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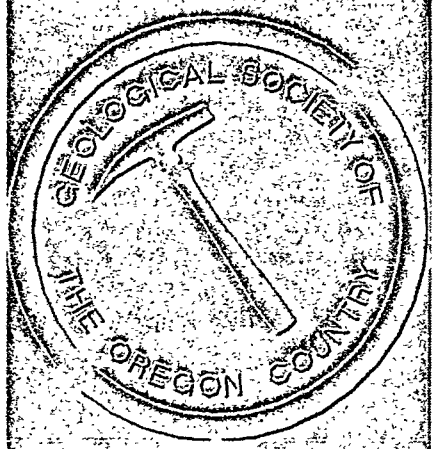

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THE GEOLOGICAL NEWSLETTER

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INFORMATION: www.gsoc.org

VOL. 73, NO. 1
JANUARY, 2007

Bonnie Prange, President, 360-693-8396, bonnie@eco-land.com
Acting Calendar Editor, Beverly Vogt, 503-292-6939, bevvogt@comcast.net

JANUARY ACTIVITIES

Friday Evening Talk, January 12, 2007, 8:00 p.m. Ken Cameron, Oregon Department of Environmental Quality, will speak on "It's Not Nice to Fool Mother Nature: Man-Made Structures and Jokuhlaups at White River Glacier, Mount Hood, Oregon." Location: Room S17, Cramer Hall, Portland State University, 1721 SW Broadway, between Montgomery and Mill. (Room S17 is on the sub-basement level of Cramer Hall, directly below the Geology Department's main office.)

Seminar, Wednesday evening, January 17, 2007, 8-10 p.m. Topic of the seminar led by Richard Bartels and Tara Schoffstall will be "A Hike Down the Kaibab Trail, Grand Canyon, Arizona." Become familiar with the stratigraphy and arid-region landforms of the Grand Canyon. The activity for the last part of the evening is an exercise to convert a topographic map into a geologic map. Location: Room S17, Cramer Hall, Portland State University, 1721 SW Broadway, between Montgomery and Mill. (Room S17 is on the sub-basement level of Cramer Hall, directly below the Geology Department's main office.)

PARKING AT PORTLAND STATE UNIVERSITY IS FREE AFTER 7 P.M. IN THE PARKING STRUCTURE ON BROADWAY DIRECTLY ACROSS FROM CRAMER HALL

REMINDERS:

ANNUAL DUES ARE PAYABLE BEGINNING JANUARY 1, 2007.

CHECK THE GSOC WEB SITE (www.gsoc.org) FOR LATEST SCHEDULE OF EVENTS.

GEOLOGY OF THE BLACK HILLS OF SOUTH DAKOTA

A synopsis of the lecture by Richard Bartels, GSOC Vice President and Past President, "South Dakota Black Hills Geology"
Friday, December 8, 2006

Richard "Bart" Bartels' geological background includes a B.S. and M.S. in geology and a lot of teaching experience in geology. Bart grew up in South Dakota and taught geology at the South Dakota School of Mines and Technology, at the University of Minnesota, and in Brazil. Bart is a longtime GSOC member (1989) and frequent GSOC lecturer, with numerous lectures, seminars, and field trips under his belt. For this lecture on the geology of the Black Hills area, Bart returned to his geological roots and showed our GSOC audience slides of field trips he led in the late 1970's.

To get an idea of the geology of the Black Hills of South Dakota, the reader should refer to the geological map listed below in the internet references while reading these descriptions. (There is an excellent geology map of the Black Hills you can link to from "dome structure" on the Geology of the Black Hills web page.) The Black Hills is an uplifted area of land which has had its topmost strata eroded away, and so resembles a peeled onion. On the geological map it resembles a bull's eye target, with the oldest strata exposed in the center of the bull's eye. These are Precambrian rocks, mostly over 1.8 billion years in age (1.8 Ba), which consist of slates, schists, gneisses, and quartzites with multiple, sill-like intrusions of granite. The granite forms some very hard outcrops that have weathered in interesting spires and other formations. Mt. Rushmore is carved from such an outcrop of granite. Many pegmatite bodies also exist in the metamorphic rocks, with good examples in the Keystone, S.D., area. Pegmatites are coarse-grained igneous rock bodies that had very low temperatures of crystallization. They are formed from fluid-rich residual melts from the granite that intrude the hot metamorphic rocks. In this type of melt, ions are able to move freely toward and away from crystallization sites, so that really large crystals up to tens of feet in length can form in the pegmatite bodies.

The old Precambrian rocks underlying the younger strata surrounding the Black Hills include the Wyoming craton (3.4-2.5 Ba) to the west and the Superior craton (3.8-2.7 Ba) to the east. The metamorphic rocks of the Black Hills were originally volcanic and sedimentary rocks that were generated in subduction zone environments and ultimately caught in the collision zone between the two advancing Archean cratons at 1.8 Ba. Some fragments of Archean rocks are exposed in the Black Hills The Precambrian Bear Mt. gneiss, at 2.5 Ba, may be part of the Wyoming craton.

Heading away from the center, the Black Hills strata include rocks from the Paleozoic and Mesozoic Eras – these formations ring the metamorphic granite core. The Deadwood Formation, consisting of Cambrian sandstone, is adjacent to the Precambrian core. The Pahasapa (Madison) Formation forms the Mississippian limestone plateau, where numerous caves occur. The Red Valley is underlain by the Permo-Triassic Spearfish Formation and the Jurassic Sundance Formation. The Sundance Formation is sandy in texture and forms low-lying cliffs around the Red Valley. Cretaceous sandstones form the hogbacks that ring the Red Valley. The dip slopes of the hogbacks disappear into the Great Plains. These Cretaceous rocks formed in floodplain, delta, and beach environments, whereas the older formations were formed in marine environments.

The uplift in the Black Hills probably occurred during the early Tertiary (65-23 million years ago) and coincided with Tertiary-age intrusions extending east-west across the northern Black Hills from Bear Butte to Devil's Tower. This thermal anomaly uplifted 7,500 feet of sedimentary rocks that were subsequently eroded off the Precambrian core. A similar process probably occurred during the Late Precambrian to Early Cambrian in the Williston Basin of western North Dakota. In the case of the Williston Basin, the anomaly cooled, and the eroded area subsided, forming a basin.

Because of the intrusive bodies in the center, the Black Hills has been an important mining region. One hundred and seventy-five distinct minerals have been found in the Black Hills. Excellent mineral samples for your mineral collections can be found in the numerous mine dumps in the area. Tungsten, tin, niobium, beryllium, and other space-age elements were mined in the Black Hills.

Carol Hasenberg, with corrections by Richard Bartels

Internet references:

The Geology of South Dakota - Martin J. Jarrett, South Dakota Geological Survey, funded through a Natural Resource Conservation Education Grant, USDA, Forest Service: http://www.northern.edu/natsource/EARTH/Geolog1.htm

South Dakota Geological Map – South Dakota Department of Environment & Natural Resources: http://www.sdgs.usd.edu/geology/index.html

Geology of the Black Hills –Howard J. Woodard, Plant Science Department, South Dakota State University: http://plantsci.sdstate.edu/woodardh/Geology/Black_Hills/General_Geology/general_geology.htm

USGS CVO site – America's Volcanic Past – South Dakota: http://vulcan.wr.usgs.gov/LivingWith/VolcanicPast/Places/volcanic_past_south_dakota.html

THE GEOLOGICAL NEWSLETTER INDEX
Volume 72, 2006
compiled by Rosemary Kenney

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

PS – If you joined GSOC in September or later, your 2007 dues are paid, good deal!!!

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VOL. 73, NO. 2
FEBRUARY, 2007

Bonnie Prange, President, 360-693-8396, bonnie@eco-land.com
Acting Calendar Editor, Beverly Vogt, 503-292-6939, bevvogt@comcast.net

FEBRUARY ACTIVITIES

Friday Evening Talk, February 9, 2007, 8:00 p.m. Dr. Scott Burns, Portland State University Geology Department, will speak on "Landslides in Southeast Portland: What the Future Has in Store." Location: Room S17, Cramer Hall, Portland State University, 1721 SW Broadway, between Montgomery and Mill. (Room S17 is on the sub-basement level of Cramer Hall, directly below the Geology Department's main office.)

Seminar, Wednesday evening, February 21, 8-10 p.m. Topic of the seminar led by Richard Bartels and Tara Schoffstall will be "A Hike Down the Kaibab Trail, Grand Canyon, Arizona." Become familiar with the stratigraphy and arid-region landforms of the Grand Canyon. The activity for the last part of the evening is an exercise to convert a topographic map into a geologic map. Location: Room S17, Cramer Hall, Portland State University, 1721 SW Broadway, between Montgomery and Mill. (Room S17 is on the sub-basement level of Cramer Hall, directly below the Geology Department's main office.) This seminar was rescheduled from January because of bad weather.

The Hatfield Marine Science Center will be the site of **Fossil Fest '07** on Saturday, February 17, from 10 a.m. to 4 p.m. For more information, see the article in this month's newsletter or contact Larry Purchase, 1-360-254-5635.

MARCH ACTIVITIES

GSOC's 72nd Annual Banquet will be on Sunday afternoon, March 11, at the Rheinlander Restaurant, 5035 NE Sandy Boulevard. Look for additional information elsewhere in this newsletter.

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IT'S NOT NICE TO FOOL MOTHER NATURE:

Jokulhlaupts, Man-made Structures, and Highway Design at White River Glacier, Mt. Hood

synopsis of GSOC Friday night presentation by speaker Ken Cameron, January 12, 2007

by Evelyn Pratt with edits by the speaker

GSOC Past President Richard Bartels introduced Ken Cameron with the following career information: Ken graduated from Portland State University with a degree in volcanic stratigraphy. He handed in his graduate thesis two weeks before Mt. St. Helens erupted on May 18, 1980. He had no trouble finding a job, and worked for the USGS at various Cascade volcanoes. In 1990 he joined Oregon DEQ to investigate toxic waste sites, and has been there ever since.

Cameron began the talk with the joke "If you remember that the title of this talk was the slogan for a brand of margarine, you're probably at least as old as I am!"

Much of the debris that is spread out around Mt. Hood is very recent, and surprisingly, is not the direct result of volcanism. We are looking at the products of glaciation and flooding .

I've been a field geologist for 30 years, and like other professionals, have absorbed a lot of the technical vocabulary. It's often the easiest way to explain what's happening.

Jokul = glacier; **hlaupt** = flood. In the U.S. we call such an event a debris flow or, more specifically, a glacial outburst flood. Mt. Hood has had a lot of them – 30 to 35 since 1900. Most have come from White River and Newton Clark Glaciers, both more or less on the southeast side of the mountain. I will be giving a talk about this area to a Washington group next spring and turned the abstract in during October . On November 6-7 the whole subject of my talk washed away! Two main jokulhlaupts burst out at that time.

To explain what happened we need other geological terms:

Lateral moraines are the debris-built banks on either side of a glacier. They are called left or right from the point of view of an observer looking downstream. **Distributary channels** are channels that fan outward [such as the streams that result when a river slows down and creates a delta.] They can act as safety valves for debris flows. A **yazoo** is a tributary that runs parallel to a main stream for a while before joining it. **Thalweg** means "way of the valley". It refers to a line connecting the lowest points along a streambed or valley – its longitudinal profile.

On Nov. 7 there was too much debris in the glacial outburst flood for the White River distributary to carry it all. The White River thalweg jumped over into little Iron Creek, the yazoo next door. Michael Mason, ODOT, is pictured standing on the downstream side of the White River Bridge. Although tons of boulders are piled on top of the bridge behind its railing, both the bridge and railing are unbroken – mute testimony to the height of the flood and the strength of the structure.

A second jokulhlaupt, mostly water, went down Newton Creek to the north. Then it flooded along the path of least resistance, which was Highway 35 in the middle of the valley. This resulted in a swath of road destruction that damaged 10 miles of road in the next 22 miles.

In hazards of any kind, the onlooker's perception of danger is very important. I believe the danger of another such event as disastrous as, or even worse than, the one that just took place in the White River, is great.

For comparison, let's look at an aerial film of the Toutle River mudflow on Mt. St. Helens in 1984 , caused by an explosion on the dome . Here is a hydraulic jump – a place where the nature of the flow changes abruptly. Something – possibly a high place in the streambed - disturbs the shallow flow, causing turbulence as the water slows down. Such a flow can go from thin and laminar (like

leaves in a book) where a liquid is only a couple of feet deep, to thick and chaotic where it piles up to 6 to 8 feet deep. Churning goes down to a depth of 10 to12 feet, eroding the streambed as the flow moves downstream. The flood is no longer just water. It includes a moving mass of rock and debris from the stream floor. Rocks, bridges, train cars, and whatever very large objects the flood picks up don't "float" on top of water; they're carried along on top of debris. Similarly, when you shake a can of mixed nuts, little peanuts sink to the bottom, while big Brazil nuts find their way to the top, "floating" on the mass of more closely-packed nuts below them.

Back to 1984 on Mt. St. Helens: Pat Pringle and I were riding in a helicopter following the Toutle River mudflow. We wanted to get samples of debris in front of the advancing mudflow (seemed like a good idea at the time). The pilot reluctantly landed the helicopter so we could get out and collect a few Toutle River samples. In the next shot I'm dashing for safety as the 5-foot wall of water in the background roars around the corner. I have no memory of how I got from that spot to high ground.

Later Pat waded out in the debris flow to get samples. You can roughly tell the velocity of water from its vertical height when it hits an obstacle – in this case, Pat's legs. It's moving about 10 feet per second, or 7 mph. Mudflows like this are about 6 0- 80% solids. A hyperconcentrated flow would be more like 40-60% solids. What's important is that either one will fill in a valley with debris and leave a flat floor.

(An interesting side effect to all our sampling was what happened to clothing and the brass sieves we collected with. A week after this event our boots, laces, and sieves were disintegrating. The glacier water, newly melted by volcanic activity, was evidently highly acidic.)

Back to Mt. Hood. We know that during the last two eruptive events [in the 1780's and about 1200 years ago], Old Maid Flat on the west side of the mountain was filled with 300 feet of debris. A relief map of Mt. Hood shows several other flat-floored valleys that are also being filled in; the valley where Highway 35 runs is probably the largest. But Highway 35's valley has been affected by glacial, rather than eruptive, debris . This has to do with insolation, or exposure of the mountain's surface to solar heat. During the hottest time of the year in the northern hemisphere, White River and Newton Clark Glaciers are in positions where they receive more direct rays of the sun than any other glaciers on the mountain.

Historical photos show the changes around Crater Rock and the old White River Glacier's starting point. In 1894, except for a fumarole hole, the area is almost solid ice. By 1912 the glacier is splitting apart. Today it has become two glaciers – Coleman above and White River below. Temperature of the fumarole at the foot of Coleman Glacier is 195° F.

A glacier has a zone of accumulation above and a zone of ablation below. The latter is where snow melts faster than it accumulates. In 1901 a stream of ice descending from Mt. Hood's summit to the White River Glacier's zone of accumulation broke away from the glacier. This deprived the glacier of a major source of ice. Now the lower part melts faster than it accumulates, so the White River Glacier is shortening or retreating.

This glacier has had more than 20 glacial outburst floods in the last 100 years. There will be more. Time lines of Mt. Hood's jokulhlaupts show that they happen in clusters. Why?

Six inches of rain fell 48 hours before the November White River floods. Precipitation records aren't kept at Mt. Hood, but are at Three Lynx Station in Clackamas County, 30 miles away. The pattern of precipitation, if not the amount, is similar. But according to these records, a lot of rain isn't necessarily a factor. Neither are high temperatures.

Late Cascades Volcano Observatory geologist Dick Janda once said, "A volcano is just a steep-sided pile of rubble, loosely held together by habit and just waiting to fall down." Gradient of the slope is important. Big lateral moraines and loose non-cohesive debris at around a 35° angle of repose (standard for sand), risk movement. Where

Timberline Trail crosses steeper valley floor, the White River is eroding. On the flats below, it is depositing. On very flat surfaces it, like other rivers, meanders back and forth. Just above Highway 35's bridge the White River snakes from here to there and back again across 800 to 1000 feet of flat glacial debris. The 120-foot wide bridge was built at a narrow part of the flow, as if it were crossing the center of a picture of an hourglass, with wider valley floors above and below it. The approaches to the bridge on either side act as dams, forcing all the flow that should cover the entire valley floor to head right for the bridge

When the highway was being constructed, the builders found a good supply of loose debris upstream. To bring it down to the highway they piled up a long berm parallel to the river, with a road on top of it. This restricted the valley even more. During the November outburst flood the berm served as a levee, channeling debris to the valley center and the bridge. So much debris was added to the valley floor that its cross-section has gone from slightly concave to convex.

Deposition above and below the 120-foot wide bridge covers an area over 1200 feet wide. After the November event the Highway Department discovered how easily culverts can become choked with rolling rocks. Iron Creek's 5-foot wide culvert was full to overflowing. The new one installed there in December is 20 feet wide.

Any time a geologist sees a tiny creek in the middle of a wide flat valley, he or she wants to know why and how it happened. Highway 35 has been repaired quickly, and for now, adequately. But the newly exhumed 120-foot bridge is a temporary fix. What is really needed at the White River crossing, so that repairs won't have to be made again and again after more glacial outburst floods, is a bridge that is either long enough or high enough to allow future floods to pass beneath it. That would cost at lot of money. The Highway Department and the State are going to have to decide whether to spend the money and create a permanent fix, or keep patching up the existing structure when events like this happen.

Winter Seminar Series 2007 Department of Geology Portland State University

Seminars in Cramer Hall S17; Wednesdays, 3:30 - 4:30 PM

February 7, 2007 "Temperature and Suspended Sediment Modeling of Detroit Lake, Cascade Mountains", Stuart Rounds, US Geological Survey, Portland

February 21, 2007 "Groundwater Hydrology of the Upper Klamath Basin: Present Understanding and Future Challenges", Marshall Gannett, US Geological Survey, Portland

March 7, 2007 "The Ups and Downs of the Columbia River", Jim O'Connor, US Geological Survey, Portland & Adjunct Professor, PSU Geology Dept.

March 20, 2007 "Geologic Influences of Midcontinent Dams", John Moylan, Retired, US Army Corps of Engineers and Richard Jahns Lecturer, AEG/GSA

For information contact: Scott Burns, 725-3389, burnss@pdx.edu

Refreshments served and everyone is invited to attend!

IMMINENT DEMISE OF SOUTHERN OREGON UNIV. GEOLOGY DEPARTMENT

Here's a recent correspondence which has come our way --

Hi [GSOC Members],

I don't know if you've heard, but Southern Oregon University is going through a dire financial crunch. Long story short, the SOU President announced in a provisional plan this past week that the geology program at SOU will be eliminated. The final plan will be announced March 5th. I wanted to pass this information on to you to be included in the GSOC Newsletter; I thought the membership might want to know about the potential loss of a geology program in Oregon? I don't know if there is anything that can be done, but we're making the best possible argument for the program. We'll see what happens.
Cheers,
-Bill

Bill Elliott
Assistant Professor
Department of Geology
Southern Oregon University

Bonnie Prange and Richard Bartels are planning to meet with the GSOC board on February 9th and will try to inspire a letter-writing campaign among our members. So do support our officers if this is a topic of concern for you. Bill Elliott led our very successful Klamath Falls field trip last September.

BANQUET SALES TABLE DONATIONS

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

Rosemary asks that you do NOT donate the following:

- NO rocks
- NO textbooks older than 5 years

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

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

PS – If you joined GSOC in September or later, your 2007 dues are paid, good deal!!!

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY
SEVENTY SECOND ANNUAL BANQUET

Speaker

The Geological Society of the Oregon Country will be having its 72st Annual Banquet on Sunday, March 11, 2007. The program topic will be ***"Origin of the Oregon Dunes"***, by Dr. Curt Peterson, Portland State University. Dr. Peterson's area of expertise includes sedimentology, stratigraphy and coastal processes For more information you may visit his website at http://coastal.geol.pdx.edu/.

Where and When

Location of the banquet will be the Rheinlander Restaurant, 5035 NE Sandy Blvd., Portland, Oregon. There is ample free parking next to the restaurant, behind the restaurant and across Sandy Blvd. Public transportation riders may get there by bus on the #12 Sandy Blvd. bus route. One may also take the MAX train to the Hollywood Transit Station, but will need to walk two blocks north to Sandy Blvd. to transfer to the Sandy Blvd. bus, which does not stop in the Hollywood Transit Station. Doors at Banquet Entrance open at 12:30 p.m. Dinner at 1:00 p.m. Program and speaker will begin at 2:15 p.m.

Menu

Chicken Waldorf Salad (chicken, apple, blue cheese, fresh organic greens)

Fresh Vegetable Penne Pasta (spatzle, mushrooms, herbs & tomato) & green salad

Munich Sausage Trio (three German sausages, sweet & sour red cabbage, spatzle) & green salad

All dinners include warm rolls, butter, plum jam, apple strudel and hot beverage or soft drink.

_____ Number of tickets at $22.00 each (includes gratuity). Please indicate entrée choice. Also, if you have a table preference, please indicate it on the reservation.

