JAN 97

THE GEOLOGICAL NEWSLETTER

GSOC

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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THE GEOLOGICAL NEWSLETTER

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ACTIVITIES

ANNUAL EVENTS: President's Field Trip - summer; Picnic - August; Banquet - March; Annual Meeting - February. **FIELD TRIPS**: Usually one per month, private car,caravan or chartered bus. **GEOLOGY SEMINARS;** Fourth Wednesday , except June, July, August. 8:00 p.m., Room S17, Cramer Hall, Portland State University. Library: Room S7. Open 7:30 p.m. prior to meetings. **PROGRAMS**: Evening:: Second Friday evening each month, 8::00 pm, Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon. **LUNCHEONS**: First and Third Fridays monthly at noon except holidays. Bank of California Tower, 707 SW Washington, 4th floor, California Room, Portland, Oregon. **MEMBERSHIP**: per ear from January 1: Individual - $20.00, Famil;y - $30.00, Junior (under 18) - $6.00. Write or call the Secretary for application. **PUBLICATIONS**: *THE GEOLOGICAL NEWSLETTER* (ISS 0270 5451), published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year. Individual subscriptions $13.00 a year. Single copies $1.00. Order from the 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.

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VISITORS WELCOME
INFORMATION: 9AM-5PM, 321-6239
after 5PM, 775-6263

VOL. 63, No. 1
JANUARY 1997

JANUARY ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room. (Cafeteria is closed permanently.)

Jan. 3: No meeting

Jan. 17: Some Methods of Repairing West Hills Landslides: 1996
Evelyn Pratt

FRIDAY EVENING MEETING: 8:00 PM Portland State U., Cramer Hall, Rm. 371

Jan. 10: The Colorado Plateau: How to See 2 Billion Years' Worth of Scenery in 3 Weeks
Evelyn Pratt

WEDNESDAY EVENING SEMINAR :

Jan. 22: Read Part II: Paleozoic, pp. 29-41; Northwest Exposures, Alt & Hyndman

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Save MARCH 14 on your calendar for the ANNUAL BANQUET!

DUES ARE DUE

(Did you DO your DUty?)

ALL ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES MUST BE SUBMITTED TO THE CALENDAR EDITOR BY THE 15TH OF THE MONTH. Write or call Evelyn Pratt, 223-2601.

DUES ARE DUE JANUARY 1, 1997

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A GSOC member, Melvin Ashwill, has completed a study of the Deschutes fossil flora of central Oregon and published a paper in "Oregon Geology", Volume 58, Number 6, November 1996 titled *THE PLIOCENCE DESCHUTES FOSSIL FLORA OF CENTRAL OREGON; ADDITIONS AND TAPHONOMIC NOTES.* The article includes pictures of many of the fossils, maps of locations and pictues of some of the sites containing the fossils.

MUCH OF NORTHWEST'S QUAKE HISTORY WRITTEN IN MUD

Geologists find evidence linking a 1700earthquake in the Northwest with tsunamis a day later in Japan

NASELLE, WASHINGTON—The earth convulsed.

Vast areas along the Pacific Northwest coast dropped 2 feet or more. An enormous tsunami wave washed in, depositing sand. High tide flowed up the rivers, as usual, but spread out over the newly lowered landscape. The flooding was so extensive that it became part of local Indian legend.

The cataclysm was caused by a giant magnitude 9.0 earthquake that shook the Northwest on Jan 26, 1700. More than 24 hours later, 6-foot-high tsunami generated by the quake struck Japan.

This is what Brian Atwater, a geologist with the U.S. Geological Survey at the University of Washington, has in the back of his mind as he canoes up the Palix River, an arm of Willapa Bay in southwest Washington.

Mud, not written records, tells much of the earthquake history of the Pacific Northwest. But Japanese records may have provided the critical clue the mud could not resolve. And trees may determine whether the rocord's clue is a red herring.

Farther up the Palix, Atwatrer and visiting Chilean geologist Marco Cisternas hoist their canoe over another submerged log, sinking up to their knees in the gray, sticky mud. They previously had worked together in Chile, looking at the record left there by a 1960 magnitude 9.5 earthquake.

The cutbanks of rivers along the Washington coast provide a 4,000-year record, one layer of mud laid down after another. Atwater reads a series of great earthquakes, magnitude 8.0 or higher, with a few hundred years to a thousand years elapsing between them. The 1700 earthquake was only the most recent.

Atwater points to gnarled Sitka spruce roots that jut out of the bank at two levels. They are the remains of ancient forests. The dark peaty soil of each forest is buried beneath gray tidal mud. The mud contain saltwater fossils—of grassy plants and of tiny single-celled organisms or diatoms. Closer to the Palix's mouth, a thin layer of sand deposited by a tsunami caps the upper buried soil.

The forests or marshes probably dropped to where they were below the high tide level during the earthquake, exposing the plants to saltwater that killed them.. These signs of the land dropping are found from southern British Columbia to Northern California – the extent of the Cascadia Subduction Zone where tectonic plates meet offshore.

But scientists are still asking whether they were the result of single, huge earthquakes or of smaller quakes in two or more segments of the zone. An answer may be possible for the most recent quake.

Atwater and colleagues carbon-dated trees and marsh plants preserved in that layer of mud. Contamination by older and younger plants caused uncertainty, but what they considered their best specimens point to 1700 to 1720 as the time of the latest land drops in southern Washington and Northern California.

This could still represent more than one earthquake. Serial earthquakes have been known to occur within a few years or even a few hours of one another. The radiocarbon dates can't distinguished these from a single quake.

But those dates did give Japanese geologists a small enough window of time in which to look for an orphan tsunami - one not caused by a quake in Japan, Kamchatka, the Aleutian-Alaska region or South America and therefore likely to have occurred along the Northwest coast.

Kenji Satake and colleagues of the Geological Survey of Japan discovered records of such a tsunami that occurred in Japan on the night of January 27, 1700. Using computer models, they found that the size of the tsunami seemed to match what would be produced by a quake involving the entire 750 mils or so of the Cascadia Zone -- about the magnitude 9 quake.

Atwater wants to find out whether the tsunami really came from a quake that occurred along the Northwest coast. Tree ring dates can do that. Western red cedar has wood so durable that the trees killed by the flooding have remained standing in what is now a tidal marsh, ghostly reminders of a forest that was. The tombstone we were looking at up high have their feet down at this level," Atwarter said, indicating the level of the soil corresponding to the 1700 earthquake.

David K. Yamaguchi, a Seattle tree-ring specialist, took wedges from many of these cedars and compared their growth rings with those of commercially logged cedars on an island in Willapa Bay. He could then assign dates to each of the rings.

"On the island, Dave found a pattern that correlated from tree to tree - a master bar code," Atwater said. "Then he took shorter bar codes from the killed trees and slid them around till he got a match.."

But the trunks had been exposed to weathering and rot and the growth rings laid down in the years just before the trees' death were missing. If there's bark, though, then the rings would be there. And in the roots, protected from oxygen that allows decay, there was bound to be bark. But twisted roots can be exasperating for matching bar codes.

So the rings from known dates from the wedges have to be followed down to the roots. Each ring from there to the bark will add another year – and the last ring was the year the tree was killed. Atwater takes a chain saw to the dug-out roots of one of these ancient red cedars standing away from the bank.

Earlier he had plunged a hollow rod into the mud by a nearby cedar. He found that the stiff, compact mud laid down in the Pleistocene over 10,000 years ago is near the surface compared to where it is under the river bank. The cedar was on a hillside when the saltwater killed it.

"Something had to actually drop the hillside," Atwater said. This indicates a drop of the whole region, not just the settling of mud in a small area – a big quake instead of a small one.

Such big drops can happen here because the plates that meet at the Cascadia zone 60 to 150 miles offshore can get stuck instead of ocean plates sliding smoothly under the North American plate. The lower plates continue to move, causing the North American plate to bulge, much as a rug would with a vacuum stuck to its edge and moving under it.

Since it's been more than 300 years since the last giant earthquake, the plates may be locked and straining now. But these earthquakes "don't happen like clock work," Atwater said. It's been long enough for another big one to happen, but "the exact odds are difficult to estimate,""he said.

Engineers and public officials have taken notice of the work of Atwater and his colleagues. Between 1988 and 1995, more than $130 million was spent in Washington and Oregon to strengthen dams, bridges, utility line and buildings. The Uniform Building Code was revised in 1994, raising the earth-resistance level for buildings to the second highest in the nation for most of Western Oregon, including Portland, and more of Western Washington.

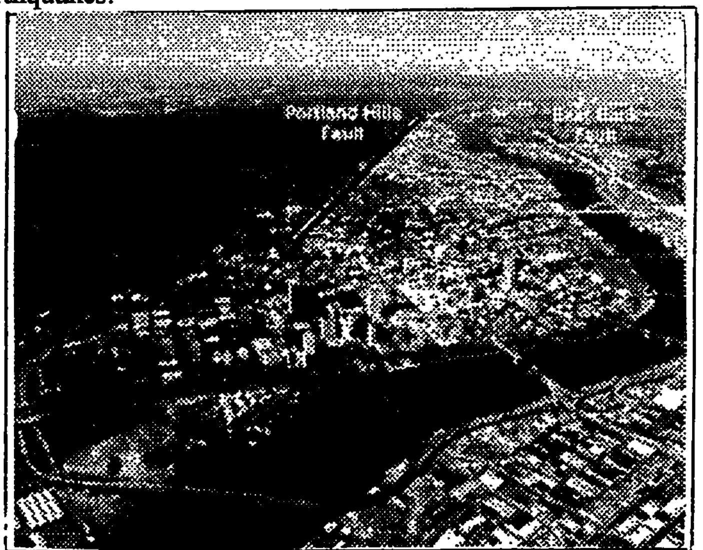
The tide is high and has reached up the Palix, making the return trip easy. The water is less than a foot below the marsh and forest that alternate along the banks. It is easy to see how a drop of 1 or 2 feet could make life hard for the plants above. Atwater hopes that won't happen again for a while.

The article " *Much of Northwest's quake history written in mud*" appeared in the Oregonian, October 1996. Permission was granted to use the article in The Geological Newsletter.

