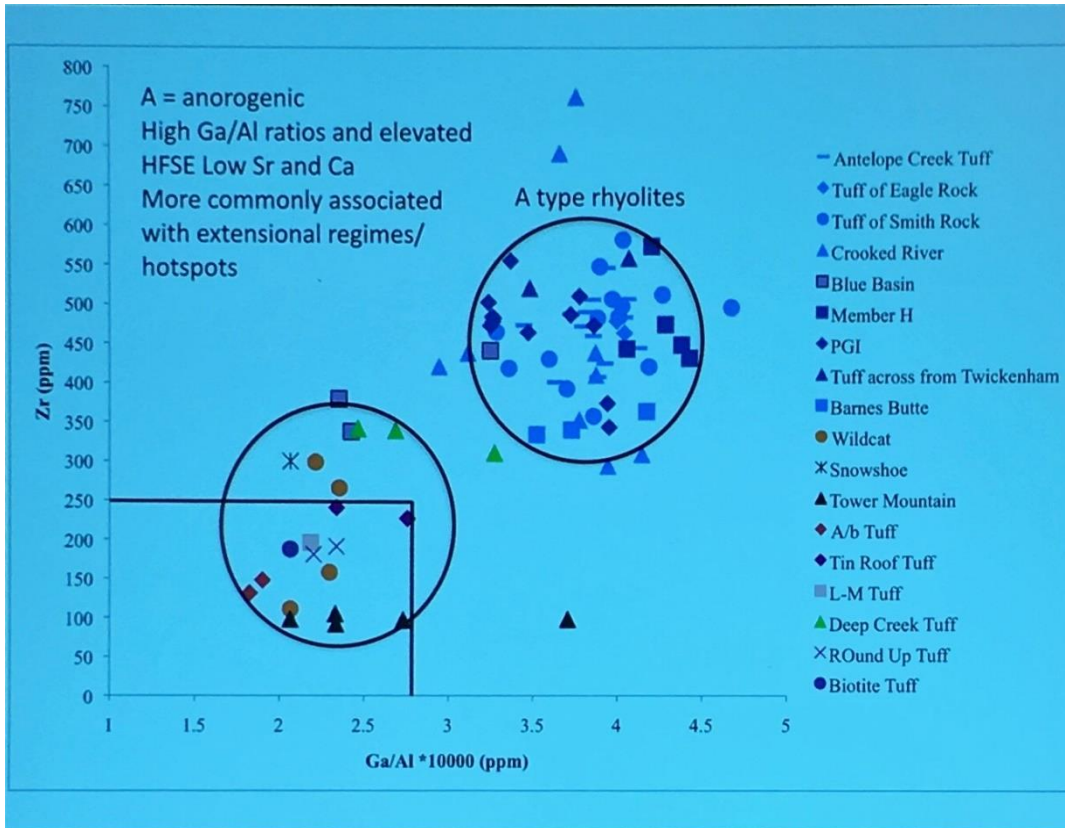
*JDNM Continued:  
Oregon PaleoLands  
Institute, Karen  
Patridge Lecture,  
Sheep Rock Unit,  
Thomas Condon  
Paleontological Center*

Sunday field trip began with a visit to the [Oregon Paleo Lands Institute \(OPLI\)](#). A

volunteer at OPLI, Karen Massau, welcomed the GSOC participants. She showed the crowd some of the exhibits

*The 2018 GSOC President's Field Trip Participants pause for a photo on the porch at OPLI. First row from left Barbara Stroud, Nancy Overpeck, Paul Edison-Lahm, Dennis Chamberlin, Charlie Montross, Patty Hyatt. Second row Mark Anderson, Jan Kessler, Christina Bennett, Julia Lanning. Third row Bo Nonn, Barbara Smoody, Larry Jordan, Sheila Alfsen, Ann McKinney, Larry Purchase. Fourth row Herb Dirksen, Jon Stroud, Bill Orr, Fennella Robinson, John Scott, Bill Stein, Madison Ball, Megan Faust, Karyn Patridge. Photo by CSH*





housed at the museum, particularly the Mitchell Plesiosaur, a find in which the lower jaw and part of the skull were recovered. Fossil cast is in Mitchell at the BLM office. Finding the plesiosaur reinforced the idea that there were oceanic remnants brought here to Oregon (the Cretaceous Hudspeth Formation). OPLI decided to make the plesiosaur their main theme.

Also, the Wheeler High School fossils have

One of Karyn's discrimination diagrams clearly shows the Crooked River Caldera magma source as being different from the other volcanoes in the region at that time. Note that outcrops of Picture Gorge Ignimbrite belong with the Crooked River group. Photo by CSH

been popular activities for amateur geologists in the past. They were formed in a lacustrine environment. 32.5 Ma, which was subjected to repeated ashfalls. This activity is located in the town of Fossil, although this field trip did not go. A fee is charged for fossil hunting.



Karyn Patridge talks about the stratigraphy in the Foree section of the JDNM. Photo by Paul Edison-Lahm

Guest field trip speaker Karyn Patridge spoke to the GSOC field trip about her interest in the volcanism of the John Day formation. Karyn's work involves determining the source of the Picture Gorge Ignimbrite and determining whether the source of the magma is the subduction zone environment or whether the chemical signature is more consistent to hot spot volcanism.

Karyn took samples from the four possible known candidates of John Day volcanism and compared their geochemical signatures to the Picture Gorge Ignimbrite. These were the Wildcat Mountain Caldera (a bit too old at 40 Ma), the

Tower Mountain Caldera (32 Ma), the Crooked River Caldera (32-28 Ma), and the Mohawk River Caldera (32 Ma). The Crooked River Caldera samples were a geochemical match for the source, and furthermore were distinctly different in character than those of the others, being an A-type rhyolite.

She plotted her findings on several discrimination diagrams. A-type rhyolites are not related to subduction signatures. Wildcat Mountain, Tower Mountain and the others were related or more related to subduction regimes. Crooked River Caldera signatures were markedly different. So, even though the Crooked River Caldera was erupting at the same time as Tower Mountain, one had a source more related to the subduction zone and the was more related to the hot spot vulcanism. Wildcat Mountain erupted much earlier and was also sourced in subduction zone derived magma.

*Dennis Chamberlin broke out his drone and took this spectacular shot of the Picture Gorge Basalt dike crowning the hill near Kimberly. Photo by Dennis Chamberlin*



## Don't Forget to Re-up!

### *GSOC Dues are Due Soon*

GSOC members and prospective members, please remember to renew your memberships for 2019. Your membership benefits include:

- Helping serve GSOC's mission of promoting geology education in the Northwest, including PSU geology scholarships
- Welcome to join in all GSOC functions, including field trips, Holiday Party, Annual Banquet and Picnic, and more!
- A printed version of the GSOC newsletter if you choose
- A great time with all your GSOC friends!

See the last page of this newsletter for details, or visit our website [www.gsoc.org](http://www.gsoc.org), where you can pay online. Membership payments are due on January 1, 2019.

### **WELCOME NEW MEMBERS!**

Chaitra Statnekov      Michael Christenson  
Clark Niewendorp      Harold E Hinds Jr  
Srirama & Deepika Chandra  
Charles & Mary Raymond  
Lin & Geoff Bunza  
Daniel Shurkus & Elizabeth Beadle  
David Wilson & Lynn Williams  
James & Marilyn Bull