Names of persons attending and meal choices:

_____Meal choice (circle one) Chicken Salad Pasta Sausage

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_____ Amount enclosed. ***Reservations must be received by Saturday, March 3, 2007.***

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

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THE GEOLOGICAL NEWSLETTER

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Business Manager:
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volunteer needed

ACTIVITIES:

ANNUAL EVENTS: President's Field Trip—Summer or Fall; Banquet—March; Annual Business Meeting—February.
FIELD TRIPS: About 6 per year. Fees: see field trip announcements on the calendar next page.
GEOLOGY SEMINAR: Usually held on the third Wednesday of some winter months, 8:00 p.m., Rm. S17, Cramer Hall, PSU. See calendar for details
GSOC LIBRARY: Rm. S7, Open 7:30 p.m. prior to meetings.
PROGRAMS: Second Friday evening most months, 8:00 p.m., Rm. S17, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon.
MEMBERSHIP: Per year from January 1: Individual--$20.00, Family--$30.00, Junior (under 18)/Student--$10.00.
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VOL. 73, NO. 3
MARCH, 2007

Richard Bartels, President, 503/292-6939
Acting Calendar Editor, Beverly Vogt, 503/292-6939, bevvogt@comcast.net

MARCH ACTIVITIES

GSOC Annual Banquet:
The Geological Society of the Oregon Country will be having its 72st Annual Banquet on Sunday, March 11, 2007. The program topic will be ***"Origin of the Oregon Dunes"***, by Dr. Curt Peterson, Portland State University. Dr. Peterson's website is http://coastal.geol.pdx.edu/. Location of the banquet will be the Rheinlander Restaurant, 5035 NE Sandy Blvd., Portland, Oregon. There is ample free parking next to the restaurant, behind the restaurant and across Sandy Blvd. Public transportation riders may get there by bus on the #12 Sandy Blvd. bus route. One may also take the MAX train to the Hollywood Transit Station, but will need to walk two blocks north to Sandy Blvd. to transfer to the Sandy Blvd. bus, which does not stop in the Hollywood Transit Station. Doors at Banquet Entrance open at 12:30 p.m. Dinner at 1:00 p.m. Program and speaker will begin at 2:15 p.m. Reservations for the banquet are due March 3, 2007. See the February 2007 Geological Newsletter for the reservation form. **NOTE: The Friday Evening Talk will be cancelled this month due to the GSOC Annual Banquet.**

APRIL ACTIVITIES

Friday Evening Talk, April 13, 2007, 8:00 p.m. Speaker to be announced. Topic will be posted on the GSOC website (www.gsoc.org) when confirmed.

Seminar, Wednesday evening, April 18, 8-10 p.m. Topic of the seminar led by Tara Schoffstall will be "Overview of the Geology of Oregon," an activity based seminar designed to give a basic understanding of the key geologic processes that helped to shape the key areas of Oregon. All are welcome! Tara Schoffstall, GSOC Member. Room 69, Cramer Hall, Portland State University, 1721 SW Broadway – between Montgomery and Mill Street.

Coming in June: Navigating the Geology Web. A seminar for people who would like to learn where to find information for current events (like earthquakes, tsnamis, volcanic eruption), and other sites of interest

PARKING AT PORTLAND STATE UNIVERSITY IS FREE AFTER 7 P.M. IN THE PARKING STRUCTURE ON BROADWAY DIRECTLY ACROSS FROM CRAMER HALL

CHECK THE GSOC WEB SITE (www.gsoc.org) FOR LATEST SCHEDULE OF EVENTS.

MOVING TOWARDS A MORE STABLE FUTURE IN OREGON CITY

synopsis of Friday, February 9, 2007 GSOC lecture by speaker Scott Burns, PhD.

by Carol S. Hasenberg

Dr. Scott Burns, professor of geology at Portland State University specializing in landslides, geomorphology, soils, and environmental geology, gave another outstanding talk to a packed lecture hall at last month's GSOC Friday night meeting. The lecture topic is one that has become familiar to many Oregonians – the problems associated with building developments occurring on ancient landslides.

Burns began the lecture by referring the audience to several familiar landslides in the area:

- the ancient Bonneville slide on the Columbia River
- the Kelso landslide, the second largest landslide involving houses in U.S. history
- the Tillamook County landslide at the Capes development
- the recent Stevenson, Washington, movement occurring on an ancient landslide, whose activation is probably due to the intense rainfall in November 2006.

In general, Burns explained that landslides occur on slopes when the driving forces, i.e., weight of soil in the slide, exceed the resisting forces, which include the shear strength of the soil in the slide and the buttressing effect of the toe of the slide. Landslides can be activated by cutting away the toe of the slide, increasing the weight of the slide material (by adding more material or water), or decreasing the shear strength of the soil (usually by adding water).

He then discussed his 1996 mapping project of landslides in the Portland area, where four major areas of landslides were identified:

- Portland West Hills (Tualatin Mountains)
- steep areas along the riverbanks
- debris flows along the Willamette and Columbia rivers
- fine-grained Troutdale Formation landslides in SE Portland.

Burns discussed the differences in the geological processes and repair of landslides in these areas. Steep-sited West Hills landslides, often abetted by poor water control methods, are generally fixable by the use of gabion walls or other slope stability methods. Riverbank slides, such as those occurring along the Wilson River on Oregon Highway 6, have been fixed by using light-weight wood chip fills in place of more heavy fills, thus lightening the slide driving forces. Debris flows are very wet slides that occur during heavy rain events in steep stream valleys. Landslides occurring on the fine-grained Troutdale Formation sediments in the southeast metropolitan area generally occur on slopes that may not be steep, cover large areas, and are not easily repaired. According to the mapping project, only 24% of the hundreds of landslides documented were caused purely by natural processes – the other 76% included cut- and fill-slopes and water control problems caused by human activity.

The remaining portion of the talk was devoted to discussing the landslides occurring in the Troutdale Formation areas of Oregon City and other Clackamas County locations. The area overlain by the Troutdale Formation was originally flat but now is a basin which keeps collecting sediment consisting of sand and silt layers. The creek canyons of southeast Oregon City contain numerous ancient landslides, which are now being developed as the population of the area increases. Burns cited several examples of new or existing developments now being threatened by landslides. The landslides are characterized by large slump blocks which create tension cracks in the earth and then fault scarps as the movement of the ground is mobilized. Movement may vary between a foot or two to tens of feet in a season. Fault scarps developing in the middle of a building can subsequently tear the foundation and walls of the building apart – or a scarp may threaten the stability of the building by occurring at the edge of the foundation. Roads in developments often cut into slides, thereby creating instability or drainage problems. Underground

utilities will break numerous times as the movement continues.

Unfortunately the victims of the landslides stand to lose a lot. Developers often opt to continue on with a project, even though the land on which they are building exhibits signs of instability. Burns' maxims on building in landslide-prone areas are:

- Don't build on old landslides if you can help it
- Control water to the slide if you find you're on one.

He and his students have done several landslide identification and documentation projects in this area. He cannot, however, forbid anyone from building on such sites. Development in Oregon City is not particularly restricted by virtue of the fact that the land may be an ancient landslide, either. There are restrictions on developments permitted on slopes over 25%, but many ancient landslides are not that steep. Landslides are an issue where the rights of property owners, ethics, and good land stewardship can be debated in depth.

So how might a home owner inform him- or herself of the landslide hazards on a particular site? Disclosure laws implemented in the late 1990's provide prospective home owners with some protection. Also, a new regional landslide identification project by the State of Oregon Department of Geology and Mineral Industries (DOGAMI) may be a great help locally. Using LIDAR technology which can map landform shapes to the resolution of one meter, geologist Bill Burns of DOGAMI, a former graduate student of Scott Burns, is identifying landslides in areas of Multnomah, Clackamas, and Washington counties. The results of the ongoing project are being posted on the internet in the site listed below. Although this method is not a substitute for a site-specific geological investigation, it can raise the issue of landslide hazards in the area to home owners and local governments. A map and report on the landslides in Oregon City is also available from DOGAMI. Refer to the additional reading section for more information.

Burns ended the evening with a Q and A period in which he was asked whether or not some of the east Portland Boring lava vents contained landslides. Luckily for the homeowners (including the author), the answer indicated that there are not many landslides on those hills.

Additional reading:

Scott F. Burns, Professor of Geology website: http://soils.geology.pdx.edu/

Pilot LIDAR Project - Portland Metro Area, Oregon Department of Geology and Mineral Industries (DOGAMI): http://www.oregongeology.com/sub/lidar/

"Map of Landslide Geomorphology of Oregon City, Oregon, and Vicinity Interpreted from LIDAR Imagery and Aerial Photographs", 2006, by Ian P. Madin and William J. Burns (DOGAMI Open-File Report O-06-27), Oregon Department of Geology and Mineral Industries.

DOGAMI Landslide Factsheet: http://www.oregongeology.com/sub/publications/landslide-factsheet.pdf

"Engineering Geology And Relative Stability Of The Southern Half of Newell Creek Canyon, Oregon City, Oregon" by William J. Burns, a thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Geology at Portland State University, 1999. Bill Burns' thesis contains a good description of the Oregon City area geology: http://nwdata.geol.pdx.edu/Thesis/FullText/1999/BurnsW/

City of Oregon City Building Department: http://www.orcity.org/community-develop/building/

Hill, Richard L., "Airborne technology gives Oregon a jump on landslides," The Oregonian, Thursday, February 15, 2007, pp. A1 and A8.

GSOC ANNUAL BUSINESS MEETING AND BOARD MEETING

February 9, 2007

The annual meeting of the Geological Society of the Oregon Country was called to order at 8:00 p.m., February 9, 2007, in Room S17, Cramer Hall, Portland State University.

The membership adopted the slate of new officers for the 2007-2008 year as presented by the Nominating Committee: Richard Bartels, President; Janet Rasmussen, Vice President; Beverly Vogt, Secretary; Marvel Gillespie, Treasurer; Jan Kem, Director for three years; Larry Purchase, Director for two years; and John Newhouse, Director for one year. Members of the Nominating Committee were Janet Rasmussen, Chair; Bonnie Prange; and Richard Bartels.

After the meeting was adjourned, the Board met briefly in the PSU Geology Office. Present were Janet Rasmussen, Beverly Vogt, Marvel Gillespie, Bonnie Prange, Larry Purchase, John Newhouse, Tara Schofstall, and Richard Bartels. Organization financial arrangements were made.

Details related to the banquet and the Newport Fossil Fest weekend were also discussed. It was decided that a formal letter from the Board and signed by the GSOC president voicing our concern for state funding for higher education and protesting the closing of the Geology Department at Southern Oregon University be sent to the Governor, State Board of Higher Education, and the Chancellor of the Oregon University System (and copied to William Elliott). Board members and GSOC members are urged to also send personal letters on this matter as soon as possible.

The next GSOC Board meeting is scheduled for 10 a.m., April 14th.

Beverly F. Vogt, Secretary

Winter Seminar Series 2007 Department of Geology Portland State University

Seminars in Cramer Hall S17; Wednesdays, 3:30 - 4:30 PM

March 7, 2007 "The Ups and Downs of the Columbia River", Jim O'Connor, US Geological Survey, Portland & Adjunct Professor, PSU Geology Dept.

March 20, 2007 "Geologic Influences of Midcontinent Dams", John Moylan, Retired, US Army Corps of Engineers and Richard Jahns Lecturer, AEG/GSA

For information contact: Scott Burns, 725-3389, burnss@pdx.edu

Refreshments served and everyone is invited to attend!

WELCOME

We welcome the following new members to the Geological Society of the Oregon Country (since last July)

John Weber
Thomas & Sally Fouch
Beth & Arthur Johnstone
Peggy Chamberlain
Lenore Coffey
Judith Teufel
Martha Jo Muncie

GSOC HISTORY SERIES

Dear GSOC Members,

Here is another interesting GSOC article from the past. As you read this article written in 1939, consider the changes in the world view paradigm of geologists since then. Plate tectonics and global warming have only fairly recently had wide acceptance.

Carol Hasenberg

SHIFTING OCEAN LEVELS

Most assuredly, the sea level is not really level. There are, in the first place, minor and temporary irregularities, such as waves which one can see with the eye, and the ups and downs of the tide which one can measure with a tide gauge, But even if one keeps tide gauges running in different parts of the ocean for months or years, and thus determines for each locality the average or mean sea level at that place, it will be found that these ,average levels are not everywhere the same. Along a mountainous coast the gravitative attraction of the mountain masses pulls sea level considerably higher than it is along a lowland coast, Where prevailing winds blow the water on-shore, sea level may be raised from a few inches to a number of feet above the average or mean sea level. Take the case of the trade winds. These blow water westward across the Atlantic and pile it up in the Gulf of Mexico. As a result the sea is slightly higher on the west side of Florida than on the east side, and the famous Gulf stream. is born, flowing eastward around the southern end of the peninsula and then northeast across the Atlantic Ocean. Evaporation lowers sea level in some places, while the outflow of great rivers raises it in others.

Fortunately, most of these irregularities of the sea surface are not very great in amount; and still more fortunately, they are relatively permanent, You visit a coastal city without fear, feeling reasonably sure that the level of the sea will not change appreciably while you are there. Thousands of people build houses only a few feet above high tide, and many hundreds of thousands lie down on sandy beaches with children playing all about. It probably never occurs to them that if the water portion of the globe were suddenly to rise by only one millionth part of that globe's diameter, or were to slop over that much, just as one might slop a tiny bit of water from a basin, such relatively insignificant changes of sea level would overwhelm people and houses in a disaster such as has never been recorded in all human history.

When we stop to think about it, the degree of permanence of that unstable-looking water surface is really quite remarkable! But what would happen if sea level did rise, let us say, half way up the Empire State Building in New York City?

Well, if that were to happen, both Louisville and St. Louis would become seaports on the enlarged Gulf of Mexico, Most of the state of Mississippi and all of Louisiana and Florida would lie under the ocean, Much of Europe would be submerged, and incidentally Hitler would lose more German territory than he has added by his policy of conquest.

Geologists believe that changes of several hundred feet have occurred quite recently in the earth's history, some of them since man has lived on this globe. But such changes are usually slow, and not readily noticed. The only changes which attract much popular attention are the relatively slight and wholly temporary ones due to hurricanes, earthquakes and volcanic explosions. Hurricanes at sea raise waves that are often called "mountain high", but scientific measurements indicate that these waves rarely rise more than .50 or 60 feet above the troughs or depressed areas between them. More damage is done to coastal cities built on low shores, by the temporary rise of sea level produced when winds of hurricane force pile water up against the shore. In the New England hurricane of last September winds with a velocity of 100 miles an hour raised the waters of the Atlantic 10 to 15 feet above normal high tide at Westerly, Rhode Island, During the Galveston storm of September 8, 1900, the Gulf waters rose 20 feet, and were the principal agent of destruction in the city.

When earthquakes occur under the sea, as a result of the sudden displacement or slipping of rocks forming the sea bottom, great waves of water sometimes sweep over the adjacent coasts, destroying houses and drowning thousands of people. Such earthquake waves, or tidal waves as they are sometimes erroneously called, have left boats stranded on the roofs of houses in Alexandria on the coast of Egypt. The great earthquake at Lima, Peru, in 1724 was followed by a wave 80 feet high which carried four vessels far inland and devastated coastal regions. A later earthquake wave carried a United States war vessel a quarter of a mile into the land, where it lay stranded for eleven years, until another great wave carried it still farther inland.

Volcanic explosions, in or under the sea may cause even more destructive waves. In 1883, following the explosion which partially destroyed the volcano of Krakatoa in the East Indies, waves of enormous height wrought destruction over great distances. On the southern end of; Sumatra one wave was over 70 feet high and carried a gunboat two miles inland. On parts of the Java coast the water rose 135 feet, causing such destruction of towns and loss of life as made this explosion one of the worst catastrophes in human history.

That the sea has sometimes been much higher than now, in relation to the continents, is proved by the finding of sea shells, wave-cut cliffs, beaches, old sea caves, and other marine features on the slopes of the lands, hundreds or even thousands of feet above present' sea level.. Such elevated beaches are found 1500 feet high on the mountainous coast of California. That the sea surface has also been relatively much lower than now, is proved by the finding of river-carved valleys, shore beaches and other land forms under the sea. Thus Chesapeake Bay is clearly the submerged valley of a former Chesapeake river to which the Susquehanna, the Potomac, and the James rivers were merely tributaries; while a submerged channel of the Hudson river can be followed far out under the open ocean.

Perhaps you noticed that I spoke of these past positions of sea level as being higher or lower than now in relation to the lands. In other words, they are merely relative positions of sea level. It still remains to be proved whether high-level sea beaches owe their position to a drop of the sea or a rise of the land. Similarly, the submerged valleys of Chesapeake Bay and the seaward continuation of the Hudson can be explained equally well by a geologically recent rising of sea level, or a geologically recent sinking of the land.

How, then, can a geologist tell whether it is the sea level or the land level that has changed?

A famous Scotchman names John Playfair many years ago explained very clearly the only way in which this can be done, If it is the sea level which has changed, he pointed out, the old shorelines ought to be found at the same elevation all over the world. This is because sea level must rise and fall uniformly on all parts of the globe. But if it is the land level which has changed, the elevated shorelines may appear in some places and not at all in others; and where they do appear, they may be found to slope upward or downward when followed along the coast. This is because some lands may rise while others sink; and any uplifted land mass is likely to be warped or tilted.

This principle is called Playfair's Law, and perhaps you think it has solved the difficulty for the student of ancient marine levels. Unfortunately, this is not the case. We do feel very sure that sea level has repeatedly gone up and down by uniform amounts all over the world. When the great continental glaciers formed over parts of North America and Europe, the water thus piled up on the lands in the form of thick ice caps must have been evaporated from the oceans to give the necessary snow and ice. Hence sea level must have fallen. perhaps a few hundred feet, perhaps more. When the ice caps melted and the water flowed back into the ocean, sea level must have risen. But unfortunately the weight of the ice piled up on the continents probably caused those parts of the land to sink unevenly. Melting of the ice apparently allowed the land areas relieved of this load to rise, but to rise unequally. Furthermore, in all parts of the world we

find that land areas have repeatedly risen and fallen irregularly due to other causes than ice formation and ice melting. Hence the likelihood that old shore-lines left at uniform altitudes by drops in sea level have been distorted out of their original positions by unequal warping of the lands.

Under such conditions, how can anyone tell whether these warped shorelines were carved when the sea was higher; and if they were, what was the level at which they were originally carved?

On its face the problem does look insoluble. Yet many investigators are working hard to solve it. They hope to discover some parts of the world were disturbing forces have not been active in recent geologic time, and where horizontal shorelines high above sea level are found along the coast. Under such conditions, they would feel that the elevated shorelines must result from a uniform drop of sea level, and hence that a key area had been discovered which could be used to unravel the complicated shore history of more disturbed regions.

Despite discouraging difficulties the study is still going on in many parts of the world, and success may eventually crown these labors. If it does, it will be a great achievement. For if we can discover how far the sea has risen on the lands, and when these rises of sea level took place we can date many important events in recent earth history. If we can tell how far the sea level has dropped below its present position, and when such drops occurred, we may be able to explain and to date forms now found on the ocean floor. If the sea level has dropped many thousands of feet sometime in the past, we could easily explain by normal stream erosion those gigantic canyons, some of them deeper than the Grand Canyon of Colorado, which constitute one of the most spectacular features concealed beneath the restless waters of the ocean.

- Douglass Johnson, Columbia University.

This talk by Professor Johnson was the second in a series of eight radio addresses presented by the Geological Society of America under the theme "Frontiers of Geology".

-published in the Geological Newsletter, Volume 5, No. 15 in 1939.

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY
SEVENTY SECOND ANNUAL BANQUET

Speaker

The Geological Society of the Oregon Country will be having its 72st Annual Banquet on Sunday, March 11, 2007. The program topic will be ***"Origin of the Oregon Dunes"***, by Dr. Curt Peterson, Portland State University. Dr. Peterson's area of expertise includes sedimentology, stratigraphy and coastal processes For more information you may visit his website at http://coastal.geol.pdx.edu/.

Where and When

Location of the banquet will be the Rheinlander Restaurant, 5035 NE Sandy Blvd., Portland, Oregon. There is ample free parking next to the restaurant, behind the restaurant and across Sandy Blvd. Public transportation riders may get there by bus on the #12 Sandy Blvd. bus route. One may also take the MAX train to the Hollywood Transit Station, but will need to walk two blocks north to Sandy Blvd. to transfer to the Sandy Blvd. bus, which does not stop in the Hollywood Transit Station. Doors at Banquet Entrance open at 12:30 p.m. Dinner at 1:00 p.m. Program and speaker will begin at 2:15 p.m.

Menu

Chicken Waldorf Salad (chicken, apple, blue cheese, fresh organic greens)

Fresh Vegetable Penne Pasta (spatzle, mushrooms, herbs & tomato) & green salad

Munich Sausage Trio (three German sausages, sweet & sour red cabbage, spatzle) & green salad

All dinners include warm rolls, butter, plum jam, apple strudel and hot beverage or soft drink.

_____ Number of tickets at $22.00 each (includes gratuity). Please indicate entrée choice. Also, if you have a table preference, please indicate it on the reservation.

Names of persons attending and meal choices:

_____Meal choice (circle one) Chicken Salad Pasta Sausage

_____Meal choice (circle one) Chicken Salad Pasta Sausage

_____Meal choice (circle one) Chicken Salad Pasta Sausage

_____Meal choice (circle one) Chicken Salad Pasta Sausage

_____ Amount enclosed. ***Reservations must be received by Saturday, March 3, 2007.***

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

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APRIL 2007

THE GEOLOGICAL NEWSLETTER

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VISITORS WELCOME AT ALL MEETINGS
INFORMATION: www.gsoc.org

VOL. 73, NO. 4
APRIL 2007

Richard Bartels, President, 503-292-6939, bartbartels@comcast.net
Acting Calendar Editor, Beverly Vogt, 503-292-6939, bevvogt@comcast.net

APRIL ACTIVITIES

Friday Evening Talk, April 13, 8 p.m., "Holocene Glaciation at Three Sisters Volcanoes and Beyond" is the subject of April's talk by Shaun Marcott. Shaun is a PhD student at Oregon State University, working with advisor Dr. Peter Clark on glacial and paleoclimate research. He received his Master's Degree from Portland State University. Location of talk: Room S17, Cramer Hall, Portland State University, 1721 SW Broadway, between Montgomery and Mill. (Room S17 is on the sub-basement level of Cramer Hall, directly below the Geology Department's main office.)

Wednesday Evening Seminar, April 18, 8-10 p.m. The topic of the seminar led by Tara Schoffstall, GSOC member, will be "Overview of the Geology of Oregon," an activity-based seminar designed to give a basic understanding of the key geologic processes that helped to shape different areas of Oregon. All are welcome! Location: Room 69, Cramer Hall, PSU.