USGS

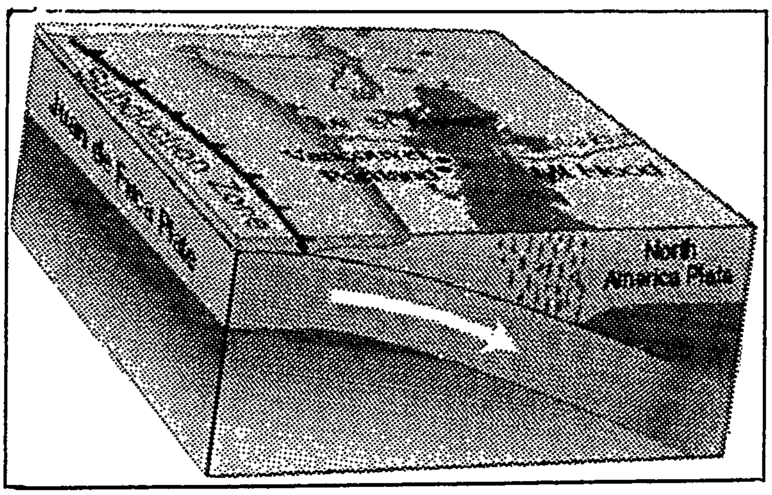
Airborne Hunt for Faults in the Portland-Vancouver Area

Geologic hazards in the Portland-Vancouver area include faults entirely hidden by river sediments, vegetation, and urban development. A recent aerial geophysical survey revealed patterns in the Earth's magnetic field that confirm the existence of a previously suspected fault running through Portland. It also indicated that this fault may pose a significant seismic threat. This discovery has enabled the residents of the populous area to better prepare for future earthquakes.

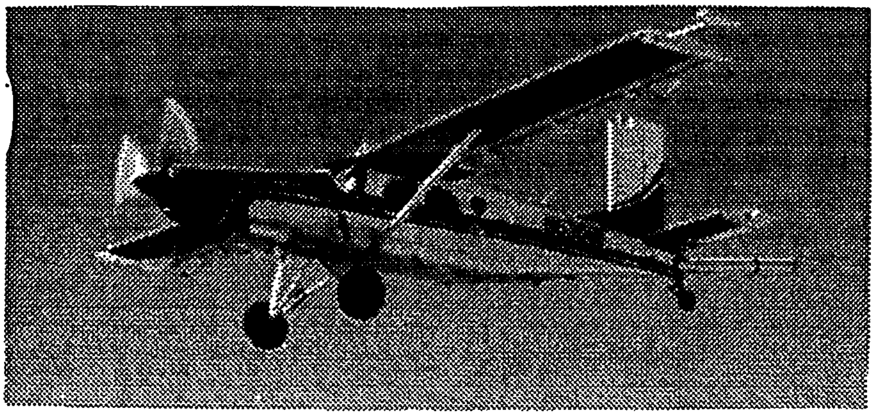


The populous Portland-Vancouver (Oregon/Washington) metropolitan area is home to 1.5 million people. This photo (view to northwest) shows downtown Portland and the Willamette River. Also shown is the long-recognized Portland Hills Fault. A 1992 aerial geophysical study conducted by the U.S. Geological Survey confirmed the existence of another fault concealed beneath sediments on the east bank of the river. The study also showed that this "East Bank Fault" might pose a significant seismic threat to the area and may be capable of producing strong earthquakes with magnitudes greater than 6. (Photo courtesy of Northern Light Studio, Portland.)

The morning of March 25, 1993, began abruptly for the 1.5 million residents of the Portland-Vancouver (Oregon/Washington) metropolitan area. At 5:34 a.m., a magnitude 5.6 earthquake had struck 30 miles to the south, rocking the entire region. The quake caused $30 million in damage and was felt over an area of more than 50,000 square miles. Only three weeks earlier, earth scientists from the U.S. Geological Survey (USGS), Oregon Department of Geology and Mineral Industries, and Portland State University had held a press conference at which they made public the results of an aerial geophysical study that indicated that the seismic hazard in the Portland-Vancouver area was greater than previously thought.



The Pacific Northwest region is geologically very active. Off the coast is a fault (subduction) zone where two plates of the Earth's crust meet and one slides under the other. Inland, hot materials rise from the subducted plate to the surface, where they build the volcanoes of the Cascade Range, including Mount Hood and Mount St. Helens. The Portland-Vancouver area is located on the highly stressed region of the Earth's crust between the subduction zone and the Cascade Range. Consequently, the area is susceptible to earthquakes on the numerous faults caused by the stress. Why do earthquakes occur in the Portland-Vancouver area? The Pacific Northwest is geologically very active region. About 75 miles off the coast, on the floor of the Pacific Ocean, is a major fault(subduction) zone where two plates of the Earth's crust meet. Along this zone, the Juan de Fuca Plate slides eastward beneath the North America Plate. Inland from the coast about 100 miles, hot materials rise from the subducted Juan de Fuca Plate to the surface of the North America Plate, where they build the volcanoes of the Cascade Range, including Mount Hood and Mount St. Helens. The Portland-Vancouver area is located on the highly stressed region of the Earth's crust between the subduction zone and the Cascade Range. Consequently, the area is susceptible to earthquakes on the numerous faults caused by the stress. These faults, however, are difficult to find and study because they are often concealed beneath sediments deposited by the Willamette and Columbia Rivers or hidden by vegetation and urban development.

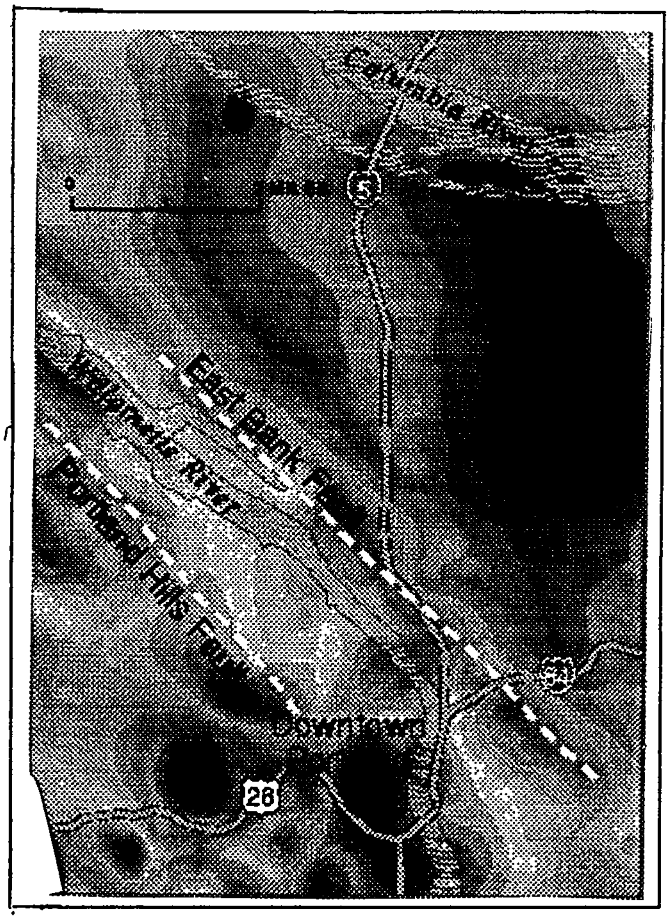


In 1992, U.S. Geological Survey (USGS) scientists used this airplane, specially equipped with a magnetometer (white boom at rear of aircraft), to measure variations in the Earth's magnetic field in the Portland Vancouver (Oregon/Washington) area. The USGS uses such aircraft to study geologic hazards, mineral resources, and environmental problems throughout the United States.

To help locate and understand these concealed hazards, the USGS in 1992 conducted the aerial geophysical survey of the Portland Vancouver area that led to the March 1993 press conference. Using a specially designed airplane and instruments, scientists measured the magnetic field of the Earth at an altitude of about 800 feet above the ground. Faults often produce distinctive patterns in the Earth's magnetic field. Careful analysis of these "magnetic anomalies" can help scientists locate and analyze unknown or poorly understood faults. The USGS uses aircraft with magnetometers to study geologic hazards, mineral resources, and environmental problems throughout the United States. The Portland Vancouver magnetic survey was planned in cooperation with scientists from the Oregon Department of Geology and Mineral Industries and from Portland State University. The data from the survey were interpreted by cooperating scientists and the USGS and are now being used by state and local planners to assess the seismic-hazard potential in the area.

The best known fault in the Portland - Vancouver area is the Portland Hills Fault, which runs northwest-southeast through the heart of downtown Portland. The aerial survey found two parallel and distinct magnetic patterns with the same northwest-southeast trend. Surprisingly, the stronger of these two linear patterns was not along the Portland Hills Fault. On the basis of data from water wells, geologists had suspected the existence of another northwest-southeast trending fault in the same position as the stronger anomaly. This fault, called the East Bank Fault, is completely concealed beneath river sediments and was not thought to be particularly significant.

This map shows variations in the strength of the Earth's magnetic field (colors) in metropolitan Portland, Oregon. It was derived from part of the 1992 aerial geophysical study conducted in the Portland-Vancouver (Oregon/Washington) area by the U.S. Geological Survey.



The study found two parallel and distinct magnetic patterns with the same northwest-southeast trend. Surprisingly, the stronger of these two linear patterns was not along the well-known Portland Hills Fault, but was along the east bank of the Willamette River. There another fault, the "East Bank Fault," had been previously suspected but was completely concealed beneath river sediments. The magnetic data for the entire study area showed that this fault extends at least 30 miles to the southeast and may be capable of producing strong earthquakes.

The strong magnetic pattern not only confirmed the existence of the East Bank Fault but also suggested that it might have the potential to produce large earthquakes. The magnetic pattern associated with this fault extends at least 30 miles to the southeast of Portland, much farther than previously thought. Scientists now believe that the East Bank Fault, the Portland Hills Fault, and other faults with similar trends in the Portland-Vancouver metropolitan area form a broad zone of faulting called the Portland Hills Fault Zone. The East Bank Fault appears to be the longest fault in the zone and may pose a significant seismic hazard to the Portland Vancouver community. Although no evidence has yet been found of past strong earthquakes on this fault, its length suggests that it could produce shocks with magnitudes greater than 6.

Because of the success of the 1992 aerial magnetic survey, a similar survey was conducted south of Portland in 1995. This new study investigates the area of the March 1993 earthquake and includes the cities of Salem, Woodburn, and Mt. Angel, Oregon. The continuing work of earth scientists in the Pacific Northwest is helping to protect the lives and property of citizens of the region from the earthquakes that are inevitable in the future.

Richard J. Blakely, Ray E. Wells, Thomas S. Yelin,
Peter H. Stauffer, and James W. Hendley II
Graphic design by
Sara Boore and Susan Mayfield

COOPERATING ORGANIZATIONS
Oregon Department of Geology and Mineral Resources
Portland State University
Oregon State University
Washington Division of Geology and Earth Resources

INFORMATION ON THE UPCOMING BANQUET WILL BE IN THE FEBRUARY NEWS LETTER. ***THE COLUMNS ON FRACTURED GEOLOGY WILL BE BACK IN FEBRUARY.*** **IF YOU HAVE A ARTICLE YOU'D LIKE TO SEE IN PRINT, PLEASE SEND IT TO THE EDITOR.**

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VOL. 63, No. 2
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FEBRUARY ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room. (Cafeteria is closed permanently.)