FUTURE ACTIVITIES

Look for details about these activities in upcoming issues of the GSOC Newsletter

Friday Evening Talk, May 11, 8 p.m., "El Nino: What Does It Mean?" talk by Dr. Robert Miller, College of Oceanic and Atmospheric Sciences, Oregon State University. Location: Room S17, Cramer Hall, PSU.

Friday Evening Talk, June 8, 8 p.m., "Community-Based Approach to Mitigating Potential Conflict over Groundwater Resources, Umatilla Sub-Basin, Oregon," talk by Dr. Todd Jarvis, Institute for Water and Watersheds, Oregon State University. Location: Room S17, Cramer Hall, PSU.

PSU Field Trip, June 10: Sixth Annual Terroir Tour: "Geology, Soils, and Wines," led by Dr. Scott Burns, Geology Department, Portland State University. The one-day bus tour will visit wineries in The Dalles area. The bus will leave the PSU Geology Department in the late morning and return in the late afternoon. Bring a lunch. Cost of the trip is $40 for one or $75 for two. For more information contact Nancy Eriksson at the PSU Geology department, 503/725-3022 or nancye@pdx.edu.

Wednesday Evening Seminar, June 20, time to be announced, "Navigating the Geology Web," a seminar for people who would like to learn where to find information on the internet about current geologic events (like earthquakes, tsunamis, volcanic eruptions), and other sites of interest.

GSOC Field Trip, Saturday, June 30, "Glacial Outburst Floods at Mount Hood," led by Ken Cameron, Oregon DEQ. This will be an opportunity to see field evidence that Ken discussed in his January 12 lecture.

PARKING AT PORTLAND STATE UNIVERSITY IS AVAILABLE AFTER 7 P.M. IN THE PARKING STRUCTURE ON BROADWAY DIRECTLY ACROSS FROM CRAMER HALL.

CHECK THE GSOC WEB PAGE FOR THE LATEST GSOC CALENDAR OF EVENTS, www.gsoc.org, OR CALL BEVERLY VOGT, 503-292-6939.

ATTACK OF THE MUD VOLCANO!

by Carol S. Hasenberg

A somewhat sensational news item of late has been that of a mud volcano erupting in the coastal town of Sidoarjo on the island of Java in Indonesia. This natural disaster has been responsible for causing at least 10,000 people to be homeless, as well as the destruction of four villages and 25 factories. Or is this a natural disaster? The controversy over the causes of the eruption and possible ways of stopping it and resolving the problems it has caused involves not only the Indonesian government but also a drilling firm in Indonesia and earth scientists in Indonesia, the United Kingdom, Norway, Australia, and the United States.

But what is a mud volcano anyway? Mud volcanoes are outpourings of thick mud or muddy water from the land surface or ocean bottom. The ejected mud is pressurized and is often accompanied by hydrocarbon gases such as methane. The pressurized intrusion causing the volcano to erupt is called a diapir. Mud volcanoes are found in compressional tectonic boundaries and large sedimentary deposits (where petroleum deposits are found). The country of Azerbaijan is famous for its many mud volcanoes, some of which spout flames as they erupt. Mud volcanoes also occur in Trinidad and Tobago, the Andaman Islands, and many other places.

The Sidoarjo mud volcano, nicknamed "Lusi", overlies two key geological layers which are believed to contribute to the ejected material. The mud source beds could be Miocene clays or the Pleistocene Kalibang Formation. These overlie a porous limestone formation called the Kujung Formation, which is pressurized and capped by a layer of hardened clay. Scientists believe that the pressurized water in the Kujung has found a conduit to the mud source beds, and the resulting pressurized mixture has created fissures which have conducted the fluid to the surface. The temperature of the erupting mixture (70-100 °C.) indicates the source depth.

Two events that occurred near the beginning of the Lusi mud eruption (on May 29, 2006) may have contributed to triggering the eruption. On May 27 a 6.3 magnitude earthquake occurred centered about 280 km from the Lusi site. The other event was the drilling of the Bajar Panji-1 gas exploratory well about 200 m from the location of the initial eruption by the Indonesian oil drilling company PT Lapindo Brantas. The well did not have a steel casing below the depth of 1 km, and a surge of pressurized fluid within the well known as a "kick" occurred on May 28 while the drill was being removed. Subsequent efforts to quell the kick may have fractured the region around the drill hole, creating a path between the Kujung and the mud-producing strata.

So various mud volcano experts have been studying Lusi to determine if the cause is natural or man-made. Richard Davies of Durham University in the U.K. initiated the discourse in a February 2007 article in *GSA Today*. He weighed in on the side of the disaster being man-made. Adriano Mazzini of the University of Oslo, Michael Manga at U.C. Berkeley, Mark Tingay at the University of Adelaide, and Rudi Rubiandini at the Bandung Institute of Technology all have contributed to the understanding of the mechanisms which led to the disaster.

Meanwhile the Indonesian government is trying to decide what to do about the growing lake of mud. Hazards from the mud volcano include inundation by the mud and a possible collapse of the source strata below the region. Efforts are underway to try to plug the vent by dropping concrete balls into it. Even in the unlikely chance that this is successful, other fractures may develop, thereby just moving the problem to another location. Right now the flow is being channeled into the nearby river. The Indonesian government has so far forced Lapindo to pay $420 million to help provide relief for the

victims and reduce the flow of mud. However, despite all efforts, the mud volcano may be erupting for many years to come.

References:

Cyranoski, David, "Muddy Waters," *Nature*, Volume 445, February 22, 2007, pp. 812-815.

Davies, Richard J., Swarbrick, Richard E., Evans, Robert J., Huuse, Mads, "Birth of a Mud Volcano: East Java, 29 May 2006," *GSA Today*, Volume 17, No. 2, February 2007, pp. 4-9.

Normile, Dennis, "Indonesian Mud Volcano Unleashes a Torrent of Controversy," Science, Volume 315, February 2, 2007, p. 586.

Wikipedia web page "Mud Volcano" is an excellent reference for describing mud volcanoes and their occurrences around the world:
http://en.wikipedia.org/wiki/Mud_volcano

Wikipedia web page "Sidoarjo mud flow":
http://en.wikipedia.org/wiki/Lusi

The Origin of the Oregon Dunes

synopsis of Seventy Second Annual GSOC Banquet talk by Dr. Curt Peterson of Portland State University

Dr. Peterson's Applied Research Interests (from his website http://coastal.geol.pdx.edu/):

- large-scale coastal sediment dynamics in Pacific Northwest
- geologic records of great earthquakes and tsunami inundation
- geotechnical and hydrological properties of coastal dunes
- coastal wetland restoration, and coastal geoarchaeology,

Also from Dr. Peterson's website, concerning this project:
"Dr. Peterson directs the Coastal Field Studies (CFS) program at Portland State University. The Coastal Field Studies program supports 1) ground penetrating radar (GPR), 2) shallow core-auger systems, 3) shallow-draft vessels, 4) georeferencing (GPS and EDM total station), 5) shallow subsurface sampling for geologic dating (210Pb, AMS14C and luminescence), and 6) subsurface sampling for groundwater geochemistry and contaminants. The Coastal Field Studies program includes collaborators from Oregon, Washington, California, British Columbia, Baja California, Australia, India, and the Netherlands."

Project collaborators include (from his talk):

- Curt D. Peterson, Portland State University, Portland, Oregon,
- Errol Stock, Griffith University, Brisbane, Queensland, Australia
- David M. Price, Wollongong University, Wollongong, New South Wales, Australia
- Roger Hart, Department of Oregon Geology and Mineral Industries, Newport, Oregon
- Frank Reckendorf, Reckendorf and Associates, Salem, Oregon,
- Jon M. Erlandson, University of Oregon, Eugene, Oregon
- Steve W. Hostetler, US Geological Survey, Oregon State University, Corvallis, Oregon

The Oregon Dune age, distribution, and origin project is funded by the NOAA Office of Oregon Sea Grant. According to Dr. Peterson, a project report is expected shortly. It will contain a two-day field trip guide to the dunes.

Dr. Peterson and his collaborators have been working on an ambitious project to determine the age, distribution, origin, source, and chemical and physical processes involved in the evolution of the Oregon Dunes. This impressive dune field is centered in the Florence, Oregon, area, and includes

dunes along the coast in the lower two-thirds of the state of Oregon. The Oregon Dunes is the only active dune field in the Western U.S. According to Dr. Peterson, it has taken a long time to understand the origin and dune formation mechanisms, and up to 40 scientists from Oregon and as far away as Australia have contributed to this process.

Along the way, many ideas previously held about the dunes have had to be reexamined and either verified or debunked. For example, it was previously thought that the coastal plains are covered by marine terrace deposits. The Sea Grant team discovered that the plains are covered with sand dune deposits that are unrelated to the marine terraces below them. Also, the age of the dune fields were rather surprising – dates going back as far as 100,000 years were determined.

A state of the art dating technique called thermoluminescence (TL) dating has been instrumental to the Sea Grant project, since this technique can date depositions of sediments ranging in the tens of years to 100,000+ years, without requiring samples of organic material as in radiocarbon dating. The grains of sand themselves are collected (in the dark) and a depositional date is determined. See article on pp. 18-19 for more information on this technique. Dr. Errol Stock from Griffith University in Queensland, Australia conducted TL dating for the Sea Grant project, as well as dune studies in Australia.

Over the duration of this project, a number of graduate students from Portland State University and Oregon State University have studied varied aspects of the Oregon dunes, contributing knowledge on the origin, age, and growth of the dunes; the chemical makeup and evolution of the dunes; the stability of the dune sediments; and other important topics. From this information one can determine how dune extent and movement can be predicted, how to properly construct buildings and roads on dune sediments, and other important information. A brief list of completed and ongoing studies are:

- Oregon dune age and origin.
- Engineered road cuts in Lincoln and Lane Counties.
- Soils testing in dune sediments for engineering properties and age dating.
- Nano-cements in dunes.
- Groundwater sampling, including geochemistry, bacterial pollutants, and groundwater depths using ground penetrating radar.
- Archaeological studies, including locational advantages and activities on sites
- Dune mapping, including high resolution and infrared airphoto analysis.

One interesting discovery occurred when the team was trying to determine a way to date the dune deposits by testing the podzolization, or leaching, of iron cations within the dunes. They were puzzled by the fact that the development of the zones of Fe^{+++} and Fe^{++} concentrations were not dependent on the age of the deposit. However, a different geochemistry technique, that of dating the dunes using the concentration of nano-cements in the dune strata, did prove useful.

The nano-cements are also important in providing some stability to dune escarpments above what the constituent sands can resist. That is why roadcuts in the coastal areas are often quite steep, and under normal conditions remain stable. However, when soil becomes saturated and additional loads occur, such as building above the cut, catastrophic failures do occur. Dr. Peterson is also very concerned that when the Cascadia Subduction Zone earthquake occurs, every coastal road will be blocked by landslides on these cut banks.

The coastal plain groundwater studies have many applications. The dune geochemistry is closely related to the location and type of water involved. Often one finds freshwater aquifers that are perched above the ocean water in the dune areas. Native Americans living on the coast were very astute in determining locations of fresh water and made their encampments in such areas. So Native American archaeological sites can be found near fresh water aquifers and vice versa.

In this study of the origin and age of the dunes, many types of data had to be collected and analyzed. These data included paleoclimate data for wind and wave action; eustatic sea level changes

over time; sand and clay mineralogy and grain size; dune orientation analysis; coring and drilling; and age dating by TL, radiocarbon, and soil development. The analysis has answered the question of why the dunes are where they are – they are located just onshore from the Heceta Head Banks, a large knob in the continental shelf offshore of Heceta Head, directly north of Florence. When the ocean level was lower in the Pleistocene, this area was able to supply vast quantities of wind-blown sand to create the dunes.

Other conclusions about the central and southern Oregon coastal dunes are that they roughly fall into two periods of existence – Holocene dunes, which average 3,000 years in age, and Pleistocene dunes, which average 30,000 years in age. During the Pleistocene when sea level was lower a northward littoral drift (wave-driven) forced sand onto the continental shelf in the Heceta Banks area. During the Holocene, strong onshore winds brought the sand inland. Dr. Peterson ended the talk by saying that observations over the last few decades indicate that beach sands on the Oregon coast are disappearing because of 1) present-day beach erosion, and 2) rising sea level during the Holocene that cut the beach off from the sand supply in the Heceta Banks area. As the amount of sand on the coast dwindles, our use of this important resource will change as well.

Carol S. Hasenberg

References:

Beckstrand, Darren L., "Origin of the Coos Bay and Florence Dune Sheets, South Central Coast, Oregon," a thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Geology at Portland State University, 2001.:
http://nwdata.geol.pdx.edu/seagrant/Thesis%20-%2072%20dpi.pdf

Peterson, Curt, "Ages, Distributions, and Origins of Upland Coastal Dune Sheets in Oregon, USA," powerpoint show presented in the March 11, 2007 Friday night meeting of the Geological Society of the Oregon Country. Dr. Peterson presented GSOC with a copy of the show for our use.

LUMINESCENCE DATING

The following definition of luminescence dating comes from the USGS Luminescence Dating Laboratory home page, http://crustal.usgs.gov/laboratories/luminescence_dating/index.html:

"Luminescence dating is a form of geochronology that measures the energy of photons being released. In natural settings, ionizing radiation (U, Th, Rb, & K) is absorbed and stored by sediments in the crystal lattice. This stored radiation dose can be evicted with stimulation and released as luminescence. The calculated age is the time since the last exposure to sunlight or intense heat. The sunlight bleaches away the luminescence signal and resets the time 'clock'. As time passes, the luminescence signal increases through exposure to the ionizing radiation and cosmic rays. Luminescence dating is based on quantifying both the radiation dose received by a sample since its zeroing event, and the dose rate which it has experienced during the accumulation period (See the Luminescence Age Equation). The principal minerals used in luminescence dating are quartz and potassium feldspar."

Luminescence dating includes Photo-Transferred (PTTL), Thermal (TL), and Optically Stimulated (OSL) techniques. The USGS website also describes the ranges of accuracy of the techniques for various applications.

The following description of Optical luminescence dating (OSL) is reprinted from the article,
"Great Victoria Desert: new dates for South Australia's ?oldest desert dune system"
by Malcolm J. Sheard, Mel J. Lintern, John R. Prescott, and David J. Huntley

MESA Journal, Volume 42, August 2006, pp. 15-26,
http://www.sfu.ca/physics/research/workarea/huntley/MESA_great_victoria_desert.pdf :

"What is optical dating?
On exposure to natural radiation from the environment, many crystals, of which quartz is an example, store a proportion of the absorbed energy in the crystal lattice. When the crystal is exposed to green light, some of this stored energy is released and some of that is emitted as ultraviolet light: this light is referred to as optically stimulated luminescence (OSL).

The intensity of this light is a measure of the energy that had been stored since the sample was last exposed to sunlight. The process serves as a clock which is set to zero by sunlight exposure and which runs at a rate determined by the rate of absorption of energy. The technique is referred to as optical dating.

This process can be used to date wind-borne and water-borne sediments that have been exposed to sunlight during transport.

Optical dating is now useful for times from tens of years to 300 ka, and is beginning to show promise for times approaching 1 Ma.

How does dating work?
The actual laboratory process of dating involves a four-step measurement:
1. suitable minerals (i.e. quartz) are extracted from a sample by chemical and/or physical means
2. energy trapped by crystal impurities as a result of environmental ionizing radiation (from K, Th, U) is measured by recording the light emitted when the sample is stimulated by light of a different wavelength (OSL)
3. the sensitivity to ionizing radiation is determined with a calibrated radiation source
4. the rate of delivery of energy (dose rate) from radioactivity in the sample and environment is found.

An age then follows from the age equation:
Age (y) = (Luminescence output) ÷ (Luminescence per unit dose x dose per year)"

THE GEOLOGICAL SOCIETY OF THE OREGON COUNTRY MEMORABILIA

"Things worthy of remembrance, also a record of such things."

The book *THE TWO ISLANDS* by Thomas Condon was published in 1902. Condon was the first scientific investigator of the fossils of the John Day area. In 1872, Condon became Oregon's first state geologist while teaching geology at Pacific University. When the University of Oregon was founded in 1876, he was appointed its first professor of geology. Condon's book *The Two Islands* was the foundation for the study of Oregon's historical geology. The book is passed on to the incoming president of GSOC each year with the understanding that it must be read or at least signed.

The PICKAX was presented to President Fred Miller in 1965 and is passed on to incoming presidents. It is in pristine condition and has never been used by diggers or miners.

The WOODEN MALLET was carved from the famous 1913 shipwreck of the full-rigged sailing ship Glenesslin at the base of Neahkahnie Mountain on the Oregon coast. The mallet was first used in opening the banquet by President Harold Schminky in 1942.

GEOLOGICAL SOCIETY OF
THE OREGON COUNTRY
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GSOC

MAY 2007

THE GEOLOGICAL NEWSLETTER

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FIELD TRIPS: About 6 per year. Fees: see field trip announcements on the calendar next page.
GEOLOGY SEMINAR: Usually held on the third Wednesday of some winter months, 8:00 p.m., Rm. S17, Cramer Hall, PSU. See calendar for details
GSOC LIBRARY: Rm. S7, Open 7:30 p.m. prior to meetings.
PROGRAMS: Second Friday evening most months, 8:00 p.m., Rm. S17, Cramer Hall, PSU, SW Broadway at SW Mill St., Portland, Oregon.
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VOL. 73, NO. 5
MAY 2007

Richard Bartels, President, 503-292-6939, bartbartels@comcast.net
Acting Calendar Editor, Beverly Vogt, 503-292-6939, bevvogt@comcast.net

MAY ACTIVITIES

Friday Evening Talk, May 11, 8 p.m., "El Nino: What Does It Mean?" talk by Dr. Robert Miller, College of Oceanic and Atmospheric Sciences, Oregon State University. Location of talk: Room S17, Cramer Hall, Portland State University, 1721 SW Broadway, between Montgomery and Mill. Room S17 is on the sub-basement level of Cramer Hall, directly below the Geology Department's main office.)

There will be no Wednesday evening seminar in May.

FUTURE ACTIVITIES

Look for details about these activities in upcoming issues of the GSOC Newsletter

Friday Evening Talk, June 8, 8 p.m., "Community-Based Approach to Mitigating Potential Conflict over Groundwater Resources, Umatilla Sub-Basin, Oregon," talk by Dr. Todd Jarvis, Institute for Water and Watersheds, Oregon State University. Location: Room S17, Cramer Hall, PSU.

PSU Field Trip, June 10: Sixth Annual Terroir Tour: "Geology, Soils, and Wines," led by Dr. Scott Burns, Geology Department, Portland State University. The one-day bus tour will visit wineries in The Dalles area. The bus will leave the PSU Geology Department at 9:30 a.m. and return around 6:00 p.m. Bring a sack lunch and prepare for a wonderful time. Cost is $40/person or $75/couple. Proceeds from the tour benefit the Marvin H. Beeson Undergraduate Research Award endowment. To reserve a place or get more information about the trip, contact Nancy Eriksson, 503-725-3022.

Wednesday Evening Seminar, June 20, time to be announced, "Navigating the Geology Web," a seminar for people who would like to learn where to find information on the internet about current geologic events (like earthquakes, tsunamis, volcanic eruptions), and other sites of interest.

GSOC Field Trip, Saturday, June 30, "Glacial Outburst Floods at Mount Hood," led by Ken Cameron, Oregon DEQ. This will be an opportunity to see field evidence that Ken discussed in his January 12 lecture.

GSOC Two-Day Field Trip, July 28-29, led by Terry Tolan, GSI Water Solutions, Inc, focusing on the structure and stratigraphy of the Columbia River Basalt Group in the Columbia Gorge and on the Columbia Plateau. Trip will be by two twelve-passenger vans and will require a one-night stay in The Dalles area. Reservations are required. Contact Richard Bartels (503-292-6939, bartbartels@comcast.net) for additional information and reservations.

President's Field Trip, September 5-9, to the Medford-Ashland area. See additional information in newsletter. If you are interested, contact Richard Bartels (503-292-6939, bartbartels@comcast.net).

PARKING AT PORTLAND STATE UNIVERSITY IS AVAILABLE AFTER 7 P.M. IN THE PARKING STRUCTURE ON BROADWAY DIRECTLY ACROSS FROM CRAMER HALL.

CHECK THE GSOC WEB PAGE FOR THE LATEST GSOC CALENDAR OF EVENTS, www.gsoc.org, OR CALL BEVERLY VOGT, 503-292-6939.

INTERNATIONAL POLAR YEAR (IPY) KICKS OFF!

by Carol Hasenberg

A recent issue of *Science* magazine (Vol. 315, March 16, 2007) contained a special section commemorating the kickoff of the International Polar Year (IPY), a 2-year collaboration of scientists worldwide to study earth science at the poles. Three previous international collaborations, First International Polar Year (1882-1883), Second International Polar Year (1932-1933), and The International Geophysical Year (1957-58), contributed a wealth of knowledge about the earth and its atmospheric, oceanic, and living systems, plus advanced the knowledge and practice of technologies used to study them. The current effort should produce all of those benefits, but with an underlying urgency to study the effects of changes to sensitive polar environmental systems.

Topics which are critical to the success of IPY include increasing our knowledge and ability to model oceanic circulation, and how it effects oceanic biology, chemistry, atmosphere and climate patterns, and sea-ice melting. Another key topic is understanding how increases in atmospheric and oceanic temperature affect the equilibrium and melting rates of land-based ice. Related to this topic is the modeling of sea-level rise over the coming century. An incidental topic, but one related to climate change, and more to the point, global economics, is the determination of locations of mineral resources in areas where ice is expected to melt.

The following are synopses of various articles from the *Science* issue, and may also contain additional information relevant to the topics gleaned from the IPY websites listed at the end of the article.

The Means to do the Research

One key aspect of IPY is that the concentrated effort affords the participating countries golden opportunities to develop new research infrastructure, rather to rely solely upon existing equipment to tailor research projects towards. For example, since the Antarctic is an excellent location for astronomical research, a new ten meter diameter South Pole Telescope, funded through the U.S. National Science Foundation Office of Polar Programs through a collaborative effort which included nine U.S. universities and several corporations, was erected at the Amundsen-Scott South Pole Station. It is the largest telescope ever built at the South Pole. The telescope was built during the 2006-2007 Antarctic summer and was successfully tested in February 2007.

Several research projects are involved in establishing climatic monitoring networks for scientific research on climate change. These include the National Oceanic and Atmospheric Administration (NOAA) program SEARCH to establish stations for long-term atmospheric research in Eureka/Alert Canada and Tiksi, Russia. These sites are part of a larger network of Arctic atmospheric research sites under the umbrella of IASOA (International Arctic Systems for Observing the Atmosphere), a research coordination program developed as an IPY effort. The European-based program DAMOCLES has its sights on researching the impacts and potential of a significantly reduced polar ice pack in the Arctic.

Countries which are relatively new to polar research now have an opportunity to build up their science programs as a result of IPY. China is taking advantage of this with its Dome Argus (Dome A) projects in Antarctica. China has been training expeditions out of its Zhongshan Station in East Antarctica since 1996 and conducted radar soundings of Dome Argus in 2005, which showed that the ice thickness of 3070 meters was twice that expected from modeling efforts. China hopes to start drilling the ice to reveal the nature of the climate over the past several hundred thousand years. They are investing many millions of dollars into the Polar Research Institute of China, including the headquarters in Shangai, Zhongshan and Great Wall Stations in Antarctica and the South Shetland Islands, respectively, their research vessel Snow Dragon, as their IPY infrastructure effort. China plans to develop infrastructure for geophysics

research and astronomy as well as the ice-coring program.

IPY researchers are also planning traverses of both land and sea in the Antarctic and Arctic. Seaborne research vessels are expensive both to fit and maintain. Researchers are scrambling to secure enough research vessels to fill their needs. German and U.S. research vessels have been dedicated to the two-year IPY effort, but researchers from other countries must compete with others to rent vessels. IPY researchers must also compete with oil and mineral companies and ecotourists for boat space in addition to other scientists. This difficulty has fostered collaborative efforts between researchers to enable their projects. One example of this is the AGAVE project whose NSF-funded mission is to launch autonomous vehicles to search for undiscovered life forms in the Arctic ice pack, joined with Japanese and German Arctic projects when ships became too difficult to find on their own. Antarctic land traverses are also planned by many countries, including the U.S., Australia, China, several European countries, and Japan. These will include missions to drill ice cores, sample local climates, analyze snow pack, and perform aerial photography.

Collaborations with Indigenous Peoples of the Arctic

Arctic scientists are collaborating much more in recent times with Arctic indigenous peoples. These collaborations include sampling the information pool of arctic natives for comparison with scientific data, supplementing instrumented remote data with indigenous field observations, incorporating indigenous personnel into field missions, incorporating scientists into the migrations of indigenous peoples, and disseminating scientific information to native peoples for their benefit. There are many advantages to working with Arctic natives, who have a centuries-old culture based upon wandering about the Arctic and observing the nature and rhythms of its animals, snow and ice, weather, etc. The difficulties involved in these efforts include incorporating the knowledge into quantifiable records, the intellectual property rights of indigenous knowledge, and other cultural differences.

Divvying up the Arctic Basin for Science or Profit

There are many exploration projects afoot targeting the Arctic Basin – and not just for studying changes to earth's climate. USGS has estimated that perhaps a quarter of the earth's undiscovered oil and gas reserves lie in the Arctic Basin. A United Nations territorial claim law, the Law of the Sea, allows a nation to claim underwater rights beyond the 200-mile limit when there exist submerged protuberances of its landmass. Crossing the Arctic Basin are several prominent ridges, running parallel to one another between Greenland and Russia. Claims are being made by Canada, Denmark (who holds Greenland) and Russia for parts of these, and the claims need to be backed by exploratory research to determine their validity.

Meanwhile the Arctic Ocean still contains a lot of ice, making research difficult. One set of deep sea cores were brought up in 2004, which covered a time period of at least 55 million years, assisting scientists in discovering information about the region's past climate. Three icebreakers working in tandem were required to perform this feat. More such projects are being planned although current access is very difficult. Other exploration plans include launching seismic sounding buoys to drift in the pack ice currents and to map the sea floor. Another idea is to explore the Arctic by hovercraft.

So this huge effort to study at the earth's poles is costing billions of dollars, employing many teams of scientists from all over the world, and will no doubt produce many startling discoveries about this changing earth. Look for future articles on the progress of IPY in future Geological Newsletters.

Editor's Afterward

If these tantalizing tastes of polar discovery have intrigued you (the reader), I suggest you go to the library to read some of the articles for your self. Multnomah County Library main branch in downtown Portland has a copy in the periodicals section. Or check out the following references.

Article References:
Pennisi, Elizabeth, Smith, Jesse, and Stone, Richard, "Momentous Changes at the Poles," *Science*, Vol. 315, March 16, 2007, p. 1513.

Mervis, Jeffrey, "IPY Means Doing What it Takes to Get to the Ends of the Earth," *Science*, Vol. 315, March 16, 2007, pp. 1514-1517.

Couzin, Jennifer, "Opening Doors to Native Knowledge," *Science*, Vol. 315, March 16, 2007, pp. 1518-1519.

Krajick, Kevin, "Race to Plumb the Frigid Depths," *Science*, Vol. 315, March 16, 2007, pp. 1525-1528.

South Pole Telescope website, University of Chicago: http://spt.uchicago.edu/

SEARCH NOAA website (there are also other SEARCH websites):
http://www.esrl.noaa.gov/psd/psd3/arctic/search/

Further reading:
Science magazine website: www.sciencemag.org
Online information/articles from this issue of *Science* magazine:
http://www.sciencemag.org/cgi/content/summary/315/5818/1514?ck=nck

IASOA website: http://www.iasoa.org

DAMOCLES website: http://www.damocles-eu.org/

ICSU/WMO IPY website: http://www.ipy.org/

U.S. IPY website: http://www.us-ipy.org/

US Government IPY website: http://www.us-ipy.gov/

NOAA IPY website:
http://www.arctic.noaa.gov/ipy-noaa.html

Canadian IPY website: http://www.ipy-api.ca/english/

Australian Government IPY website:
http://www.aad.gov.au/default.asp

Wikipedia IPY website:
http://en.wikipedia.org/wiki/International_Polar_Year

BOARD MEETING NOTES

April 14, 2007

The meeting was called to order by President Richard Bartels using the GSOC wooden mallet at the home of Past President Rosemary Kenney,. Board and GSOC members present included Richard (Bart) Bartels, Janet Rasmussen, Marvel Gillespie, Jan Kem, Larry Purchase, John Newhouse, Bonnie Prange, Tara Schoffstall, and Rosemary Kenney.

Vice President Janet Rasmussen is planning Dr. Robert Miller (OSU) to be our May 11 speaker, Dr. Todd Jarvis (OSU) to be our June 8 speaker, and Richard Bykowski (U of O) to be the July 13 speaker. Janet expressed concerns about a possible large audience for Richard Bykowski's talk on dinosaurs in general and on Triceratops specifically because of a potential influx of young people. She will pursue the possibility of obtaining a larger room at a reasonable cost.

Tara Schoffstall has decided to run the GSOC seminar on alternate months (April, June, and August).

The current planned field trips will be Scott Burns' 6th Annual Terroir Tour (June 10), Ken Cameron's Glacial Outburst Floods at Mt. Hood (June 30), Terry Tolan's two day trip to the Columbia Gorge and Washington's Columbia Plateau (July 28-29), President's Field Trip to the Klamath Mountains & Rogue River Valley with Jad D'Allura and Bill Elliott from SOU (Sept 5-9). Other possible trips were discussed. These included a downtown Portland building stone tour and glacial erratics and flood features. Larry will investigate the possibility of a trip to see the now famous pseudo-coprolites near Toledo, Washington. Also the possibility exists

for a three-day camping trip to see the basin and range topography, pluvial lakes and volcanism in south-central Oregon if not this year perhaps in 2008.

GSOC participation in the late summer Geology Symposium and the February Fossil Fest was planned, including a promotional banner, DVD projector, and pamphlet.

The GSOC board also made plans to purchase a sound system for field trips and some meetings.

Bonnie will investigate the possibility of co-hosting the "Orphan Tsunami of 1700" talk by Brian Atwater (USGS). This potential talk would be a special event in which they would want a room/auditorium that could seat 200 people. Our expense would be only obtaining the room. Brian suggested either PSU or perhaps OMSI for the event. The lecture series is sponsored by the Incorporated Research Institutions for Seismology and the Seismological Society of America. Some information is available at the web site, http://www.iris.edu/services/lectures/iris_ssa.htm. IRIS and SSA cover travel, the speaker's travel expenses, and provide complimentary materials to attendees (which includes a CD of earthquake and tsunami publications in pdf form to our group).

Larry reported that he has the CD's of Curt Peterson's talk from the GSOC annual banquet and references. These will be eventually stored in our library and members would be able to use them.

Each year GSOC is invited to attend a PSU "Thank You" event because we give $800 to the PSU Geology Scholarship Fund each November. Last year Rosemary, Beverly, and Bart attended and had a great time and met with two students from the department. In May, Rosemary, Jan, and perhaps another GSOC representative will attend this year's event.

Probably the most important issue of the meeting was to fill vacancies that exist in GSOC. Jan Kem will become the new Business Manager with Rosemary as his experienced Assistant Business Manager. The vacancy for Historian will be filled by Rosemary who is obviously the most qualified.

edited from GSOC Board Meeting Minutes by Beverly Vogt, secretary

FIELD TRIP INFORMATION - MARK YOUR CALENDAR!

JULY 28-29 Two day trip by passenger vans led by Terry Tolan, GSI Water Solutions, Inc. Trip would involve one night motel (and possibly camping) in The Dalles. Details and cost is unknown at this time. Content of the trip would be similar to his October 2006 lecture to GSOC. Areas to be covered by the field trip would be the Columbia River Gorge and up into the Coumbia Plateau.

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GSOC members who will plan on attending these field trips should call Richard Bartels (503-292-6939) or e-mail him at bartbartels@comcast.net. This information would be helpful in planning these two trips.

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JUNE 2007

THE GEOLOGICAL NEWSLETTER

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VOL. 73, NO. 6
JUNE 2007

Richard Bartels, President, 503-292-6939, bartbartels@comcast.net
Acting Calendar Editor, Beverly Vogt, 503-292-6939, bevvogt@comcast.net

JUNE ACTIVITIES

Friday Evening Talk, June 8, 8 p.m., "Community-Based Approach to Mitigating Potential Conflict over Groundwater Resources, Umatilla Sub-Basin, Oregon," talk by Dr. Todd Jarvis, Institute for Water and Watersheds, Oregon State University. Location: Room S17, Cramer Hall, PSU. Meet us at 6:00 p.m. at Hot Lips Pizza, 1909 SW 6th, for informal dinner before the lecture. Look for the table with a GSOC sign.

PSU Field Trip, June 10: Sixth Annual Terroir Tour: "Geology, Soils, and Wines," led by Dr. Scott Burns, Geology Department, Portland State University. The one-day bus tour will visit wineries in The Dalles area. The bus will leave the PSU Geology Department at 9:30 a.m. and return around 6:00 p.m. Bring a sack lunch and prepare for a wonderful time. Cost is $40/person or $75/couple. Proceeds from the tour benefit the Marvin H. Beeson Undergraduate Research Award endowment. To reserve a place or get more information about the trip, contact Nancy Eriksson, 503-725-3022.

Wednesday Evening Seminar, June 20, 7:30 p.m., "Navigating the Geology Web," a seminar for people who would like to learn where to find information on the internet about current geologic events (like earthquakes, tsunamis, volcanic eruptions), and other sites of interest. Location: Room 69, Cramer Hall, PSU.

GSOC Field Trip, Saturday, June 30, 9:00 a.m., "Glacial Outburst Floods at Mount Hood," led by Ken Cameron, Oregon DEQ. This will be an opportunity to see field evidence that Ken discussed in his January 12 lecture. Cost is $5 per member, $8 for nonmembers. Meet in the shopping center at the Welches traffic light intersection on Highway 26 on the way to Mount Hood. Bring lunch and water, dress appropriately, and wear good walking shoes and boots. If you plan to attend or have any questions, contact Richard Bartels (503-292-6939, bartbartels@comcast.net).

FUTURE ACTIVITIES

Look for details about these activities in upcoming issues of the GSOC Newsletter

GSOC Two-Day Field Trip, July 28-29, led by Terry Tolan, GSI Water Solutions, Inc, focusing on the structure and stratigraphy of the Columbia River Basalt Group in the Columbia Gorge and on the Columbia Plateau. Trip will be by two twelve-passenger vans and will require a one-night stay in The Dalles area. Reservations are required. Contact Richard Bartels (503-292-6939, bartbartels@comcast.net) for additional information and reservations.

President's Field Trip, September 5-9, to the Medford-Ashland area. If you are interested, contact Richard Bartels (503-292-6939, bartbartels@comcast.net).

PARKING AT PORTLAND STATE UNIVERSITY IS AVAILABLE AFTER 7 P.M. IN THE PARKING STRUCTURE ON BROADWAY DIRECTLY ACROSS FROM CRAMER HALL.

CHECK THE GSOC WEB PAGE FOR THE LATEST GSOC CALENDAR OF EVENTS, www.gsoc.org, OR CALL BEVERLY VOGT, 503-292-6939.

INTERNATIONAL POLAR YEAR (IPY) KICKS OFF! – part 2

by Carol Hasenberg

A recent issue of *Science* magazine (Vol. 315, March 16, 2007) contained a special section commemorating the kickoff of the International Polar Year (IPY), a 2-year collaboration of scientists worldwide to study earth science at the poles. Three previous international collaborations, First International Polar Year (1882-1883), Second International Polar Year (1932-1933), and The International Geophysical Year (1957-58), contributed a wealth of knowledge about the earth and its atmospheric, oceanic, and living systems, plus advanced the knowledge and practice of technologies used to study them. The current effort should produce all of those benefits, but with an underlying urgency to study the effects of changes to sensitive polar environmental systems.

Topics which are critical to the success of IPY include increasing our knowledge and ability to model oceanic circulation and how it affects oceanic biology, chemistry, atmosphere and climate patterns, and sea-ice melting. Another key topic is understanding how increases in atmospheric and oceanic temperature affect the equilibrium and melting rates of land-based ice. Related to this topic is the modeling of sea-level rise over the coming century. An incidental topic, but one related to climate change, and more to the point, global economics, is the determination of locations of mineral resources in areas where ice is expected to melt.

Last month, the Geological Newsletter article described some of the ways that researchers are getting to the research sites, the use of native knowledge in the research, and the economic and territorial incentives for exploring the Arctic Ocean. This month we will focus upon some of the oceanic and climate studies being conducted.

Methods and Results for Determining Shrinking Rates for Land-Based Ice Sheets

There are several key questions that are high on the priority list in determining the climate change ramifications of global warming. One of these is to determine if land-based ice sheets are shrinking, and how fast they are shrinking. One reason that land-based ice is important is that the melting of these ice sheets can dramatically increase sea levels around the world. The combined reservoirs of ice in the Antarctic and Greenland ice sheets is enough to make sea levels rise by 70 meters (230 feet).

The favored approach to calculating the changes in the ice sheets is to take measurements of the ice sheets on a regular basis in order to calculate either the changing volume, then the changing mass of the ice, or the changing mass of the ice directly. This is known as either mass-budget or mass balance analysis. There are three popular methods for performing these analyses:

- Altimetry readings of the ice – these measurements can be taken by satellite or aircraft using radar, and laser technology.
- Measuring the gravitational attraction of the ice sheets using the GRACE (Gravity Recovery and Climate Experiment) satellites.
- Interferometric synthetic aperture radar (InSAR)

The mass balance of the ice sheets is determined by calculating the difference between the inflows in the ice system less the outflows from the system. Inflows come in the form of snowfall, and outflows occur when ice leaves the system, either by melting directly from the ice sheets or ice flowing off the land and into the sea, usually in an ice stream called an outlet glacier.

The inflows of snowfall are estimated volumetrically; then these volumes must be converted to mass to determine the mass inflow. This is a bit tricky, since the mass density of snow and ice differ by a factor of about 3, so scientists have to be able to also estimate the densities through the snow-ice column.

The outflows can be estimated volumetrically where they affect the ice elevations, but also they are estimated from the flow rates of the outlet glaciers.

Current models based upon the methods described above show different and varying results for the ice mass balance of the Greenland, West Antarctic, and East Antarctic Ice Sheets. The West Antarctic Ice Sheet, or WAIS, lies above the smaller lobe of the Antarctic continent and includes the Antarctic Peninsula. The East Antarctic Ice Sheet, or EAIS, covers the main body of the continent and is described in the Shepherd-Wingham article (referenced below) as the "largest reservoir of ice on earth". Size, bedrock characteristics and location play important roles in the melting or thickening and are responsible for the overall differences in the mass balance results for the different ice sheets.

The Greenland Ice Sheet, or GIS, is the most sensitive to the warming of the climate, since it contains one-tenth of the ice that Antarctica contains and is also situated furthest from the poles. All but one of the recent predictions for the GIS mass balance reported in the Shepherd-Wingham article predict a negative net mass balance, or yearly mass loss, for the GIS. The Greenland outlet glaciers also doubled their flow rates between the mid 1990's and mid 2000's, although the rate has slowed down in the past two years. Scientists are working hard to figure a way to model the mechanisms which contribute to outlet glacier flow speed, which seems to be critical for predicting the net mass balance of ice.

Most of the current mass balance models are predicting about half the rate of mass loss for WAIS as that for the GIS. Rapidly diminishing marine ice shelves floating around the Antarctic Peninsula are given credit for accelerating the outlet glacier rates in that area.

In contrast to the other ice sheets, the EAIS is the largest and most stable of the three. Model results for mass balance vary, but most predict a modest net gain in ice according to current conditions, about one-third of the mass loss predicted for GIS. The conditions which contribute to this are a year-round freezing atmosphere which does not contribute surface ice melting, increased snowfall from the global warming, ice thickness, and ocean boundary conditions.

Despite the recent advances in measurement technology, results of the models for determining ice mass losses or gains are still highly variable (in several models, the variation in accuracy exceeds the predicted amount of loss or gain!) and not in close agreement between the methods used. Much work needs to be done to correct this imprecision. The character and effect of boundary conditions such as marine ice shelves, sub-surface roughness and slope, and sub-glacial water on outlet glacier flow must be determined before outlet glacier flow rates can be predicted. The density characteristics of the ice columns need to be studied, and the meteorological conditions (snowfall, temperature, etc.) must be predictable. Scientists will be doing many field investigations during IPY to better understand these models.

Editor's Afterward

If these tantalizing tastes of polar discovery have intrigued you (the reader), I suggest you go to the library to read some of the articles for your self. Multnomah County Library main branch in downtown Portland has a copy in the periodicals section. Or check out the following references.

Article References:

Shepherd, Andrew, and Wingham, Duncan, "Recent Sea-Level Contributions of the Antarctic and Greenland Ice Sheets," *Science*, Vol. 315, March 16, 2007, pp. 1529-1532.

Vaughan, David G., and Arthern, Robert, "Why Is It Hard to Predict the Future of Ice Sheets?," *Science*, Vol. 315, March 16, 2007, pp. 1503-1504.

Howat, Ian M., Joughin, Ian, and Scambos, Ted A., "Rapid Changes in Ice Discharge from Greenland Outlet Glaciers," *Science*, Vol. 315, March 16, 2007, pp. 1559-1561.

AGU Release No. 98-30, "Scientists to report on vast Antarctic ice sheet, seek clues to its future," *American Geophysical Union News*, September 2,

1998,
http://www.agu.org/sci_soc/prrl/prrl9830.html

NASA's Earth Science Enterprise ICESat mission website home http://icesat.gsfc.nasa.gov/, mission descriptions http://icesat.gsfc.nasa.gov/icesat_science_mission.php, and latest Antarctica ice sheet elevation readings http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img%20id=16758 describe the latest research in laser altimetry for determining ice sheet mass balance. The mission description has a very well written description of the theory and process of the mass balance problem addressed by this method.

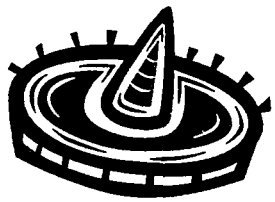
Further reading:
Science magazine website: www.sciencemag.org
Online information/articles from this issue of *Science* magazine:
http://www.sciencemag.org/cgi/content/summary/315/5818/1514?ck=nck

Appenzeller, Tim, "The Big Thaw," *National Geographic*, Volume 211, No. 6, June 2007, http://www.ngm.com/climateconnections.

USGS InSAR website:
http://volcanoes.usgs.gov/insar/

NASA Jet Propulsion Laboratory GRACE website page:
http://sse.jpl.nasa.gov/scitech/display.cfm?ST_ID=186

EL NIÑO/LA NIÑA PHENOMENA AND PREDICTIONS



Synopsis of Friday, May 11, 2007, GSOC meeting featuring Dr. Robert Miller delivering his lecture "El Niño: What Does It Meaño?"

GSOC members at last month's Friday night lecture were treated to a fascinating talk about the El Niño climate phenomenon by a preeminent mathematical climate modeler – Dr. Robert Miller of Oregon State University's College of Oceanic and Atmospheric Sciences (COAS). Dr. Miller has been working on climate models since obtaining his PhD from U. C. Berkeley in 1976.

The sort of climate models that Dr. Miller develops combine the effects of wind and water motion, and take a tremendous amount of computing power to perform. Dr. Miller uses these models to predict the occurrences of El Niño in the Pacific Ocean.

To introduce the El Niño phenomenon, Dr. Miller explained that it is important to understand a few basic facts about the circulation of water in the Pacific Ocean. First, it has long been understood that the warmest water in the ocean is not located at the equator, as one might think. The reason for this is the interaction of wind and water. The westward-blowing trade winds are centered at the equator, but the surface water does not flow due west as a result – instead, water north of the equator flows northwest and water south of the equator flows southwest, creating a suction force for upwelling of deeper water to replace the water leaving. This phenomenon is especially prominent in the Pacific Ocean, the largest body of water on the earth and with a very wide width at the equator. As such it can store a vast amount of heat and has been referred to as a "climatic flywheel".