Feb. 7 Glacial Deposits of Minnesota
Richard Bartels, Past GSOC President

Feb. 21 East Mojave Desert: Zion, Red Rocks, Petrified Forest
Don Barr, GSOC Newsletter Editor & Past President

FRIDAY EVENING MEETING: 8:00 PM Portland State U., Cramer Hall, Rm. 371

Feb. 14 Current Hawaiian Volcanic Activity
Paul Brown, GSOC Vice-president

WEDNESDAY EVENING SEMINAR :

Feb. 26: Part III: Mesozoic, first 1/2: pp.51-71, Northwest Exposures, Alt & Hyndman. Should we accept all of their conclusions? Ev Pratt

****

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62ND ANNUAL BANQUET NOTICE

PLACE: Auditorium, Terwilliger Plaza, 2545 SW Terwilliger Blvd., ground floor*

DATE: March 14, 1997 - **MARK YOUR CALENDAR!!!!!**

TIME: 5:30 PM. Auditorium will be open for viewing exhibits, purchasing items from the sales table, chatting with old friends, and meeting new members. Dinner will be served at 6:30 PM.

SPEAKER: Dr. Gary Retallack, OSU, will speak on **"The World's Greatest Midlife Crisis: The Permian-Triassic Extinctions in Antarctica."**

PRICE: $14.00

TICKETS: Mail or give money or check to:
Phyllis Thorne
P.O. Box 907
Portland, OR 97207

PARKING: Terwilliger Plaza has 4 places to park:

1. in front of the building
2. behind the building
3. in the Parkview Center lot just north of the back parking lot
4. across the street on the north side of Juanito's (a no-longer-operating restaurant with an A-frame roof)

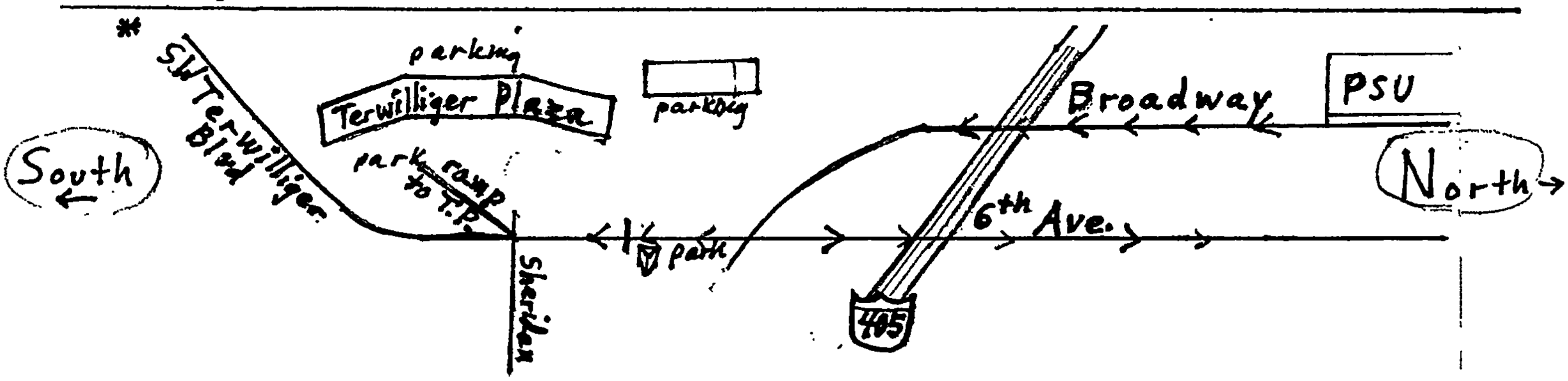
If you need to come early to set up exhibits or sales table or work on the banquet, please call **Rosemary Kenney** at 221-0757 so she can put your name on her list and direct you to where you can bring things. (It's MUCH easier than last year.)
Otherwise, come to the lobby at 5:30 PM. A sign will direct you to the banquet room.

BANQUET SALES TABLE NEEDS GOOD MATERIAL!

Proceeds from the sales table at the Annual Banquet help meet banquet expenses. Please bring GOOD, EYE-CATCHING, SALABLE material that will attract buyers. Hand specimens or smaller, please. Some suggestions: minerals, slices of agate, crystals, fossils, thundereggs, tumbled agates, geodes; jewelry; and worthwhile books on geology and natural history. If you need help transporting your material to Terwilliger Plaza, call **Don Botteron** at 245-6251.

SHOW OFF YOUR BEST SPECIMENS, PICTURES, GEOLOGY-HOBBY ITEMS!

Displays for the Annual Banquet are eagerly solicited. Please call **Don Turner** at 246-3192 to reserve space. Please bring your own lamps and extension cords. You may set up material from 3:00 PM the afternoon of March 14 on.



In Memoriam Dr. John Allen. 1908-1996

The members of the Geological Society of the Oregon Country were saddened to learn of the sudden passing of Dr. John E. Allen who had been with the Society for more than 50 years. He was an active member while living in Portland during the time he served on the staff of he Oregon Department of Geology and Mineral Industries, and later, when he returned to Oregon to chair the new Department of Geology at Portland State University. He was elected President of the Society in 1946 and served for many years as a member of the Board.

The 30's and 40's were a busy time for John after he received his Master's degree from the University of Oregon in 1932. The State Department was established under the directorship of Earl K. Nixon who lost no time in hiring some eager young geologists to begin field mapping and exploring the mineral potential in Oregon. John was part of the original "team" , a natural selection because of his previous experience in southwest Oregon developing new chromite deposits for Rustless Iron and Steel Company. The results of his field studies were published by the Department on a regular basis. The report on the Wallowa mountains in Northeast Oregon by John and Professor W.D. Smith established the basic geology framework in one of the most scenic areas of the state. At Coos Bay, he co-authored with Dr.. E.M.Baldwin and Ralph Mason ,(also GSOC members), a detailed study of the coal deposits in that area.

While a graduate student at the University of Oregon he wrote his Master's thesis on the Geology of the Columbia River Gorge, and he developed a love for that part of the state that he never forgot. In 1974, after he retired from Portland State University, he returned once again to that area in order to write a book about it. The result was "Magnificent Gateway - a layman's guide to the geology of the Columbia River Gorge."

Earlier this century, a geologist by the name of J. Harlan Bretz had proposed a theory that a tremendous flood had swept through the Gorge sometime in the past, creating channeled scablands, giant ripple marks, and hanging tributaries to mark its passage. John Allen felt that it was time to write a book about this geologic catastrophe and bring it up to date by summarizing all the work that had been dune since Bretz' original field studies. The result was his now-famous book, "Cataclysms on the Columbia" which showed that not just one, but perhaps as many as thirty or forty floods had poured down the Columbia at the end of the last ice age.

John never lost his youthful exuberance and enthusiasm throughout his long career; field mapping, university teaching, or book writing. He was a continuing inspiration to his students and to his scientific colleagues. All of us will certainly miss him.

Andy Corcoran

COMPLETELY FRACTURED GEOLOGY

Ralph & Evelyn Pratt

1. taphonomy: a descriptive labeling system for hard, chewy candies
2. punctuated equilibrium: what the loser in a boxing match ends up with
3. colonnade: a laxative
4. trona: as in, "He got arrested for trona tomato at the speaker."
5. ultramafic: an extremely ardent member of a Sicilian criminal organization
6. wolframite: curly hair that can be shorn from a very small arachnid
7. xenotime: what clocks on an alien planet run on
8. pluvial: meat from a very sad calf
9. eurypterid: the way a psychologist accused a man of damaging his girlfriend's primitive psyche;

10. "Eurypterid "

10. fondo: a dish featuring melted cheese

A Review of The Evidence For Trilobite Predecessors in the Fossil Record

Robert B. MacNaughton, Ph.D. Candidate
Department of Geological Sciences, Queen's University
Kingston, Ontario, Canada, K7L 3N6

INTRODUCTION

Skeletons of trilobites, an extinct group of arthropods, first appear in the fossil record in rocks of Early Cambrian age. Trilobites were among the first organisms to possess a well-mineralized exoskeleton, and are sufficiently common in rocks of Cambrian age that the Cambrian Period is sometimes informally referred to as "The Age of Trilobites". While trilobites are indeed a typical fossil in Cambrian deposits, the lineage continued for approximately 300 million years, finally becoming extinct at the end of the Permian Period. A very accessible introduction to these fascinating organisms (as well as many pointers to more technical literature) can be obtained from Ricardo Levi-Setti's (1993) book ***Trilobites.***

Interpreting the early history of trilobites is a complex task. The first appearance of skeletal faunas is strongly diachronous during the Early Cambrian (Brasier, 1989). That is, the faunas first appeared during different time intervals at different places around the world. Another difficulty is that trilobite faunas show marked provinciality during this interval (Cowie, 1971; Brasier, 1989). This means that different parts of the world were characterized by different genera of trilobites. There is also evidence that some patterns of first appearance are probably due to facies control (Mount and Signor, 1992). Simply stated, facies control means that some rock types be increasingly well understood (Brasier, 1989; Briggs and Fortey, 1992).

Interestingly, certain creationists have pressed the allegation that the fossil record contains no evidence of predecessors or ancestors to trilobites and that the abrupt first appearance of trilobites is thus positive evidence for the instantaneous creation of the lineage. However, this assertion is plainly untenable if the fossil records examined in more than a cursory manner. The Early Cambrian was a time when numerous taxa, including the arthropods, attained mineralized skeletons (Lipps and Signor, 1992); any soft-bodied ancestors would have had little chance for preservation as fossils. (While soft-bodied organisms can be preserved under exceptional conditions, these conditions are very rare. Normally it is only the hard-parts of organisms that are preserved as fossils.) Nonetheless, the fossil record does offer two lines of direct evidence that point to the existence of trilobite predecessors.

EVIDENCE FROM TRACE FOSSILS

The first line of evidence comes from trace fossils, the preserved tracks, trails, and burrows of living organisms. Marine sedimentary rocks of many different ages (Cambrian to Permian) have been found to contain a very distinctive suite of burrows, scratch-marks, and furrowing traces that can confidently be ascribed to the activities of trilobites (Seilacher, 1970; Crimes, 1973). Indeed, rare specimens have been found which contain trilobite body fossils within the burrows (Osgood, 1970). In sections of rock that span the boundary between the Cambrian and the preceding Vendian Period, these distinctive trace fossils are commonly found in strata that are lower stratigraphically (and thus older) than those containing the first preserved trilobite skeletons (Crimes, 1987, 1994). Non-existent organisms cannot produce burrows, and so these trace fossils demonstrate that trilobites, or their ancestors, did in fact exist prior to the first appearance of trilobite body fossils. Even more intriguing is the observed fact that these trace fossils become progressively more complex with time during the period preceding the advent of mineralized skeletons (Crimes, 1992). This implies that the behaviors of these ancestral trilobites were evolving.