On a normal year, the surface water in the Pacific Ocean is warmer to the west than the east due to

this circulatory phenomenon. Particularly cold is the water off the coast of Peru, and also this cold water coming from the depths of the ocean is very nutrient rich (as nutrients tend to sink towards the bottom of the ocean). Peru is one of the richest fisheries on the earth for this reason.

The El Niño phenomenon usually manifests itself in the season before Christmas, so it was given this name in commemoration of the season by the Peruvian fishermen. El Niño differs from a normal year in that the trade winds do not blow as strongly, and as a result, a belt of warm water stretches across the Pacific rather than only at the western side. Upwelling is reduced, and fishing is "lousy". El Niño episodes affect the climate world-wide. One of the most prominent climatic effects of El Niño is the reduction of the Indian monsoon rains. In this part of the world the El Niño phenomenon is known as the Southern Oscillation, so scientists often refer to the weather pattern as ENSO (El Niño Southern Oscillation).

The reverse situation to El Niño (ENSO) occurs when the trade winds are stronger than normal. This has been dubbed the La Niña phenomenon, and is characterized by stronger than normal upwelling of cold water in the eastern Pacific.

Dr. Miller also explained the role of state of the art climatic models on predicting the occurrences of the El Niño/La Niña phenomena. Right now the models are able to predict occurrences as far out as about nine months. This does not mean that they can predict what the weather will be like at any one location that far in advance – weather predictions cannot now be made more than one week in advance. Also, when asked about whether the models input solar conditions or other outside influences on the climate, Dr. Miller answered that they did not have that capability. Dr. Miller also said that it was very difficult for the models to incorporate the generation and effect of clouds on the climate.

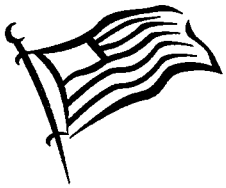
Dr. Miller was asked two very interesting questions after his lecture. The first question was what the current ENSO predictions were for this year. He answered that there is a prediction for an upcoming La Niña phenomenon. The reader may follow this by monitoring the NOAA National Center for Environmental Prediction (NCEP) website (http://www.cpc.ncep.noaa.gov/). Dr. Miller also mentioned that 2006 was a mild ENSO year.

The second question asked was what the effect of global warming was on the ENSO cycles. Since the monitoring of the phenomenon is fairly recent, Dr. Miller answered that there is no way to answer this question currently. The discussion then drifted towards the possibility of the disruption of oceanic currents by global warming. Dr. Miller is skeptical of this possibility because of two major physical phenomena which drive the production of oceanic currents. First, the wind which drives the currents is caused by solar radiation which will not go away; and second, the temperature differences between the poles and the equator also create currents.

Carol S. Hasenberg

Editor's note: One of the referred articles on the NOAA NCEP website, El Niño/ La Niña FAQ page (http://www.pmel.noaa.gov/tao/elnino/faq.html#often), has this to say concerning the frequency of El Niños:
"The tendency for more frequent El Niño events and fewer La Niña events since the late 1970's has been linked to decadal changes in climate throughout the Pacific basin. Aspects of the most recent warming in the tropical Pacific from 1990 to 1995, which are connected to but not synonymous with El Niño, are unprecedented in the climate record of the past 113 years. There is a distinction between El Niño (EN), the Southern Oscillation (SO) in the atmosphere, and ENSO, where the two are strongly linked, that emerges more clearly on decadal time scales. In the traditional El Niño region, sea surface temperature anomalies (SSTAs) have waxed and waned, while SSTAs in the central equatorial Pacific are better linked to the SO and have remained positive from 1990 to 1995. We carry out several statistical tests to assess the likelihood that the recent behavior of the SO is part of a natural decadal-timescale variation...Both the recent trend for more ENSO events since 1976 and the prolonged 1990-1995 ENSO event are unexpected given the previous record, with a

probability of natural occurrence about once in 2,000 years. This opens up the possibility that the ENSO changes may be caused by the observed increases in greenhouse gases."
from abstract for Trenberth, K., and T. J. Hoar, 1995: "The 1990-1995 El Niño-Southern Oscillation Event: Longest on Record," *Geophysical Research Letters*, 23, 57-60.



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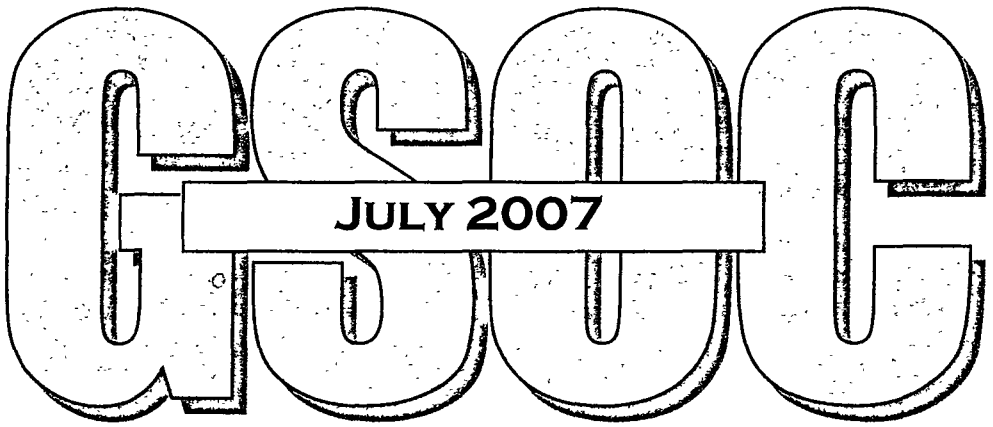

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COMMUNITY-BASED APPROACH TO MITIGATING POTENTIAL CONFLICT OVER GROUNDWATER RESOURCES – UMATILLA SUB-BASIN, OREGON.

from the June 8, 2007 talk by Todd Jarvis, Inst. For Water & Watersheds, OSU
todd.Jarvis@oregonstate.edu
by Evelyn Pratt

Todd Jarvis has a post-graduate certificate in conflict resolution in water resources from Dr. Wolff, OSU. He's been studying the Umatilla Basin, which includes areas from Milton-Freewater to Pendleton. His presentation was a quick yet detailed summary of a very complex issue – water rights in a part of Oregon with a limited supply of a very sought-after resource.

Hydrogeologists can help people communicate with each other over complex water problems. The Umatilla Basin has many overlapping legislative boundaries, so conflict is a given. Water levels have declined 200-300 feet in some places in the basin, and in a couple of spots, up to 500 feet.

Deeper basalts are the principle aquifers. More than 90% of the water is used for agriculture.

Any change in governing a resource leads to conflict. Jarvis showed a pie chart with six pieces, labeled Circle of Conflict: values, relationships, data, structure, interests, and identity. Boundary conflicts can be natural, human, based on "hydrocommons", or based on groundwater boundaries. In Sept. 2008 there'll be a big international groundwater conference at Edgefield, Portland, to make decisions about some of these. There are two main ways of making such decisions: technology-regulated, where a particular agency is the arbitrator, and discourse-based, which is collaborative. All too often such a conference is based on the 3 I's – Inform, Invite, and Ignore.

Discourse-based learning is collaborative. Around 1992 this kind of discussion started in forestry, [featuring] conflict resolution between science and traditional/local knowledge. Approaches used are: informing and engaging citizens, systems thinking, [looking at] concerns and improvements, and seeing what is desirable and feasible. The groundwater domain has a lot of dueling experts, and all have their own lawyers. These include agriculture, municipalities (counties, cities), fisheries, ecological interests, soil and water conservation districts, et al. There's a strong need for scientists to be mediators.

Today's problem is the intensive use of non-renewable groundwater. Should the aquifer, which has dropped 200-500 feet in the last 50 years, be depleted, stabilized, and/or recovered? What time frame? One problem is that groundwater moves. This means there's always a risk of investing time and money into groundwater and having someone steal it.

The most successful approach so far is to mount intensive public awareness campaigns. Use the news media. Emphasize that "groundwater depletion is a global problem." Many farmers know there's a problem, but don't know what to do about it. There are a lot of unknowns. When approached for funds, the Feds say, "Wish we could help, but we're at war."

Thanks to such things as 30-second radio spots, talks to schools, et al, Umatilla Basin's getting cooperation and getting equipment for the retrieval and storage of groundwater. The idea is to keep trying to get the public to say, "I finally get it." It often takes as much as a couple of years for the message to get through. To clear up all the legalities might take as long as ten.

Multiple working hypotheses are needed; a community will never have all the information, but must go ahead anyway. The agriculture industry in Umatilla county has generally been cooperative, but the municipalities are not always so.

Pendleton is proud of its water treatment. The city reinjects waste water into shallow ground storage. Drinking water comes from deep in a basalt aquifer.

BOARD MEETING NOTES

June 9, 2007

The meeting was called to order by President Richard Bartels using the wooden mallet at the home of Rosemary Kenney, 7000 SW 15th Ave, Portland. Board and GSOC members present included Richard Bartels, Janet and Doug Rasmussen, Beverly Vogt, Marvel Gillespie, Jan Kem, Larry Purchase, John Newhouse, Bonnie Prange, and Rosemary Kenney.

The Annual Picnic will be held on August 12 At Beacon Rock State Park in Washington. See the announcement in the calendar, website, or page ___ of the newsletter.

Vice President Janet Rasmussen reported that Richard Bykowski (UofO) would be the July 13 speaker. Upcoming tentative speakers include Doug Larson on Oregon Lakes, and Sherry Cady on thermophiles. Because the July talk on dinosaurs may attract a large audience, Janet will make sure we have access to extra chairs from another nearby room.

The current planned field trips will be Scott Burns' 6th Annual Terroir Tour (Juné 10), Ken Cameron's Glacial Outburst Floods at Mt. Hood (June 30), Terry Tolan's two day trip to the Columbia Gorge and Washington's Columbia Plateau (July 28-29), President's Field Trip to the Klamath Mountains & Rogue River Valley with Jad D'Allura and Bill Elliott from SOU (Sept 5-9). Bev and Bart will check out the possibility for a three-day camping trip to see the basin and range topography, pluvial lakes and volcanism in south-central Oregon--if not this year perhaps in 2008.

GSOC has purchased a portable DVD player. Plans are being made for GSOC's participation in the Fossil Fest in February.

GSOC board members plan to order the Chattervox speaker system and have it available to try out at Ken Cameron's trip on June 30.

GSOC board members discussed plans for a jointly sponsored tsunami talk featuring Brian Atwater. It will probably be sometime during the first two weeks in November and should not conflict with our Friday night lecture.

The GSOC board plans to appointed the Banquet Committee be by the next meeting so they can start looking for a new location as soon as possible.

The next board meeting will be on August 12 at 10 a.m. at Beacon Rock before the Annual Picnic. The meeting was adjourned.

edited from GSOC Board Meeting Minutes by Beverly Vogt, secretary

2007 GSOC FIELD TRIP INFO – MARK YOUR CALENDARS!

JULY 28-29 Two-day trip by passenger vans led by Terry Tolan, GSI Water Solutions,Inc. Trip will involve one-night in motel (or possibly camping) in The Dalles. Details and cost are unknown at this time. Content of the trip will be similar to Tolan's October 2006 lecture to GSOC. Areas to be covered by the field trip are the Columbia River Gorge and up into the Columbia Plateau.

SEPTEMBER 5-9 President's Field Trip to the Medford-Ashland Area. First and last days are for travel from and to Portland. Jad D'Allura (SOU) will lead us along the Klamath River (CA-94) on September 7. Bill Elliott (SOU) will lead us on September 8 to look at the Late Cretaceous Hornbrook Formation and younger Tertiary units.

GSOC members who will plan on attending either or both of these field trips should call Richard Bartels (503-292-6939) or e-mail him at bartbartels@comcast.net. He needs to know the number of people planning on attending the trips.

GSOC ANNUAL PICNIC

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

GSOC will provide plates, eating utensils, and paper cups, as well as coffee and non-alcoholic beverages. We will not be grilling this year, but just having a potluck meal. If your last name begins with A through G, bring a main dish; H through P, bring a side dish or salad; Q through Z bring dessert. Alcoholic drinks (other than kegs) are permitted, bring your own if desired.

GSOC President Richard Bartels will give an overview of Beacon Rock geology. Some members would like to hike to the top of Beacon Rock, or perhaps to the waterfall in the woods. We encourage anyone with musical abilities to bring their instrument for entertainment and sing-alongs.

WEBSITES COVERING RECENT VOLCANIC ERUPTIONS AND EARTHQUAKES

You may have heard of the recent seismic/magma activity under the Kilauea volcano in Hawaii. Here is information from the USGS Hawaii Volcanoes Observatory (HVO) website about this activity and the sites you can get more information from:

USGS HVO Status site (http://volcano.wr.usgs.gov/hvostatus.php):

"Kilauea Daily Update issued Jun 18, 2007 18:32 HST Volcanic-Alert Level WATCH - Aviation Color Code ORANGE
Report prepared by the Hawaiian Volcano Observatory (HVO):

Earthquake Swarm Beneath Kīlauea's Upper East Rift Zone Continues

"The earthquake swarm in the upper East Rift Zone of Kīlauea that started early Sunday morning, June 17, is continuing. From midnight to 3:45 p.m. on June 18, HVO located about 3 earthquakes greater than magnitude-1.7 per hour, down from the average of 12/hr yesterday, June 17. At 3:45 p.m. today, HVO detected an increase in earthquake activity between Makaopuhi and Napau craters, farther east than previous quakes, that lasted about an hour. During this increase, the earthquakes were occurring at near yesterday's rate. As of this posting, the rate of earthquake occurrence has again decreased."

"This morning, HVO scientists inspected Pu`u `O`o vent and the entire flow field. The crater floor within the vent had dropped about 20 m. Several spatter cones within the crater had further collapsed into pits...This information strongly suggests that activity at Pu`u `O`o has decreased substantially in response to the June 17 intrusion.

"Such an effect on the activity at Pu`u `O`o has been expected because similar past events, most recently the 1997 episode 54 eruption and the 1999 intrusion, resulted in cessation of Pu`u `O`o activity for several days to weeks.

"All data indicate that an intrusion of magma started in the Mauna Ulu area early Sunday morning and moved slowly 5 km (3 miles) east along the rift zone throughout June 17. This afternoon, the intrusion moved a bit farther east in a burst of earthquake activity starting at about 3:45 p.m."

USGS Hawaiian Earthquakes site:
http://tux.wr.usgs.gov/

"USGS HVO News Release
June 19, 2007 9:00 a.m.

"The intrusion of magma that was signaled by a swarm of earthquakes and rift zone widening over the last two days has finally made it to the surface. Early this morning, HVO scientists confirmed that a small outbreak of lava had oozed from a 250 m long fissure in the forest northeast of Kane Nui o Hamo, approximately 6 km west of Pu`u `O`o and 13 km southeast of Kilauea summit. In addition, steam was issuing profusely from a spot high on the north flank of Kane Nui o Hamo. This event will be called Episode 56 of the ongoing eruption.

"When observed at about 7 a.m., the lava was cooling and not advancing. Steam and gas were issuing from the fissure. The outbreak appeared to be a short one that had been over for at least a few hours by the time it was seen this morning. This may be related to the abrupt eastward migration of earthquake epicenters into this area noted between 3:45 and 5 p.m. yesterday. Small earthquakes continue to occur in the area at low levels."

USGS HVO Home page:
http://hvo.wr.usgs.gov/

Other geology news sites of interest:

Geology/Earth Science News from Geology.com:
http://geology.com/news/

NASA Earth Observatory Newsroom:
http://earthobservatory.nasa.gov/Newsroom/

Volcano World Current Volcano Activity:
http://volcano.und.edu/vwdocs/current_volcs/current.html

GEOLOGICAL SOCIETY OF
THE OREGON COUNTRY
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GSOC

AUGUST 2007

THE GEOLOGICAL NEWSLETTER

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ACTIVITIES:

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

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INFORMATION: www.gsoc.org

VOL. 73, NO.8
August 2007

Richard Bartels, President, 503-292-6939, bartbartels@comcast.net
Acting Calendar Editor, Beverly Vogt, 503-292-6939, bevvogt@comcast.net

AUGUST ACTIVITIES

Annual Picnic, August 12, Beacon Rock State Park, Washington. Board Meeting at 10:00 am, followed by potluck picnic for everybody at noon. Drive east on Hwy. 14 from Vancouver, Washington, for 35 miles. We have reserved the upper picnic area (signs will be posted) until dusk. The picnic area is covered and has electricity and water. There is no day use or parking fee charged; however, GSOC will assess $5 per person to cover facility rental and other costs. GSOC will provide plates, eating utensils, and paper cups, as well as coffee and non-alcoholic beverages. We will not be grilling this year, but just having a potluck meal. If your last name begins with A through G, bring a main dish; H through P, bring a side dish or salad; Q through Z bring dessert. Alcoholic drinks (other than kegs) are permitted; bring your own if desired.

Because of the picnic, there will be no Friday night lecture or Wednesday night seminar in August.

FUTURE ACTIVITIES

Look for details about these activities in upcoming issues of the GSOC Newsletter

President's Field Trip, September 5-9, to the Medford-Ashland area. People interested in attending should contact Richard Bartels (503-292-6939, bartbartels@comcast.net) as soon as possible. See registration forms and other information about the trip in this Newsletter.

Because of the President's Field Trip, there will be no Friday night lecture or Wednesday night seminar in September.

Friday evening talk, October 12, 2007, 8 p.m., Dr. Sherry Cady, a professor at Portland State University, will give us an update on her research. She has studied extremophilic bacteria in Yellowstone National Park, the Kamchatka Peninsula, and southeastern Oregon hot springs. Location, Room S17, Cramer Hall, PSU. Meet us at 6:30 p.m. at Hot Lips Pizza, 1909 SW 6th, for informal dinner before the lecture. Look for the table with the GSOC sign.

Wednesday evening special talk, November 7, 2007, 7:30 p.m., Dr. Brian Atwater, author of "The Orphan Tsunami of 1700" will give a special talk on the tsunami of 1700 in Room 327/329, Smith Center, PSU. The talk is sponsored by GSOC, PSU, and Sigma XI. Look for more details in upcoming Newsletters.

Friday evening talk, November 9, 2007, 8 p.m., "The Origins of Lake Basins in the Pacific Northwest," our regular Friday night lecture by Dr. Doug Larson, PSU Adjunct Professor, Department of Environmental Sciences and Resources. Dr. Larson is a limnologist who has studied Pacific Northwest lakes and collected over 8,000 photographs of them over the past 40 years.

PARKING AT PORTLAND STATE UNIVERSITY IS AVAILABLE AFTER 7 P.M. IN THE PARKING STRUCTURE ON BROADWAY DIRECTLY ACROSS FROM CRAMER HALL.
CHECK THE GSOC WEB PAGE FOR THE LATEST GSOC CALENDAR OF EVENTS, www.gsoc.org, OR CALL BEVERLY VOGT, 503-292-6939.

FOR TRICERATOPS, THE JURY IS IN

from the July 13, 2007 talk, "Was Triceratops like a bison, rhino, or hippo?: Implications for lifestyle and habitat," presented by Richard Bykowski of University of Oregon. Bykowski has been working with Dr. Greg Retallack on new findings regarding this dinosaur and its natural environment.

Over the range of about 100 million years, from the late Jurassic to the end of the Cretaceous, the Ceratopsian Infraorder of dinosaurs showed three general trends. Early ceratopsians were bipedal, gracile, and lacked neck frills. By the end of the Cretaceous, ceratopsians such as Triceratops were quadripedal and robust, with conspicuously large neck frills.

Many of us remember the old images of dinosaurs from Charles Knight's paintings. Newer knowledge has made some of these images obsolete. In the paintings Triceratops was portrayed as a cold-blooded quadruped in a dry environment. Was there any anatomical evidence for the animal having an upright stance and being able to run and possibly to gallop? In short, being a bison- or rhino-like creature of dry plains? No. That picture has changed. Triceratops forelimbs were definitely somewhat sprawling. Its long scapular bones would have made fast movement almost impossible. Bison and rhinos have longer distal limb bones than proximal, enabling them to move at high speeds. Triceratops was built more like a hippo, with sturdy leg bones for weight support rather than for running.

To illustrate the range of Triceratops finds, Bykowski showed the GSOC audience a map of the north-south middle North American Cretaceous seaway on the east, an intermontane stretch of land in the middle, and north-south uplands to the west. During the earliest late Cretaceous, about 75 mya, the inland seaway was similar to the Gulf of Mexico. By 65 mya it had begun to dry up. Subducting plates to the west brought about the rise of an analogous volcanic chain similar to the modern Cascades. This in turn likely produced a rain shadow east of the mountains.

On this map the ranges of fossils of various dinosaurs were shown. The fossil faunal province furthest west included species such as Alamosaurus, Torosaurus, and Hadrosaurus that have been associated with areas that would have been dry, with shallow soils low in organic matter and high in calcium nodules – typical aridosols. The second fossil faunal zone included Ankylosaurus and Leptoceratops, the latter a ceratopsian with a small frill, lived in semi-arid zones, again dominated by aridosols. But Triceratops discoveries have nearly all been made along what were then humid coastal floodplains of the Cretaceous seaway. Fossil soils in these areas showed boggy, wet conditions with lots of peat, indicating low oxygen levels. These histosols are more indicative of swampy conditions.

The species of dinosaurs appear to be restricted to their local fossil zone. Triceratops fossils appear to be restricted to coastal areas where it was wet. Few, if any Triceratops specimens are found outside their province, making this a case of habitat selection as opposed to fossilization bias. Like hippos, their eyes were high enough on their heads to enable the animals to see above water without exposing too much skull.

Taking into account weight-bearing, non-running limb bones; ancient swampy soil in which Triceratops fossils have been found; and the high location of the eye sockets, it seems most likely that Triceratopsians were more hippo-like than bison or rhino-like. More work may establish what advantages the animals received from their rather fragile frills, and whether or not they could swim.

Evelyn Pratt

Nicaragua's Tectonic Setting and Natural Hazards

by Carol Hasenberg

This article is based upon a powerpoint show I prepared for students at Portland State University. The students were traveling to Nicaragua for an overseas program sponsored by the PSU Institute on Aging (IOA) last year. I traveled with the students as a faculty mentor in order to facilitate engineering projects some of the civil engineering students in my senior design project class were doing as part of the program. The student projects involved water supply and distribution improvements in retirement facilities in two cities in Nicaragua.

As part of the preparation for all the students in the IOA group, I prepared a slide show to introduce the natural geological hazards of Nicaragua. In my research I found the excellent website of the Nicaraguan Geosciences Institute (in Spanish), or INETER, which describes all of the hazards and includes many detailed interactive maps and photographs. There were also some reports for Nicaraguan geological hazards on the USGS website. In addition, I ordered a report produced in 1973 by the Earthquake Engineering Research Institute (EERI) that described the causes and results of the catastrophic 1972 earthquake in Managua, the capital city of Nicaragua. The EERI website also included slides that were taken in the reconnaissance for the production of the report. I would also recommend GSOC users to study the geophysical map of Mexico and Central America, titled 'The Dividing Link,' which has just been released as an insert in the August 2007 National Geographic Magazine. It has some excellent captions describing the major geophysical workings of the area, as well as three time-lapse diagrams depicting the geological history of the area.

Nicaragua, like most of Central America, has very active geology. Set on the boundary of the Cocos, North American, and Caribbean tectonic plates, Central America is a land of earthquakes, volcanoes, landslides, and tsunamis. The Cocos Plate, situated directly to the south of the land on the Pacific side, is subducting beneath the North American and Caribbean Plates to the north. These two plates are also separated by the Cayman Trench, which terminates in the Motagua fault in Guatemala. Earthquakes occur on these two major faults and also local crustal faults. The subduction rate for the Cocos Plate is about 80 mm per year, as opposed to the less active 34 mm per year rate for our subducting Juan de Fuca Plate in the Pacific NW. This subduction zone is responsible for producing earthquakes, volcanoes, landslides, and tsunamis along the Pacific side of Nicaragua.

Major earthquakes have struck Managua three times in recent history: 1885, 1931, and 1972. The December 23, 1972 Great Managua Earthquake had a magnitude 6.4, delivered in a series of 3 great shocks. The earthquake killed somewhere between 4,000 and 10,000 people and left 250,000 people homeless. A great fraction of the traditional rubble masonry dwellings in Managua were leveled. The earthquake destroyed critical resources and contributed to Nicaragua's economic and political turmoil. INETER now has a seismic network in place in the country to monitor seismic activity.

Nicaragua is also the home of many active volcanoes, some of which have erupted many times in the last 100 years. These volcanoes are located in a range parallel to the subduction zone of the Cocos Plate and about 50-100 miles inland. The names listed in the Nicaraguan Geosciences Institute website are Cosigüina, El Chonco - San Cristóbal - Casita, Telíca - Santa Clara, Rota, Cerro Negro - Las Pilas - El Hoyo - Asososca, Momotombo - Momotombito, Apoyeque - Chiltepe, Masaya, Apoyo, Mombacho, Zapatera, Concepción - Maderas, and Managua volcanoes Tiscapa, Nejapa, and Asososca. Pictures of these are available for viewing on both the INETER or Volcano World websites. The INETER website has a film clip of the January 2007 eruption of Telíca.

In conjunction with steep slopes of loose volcanic ash and debris come landslides. On October 30, 1998, Nicaragua experienced its worst natural disaster since the Managua earthquake. A mud avalanche on Casita volcano killed about 1600

people, as a result of heavy rains produced by Hurricane Mitch. The rainfall there for October 1998 was about 78 inches, many times the normal average.

Tsunamis are also a hazard in Nicaragua, and can be locally produced by earthquakes on the subduction zone or transported from afar. A deadly tsunami killed about 170 people along the Pacific coast of Nicaragua in 1992. Afterwards the government realized that this disaster could have been averted with a warning system, since the responsible earthquake occurred 45 minutes prior to the wave. As a result, a warning system was set into place along the coast.

Even though the western, Pacific side of Nicaragua is subject to these natural disasters, and is hot and dry much of the year, most of the population of the country lives there. The eastern, Caribbean side, nicknamed 'The Mosquito Coast,' is a wet lowland and receives the brunt of hurricanes that come to land here.

During my stay in Nicaragua, I traveled to several cities including Managua, Granada, and Masaya in the great valley between the coastal mountains and the volcanoes, Jinotepe in the coastal mountains, a small town on the Nicaraguan coast, and Matagalpa in the interior highlands. To my disappointment I never saw any of the active volcanoes, as there was a lot of air pollution from fires and other agricultural practices. We were there near the end of the dry season. If I return to Nicaragua someday I would very much like to see more of the natural landscape.

References and Additional Reading:

Nicaraguan Geosciences Institute, or INETER, website (in Spanish):
http://www.ineter.gob.ni/geofisica/geofisica.html

"The Great Managua Earthquake" by Jay Mallin
http://www.ineter.gob.ni/geofisica/sis/managua72/mallin/great01.htm

Managua, Nicaragua Earthquake of December 23, 1972, Earthquake Engineering Research Institute Reconnaissance Report, May 1973

Volcano World website:
http://volcano.und.edu/volcanoes.html - see Volcanoes in South America for Nicaraguan volcanoes

"Report on the October 30, 1998 avalanche and breakout flow of Casita Volcano, Nicaragua, triggered by Hurricane Mitch", November 14, 1998, www.eng.buffalo.edu/~mfs/Casitafinal.doc

"Casita Mudflow, October 30, 1998" report on USGS CVO website:
http://vulcan.wr.usgs.gov/Volcanoes/Nicaragua/description_casita_mudflow_oct98.html

2007 GSOC PRESIDENT'S FIELD TRIP TO THE KLAMATH MOUNTAINS

September 6 through September 9, 2007

THURSDAY, SEPTEMBER 6

This is a travel day from Portland to the Medford area. Because of the difficulty of obtaining motels in Ashland during the Shakespeare Festival, we decided to stay in Medford. Information regarding Medford motels is listed below. Those interested in camping instead of staying in motels should mention this on the registration form. Camp sites are available at the Valley of the Rogue State Park (see below). We expect a group from the Ashland area to register for the field trip. Field guides will be available 8 p.m. at a meeting in either Ashland or Medford. Specifics will follow in the September Newsletter.

FRIDAY, SEPTEMBER 7

Our field trip leader for Friday is Dr. Jad D'Allura, who received his Ph.D. from the University of California (Davis) in 1977. He has taught geology

at SOU from 1977 to the present. The upper division courses he has taught at SOU include igneous and metamorphic petrology and petrography, structural geology, remote sensing, and geologic field methods. Current research projects include analysis of mafic volcanic rocks using remote sensing tools, geology of the Oligocene Roxy Formation (Western Cascades), and geologic mapping of the Ashland and Siskiyou Pass quadrangles.

Jad will lead us on a traverse perpendicular to the major structure of the Klamath Mountains. We will follow the Klamath River along California Highway 96 and have the opportunity to see many types of metamorphic rocks and complex structural relationships within the Western Paleozoic and Triassic Belt. A general reference for the geology of the Klamath Mountains is Geology of Oregon (4th or 5th ed.) by Orr, Orr, and Baldwin. Field trip participants may want to review metamorphism, metamorphic rock types, and structural geology prior to the trip. What exactly is a mélange? What is an ophiolite?

SATURDAY, SEPTEMBER 8

Our field trip leader for Saturday is Dr. Bill Elliott, who received his Ph.D. from Indiana University (Bloomington) in 2002 and came directly to SOU as an Assistant Professor. His research interests are in sedimentology, stratigraphy, geomorphology, and low temperature geochemistry. His research projects include (1) sedimentology and stratigraphy of Miocene to Pleistocene volcaniclastics and hydroclastites of the Basin and Range province of Klamath County, Oregon, (2) geochemistry of acid mine drainage, (3) stable carbon isotope studies in the Cretaceous Hornbrook Formation.

The field trip will focus on the stratigraphy and the depositional environment of the Hornbrook Formation, which was deposited as the Cretaceous seas advanced over continental land surfaces worldwide. This transgressive sea probably originated due to rapid rates of seafloor spreading and subduction which caused shallowing of ocean basins and therefore advancing seas. The Hornbrook Formation is exposed in the northeast corner of the Klamath Mountains. Similar rocks of Cretaceous age are exposed in the Mitchell-Suplee area of central Oregon, at Cape Sebastian on the Oregon coast, and in the Great Valley in California. The President's Field Trip officially ends Saturday evening.

SUNDAY, SEPTEMBER 9

Leave Medford in the morning to return to Portland. Some may want to remain and camp at Valley of the Rogue State Park for additional sightseeing and perhaps follow some previously published field trip guides.

REGISTERING FOR THE TRIP

GSOC members who plan on attending this field trip should fill out a registration form located at the end of this month's Geological Newsletter, and mail it to the address given on the form. You are responsible for arranging and providing your own transportation, lodging, meals, and water. For more information, call Richard Bartels (503-292-6939) or e-mail him at bartbartels@comcast.net. Please review additional information to be published in the September 2007 Geological Newsletter.

MOTELS IN THE MEDFORD AREA

The Holiday Inn Express In Medford, Oregon
1501 S. Pacific Highway
Medford, Oregon 97501
Phone 541-732-1400, fax # 541-732-0700
Online reservations can be made at
http://www.rogueweb.com/holidaymedford/
Room rates are about $140 per night

Red Lion Hotel Medford
200 N. Riverside Avenue
Medford, OR 97501
Phone (541) 779-5811
Online reservations can be made at
http://redlion.rdln.com/
Room rates are about $105 per night

Best Western Horizon Inn
1154 Barnett Road, Medford, OR
Phone (541) 779-5085, Fax: 541-772-6878

Online reservations can be made at http://www.bestwesternoregon.com/hotels/best-western-horizon-inn/
Room rates are about $92 per night

Comfort Inn South:
60 E. Stewart Ave.
Medford, OR 97501
Phone (541) 772-8000
Online reservations can be made at http://www.choicehotels.com
Room rates are about $105 per night

Days Inn Medford
850 Alba Drive
Medford, OR, 97504
Phone (541) 779-6730
Online reservations can be made at http://www.daysinn.com/
Room rates are about $70 per night

CAMPING IN THE MEDFORD AREA

Valley of the Rogue State Recreation Area
From I-5, 12 miles E of Grants Pass and 17 miles W of Medford (541) 582-1118 or (800) 551-6949
Park rates (subject to change), May 1 to September 30, 2007:

- RV rate w/ hookups: $20 – 146 sites
- Tent site: $16 – 21 sites
- Yurt: $27 – 6 yurts

Online reservations can be made at http://www.oregon.gov/OPRD/PARKS/reserve.shtml

GSOC ANNUAL PICNIC

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

GSOC will provide plates, eating utensils, and paper cups, as well as coffee and non-alcoholic beverages. We will not be grilling this year, but just having a potluck meal. If your last name begins with A through G, bring a main dish; H through P, bring a side dish or salad; Q through Z bring dessert. Alcoholic drinks (other than kegs) are permitted, bring your own if desired.

GSOC President Richard Bartels will give an overview of Beacon Rock geology. Some members would like to hike to the top of Beacon Rock, or perhaps to the waterfall in the woods. We encourage anyone with musical abilities to bring their instrument for entertainment and sing-alongs.

WEBSITES COVERING RECENT VOLCANIC ERUPTIONS AND EARTHQUAKES

You may have heard of the Monday, July 16, 2007 earthquake on the island of Honshu, Japan, which caused a fire and other problems at a nuclear power plant there. Here are some links to information about the magnitude 6.6 earthquake and its effects:

USGS Honshu, Japan earthquake webpage:
http://earthquake.usgs.gov/eqcenter/eqinthenews/2007/us2007ewac/

Geology.com article from July 23:
http://geology.com/news/

MSNBC July 17 article:
http://www.msnbc.msn.com/id/19778870/

The Kilauea, Hawaii big island eruptions reported in last month's Geological Newsletter have continued and can be reviewed on these websites:

USGS HVO Home page:
http://hvo.wr.usgs.gov/

Volcano World Current Volcano Activity:
http://volcano.und.edu/vwdocs/current_volcs/current.html

President's Field Trip
Klamath Mountains
September 6 through September 9, 2007

The focus of this year's trip is the geology of the Klamath Mountains, southern Oregon and northern California. The leaders will be Dr. Jad D'Allura and Dr. Bill Elliott both from Southern Oregon University. Jad will introduce us to the complex geology accreted terranes of Paleozoic and Triassic age which are intruded by granitic plutons. Bill will present his work dealing with the Cretaceous marine transgressive Hornbrook Formation. Last year Bill led our successful field trip to the Klamath Basin.

September 6: Leave Portland in the morning in private vehicles. Participants will stay in Medford motels or camp. First session will be an introduction to the field trip in either Ashland or Medford at 8 p.m. Field guides will be provided at that time. The location of the meeting place will be given in the September Newsletter.

September 7: Jad D'Allura will lead a car caravan along the Klamath River (CA-94). He promises a long day with numerous stops. The trip will probably start in Ashland, where we will carpool.

September 8: Bill Elliott will lead a car caravan within the Medford-Ashland area to document the Cretaceous marine transgression. The trip should last most or all of the day.

September 9: Leave Medford in the morning to return to Portland. Some may want to remain and camp at Valley of Rogue State Park for additional sightseeing. (Oregon Caves National Monument, historic Jacksonville, Ashland's Shakespeare Festival)

Cost of the President's Trip and Payment

Cost of the President's Trip (Sept. 6-9) is $30 for GSOC members and nonmembers. Field trip participants are expected to make their own arrangements for transportation, lodging (see list of possible motels in Medford elsewhere in the Newsletter), pay for their own meals, and pack a lunch and carry water each day. Please make checks out to the "President's Field Trip" and send to the Geological Society of the Oregon Country, P.O. Box 907, Portland, Oregon 97207-0907 by **August 30, 2007**.

Policy for Minors: In order to attend a GSOC field trip, participants under 21 are required to have permission in writing from a parent or other legal guardian. In addition, minors must be accompanied by a parent, guardian, or responsible adult designated by that person.

Name(s) _____

Name(s) _____

Number of registrants _____ Payment enclosed _____

Address _____

Telephone _____ Email _____

For questions contact Richard Bartels at bartbartels@comcast.net or 503-292-6939

Important: A waiver/medical form for each participant must accompany this registration form. See next page.

Geological Society of the Oregon County
P.O. Box 907
Portland, Oregon 97207-0907

President's Field Trip to the Klamath Mountains

Note: Please fill out a separate waiver form for each participant.

I understand that the Geological Society of the Oregon County field trips may involve inherent risks. I realize that natural hazards do exist, and that falls and collisions do occur, that therefore injuries may result, and therefore accept the risks to myself and others and I agree to use extreme caution at all times on this trip.

I understand that any costs for medical expenses incurred as a result of accidental injury or death while participating in the field trip WILL NOT BE PAID BY THE GEOLOGICAL SOCIETY OF THE OREGON COUNTRY.

I, undersigned, intending to be legally bound, hereby for myself, my heirs, executors, and administrators, waive and release any and all rights and claims for losses and damages I may have against the Geological Society of the Oregon Country, its officers, board members, and field trip leaders, and all other parties and their representatives, successors, and assigns for all and any injuries suffered by me on this field trip. I attest and verify that I am participating at my own risk.

Signed: _____ Dated: _____

Parent or other legal guardian signature: _____

Medical Information

Name _____

Phone number _____; Email _____

Name of physician _____; Phone number _____

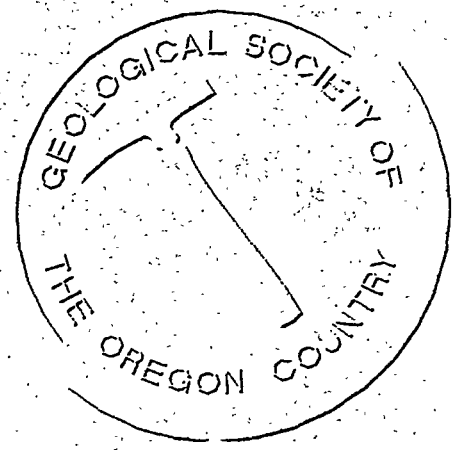
Allergies _____

Special medications _____

Special medical conditions _____

In Case of Emergency call _____

GEOLOGICAL SOCIETY OF
THE OREGON COUNTRY
P. O. BOX 907
PORTLAND, OR 97207



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GSOC

SEPTEMBER 2007

THE GEOLOGICAL NEWSLETTER

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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ACTIVITIES:

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

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

TRIP LOGS: Write to the same address for names and price list.
WEBSITE: www.gsoc.org. Email address: gsoc@spiritone.com.

APPLICATION FOR MEMBERSHIP-
THE GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

Name_____ **Spouse**_____

Children under age 18_____

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

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

Geologic Interests and Hobbies_____

_____

Please indicate Membership type and include check for appropriate amount:

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

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

GEOLOGICAL NEWSLETTER

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

VISITORS WELCOME AT ALL MEETINGS
INFORMATION: www.gsoc.org

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Richard Bartels, President, 503-292-6939, bartbartels@comcast.net
Acting Calendar Editor, Beverly Vogt, 503-292-6939, bevvogt@comcast.net

SEPTEMBER ACTIVITIES

President's Field Trip, September 6-9, to the Ashland area. People planning on attending should have already registered and paid registration fees. Participants are to meet at 7 p.m., Thurs. night, Sept. 6, Room 118, Science Building, Southern Oregon University, Ashland. NOTE: To avoid getting a ticket, park on the street, not in the university parking lots. Field trip guides will be distributed Thurs. evening, and the first trip will start at 8 a.m., Fri. morning. Field trip participants are to make their own motel or camping arrangements. Campers: Because Valley of the Rogue State Park Campground is almost 40 mi. from Ashland, we suggest you camp instead at Emigrant Lake County Park, 6 mi. southeast of Ashland, cost $18 per night, reservations and/or information available at 541-774-8183, www.jacksoncountyparks.com/emigrant_lake.htm. For any questions, contact Richard Bartels (503-292-6939, bartbartels@comcast.net).

Because of the President's Field Trip, there will be no Friday night lecture or Wednesday night seminar in September.

FUTURE ACTIVITIES

Look for details about these activities in upcoming issues of the GSOC Newsletter
Friday evening talk, October 12, 2007, 8 p.m., Dr. Sherry Cady, a professor at Portland State University, will give us an update on her research. She has studied extremophilic bacteria in Yellowstone National Park, the Kamchatka Peninsula, and southeastern Oregon hot springs. Location, Room S17, Cramer Hall, PSU. Meet us at 6:30 p.m. at Hot Lips Pizza, 1909 SW 6th, for informal dinner before the lecture. Look for the table with the GSOC sign.

Wednesday evening special talk, November 7, 2007, 7:30 p.m., Dr. Brian Atwater, author of "The Orphan Tsunami of 1700" will give a special talk on the tsunami of 1700 in Room 327/329, Smith Center, PSU. The talk is sponsored by GSOC, PSU, and Sigma XI. Look for more details in upcoming Newsletters.

Friday evening talk, November 9, 2007, 8 p.m., "The Origins of Lake Basins in the Pacific Northwest," our regular Friday night lecture by Dr. Doug Larson, PSU Adjunct Professor, Department of Environmental Sciences and Resources. Dr. Larson is a limnologist who has studied Pacific Northwest lakes and collected over 8,000 photographs of them over the past 40 years.

PARKING AT PORTLAND STATE UNIVERSITY IS AVAILABLE AFTER 7 P.M. IN THE PARKING STRUCTURE ON BROADWAY DIRECTLY ACROSS FROM CRAMER HALL.
CHECK THE GSOC WEB PAGE FOR THE LATEST GSOC CALENDAR OF EVENTS, www.gsoc.org, OR CALL BEVERLY VOGT, 503-292-6939.

PRESIDENT'S FIELD TRIP PRIMERS

Attention 2007 GSOC President's Field Trip participants! These articles contains some background information which will be helpful on the field trip, so bring along your Geological Newsletter when you go. As you were advised in last month's newsletter, "[on the trip, you will] see many types of metamorphic rocks and complex structural relationships within the Western Paleozoic and Triassic Belt. A general reference for the geology of the Klamath Mountains is Geology of Oregon (4th or 5th edition) by Orr, Orr, and Baldwin. Field trip participants may want to review metamorphism, metamorphic rock types, and structural geology prior to the trip. What exactly is a mélange? What is an ophiolite?" These articles has been written to give you some background information on these phenomena, but if you have time to study Geology of Oregon or your elementary geology textbook, so much the better!

PRIMER ON SUBDUCTION ZONES, OPHIOLITES, ACCRETIONARY WEDGES, AND MELANGES

by Richard Bartels

Subduction Zones

A subduction zone, as most of you might already know, is the location where two tectonic plates on the earth's surface are converging. One of the plates, always an oceanic plate, is pushed below the other until it melts far below the surface. The subduction zone environment is complex and can lead to many unique features. The oceanic crust (6-10 km thick) is "pulled" down into the earth's mantle by virtue of a density instability created by the conversion, within the crustal margin at depth, of basalt (with a density of 3.0 grams/cc) to a higher density rock called eclogite (with a density of 3.5 grams/cc). The eclogite is denser than the earth's mantle (with a density of 3.3 grams/cc). Subduction helps drive circulation of mantle material in giant convection cells in which upwelling mantle material produces new oceanic crust (sea-floor spreading) that ultimately sinks back into the mantle at the subduction zone.