EVIDENCE FROM THE PRECAMBRIAN FOSSIL RECORD

The second line of evidence comes from the fortuitously preserved soft-bodied organisms of the latest Precambrian-aged (Vendian) Ediacaran Fauna. The Ediacaran Fauna were traditionally interpreted as ancestral representatives of and predecessors to taxonomic groups which occur more abundantly in rocks of Cambrian age (Glaessner, 1984; Fedonkin, 1985). This view was challenged by Seilacher (1984, 1989), who argued that the Ediacaran Fauna were not animals but instead were a group of structurally unique organisms belonging to a previously unrecognized kingdom, dubbed the Vendozoa. Seilacher's hypothesis has been vigourously debated (Gehling, 1991; Fedonkin, 1992; Conway Morris, 1993; Crimes et al., 1995; Waggoner, 1996) and Seilacher himself seems to have moved away somewhat from his earlier hypothesis (Buss and Seilacher, 1994). A concensus seems to be emerging that while the Vendozoan hypothesis may apply to some Ediacaran organisms, it does not apply to them all. Certainly, representatives of several extant phyla have been compellingly documented (Gehling, 1987, 1988, 1991; Fedonkin, 1992).

The organisms represented in the Ediacaran fauna were soft-bodied and are preserved as impressions, generally (but not exclusively) on the soles (bottoms) of sandstone beds. They were apparently preserved as the result of the fortuitous sediment-binding action of microbial mats (Gehling, 1991; Seilacher and Pfluger, 1994). In Gehling's (1991, p. 218) view, these microbial mats "acted both to erosion proof the substrates occupied by organisms buried under storm sands, and to initiate immediate mineral encrusting of organic surfaces and cementation of the sand at the interface." (The interface referred to is the one between layers of sediment.) This mode of preservation seems to have been confined to the Precambrian--it was presumably curtailed by the activities of microbe-eating burrowing and grazing organisms which appeared in the latest Precambrian and early Cambrian (Gehling, 1991; Crimes, 1992, 1994) and (or) by changes in seawater chemistry during this interval (Grotzinger, 1990).

The Ediacaran Fauna contains several species which may represent, if not ancestral trilobites, then at least ancestral arthropods. These include such taxa as *Vendia, Vendomia, Onega, Praecambridium, Parvancorina,* and *Marywadea* (Gehling, 1991; Fedonkin, 1992; Jenkins, 1992). All of these genera show well-developed head and tail differentiation and possess body outlines such as might be expected in a primitive arthropod. There is one additional taxon, yet to be formally described, which shows great promise to elucidate the early history of the trilobites. It has been described in the following terms by *Gehling (1991, p. 206):*

> *A new metameric form . . . features a head end with a symmetrically placed D-shaped ridge. The ridge parallels the front margin, and seems to contain a domed area within. The body has a raised axial zone, and segments that show evidence of articulation . . . This organism has more external resemblance to the trilobites than any form so far described from the Ediacara assemblage.*

The photograph which Gehling provides (Plate 4, Fig. 4) definitely supports his last assertion. The same taxon has also been described in more detail by Jenkins (1992), who dubs it a "soft-bodied trilobite" and states that, "Its observed characteristics occur in a variety of Paleozoic trilobites, but it can probably be considered to differ from all known forms at the ordinal level" (p. 169). Jenkins (1992, Figure 15) figures sketches of several specimens of the organism; like Gehling's photograph, they show an organism strongly resembling a trilobite.

CONCLUSION

The fossil record evidently provides significant evidence for the existence of trilobites prior to their aquisition of a mineralized skeleton. Trace fossils offer a record of the evolving behavior of soft-bodied ancestral trilobites, while the latest Precambrian Ediacaran Fauna contains probable primitive arthropods, including an organism which may be an ancestral trilobite. Assertions that trilobites appear "instantaneously" in the rocks of the Cambrian System, without any sign of ancestral forms, are plainly incorrect.

ACKNOWLEDGEMENTS

My thanks to Andrew MacRae for helpful comments on an early version of this paper. This essay can also be viewed on the WWW as part of the "Answers About Evolution" page http//www.rt66.com/diamond/cre_answ.html> maintained by Russell Stewart.

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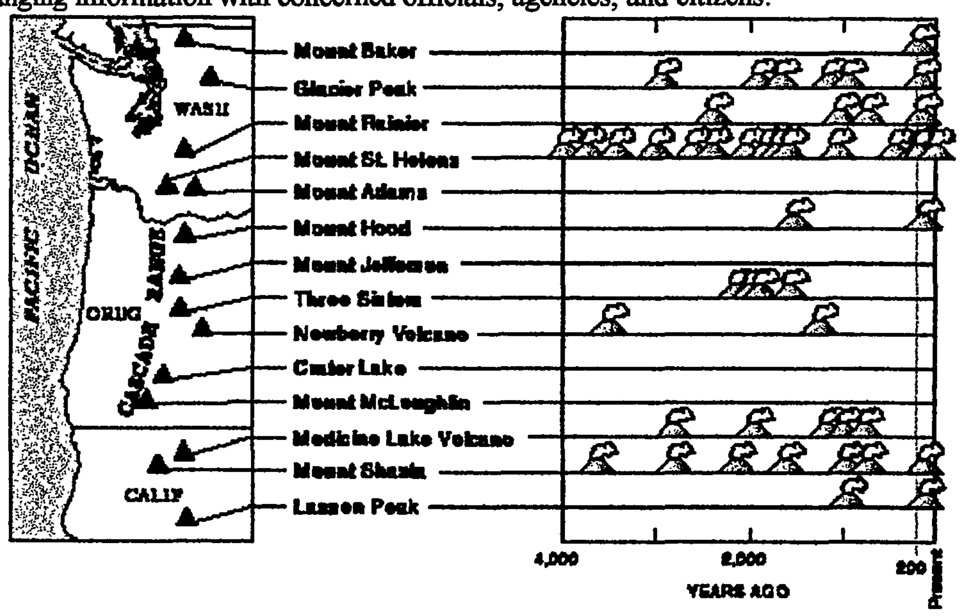
Correct definitions to "**COMPLETELY FRACTURED GEOLOGY**" adapted from AGI Dictionary of Geological Terms, 3rd Edition, Bates & Jackson; by Evelyn Pratt

1. taphonomy: the study of the environmental conditions affecting the fossilization of plant or animal remains (Random House Dictionary of the English Language, 2nd Ed.)
2. punctuated equilibrium: a hypothesis holding that the evolution of species proceeds in a characteristic pattern of relative stability for long periods of time interspersed with much shorter periods during which many species become extinct and new species emerge. (Ibid.)
3. colonnade: the lower portion of a lava flow with well-formed parallel shrinkage columns (Geology of the Pacific Northwest, Orr & Orr)
4. trona: a whitish mineral occurring in fibrous or columnar layers and thick beds in saline residues; a major source of sodium compounds
5. ultramafic: said of an igneous rock composed chiefly of iron-magnesium minerals such as hypersthene, augite, or olivine
6. wolframite: an iron-magnesium mineral occurring in crystals, granular masses, or columnar aggregates; the principle ore of tungsten
7. xenotime: a brown to reddish mineral, often containing rare earths or uranium, occurring as an accessory mineral in granites and pegmatites
8. pluvial: pertaining to rain; said of a geologic feature resulting from precipitation
9. eurypterid: one of a group of large extinct arthropods that lived in brackish or fresh water during the Paleozoic
10. fondo: a term applied to the environment of sedimentation that lies on the deep floor of a body of water

Volcanic Hazards in Oregon

Seven volcanoes in the Cascade Range have erupted during the past few hundred years, two of them during this century (fig. 1). Future eruptions are virtually certain to pose hazards to communities, aviation, and interstate commerce in Washington, Oregon, and northern California. Recent coordination efforts by scientists and emergency planners have successfully demonstrated that losses from future eruptions can be reduced substantially through effective land-use planning and timely warnings of impending volcanic activity. The U.S. Geological Survey (USGS), in cooperation with the U.S. Forest Service, National Park Service, Bureau of Land Management, Federal Aviation Administration, Oregon Office of Emergency Management, Oregon Department of Geology and Mineral Industries, and other Federal, State, and county agencies, is working to identify and mitigate hazards from future eruptions in the western United States . USGS scientists are studying the effects of past eruptions, monitoring for signs of renewed activity, developing new monitoring tools, and exchanging information with concerned officials, agencies, and citizens.



MAR 97

THE GEOLOGICAL NEWSLETTER

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ACTIVITIES

ANNUAL EVENTS: President's Field Trip - summer; Picnic - August; Banquet - March; Annual Meeting - February. **FIELD TRIPS**: Usually one per month, private car,caravan or chartered bus. **GEOLOGY SEMINARS;** Fourth Wednesday , except June, July, August. 8:00 p.m., Room S17, Cramer Hall, Portland State University. Library: Room S7. Open 7:30 p.m. prior to meetings. **PROGRAMS**: Evening:: Second Friday evening each month, 8::00 pm, Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon. **LUNCHEONS**: First and Third Fridays monthly at noon except holidays. Bank of California Tower, 707 SW Washington, 4th floor, California Room, Portland, Oregon. **MEMBERSHIP**: per ear from January 1: Individual - $20.00, Famil;y - $30.00, Junior (under 18) - $6.00. Write or call the Secretary for application. **PUBLICATIONS**: ***THE GEOLOGICAL NEWSLETTER*** (ISS 0270 5451), published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year. Individual subscriptions $13.00 a year. Single copies $1.00. Order from the 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.

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VOL. 63, No. 3
MARCH 1997

MARCH ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room. (Cafeteria is closed permanently.)

March 7 — No meeting. LAST DAY FOR ANNUAL BANQUET RESERVATIONS!

March 21 — The Andes of South America
Rosemary Kenney, GSOC Past President

ANNUAL BANQUET PRE-EMPTS REGULAR FRIDAY EVENING MEETING

March 14 — Annual Banquet at Terwilliger Plaza, 2545 SW Terwilliger Blvd., a few blocks S of PSU. **GREGORY RETALLACK will speak on "The World's Greatest Midlife Crisis: The Permo-Triassic Extinctions."**
Come from 5:30 PM on. Dinner at 6:30 PM. Presentation at 8:00 PM.

WEDNESDAY EVENING SEMINAR :

March 26: — Part III: Mesozoic: Ch. 11-14, pp.71-94, Northwest Exposures, Alt & Hyndman. Led by Clay Kelleher, Past President.

****

The 1997-98 Membership Directory will be prepared in April. It will list all members whose dues are paid as of March 30, 1997.

In the future please send all memorials for Portland State directly to the Foundation. They can be designated as scholarships for the Geology PSU Foundation, PO Box 243, Portland, OR 97207-0243. Designate memorials for Dr. Allen: "John Eliot Allen Geology Scholarship Fund."

****

ALL ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES **MUST** BE SUBMITTED TO THE CALENDAR EDITOR BY THE **15TH** OF THE MONTH. Write or call Evelyn Pratt, 223-2601.

Chaney's Deschutes fossil flora site near Madras, Oregon revisited

Melvin S. Ashwill, 940 Southwest Dover Lane, Madras, Oregon 97741

Figure 1. Unidentified man viewing a fossil mold of a tree trunk at the Deschutes fossil flora site. Probably about 1936. Photograph from the University of Oregon archives.

During the fall and winter of 1990 I watched highway construction workers on the Highway 26 Warm Springs to Agency Plain grade eight miles northwest of Madras, Oregon excavate and set aide boulder after huge boulder bearing early Pliocene leaf compressions. This is the same "Deschutes Flora" site that the late paleobotanist Dr. Ralph Works Chaney studied in 1936. I know that were he alive, Chaney would have been thrilled along with me at the magnificent specimens and new paleobotanical data brought to light after more than five million years of repose.

CHANEY IN OREGON

As an amateur paleobotanist, I work in the shadow of a giant. Collecting and studying fossil plant material in Oregon for several decades, I meet at every turn with the ghost of Dr. Ralph Works Chaney. Few of the localities from which I collect have not previously been visited by him. This includes the fossil flora found in the Warm Springs grade road cut along Highway 26 northwest of Madras, Oregon. The literature teems with his works and references to his work. Former students of his and old timers that I contact are full of reminiscences and praise for his person and his scholarly work. In letters to Louis and Viola Oberson, Chaney describes the close friendly association he enjoyed with them. At the time of this writing, the late Louis Oberson was the only present Geological Society of the Oregon Country who took part in one of Chaney's trips to the Deschutes fossil flora site. Louis made the following observations: "Mildred Phillips' husband Clarence Phillips was president of GSOC in 1936 when we had 85 people in the two day field trip over Decoration (Memorial) Day. We had Dr. Chaney and Phil Brogan as leaders. There were four pages about this trip in Volume II of our newsletter (Enders, 1936). Dr. Chaney was our friend from 1935 until his death (1971). Many times he came to our home. Our home served as a meeting place for the leaders in our geological society. Phil Brogan was a loyal friend. I can say my best friends have been members of our

We were back in Madras before dark and after an excellent dinner in the restaurant adjoining Turk's service station we spent the night in the hotel."

The following is part of an account of a GSOC trip to the same locality during ;the Memorial Day weekend of 1936. This group included Chaney and Phil Brogan for the two days, according to Louis Oberson (Oberson, written communication, l991).

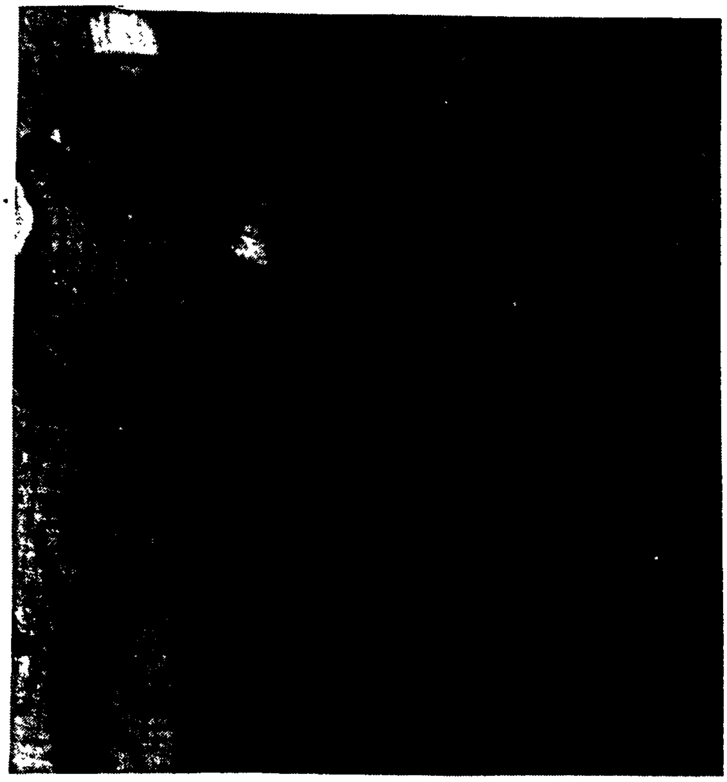


Figure 2. Melvin Ashwill at the Deschutes fossil flora site standing by a large fossiliferous boulder holding hundreds of leaf compressions.

"It was with all worldly cares and worries left behind that eighty-five people met at Madras on Decoration Day morning for two wonderful days of exploration in the neighboring canyons and mountains." This is the beginning paragraph of a story called "The Madras Trip" (Enders,l~SB).

"Promptly at 7:00 o'clock Saturday morning the caravan left (Madras) to view a massive structure of pillar basalt, nine miles from Madras along the Warm Springs Highway. Tree casts and leaf molds were also seen, and those who were ambitious managed to get specimens of imprints from large boulders."

Viola and Louis Oberson took part in this expedition. An interesting sidelight is preparatory notes for the 1936 Memorial Day weekend Geological Society of the Oregon Country trip to Madras included a rate quotation for hotel rooms in Madras of one dollar per night!

PAST WORK

Chaney states that the occurrence of fossils at this site was first reported by an engineer with the state highway department to Phil Brogan, writer and amateur geologist/paleontologist of Bend, OR. (Chaney, 1936). Later, Dr. Luther S. Cressman (anthropologist and archaeologist at the University of Oregon and former husband of renowned anthropologist Margaret Mead) made a collection of leaf impressions from the site. Chaney visited Cressman in Eugene and saw his collection. Cressman's material and that collected by Chaney in June of 1838 supplied the data for Chaney's initial study of the Deschutes flora.

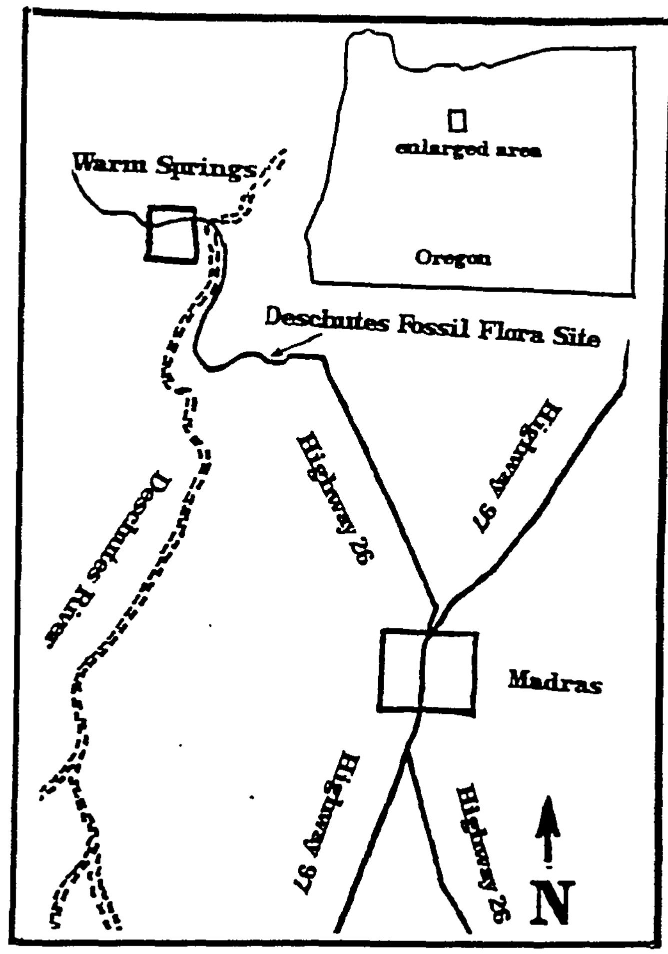
Little additional collecting was done between 1936 and the present. This is due to the fact that the rather spongy tuffaceous mudflow rock that hosts the leaves is extremely hard to split. Chisels tend to be absorbed or embedded in the material without causing a fracture. Because of this, and despite countless onslaughts by would-be collectors, modern photographs of the out look almost exactly like those taken by Chaney. The only visible change in the fossil bearing cliff through the years was the creation of a small undercut at the richest parting layer. The undercut was no more than two feet back into the cliff and extended only twenty or thirty feet along the face. A number of core-drill holes also appeared in the cut as samples for age-dating were taken by one or more geologists.

The article on Chaney's Deschutes fossil flora site near Madras, Oregon revisited has been divided into three parts. The first part appears in this issue of the Newsletter. The next two issues of the Newsletter will have the rest of Mr. Ashwill's article.

geological group.---You may wish to contact Kenneth Phillips and Mildred Phillips, widow of Clarence Phillips who was our second president in 1936. They are the other two remaining members who were part of the original 140 charter member." In a letter to Viola Oberson dated January 18, 1969, Dr. Chaney said: "I very much appreciate all you did for me (he had been ill while in Portland to deliver the Condon Lecture). The raspberries from your garden and refrigerator were a great treat. You have such a wonderful yard and garden. Some time I want to show you mine- it is totally different and you may not even like it.---Again , my thanks for taking care of me, and for showing me your garden, and your current study."

John Elliot Allen said: " Your letter brings back many memories. Did you know that I was one of Chaney's five teaching assistants for three years at Berkeley (1932-1935)? He had 1000 students taking his course in paleontology filling Wheeler Auditorium. I never did go into the field with him except on the annual class field trip with twenty busloads of students, since I had my own dissertation to work on...(The Geology of the San Juan Bautista Quadrangle)." ..(Allen, written comm., 1991).

LOCATION MAP



The late Margaret Steere also wrote: "I regret to report that I didn't come to Portland until 1942, so I missed out on the GSOC trip of 1936,-- I can only say that on several trips during the 1950s I saw some fairly good aspen leaf prints on large blocks of rock at the side of the highway (at the Deschutes fossil flora site)." (Steere, written comm. 1991).

Micropaleobotanist Dr. Jane Gray (University of Oregon) was a student of Chaney's and has high praise for his work. Dr. J.Arnold Shotwell (former paleontologist, University of Oregon knew and worked with Chaney and regards his work with affection.