Ophiolites

Ophiolites are thought to be thrust sheets of oceanic crust which have been **obducted** (or pushed on top of, rather than below, a continental plate) over rocks produced in the subduction zone. The ophiolite sequence, from bottom to top, includes peridotite, gabbro (often layered), sheets of basaltic dikes, and pillow lava. The sheeted dikes are thought to be the feeder dikes of the pillow basalts. This sequence can be overlain by oceanic sedimentary deposits such as bedded cherts (radiolarian tests [shells]), shale, limestone, and greywacke sandstone. Often these sedimentary deposits are not preserved with the obducted ophiolite. Rock types found in an ophiolite sequence match perfectly with oceanic crust sequences obtained from drilling and geophysical studies. However, ancient ophiolite sequences are somewhat thinner than current oceanic sequences and can be dismembered by faulting. The Klamath Mountains have numerous ophiolites of different ages. They are from east to west, the Trinity ophiolite (early Paleozoic), the Preston Peak ophiolite (Permo-Triassic), and the Josephine ophiolite (Jurassic). They represent different pulses in time in the construction of the geology of the Klamath Mountains. In the field, the basalts and gabbros are commonly altered to patchy green rocks, and the peridotite is changed mostly into green to black sheared serpentinite.

Accretionary Wedges

As subduction occurs, several processes are active:

- Some of the oceanic sediments are scraped off the descending oceanic crust, thereby creating folded and faulted piles of sediments. This pile of sediments forms an accretionary wedge that continually grows as subduction proceeds.
- Some of the sediments are carried down the subduction zone. **Prograde metamorphic reactions*** always generate water and carbon dioxide, which lower the melting points of hot mantle rocks. This in turn leads to the production of magma whose eruption creates

volcanic arcs that will occur as a belt perhaps 100 km away in the direction of subduction.

- Some of the water returns as seeps at the toe of the developing accretionary wedge.
- The oceanic plate is colder than the earth's mantle through which it is descending. This creates the unique situation in the earth's crust where the stable mineral assemblages in several types of rocks undergoing prograde metamorphism contain sodic amphiboles rather than calcic amphiboles. These rocks are called "blueschists" because the sodic amphiboles are blue. The occurrence of blueschists sometimes can be a tip-off that rocks developed in a subduction zone environment.

Accretionary wedges have another interesting feature. Since they represent the scraped accumulation of oceanic sediments, the fossils that they contain could be much older than the age of the development of the wedge itself. This is especially true for microfossils such as radiolarians in the bedded chert or foraminifera and megafossils in limestones.

The only accretionary wedge in the Pacific Northwest that we can directly observe today is the one forming on the Olympic Peninsula. The modern accretionary wedge in Oregon is offshore.

*Prograde metamorphism is the term used to describe the progressive development of, say, a mudstone or shale to a slate, then to a phyllite, then to a schist, then to a gneiss. In pelitic rocks prograde metamorphism produces diagnostic minerals at each stage. such as chlorite followed by biotite followed by garnet followed by staurolite followed by sillimanite. There is always an increase in pressure and/or temperature. Sometimes a high grade mineral will be replaced by a low grade mineral in which case it is referred to as retrograde metamorphism. Water is added to the rock in retrograde metamorphism

Mélanges

Masses of mixed rock called "mélanges" (French for mixture) have been recognized widely in the geologic record since 1919. The only current agreement about mélanges is that mélanges are bodies of mixed rocks (not to be confused with sedimentary conglomerates). The size of individual blocks within a mélange can range from miniscule fragments to gigantic blocks. These components are imbedded in a matrix of finer grained material. Figure 1 from Raymond (1984) depicts the progressive fragmentation and mixing (from left to right) of "A", an interbedded sandstone/shale sequence, and "B", an ophiolite sequence showing sediments, pillow basalt, sheeted dikes, gabbro, and peridotite. The continuum is divided into four units—1, 2, 3, and 4, based on appearance. The arrows show mixing of rocks from unit A and unit B.

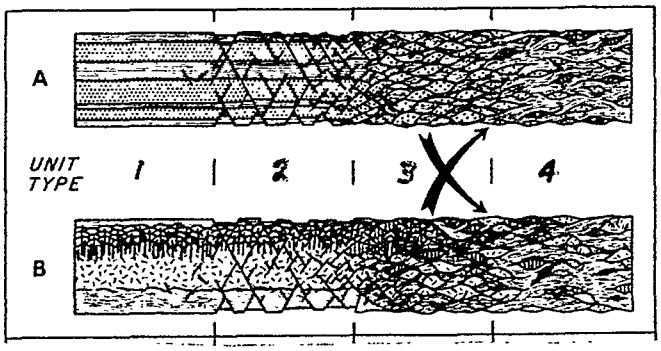


Figure 1. Possible appearances of separate units vs. mélanges from Raymond (1984):

Unit 1: Coherent units with internal stratal continuity. A is a formation, and B is a complex.

Unit 2: Broken units with locally internal stratal continuity. A is a broken formation, and B is a broken complex.

Unit 3: Dismembered units without internal stratal continuity or exotic blocks. Both units fit the description of a mélange. A could be called an "olistostrome".

Unit 4: Mélanges that lack internal stratal continuity and contain exotic blocks. Either A or B could be a tectonic mélange or a diapiric mélange.

Reference Cited

Raymond, L.A., 1984, Classification of mélanges, *in* Raymond, L.A., 1984, Mélanges: Their nature, origin, and significance: Geological Society of America Special Paper 198, p. 7-20.

METAMORPHIC ROCK PRIMER

by Carol Hasenberg

Metamorphism is a process that changes rocks, and is caused by an environment which differs from the environment which originally produced the rock. Metamorphosed rocks can change in both texture (graininess, cleavage, "feel") and chemical composition. The agents of metamorphism include temperature, pressure, and chemical agents. The environments which facilitate metamorphic processes include proximity to a **convergent plate boundary**, such as that we will be observing on the President's field trip. Other such environments include **deep burial**, introduction of **fluids** foreign to the rock, and proximity to an **intrusive body** of magma.

One of the ways in which metamorphic rocks can be classified is whether the rocks exhibit foliation, a texture in which the orientation of minerals produces a planar feature, or the rocks are non-foliated and have a more granular texture. Foliated rocks include the familiar building material **slate**, whose foliation makes it easy to split for roofing tiles, **phyllite**, **schist** and **gneiss**. The un-metamorphosed parent rock shale, or mudstone, can metamorphose progressively into slate, then phyllite, then schist, then gneiss, and each of these rocks represents a higher state of metamorphism (refer to the starred comments in the Bartels article). Slates have a very fine-grained texture and split on cleavage lines that are independent of the original bedding planes of the mudstone. Phyllite has a coarser texture intermediate between slate and schist – the term phyllite is used when the mica crystals have grown large enough to see; however, the rock still exhibits a slaty cleavage. Schists have a coarse texture which is apparent to the eye, and conspicuous planes of foliation. The foliation comes from the development of large grains of platy minerals, such as mica. Schists contain many types of granular minerals and are further classified by chemical composition. Schists can also be formed from rocks of volcanic origin, including rhyolite, basalt, and tuffs as well as other sedimentary rocks such as graywackes (dirty sandstones) and siltstones. In gneisses, the chemical reorganization has progressed into bands of different colored minerals. The banding can be highly deformed from the high pressures to which the rocks have been subjected. Gneisses can also form by deformation of coarse grained igneous rocks like granite.

Non-foliated metamorphic rocks include **quartzite**, **marble**, **amphibolite** (which may be weakly foliated), **migmatites**, and **hornfels**. Quartzite and marble, metamorphosed from quartz-rich sandstone and limestone respectively, have coarse granular, sugary textures of interlocking grains. Amphibolite is a dark colored, coarse grained rock, composed largely of amphibole and plagioclase, metamorphosed from rocks high in iron and magnesium, such as basalt. Migmatities have such a high grade of metamorphism that some partial local melting and recrystallization has occurred, so they are both metamorphic and igneous. Hornfels are dense, fine grained products of contact metamorphism around igneous intrusions, and are usually dark in color.

Subducting plate boundaries provide many opportunities for metamorphic rocks to form. Indeed, ancient subduction zones can be recognized from the metamorphic rocks formed in them. Also, various portions of a subduction zone produce distinctive types of rock based upon the parent rock chemical composition, and the temperature and pressure conditions which formed them. These distinctive zones are called **metamorphic facies**, which are named after the rock they produce. In the subduction zone's accretionary wedge (refer to the Bartels article) we can have the **blueschist facies**, formed at low temperature, high pressure conditions. In the convergent continental crust adjacent to the subducting plate, there are zones of increasing pressure and temperature as the depth increases. Starting at the surface, we have the **zeolite**, **greenschist**, and **amphibolite facies**. Below these are the regions of partial melt, which include the **granulite** and **eclogite facies**, and the melt.

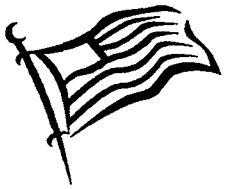
References and Additional Reading:

Hamblin, W. Kenneth, The Earth's Dynamic Systems, Fourth Edition, Burgess Publishing Company, Minneapolis, Minnesota 1985.

Wikipedia page on Metamorphic Rock: http://en.wikipedia.org/wiki/Metamorphic_rock

University of Alabama website for GEO.101-02, Introduction to Geology class, Dr. Nathan Green, instructor, Metamorphism and Metamorphic Rocks, http://www.geo.ua.edu/intro03/Meta.html

Delta Mine Training Center, Delta Junction, Alaska, website has a good diagram of the subduction zone metamorphic facies: http://www.dmtcalaska.org/course_dev/explogeo/class09/notes09.html



2007 GSOC PRESIDENT'S FIELD TRIP TO THE KLAMATH MOUNTAINS

September 6 through September 9, 2007

PARTICIPANTS: Please read this section carefully as there are a number of revisions from last month.

THURSDAY, SEPTEMBER 6

This is a travel day from Portland to the Medford area. Field guides will be available at the **7 p.m.** (note time change from the August Geological Newsletter) orientation meeting in Ashland. The meeting is scheduled for Room 118, Sciences Building, Southern Oregon University (SOU), Ashland. **NOTE**: To avoid getting a ticket, **park on the street**, NOT in the university parking lots. For a map of the SOU campus, see page 44 or go to the SOU website http://www.sou.edu/map/. Click on Sciences in the list to the left and you will see the Sciences Building highlighted. To get there, take exit 14 off I-5 onto Highway 66 (Ashland St.) heading west. Turn right at 1.2 miles onto Siskiyou Blvd. Turn left onto University Way at about 6 blocks. You are now on the SOU campus. The building is near the corner of Elkader and Ashland Sts. (refer to map).

FRIDAY, SEPTEMBER 7

We will be leaving at 8 a.m. from Ashland – exact place will be announced on Thursday night at the orientation meeting. Our field trip leader for Friday is Dr. Jad D'Allura, who received his Ph.D. from the University of California (Davis) in 1977. He has taught geology at SOU from 1977 to the present. The upper division courses he has taught at SOU include igneous and metamorphic petrology and petrography, structural geology, remote sensing, and geologic field methods. Current research projects include analysis of mafic volcanic rocks using remote sensing tools, geology of the Oligocene Roxy Formation (Western Cascades), and geologic mapping of the Ashland and Siskiyou Pass quadrangles.

Jad will lead us on a traverse perpendicular to the major structure of the Klamath Mountains. We will follow the Klamath River along California Highway 96 and have the opportunity to see many types of metamorphic rocks and complex structural relationships within the Western Paleozoic and Triassic Belt.

A general reference for the geology of the Klamath Mountains is Geology of Oregon (4th or 5th ed.) by Orr, Orr, and Baldwin. Field trip participants may want to review metamorphism, metamorphic rock types, and structural geology prior to the trip. What exactly is a mélange? What is an ophiolite? Participants who also attended the GSA Cordilleran Section meeting in 2002 may also want to refer to the "Josephine and Coast Range Ophiolites" article in the Field Guide to Geologic Processes in Cascadia, Oregon Department of Geology and Mineral Industries Special Paper 36, for additional background information.

SATURDAY, SEPTEMBER 8

Our field trip leader for Saturday is Dr. Bill Elliott, who received his Ph.D. from Indiana University (Bloomington) in 2002 and came directly to SOU as an Assistant Professor. His research interests are in sedimentology, stratigraphy, geomorphology, and low temperature geochemistry. His research projects include (1) sedimentology and stratigraphy of Miocene to Pleistocene volcaniclastics and hydroclastites of the Basin and Range province of Klamath County, Oregon, (2) geochemistry of acid mine drainage, (3) stable carbon isotope studies in the Cretaceous Hornbrook Formation.

The field trip will focus on the stratigraphy and the depositional environment of the Hornbrook Formation, which was deposited as the Cretaceous seas advanced over continental land surfaces worldwide. This transgressive sea probably originated due to rapid rates of seafloor spreading and subduction which caused shallowing of ocean basins and therefore advancing seas. The Hornbrook Formation is exposed in the northeast corner of the Klamath Mountains. Similar rocks of Cretaceous age are exposed in the Mitchell-Suplee area of central Oregon, at Cape Sebastian on the Oregon coast, and in the Great Valley in California. The President's Field Trip officially ends Saturday evening.

SUNDAY, SEPTEMBER 9

Leave Medford in the morning to return to Portland. Some participants may want to remain for additional sightseeing and perhaps follow some previously published field trip guides. Enjoy!

REGISTERING FOR THE TRIP

GSOC members who plan on attending this field trip should be registered as of August 30. Remember, as a participant, **you are responsible** for arranging and providing your own transportation, lodging, meals, and water. For more information, call Richard Bartels (503-292-6939) or e-mail him at bartbartels@comcast.net.

MOTELS IN THE AREA

Revision to recommendations!
Because of the potential difficulty of obtaining motels in Ashland during the Shakespeare Festival, we originally recommended participants to stay in Medford. However, since the orientation meeting and anticipated field trip starting points will be in Ashland, we now recommend participants to stay in either southern Medford or Ashland. It looks like there will be availability in the Ashland area. We've added Ashland motels near I-5 exit 14 to our list, but participants may also stay anywhere nearby (see comments below for hotel sites).

Ashland, Oregon Motels
Windmill Inn & Suites of Ashland
2525 Ashland Street, Ashland, OR 97520
Phone (800) 547-4747
Online reservations can be made at http://www.windmillinns.com/ie40/ash/ash.htm.
Room rates are about $120 per night

Holiday Inn Express Hotel & Suites Ashland, Or
565 Clover Lane, Ashland, OR
Phone (541) 201-0707
Online reservations can be made at http://www.innashland.com/.
Room rates are about $130 per night

Ashland Super 8 Motel
2350 Ashland Street, Ashland, OR 97520
Phone (541) 482-8887, Fax: (541) 482-0914, E-Mail: ashlandsuper8@msn.com.
Online reservations can be made at http://www.super8.com/.
Room rates are about $90 per night

For additional hotels and motels in Ashland, I refer the participants to the Trip Advisor website (http://www.tripadvisor.com/Travel-g29998-s1/Ashland:Oregon:Inside.html) or the Trails.com website (http://www.trails.com/all-hotels/city-hotel.asp?dest=OR+Ashland). There are quite a few listings.

Medford Motels
The Holiday Inn Express In Medford, Oregon
1501 S. Pacific Highway, Medford, Oregon 97501

Phone 541-732-1400, fax # 541-732-0700
Online reservations can be made at
http://www.rogueweb.com/holidaymedford/
Room rates are about $140 per night

Red Lion Hotel Medford
200 N. Riverside Avenue, Medford, OR 97501
Phone (541) 779-5811
Online reservations can be made at
http://redlion.rdln.com/
Room rates are about $105 per night

Best Western Horizon Inn
1154 Barnett Road, Medford, OR
Phone (541) 779-5085, Fax: 541-772-6878
Online reservations can be made at
http://www.bestwesternoregon.com/hotels/best-western-horizon-inn/
Room rates are about $92 per night

Comfort Inn South:
60 E. Stewart Ave., Medford, OR 97501
Phone (541) 772-8000
Online reservations can be made at
http://www.choicehotels.com
Room rates are about $105 per night

Days Inn Medford
850 Alba Drive, Medford, OR, 97504
Phone (541) 779-6730
Online reservations can be made at
http://www.daysinn.com/
Room rates are about $70 per night

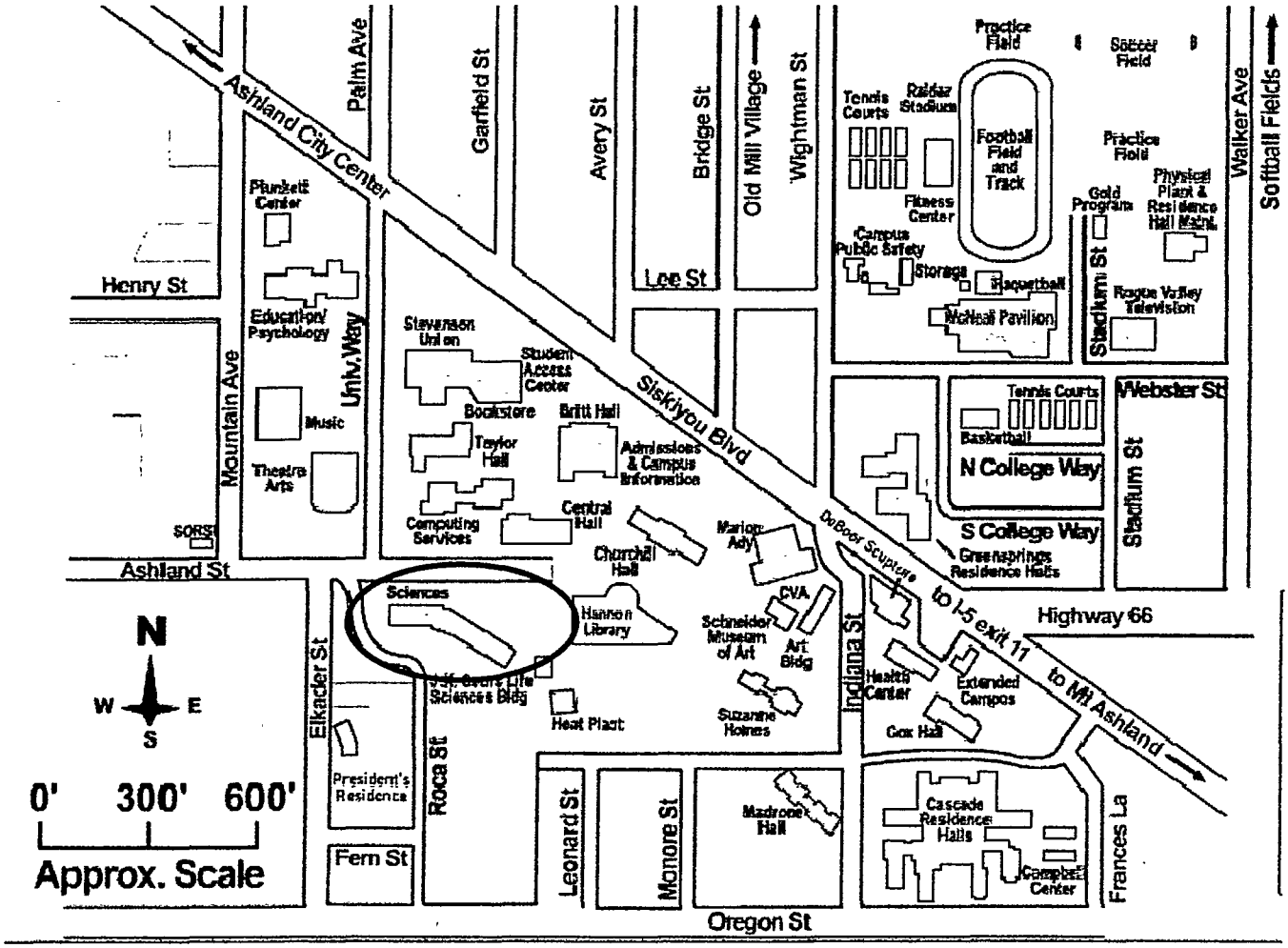
CAMPING IN THE MEDFORD AREA

Revision to recommendations!
Because Valley of the Rogue State Recreation Area Campground is almost 40 mi. from Ashland, we suggest you camp instead at **Emigrant Lake County Park**, 6 mi. southeast of Ashland, cost $18 per night, reservations and/or information available at (541) 774-8183, www.jacksoncountyparks.com/emigrant_lake.htm. (Bev and Bart checked the county park out on the reconnaissance trip for the field trip.)