FOSSIL FLORA DISCOVERED IN 1935

The following is an excerpt from an account of a several days duration collecting trip to central Oregon in the last week of June, 1938. It was written by A.D. Vance (Vance, 1936). In the party were Ralph Works Chaney, A.D. Vance, A.W. "Lon" Hancock and Carlton Condit, at the time a University of California (Berkeley) graduate student in paleobotany. At Madras, Lewis "Turk" Irving and Phil F. Brogan joined the group. "By the time we had eaten dinner Phil Brogan was on hand and we drove to the leaf fossils on the new grade between Madras and Warm Springs Agency. Here specimens of Poplar, Box Elder, Maple and Wild Cherry leaves were secured.

Dr. Chaney pronounced this fossil flora to be the first of Pliocene age to be found in Oregon.

The Doctor's excitement was evident. Phil Brogan whose enthusiasm for the study of Oregon Geology is as great, if not as apparent as is that of Turk Irvin's was visibly affected. Turk, in his excitement almost swallowed a chew tobacco and forced to stagger up the hill to the water jug. Dr. Chaney told us that his first order of business after taking the boat for Alaska on July 1st would be to write a paper on this Pliocene Flora.

COMPLETELT FRACTURED GEOLOGY

1. **norite** refers to a question that can't be answered correctly.
2. **hypercarbia** as in, I'm buying a Toyota there, it's to hypercar, Bea.
3. **ferromagesian**, (1) formerly tame magnesium now living in the wild (2) refers to an ancient Egyptian ruler's enlarged leg joint.
4. **stria** as in, "Don't give up! Let'striagain!"
5. **neutron log** record of a sea voyage by two prominent Republicans.
6. **acicular,** decribes a vehicle that has lost its wheels.
7. **spinel** as in, "What a horible experience! I tell you, it'sspinel!"
8. **oxidate,** a girl's appointment with a big dumb guy - or vice versa.
9. **phase velocity** in a skiing mishap, a measure of how fast the front of one's head gets covered with snow when diving into it.
10. **offlap** when a toddler slides from when the pizza person rings the doorbell.

WELCOME NEW MEMBERS JOINING SINCE JANUARY 1996

Jesse Gard	*Robert Perron*
Richard Donaldson	*Dottie Taccogna*
Costa and Marge Columbus	
Travis Thornton	*Eldred Gilpin*
Norma Hunt	*Frank Poundstone*
Ann Cabot	*C.J.Ingram*
Tom and Faye Gregg	
Tim and Lynn Tolle	
Marilyn Lum	*Jeffery Mann*
Ron Culver	*Margaret Giddings*
Mike, Gail and Brooke Warren	
Benton Daily	*Andrew Manning*
Kenneth and Annette Wilbur	
Larry and Bonnie Magura	
Warren Purdy	*Jesse B. Walters*
Robert and Marlene Jack	

Unusual landscapes and geologic problems in the Pacific Northwest

by John Eliot Allen, Emeritus Professor of Geologv, Portland State University, P.O. Box 751, Portland, OR 97207-0751

Geologists and laypersons alike are familiar with the chain of High Cascade volcanoes (Williams, 1953; Allen, 1984), which reach from British Columbia to northern California, the most prominent being Mount Rainier in Washington, Mount Hood in Oregon, and Mount Shasta in California. Most of us are also familar with the two great collapsed volcanoes known as "calderas," Crater Lake (Williams, 1942) and Paulina or Newberry Crater (Williams, 1935).

There are, however, at least five other unusual and remarkable landforms in the Pacific Northwest that are less familiar and may have origins that are of interest, since there are still questions to be answered and alternate hypotheses to be considered. These are the Channeled Scablands, the Mima Mounds, coastal and Willamette Valley terraces, great landslides, and great Tertiary rivers.

I. Channeled Scablands: Are really, the most widespread landform, the Scablands cover nearly 16,000 mi² of eastern Washington and affect the Columbia River Gorge, Willamette Valley, and a small area north of Newberg, Oregon, known as the "Tonkin Scablands." J Harlen Bretz first suggested in 1923 that these dry valleys were cut in the loess and underlying basalt by a gigantic flood. Later authors have proposed at least 40 and perhaps a hundred floods, occurring between 15 and 12 thousand years ago at the end of the Pleistocene (Allen, 1986; O'Connor and Waitt, 1995).

II. Mima Mounds: One of the still puzzling landscapes in the Pacific Northwest consists of "Mima Mounds", whose type locality is south of Tenino, Washington. More than a dozen hypotheses have been advanced to explain the fields of hundreds of mounds, which are about a yard high and 4-5 yards in diameter. Similar mounds occur in Oregon in such places as upon the basalt of Tom McCall State Park in th Columbia River Gorge. Hypotheses include gophers, earthquakes, glacial deposits, and wind erosion of volcanic ash over depressions in basalt. It is highly probable that Mima Mounds have multiple origins, but although many papers have been published, the issue is still moot.

III Terraces: Most of the coastal towns along Highway 101 are located upon the lowermost (50-foot) of a series of marine terraces first described by Diller in 1902. These are wave-cut platforms resulting from upper Tertiary and post-Pleistocene changes in sea level, and so far few of their ages and locations have been mapped. Little attention has been paid to the terraces, first noted by Condon and later by Allison (1936). (Madin and others [1995] mapped such terraces in the Charleston quadrangle. --ed)

IV. Landslides: Great landslides have recently been recognized as having been caused by great earthquakes. The 14-mile^{2}square Cascade Landslide in the Columbia River Gorge at Bonneville has been dated at about 800 to 1,000 years ago. The mud slide that buried an Indian village on the Olympic Peninsula coast west of Ozette occurred about 400 years ago. Landslides that formed Triangle and Loon Lakes in the southern Coast Range have yet to be dated.

V. Great Tertiary rivers of eastern Oregon: Highlevel gravel deposits, many of them gold-bearing, have been found high on the summits of the Wallowa Mountains and on the crests of many other ridges (Allen, 1991). They contain numerous and sometimes very large boulders of quartzite and other metamorphic rocks from the Rocky Mountains and must represent at least one very large Tertiary river, either an ancestral Columbia or Snake River. Little has been published as yet on these rivers.

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OREGON GEOLOGY, VOLUME 58, NUMBER 5, SEPTEMBER 1996

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Correct definitions to "**COMPLETELY FRACTURED GEOLOGY**" adapted from AGI Dictionary of Geological Terms, 3rd Ed., Bates & Jacksson.

1. **norite** a gabbro-like rock with hypersthene as its major mineral instead of labradorite.
2. **hypercarbia**. Overabuncance of Cos in body tissures - possible cause of major extinctions
3. **ferromagnesium**: applied to minerals suc as biotite, olivine, amphibole and pyroxene.
4. **stria** one of a series of straight parallel lines on a crystal.
5. **neutron log** the result of rocks in a borehole being bombarded with neutrons - a radioactivity log curve that tells how intense radiation is: show how much fluid is in the rocks.
6. **acicular** needle-shaped.
7. **spinel** magnesium aluminum oxide: a hard mineral that forms octagonal crystals and is used as a gemstone.
8. **oxides** sediments composed of iron and maganese plus oxygen and hydroxide (-OH) that settle out of water.
9. **phase velocity** a measure of the velocity with which an observable, individual wave goes through a medium: walelength x frequency.
10. **offlap** out from a shoreline, each younger unit exposes a part of thje older unit it is lying on.

APR 97

THE GEOLOGICAL NEWSLETTER

GSOC

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ACTIVIES

ANNUAL EVENTS: President's Field Trip - summer; Picnic - August; Banquet - March; Annual Meeting - February. **FIELD TRIPS**: Usually one per month, private car,caravan or chartered bus. **GEOLOGY SEMINARS**; Third Wednesday , except June, July, August. 8:00 p.m., Room S17, Cramer Hall, Portland State University. Library: Room S7. Open 7:30 p.m. prior to meetings. **PROGRAMS:** Evening: Second Friday evening each month, 8:00 pm, Room 383, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon. **LUNCHEONS**: First and Third Fridays monthly at noon except holidays. Bank of California Tower, 707 SW Washington, 4th floor, California Room, Portland, Oregon. **MEMBERSHIP**: per year from January 1: Individual - $20.00, Family - $30.00, Junior (under 18) - $6.00. Write or call Secretary for application. **PUBLICATIONS**: THE GEOLOGICAL NEWSLETTER (ISSN 0270 5451), published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year. Individual subscriptions $13.00 a tear. 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.

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VOL. 63, No. 3
APRIL 1997

APRIL ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 noon. Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room.

April 4 TBA

April 18 History of Eastern Oregon Mining.
Andy Corcoran, GSOC Past President

FRIDAY EVENING MEETING: 8:00 PM. Rm. 371 Cramer Hall, PSU

April 11 Oxygen vs. Iron in the Evolution of Our Atmosphere
Dr. Mike Cummings, PSU Geology Dept.

WEDNESDAY EVENING SEMINAR : 8:00 PM. Rm. S-17 Cramer Hall, PSU

April 23 Northwest Exposures, Alt & Hyndman; Ch. 15-17, pp. 95-114. Topics: Docking terranes in northern Washington and moving land blocks in northern California 100 million years ago

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REPEAT ANNOUNCEMENTS:

The 1997-98 Membership Directory will be prepared in April. It will list all members whose dues are paid as of March 30, 1997.

In the future please send all memorials for Portland State directly to the Foundation. They can be designated as scholarships for the Geology PSU Foundation, PO Box 243, Portland, OR 97207-0243. Designate memorials for Dr. Allen: "John Eliot Allen Geology Scholarship Fund."

****

ALL ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES **MUST** BE SUBMITTED TO THE CALENDAR EDITOR BY THE **15TH** OF THE MONTH. Write or call Evelyn Pratt, 223-2601.

ELECTED OFFICERS FOR 1997-1998

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Arnald and Marlene Adams
April Aldrich
Elizbeth Rayner
Ralph and Megan Leftwich

COMPLETELY FRACTURED GEOLOGY

by Evelyn & Ralph Pratt

1. **diachronous** flimsy, almost transparent, as in "She appeared wearing a diachronous negligee.
2. **taxa** the method of financing governments in Italy.
3. **witness corner** a country health officer testifying at an inquest.
4. **tufflava** what parents need to give
5. misbehaving rock-band players in order to reform them.
5. **olistostrome** brand name of a no-calorie fat substitute.
6. **progradation** the state of being upright and true rather than corrupt and disgraded.
7. **T-chert** as in, "Take off that grubby T-chert.
8. **monzonite** in India, a tropical rainstorm after dark.
9. **overbank** deposit too much money in the checking account.
10 **fauna** as in, "Did you have a lot of faunat the party?"

KOBE EARTHQUAKE WAS DEADLIEST, BUT NOT LARGEST IN '95

The magnitude 6.8 earthquake that killed 6,308 people and injured and displaced thousands of others in Kobe, Japan on Jan. 16, 1995, was certainly the deadliest and most expensive natural disaster anywhere in the world last year, but it was not the largest earthquake of the year, according to scientists at the U.S. Geological Survey, Department of the Interior.

Twenty-five earthquakes around the world registered a higher magnitude than Kobe, according to USGS records at its National Earthquake Information Center in Golden, Colorado. Forty-seven "significant" earthquakes were recorded throughout the world in 1995, 22 more than occurred in 1994, but only about two-thirds the long-term average of 60 per year. A significant earthquake, according to the USGS, is defined as one that registers a magnitude of at least 6.5, or one of lesser magnitude that causes casualties or considerable damage.

In spite of the 6,308 people killed in the Kobe quake, and another 2,000 killed in other earthquakes around the globe, 1995 was "below average, for earthquake fatalities" , said Waverly Person chief scientist at the USGS facility in Colorado. "Since comprehensive record keeping began in the early 1960s," Person said, "the average annual death toll, worldwide, has been about 10,000."

Four of the 1995 earthquakes were "great" earthquakes, registering a magnitude of 8.0 or greater. Two were centered on the floor of the Pacific Ocean; one near Tonga in the South Pacific, on April 7, and one off the northern coast of Japan, December 3. The only land-based " great" earthquake occurred onshore near the northern coast of Chile on July 30. That 8.1 earthquake killed three people, injured several and generated a tsunami (sea wave) that traveled north and westward across the Pacific Ocean, but never reached heights of more than about two meters.

There were no significant earthquakes or earthquake fatalities recorded in the United States during 1995. One miner was killed in the implosion of a trona mine in southwestern Wyoming on February 3, but although that event registered a magnitude 5 on seismometers, its cause was determined to be associated with the structure of the mine, rather than a natural shift in the earth's crust.

The largest earthquake to occur anywhere in the U.S. or its coastal waters during 1995 was a 6.8 earthquake that occurred off the coast of Northern California on February 19. Although the tremor was felt over a large area of northern California, no injuries or damages were reported. A 6.5 earthquake was recorded in the Aleutian Islands on April 23.

The second-largest felt earthquake in the U.S. during 1995 was a 5.8 tremor, September 20, near Ridgecrest, Calif., in the Mojave Desert, northeast of Los Angeles. Although this earthquake has been followed by thousands of smaller after shocks, no deaths, injuries or major damage have been attributed to the earth movements.

The third-largest earthquake in the U.S. during 1995 occurred in Brewster County, Texas, April 14. Two people were slightly injured in the 5.7 shaker that was felt throughout most or west-central Texas, and as far east of the Dallas-Fort Worth area. While not unheard of, earthquakes are fairly unusual in Texas.

The USGS, using data from seismograph stations throughout the world, presently locates from 16,000 to 19,000 earthquakes each year having magnitudes of about 1.0 up to 8.0 or more Earthquake data gathered by the USGS is used to report on occurrences of earthquakes worldwide, to alert disaster response teams, and to provide information used by governments and industry to study causes of earthquakes, when and where they may occur and how the hazards of earthquakes might be reduced.

Weekly reports of earthquake activity in California, Alaska and Hawaii are issued by USGS offices in those states. A list of significant earthquakes throughout the world and those in the U.S. with a magnitude of 5.5 or larger can be obtained by calling the USGS Earthquake Center at 303-273-8516. The recorded message is updated daily at 8 a.m., MST. ***USGS***

This article is a public Affairs Office release of the United States Geological Survey, February 1996.

Correct definitions to **"COMPLETELY FRACTURED GEOLOGY"** adapted from AGI Dicctionary of Geologic Terms, 3rd Ed. Bates &Jackson by Evelyn Pratt.

1. diachronous appearing at different times at
2. different places in the fossil record, such as
3. a narine sand that was deposited farther and farther our as time went on

2, taxa named groups of organisms - genera, families, classes, ect.

3. witness corner a survey point with a monument on it, up a surey line when the true corner isn't accessible.

4. tufflava... an extrusive rock containing
5. characterisics of fragmented rock ejected
6. from a volcanic vent, and of lava-like rock

5...olistostrome a mappable lens of sedimentary rock that formed when a chaotic underwater slurry of blocks and mud flowed and hardened.

6 progradation....seaward growth of a beach or delta as sediment from rivers and shoelines is deposited farther and farther out.

7. T-chert.... Irregular masses of sedimentary rock
8. made of tiny quartz crystals, which
9. occur by fractures and ore bodies;
10. Techonically derived chert as opposed
11. chert formed by weathering.
12. monzonite rocks formed at great depth,
13. containing equal amounts of alkali
14. feldspar and plagioclase, no quart, and
15. usually augite; intermediate between syenite and diorrite.

9...overbank deposit silt and clay suspension onto a flood plain by flood waters that leave a stream channel.

10. fauna animals, especially of a certain region or time.

The next three pages contains the second part of Melvin S. Ashwill's article on "Chaney's Deschutes fossil flora site near Madras, Oregon revisited."

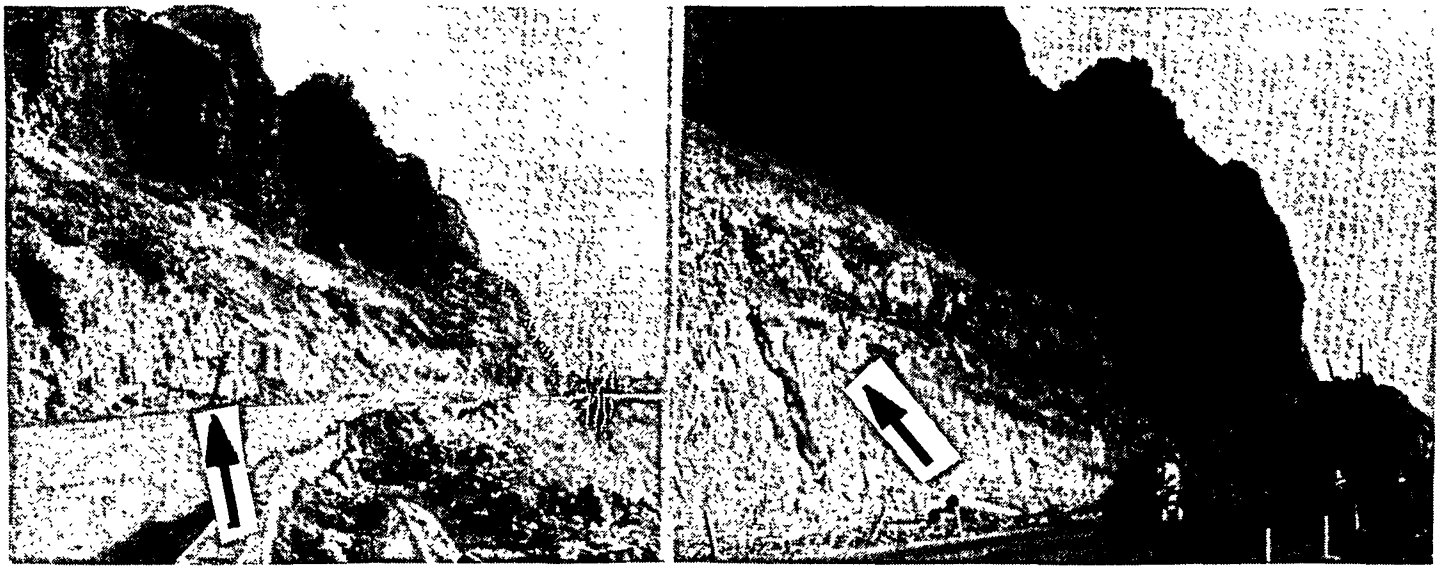

Figure 3. (left) The Campbell Canyon (Vanora) Grade before the 1990-91 work. Fossil site is at the whitish stain in the road cut. (right) Same view after the excavation was completed. Arrow marks fossil site.

hillside road curve had caused the engineers to decide that although cutting into the hill·above and below the site was necessary, a fill on the lower side of the road would do the job right where the fossils were hiding! They did not plan to excavate there. Then the laws of gravity came to the aid of those of us who wanted to see more of those fossil leaves. Overloading had caused the "skin"of the hillside below the road (colluvium covering bedrock) to begin to creep. Work was halted while heads were scratched. While the scratching was going on, I was elated. It looked to me and others as though a cut back into the fossil-bearing rocks was inevitable. Sure enough, when work resumed, a fascinating maneuver to stabilize the slide took pface. Vast amounts of rock fill that had overloaded the slope was taken up and moved to the bottom toe of the slide, successfully halting it. Then the cut was made.

When the excavation began to get into fossil-bearing strata, a remarkable assemblage of people and agencies joined in conserving the specimens. The contractor's superintendent instructed his men to give me all possible help. The landowners were anxious to see the fossils preserved for the public's enjoyment and also for scientific value .Oregon Department Transportation supervisors helped mark specimens to be set aside. The Confederated Tribes of the Warm Springs Reservation of Oregon sent trucks and crews, the Jefferson County Roads Deparment did likewise. J.C. Compton Contractor crew helped load the huge rocks..

Happily, I can report to you that fifteen of the specimens are now at The Museum at Warm Springs and are now incorporated into the landscaping of the "meadow" of the museum grounds. Two are displayed at the Jefferson County Library in Madras, Oregon. One is on display at the Jefferson County fairgrounds. Three were placed in the state highway compound at the top of the grade, where an interpretive display is planned. Two are on display at the author's home at Madras. The bulk of the collection can be viewed at Jefferson County's Juniper Hills Park on the eastern edge of Madras. They have been stacked as a massive covered wall with thousands of fossil leaf impressions all on one outside face. The Deschutes flora can thus be viewed by the public as well as studied by scientists for the indefinite future.