If you really wanted to stay at Valley of the Rogue State Recreation Area anyway, or need to change your reservation, here is the info:
From I-5, 12 miles E of Grants Pass and 17 miles W of Medford (541) 582-1118 or (800) 551-6949
Park rates (subject to change), May 1 to September 30, 2007:

- RV rate w/ hookups: $20 – 146 sites
- Tent site: $16 – 21 sites
- Yurt: $27 – 6 yurts

Online reservations can be made at http://www.oregon.gov/OPRD/PARKS/reserve.shtml


Ashland City Center
Palm Ave
Garfield St
Avery St
Bridge St
Old Mill Village
Wightman St
Practice Field
Soccer Field
Tennis Courts
Raider Stadium
Football Field and Track
Practice Field
Walker Ave
Softball Fields
Fitness Center
Gold Program
Physical Plant & Residence Hall Maint.
Campus Public Safety
Storage
Racquetball
McNeal Pavilion
Rogue Valley Television
Stadium St
Henry St
Plunkett Center
Education/ Psychology
Univ. Way
Mountain Ave
Music
Theatre Arts
SORS
Ashland St
Stevenson Union
Student Access Center
Bookstore
Britt Hall
Taylor Hall
Admissions & Campus Information
Computing Services
Central Hall
Churchill Hall
Lee St
Siskiyou Blvd
Tennis Courts
Basketball
Webster St
N College Way
S College Way
Stadium St
Greensprings Residence Halls
DeBoer Sculpture
to I-5 exit 11
Highway 66
to Mt Ashland
Marion Adv
CVA
Sciences
Hannon Library
Schneider Museum of Art
Art Bldg
Indiana St
Health Center
Extended Campus
Cox Hall
Heat Plant
Suzanne Holmes
N
W
E
S
0' 300' 600'
Approx. Scale
Elkader St
President's Residence
Roca St
Fern St
Leonard St
Monroe St
Madrone Hall
Cascade Residence Halls
Campbell Center
Frances La
Oregon St

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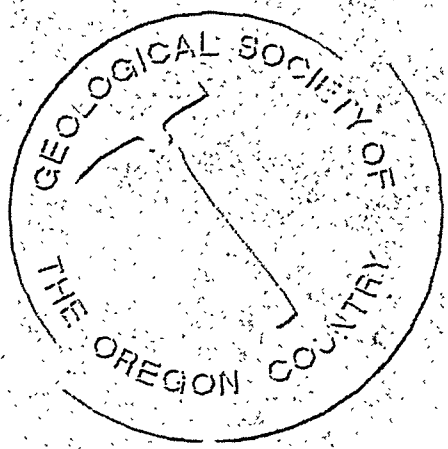

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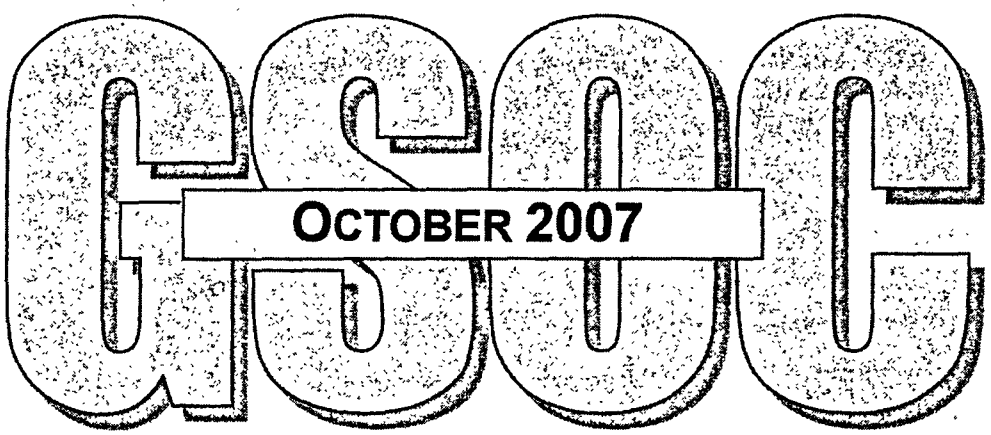

THE GEOLOGICAL NEWSLETTER

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

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OCTOBER 2007

Richard Bartels, President, 503-292-6939, bartbartels@comcast.net
Acting Calendar Editor, Beverly Vogt, 503-292-6939, bevvogt@comcast.net

OCTOBER ACTIVITIES

Friday evening talk, October 12, 2007, 8 p.m., Dr. Sherry Cady, a professor at Portland State University, will give us an update on her research. She has studied extremophilic bacteria in Yellowstone National Park, the Kamchatka Peninsula, and southeastern Oregon hot springs. Location, Room S17, Cramer Hall, PSU. Meet us at 6:30 p.m. at Hot Lips Pizza, 1909 SW 6th, for informal dinner before the lecture. Look for the table with the GSOC sign.

Wednesday Evening Seminar, October 17, 8:00 p.m., The President's Field trip to southern Oregon and Northern California, a summary of the September field trip to study the complex volcanic and metamorphic Paleozoic to Jurassic history of the Klamath Mountains and the Cretaceous sedimentary rocks around I-5 in the Ashland and Siskiyou Summit area. Location: Room S17, Cramer Hall, PSU.

FUTURE ACTIVITIES

Wednesday evening special talk, November 7, 2007, 7:30 p.m., Dr. Brian Atwater, author of "The Orphan Tsunami of 1700" will give a special talk on the tsunami of 1700 in Room 327/329, Smith Center, PSU. The talk is sponsored by GSOC, PSU, and Sigma XI. Look for more details in upcoming Newsletters.

Friday evening talk, November 9, 2007, 8 p.m., "The Origins of Lake Basins in the Pacific Northwest," our regular Friday night lecture by Dr. Doug Larson, PSU Adjunct Professor, Department of Environmental Sciences and Resources. Dr. Larson is a limnologist who has studied Pacific Northwest lakes and collected over 8,000 photographs of them over the past 40 years.

PARKING AT PORTLAND STATE UNIVERSITY IS AVAILABLE AFTER 7 P.M. IN THE PARKING STRUCTURE ON BROADWAY DIRECTLY ACROSS FROM CRAMER HALL.
CHECK THE GSOC WEB PAGE FOR THE LATEST GSOC CALENDAR OF EVENTS, www.gsoc.org, OR CALL BEVERLY VOGT, 503-292-6939.

PRESIDENT'S FIELD TRIP SYNOPSIS

Well, the President's field trip is over for another year. This year's trip was an excellent one that was planned by our experienced President Richard Bartels with great contributions from a couple of the faculty of Southern Oregon University.

The first day of the trip, Friday, September 7, 2007, was led by Dr. Jad D'Allura, geology professor at Southern Oregon University (SOU), and a specialist in igneous and metamorphic petrology, amongst other research pursuits. Dr. D'Allura took the GSOC party westward along the Klamath River in northern California to observe the metamorphic rock exposures in several terranes of the Klamath Mountains. These included the Permian-Jurassic North Fork, Permian-Carboniferous Salmon River, Permian-Jurassic Eastern Hayfork, Permian-Jurassic Western Hayfork, Permian-Jurassic Marble Mountain, and Jurassic Condrey Mountain terranes. All of these terranes are included in the Western Paleozoic and Triassic Belt.

The oldest of the terranes is the Salmon River (primarily basalts) which formed the basement for the Eastern Hayfork and North Fork terranes. The Marble Mountain and Western Hayfork Terranes represent an accretionary wedge (mélange) and a volcanic arc. The assembly of these terranes began in Late Middle Jurassic times with westward thrusting with associated deformation and metamorphism. Plutonic bodies intruded into the terranes and across their boundaries, and are thus referred to as "stitching plutons". These intrusions occurred in Early Late Jurassic time and mark the latest possible assembly of the Western Paleozoic and Triassic Belt.

In the late Jurassic, a major tectonic event underthrust the Condrey Mountain terrain beneath the other layers, which were now stacked over one another similarly to roof shingles (geologists use the term imbrication to describe this), and further deformed by metamorphism. Later, in the Miocene, uplifting caused a dome structure in the Condrey Mountain terrane to rise past the other terrane layers to the surface. Metamorphism is greatest in the Marble Mountain terrane, closest to the Condrey Mountain dome, and decreases toward the Salmon River terrane. This doming during the Miocene also explains why the late Cretaceous Hornbrook formation dips to the northeast. This is the tie-in between the field trips taken on Friday and Saturday by the GSOC group.

The GSOC field trip observed the rocks in these terranes at Stops 1, 3, 4, 6, 7 and 7b of Dr. D'Allura's "Geological Field Guide Along the Klamath River" (see reference below). The terranes viewed were the North Fork at Stop 1, Eastern Hayfork at Stops 3 and 4, Marble Mountain at Stops 6 and 7b, and Condrey Mountain at Stops 7 and 7b. The rocks observed at these locations included a large spectrum of metamorphic and intrusive examples. Lower grade metamorphic rocks included dark **argillite**, greenstone, chert, and phyllite at Stops 1 and 3, and somewhat deformed and altered pillow basalts at Stop 4. Stop 6 was dominated by higher grade **amphibolite**, a dark rock which sparkled with crystals of metamorphic minerals. Stops 7 and 7b included graphitic schists and greenschists of the Condrey Mountain terrane as well as an example of **retrograde metamorphism** of ultramafic rock in the Marble Mountain terrane at the contact boundary.

Between stops Dr. D'Allura pointed out the changes in topography that accompanied moving from one terrane to another. For example, between Stops 1 and 3 the party traveled through a rugged canyon whose narrow walls consisted of Salmon River terrane rocks. As the field trip passed into the Eastern Hayfork terrane, the canyon widened and became less steep and rugged.

At Stop 6, in addition to the outcrop observation, the GSOC party went down to the Klamath River floodplain to observe the myriad variety of river cobbles and pebbles to be found there. Examples of grano-diorite, quartzite, schist and marble cobbles, some with very large and interesting crystals, were to be found.

At the end of a hot afternoon of rock observation and sample collection, the GSOC party decided to make a Stop 8 at Quigley's Market to relax in the shade on the patio, re-hydrate and prepare for Saturday's trip.

The following day, Saturday, September 8, 2007, the GSOC group was ably led by Dr. Bill Elliott, assistant professor of geology at SOU, and an expert in sedimentary petrology. Dr. Elliott took the group on a route in the area near Hilt, California, to observe sedimentary rocks in several members of the Late Cretaceous Hornbrook, the Oligocene Colestin, and the Late Oligocene to Early Miocene Roxy Formations. The Tertiary Colestin and Roxy Formations unconformably overlie the Hornbrook Formation in the Cottonwood Creek Valley of northern California and are part of the Western Cascades group.

The Hornbrook Formation, which consists of mainly marine clastic sediments (i.e., derived from the fragments of other rocks), are believed to be formed in a forearc basin in a subduction zone during the late Cretaceous. (A forearc basin will be to the oceanic side of a volcanic arc in a subduction zone.) The members of the Hornbrook Formation, all of which were viewed by the GSOC party, are the oldest unit, the Klamath River Conglomerate Member, which also has the only non-marine sediments, the Osburger Gulch Sandstone Member, the Ditch Creek Siltstone Member, the Rocky Gulch Sandstone Member, and the youngest Blue Gulch Mudstone Member. Each of the members consist of alternating units of varying texture – the member names refer to their general characteristics. The Hornbrook Formation was viewed in Stops 1-7 of the field trip, following the "Field Trip Guide to the Upper Cretaceous Hornbrook Formation and Cenozoic Rocks of southern Oregon and northern California" field trip guide which was written specifically for this trip by Dr. Elliott.

The highlights of the Hornbrook Formation seen by the group included fossil lenses of cephalopods, gastropods, and other marine fauna in the extremely hard matrix of the Osburger Gulch Sandstone, the beautiful arkosic sandstone matrix for the Klamath River Conglomerate, worm burrows in the Ditch Creek Siltstone, interesting turbulent depositional traits and composition of the conglomerates in the Rocky Gulch Sandstone, and the oddly solid Hilt Bed amongst the Blue Gulch Mudstone units.

The remaining Stops 8-11 contained material from the Colestin and Roxy Formations of the Western Cascades. The Colestin Formation consists of volcanic arc material. Layers of this formation were viewed at the top of Siskiyou Pass along I-5. Volcanic tuffs, including vitric and crystal types, and volcanic sandstones were present. Dikes with an assortment of clastic xenoliths cut through the layers. Stop 9 included a landslide and Colestin conglomerates, and Stop 10 consisted of alternating lava flow and paleosol layers. Stop 11 gave the group an opportunity to excavate some *Metasequoia* fossils from a whitish colored layer of mudrock in the Colestin.

After another hot day the group headed back to a little restaurant in Hilt. Some of the members made plans to cap their interesting field trip days with further exploration of the area, including a trip to Oregon Caves. This area of Oregon is a very interesting place to study geology.

Carol S. Hasenberg

References and Additional Reading

Orr, Elizabeth L., Orr, William N., and Baldwin, Ewart M., Geology of Oregon, Fourth Edition, Kendall/Hunt Publishing Company, Dubuque, Iowa, 1992. Refer to the Klamath Mountains chapter pp. 51-78.

D'Allura, Jad Alan, "Geologic Field Guide Along the Klamath River; From Interstate 5 Near Hornbrook to Seiad Valley," California Geology, March 1990, pp. 58-67.

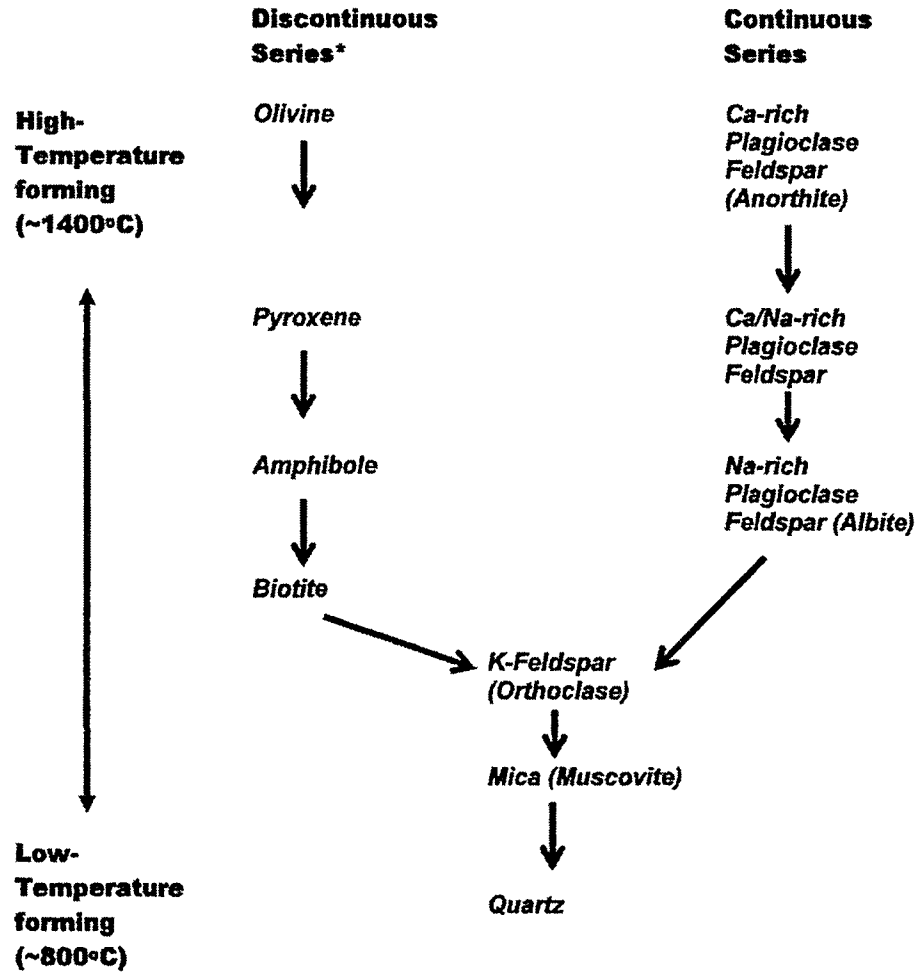
Elliott, Bill, "Field Trip Guide to the Upper Cretaceous Hornbrook Formation and Cenozoic Rocks of southern Oregon and northern California," Saturday, September 8, 2007.

SOU Geology Department:
Dr. D'Allura:
http://www.sou.edu/geology/faculty/JDallura.htm
Dr. Elliott:
http://www.sou.edu/geology/faculty/ElliottB.htm

Wikipedia articles on various metamorphic processes and minerals:
Metamorphism (incl. definitions of prograde and retrograde metamorphism):
http://en.wikipedia.org/wiki/Metamorphism
Metamorphic rock:
http://en.wikipedia.org/wiki/Metamorphic_rock
Amphibole and Hornblende:
http://en.wikipedia.org/wiki/Amphibole
Amphibolite:
http://en.wikipedia.org/wiki/Amphibolite
Bronzite:
http://en.wikipedia.org/wiki/Bronzite
Anthophyllite:
http://en.wikipedia.org/wiki/Anthophyllite
Mudstone and Argillite:
http://en.wikipedia.org/wiki/Mudstone

About.com geology pages:
Metamorphic rocks gallery:
http://geology.about.com/od/more_metrocks/ig/metamorphics/index.02.htm

Bowen's Reaction Series



*Bowen found that minerals stable at progressively lower temperature would crystallize replacing the higher temperature minerals as the magma continued to cool.

Igneous Rock Properties Table

Magma Type	Felsic	Intermediate		Mafic	Ultramafic
Intrusive	*Granite**	*GranoDiorite*	*Diorite*	*Gabbro*	*Peridotite-Dunite*
Extrusive	*Rhyolite*	*Dacite*	*Andesite*	***Basalt****	**
Principal Mineral Contents	*Quartz Mica Biotite K-Felspar Na-Feldspar*	*Amphibole Biotite Quartz Na-Feldspar*	*Amphibole Pyroxene Biotite Ca/Na-Feldspar*	*Pyroxene Ca-Feldspar*	*Olivine Pyroxene*
Magma Temperature	*800-1000°C*	*1000-1100°C*		*1100-1200°C*	
Magma fluidity*	*Highly viscous*			*Very fluid*	
Silica Content from USGS by weight	*>68%*	*63-68%*	*52-63%*	*48-52%*	

*Magma fluidity is a direct result of silica content. Since felsic magma is so sticky, the intrusive form granite is far more common than rhyolite (Oregon being an exception to this rule). Also, fluid mafic magma produces more basalt than the intrusive gabbro.

**Since this magma is produced as a result of fractionation of mafic magma and with the high crystallization temperature of the mineral content, this type of magma is almost always intrusive.

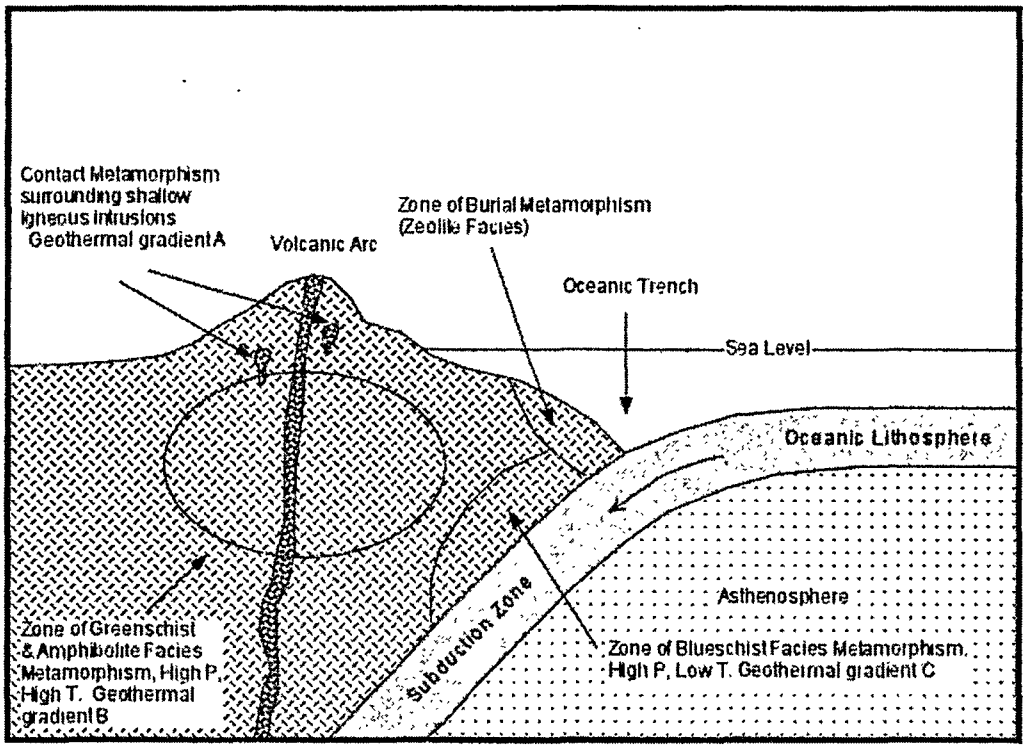


Figure 1. Metamorphic facies locations within a subduction zone.

From Tulane University Physical Geology course, EENS 111, class notes by Professor Stephen A. Nelson, http://www.tulane.edu/~sanelson/geol111/metamorphic.htm.

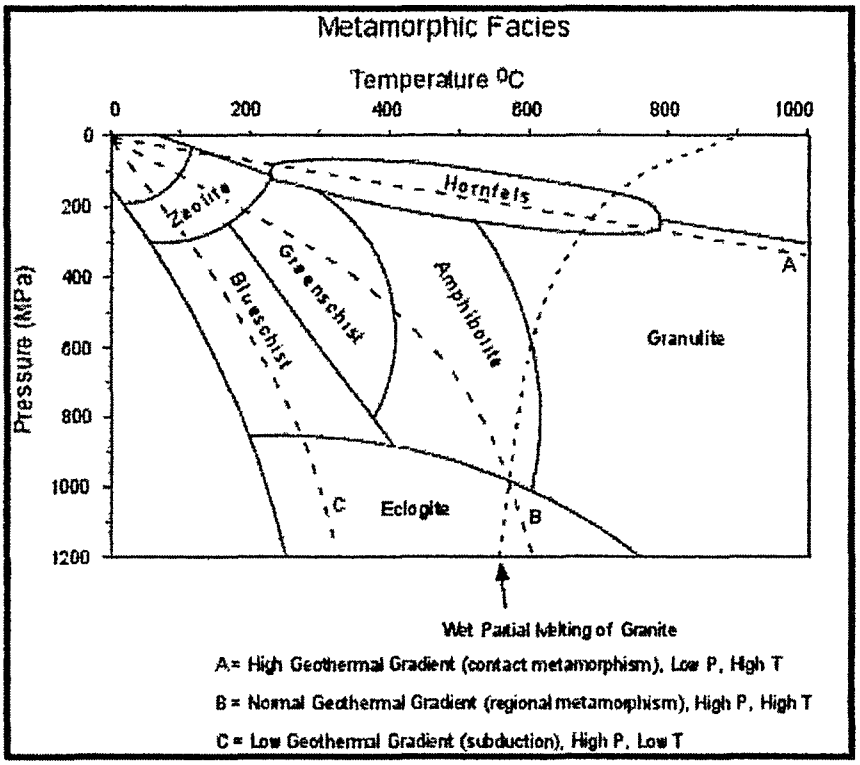


Figure 2. Metamorphic facies formation conditions, with respect to temperature and pressure.

From Tulane University Physical Geology course, EENS 111, class notes by Professor Stephen A. Nelson, http://www.tulane.edu/~sanelson/geol111/metamorphic.htm.