ADDITIONS TO THE FLORA

The number of newly recovered leaf impressions from the site is staggering. On the approximately 40 large blocks of stone it is estimated that between 8,000 and 10,000 were found. By far most of these are duplicates from the originally listed species. Horsetail (*Equisetum* sp.), spiraea (*Spiraea sp.*), Elm

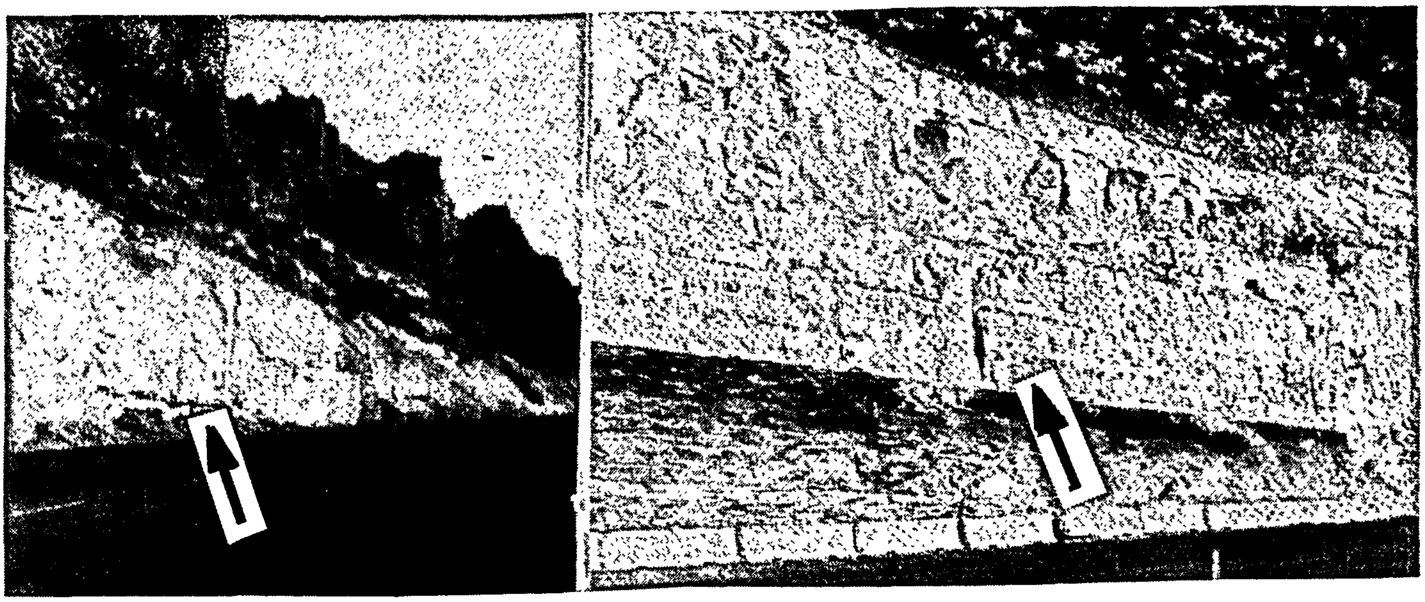

Figure 4. (left) Before and (right) after excavation close up views of the Deschutes fossil flora site.

(*Illaus sp* .), Oregon Grape (*Mahonia marguerita*), Another species of cottonwood (*Populus subwahoen* was identified by Dr. Axelrod. Two types of oak (both black oak and white oak) (*Quercus spp.*), rose (*Roae sp.*), madrone (*Arbutus sp.*) and hawthorn (*Crataegus sp.*) may also be added to the list. A second species of willow (*Salix sp.*) may be represented. There are also specimens not yet identified that appear to represent at least two additional species. A few impressions of grasses along

LOCATION, AGE,GEOGRAPHIC AND GEOLOGIC SETTINGS

The fossil leaves are found in tuffaceous volcanic mudflow rocks. The mudflow, which is rich in pumice fragments, came down an ancestral Deschutes River Canyon, most likely arriving from southwesterly direction (Smith,1986).

The site is in the NW1/4, NEl/4, SEC.8, T1OS, Rl3E. This is in the "low desert" province of central Oregon. It is in the Deschutes River Valley, east of the Cascade Mountains and west of the Ochoco Mountains. It is about sixteen kilometers (ten miles) south of the Mutton Mountains, about 20m (86 feet) west of milepost 110 on highway 26.

The formations exposed near here include the Oligocene-Miocene John Day Formation, the Miocene Colunbia River Basalt Group, the Miocene Simtustus Formation and the Miocene-Pliocene Deschutes Formation (Smith, 1986). The highway grade at the site area climbs through all of these formations.

The Agency Plains basalt flow (the rimrocks here) has been dated at 5.3 Ha using the Ar/ Ar method (Smith, 1986). The Pelton Basalt flow, which is exposed about half way to the bottom of Campbell canyon 1/2 mile (.8 km) southwest of the site and has been dated at 7.4 Ma (Ar40Ar39) (Smith, 1986).

The fossil leaf site lies between these two units, and is about 98 feet (30 m) below the canyon rim. The tuff itself at the site has been dated at 5.3 Ma and 4.3 Ma using the K-Ar method of dating (Evernden and James, 1968). Since the 4.3 Ma age is younger that the rimrock flow, it seems likely to be spurious and the fossils are most likely contemporaneous with the Agency Plains lava. The apparent discrepancy of the rimrock flow and the fossil site which is considerably lower than the rimrocks) both having the sane age can be explained by the fact that the rimrock flow at this point was also filling the ancestral Deschutes Rveer Valley, and is here considerably thicker than at other places. In other words, at the time the Agency Plains lava covered the area, the relatively level surface of the plains and the 66 feet (20 m) lower riparian deposits in the bottom of the ancestral Deschutes

with seeds and fruiting structures of box elder and alder were also found.

Chaney's publications listed five species from this locality, and included the following four:

(*Illaus sp* .), Oregon Grape (*Mahonia marguerita*), Another species of cottonwood (*Populus subwahoen* was identified by Dr. Axelrod. Two types of oak (both black oak and white oak) (*Quercus spp*.), rose (*Roae sp*.), madrone (*Arbutus sp*.) and hawthorn (*Crataegus sp*.) may also be added to the list. A second species of willow (*Salix sp*.) may be represented. There are also specimens not yet identified that appear to represent at least two additional species. A few impressions of grasses along with seeds and fruiting structures of box elder and alder were also found.

Chaney's publications listed five species from this locality, and included the following four:

Salix florissantl Knowlton & Cockerell (willow)
Populus pliotreouloides Axelrod (Quaking aspen)
Populus alexanderi (Dorf) Chaney (cottonwood
Acer negundoides MacGinitie (box elder)

The fifth species listed was a *Prunus* (cherry family). In a later publication (Chaney and Axelrod, 1959 p. 185-186). This identification was rescinded, leaving a floral list numbering four. A later find of a partial Quercus (white oak) leaf once more raised the total to five (Ashwill, 1983, p. 110).

All of the material has not yet been examined, and this page is preliminary. Recognizing this, we can present the following newly revised plant list for the Deschutes Flora:

Equisetum sp. (horsetail)
Mahonia marguerita Smiley?
(Oregon grape)
Ulmus sp. (elm)
Quercus sp. (black oak)
Quarcus sp. white oak)
Salix florissanti Knowlton & Cockerell (willow)
Populus pliotremuloides Axelrod (Quaking aspen)
Populus subwashoensis Axelrod (cottonwood)
Populus alexanderi (Dorf) Chaney (cottonwood)
Populus alexanderi(Dorf)) Chaney (cottonwood junvenile leaves. Identification by Dr. Daniel I. Dr. Daniel Axelrod. *Arbutus sp*. (madrona) *Rosa sp*. (rose)
Spiraea? sp. (spiraea)
Crataegus sp. (hawthorn)
Acer negundoides Macginitie (box elder)
Incertae sedis: At least two unidentified species of dicotyledon leaf impressions.

The above listed specimens are not figured in this paper, but may be viewed in the November, 1996 issue of Oregon Geology in "The Pliocene Deschutes fossil flora of central Oregon: Additions and taphonomic notes" (Ashwill, 1998).

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VOL. 63, No. 5
MAY 1997

MAY ACTIVITIES

FRIDAY NOON MEETINGS: 12:00 noon. Bank of Calif. Tower, 707 SW Washington, 4th floor, Calif. Room.

May 2	The Central Wasatch Range of Utah Don Barr, GSOC Past President
May 16	Conducted Tour of Korea Lois Sato, GSOC member

FRIDAY EVENING MEETING: 8:00 PM. Rm. 371 Cramer Hall, PSU

May 9	The Big Bang and the Universe Dr. John Straton, PSU Physics Dept.

WEDNESDAY EVENING SEMINAR : 8:00 PM. Rm. S-17 Cramer Hall, PSU

May 21 (3rd Wed.)	Northwest Exposures, Alt & Hyndman; Ch. 18-20, pp.115-140. Topic: Continued summary of the Paleozoic and Mesozoic geology of the Pacific Northwest

****

ALL YOU EAGER VOLUNTEERS OUT THERE - YOU KNOW WHO YOU ARE! Will you agree to either (a) produce a speaker, or (b) do a program yourself? This kind of help from our members is *needed*, and will be *very much appreciated*! Thanks in advance!

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Our thanks to the generous Friday Night Cookie Makers for May are: Clay Kelleher, Beverly Vogt and Richard Bartels.

ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES **MUST** BE SUBMITTED TO THE CALENDAR EDITOR BY THE **15TH** OF THE MONTH. Write or call Evelyn Pratt, 223-2601.

Past Presidents

Richard Bartels handing over the pick to Paul Brown

Clay Kelleher swearing in the new elected board.
Ray Crowe, Walter Sunderland, Richard Bartels, Phyllis Thorne, and the 1997-98 President, Paul Brown

Guest Speaker Gregory Retallack

Conversations at the Head Table, Donald Bottern, Richard Bartels MC Clay Kelleher, New President Paul Brown

The Geologicial Society of Oregon 1997 Banquet

The Geological Society of the Oregon Country Banquet was held at the Terwilliger Plaza and was a great success. . Evelyn Pratt, Phyllis Thorne and Esther Kennedy worked hard at getting the Banquet organized and seeing that all the pieces fit together to make a successful Banquet. The sales table was successful and the displays were wonderful. The guest speaker was Gregory Retallack. His exciting presentation was titled **"The World's Greatest Midlife Crisis: The Permo-Trassic Extinctions."**

Robert Richmond in conversation with Mildred Phillips

THE PRSIDENT'S CAMPOUT

The President's Campout will be held from Sunday, September 7 to Friday or Saturday, September 12 or 13. The trip will be to the area just east of Mt. Rainier and will be guided by Dr. Paul Hammond and staff who know the area so well. We need to know how many people would like to do the trip in a large bus, where we can all hear and interact with the guides. We would also like to know how many of the participants would like to camp. Please call Rosemary Kenney—221-0757 in the evening if you plan to attend the campout letting him know if you to be a bus-motel participant or if your intending to participate in the campout and will be camping. These numbers are important for the leaders to line up motels and campgrounds **<u>Please call as soon as possible</u>**

WELCOME NEW MEMBERS

Liga Dale
Stan Cassell
Bruce and Paulette Smith

COMPLETELY FRACTURED GEOLOGY

by Evelyn Pratt

1. **oceanic crust**: bad manners on a cruise
2. **talus**: as in, "He's going to talus that old story again!"
3. **palingenesis**: a friend in the making
4. **Iceland spar**: a boxing match in Reykjavik
5. **pediplain:** a aircraft that is kept a lot by foot power
6. **astrobleme**: to hold a space plot responsible for making a mistake
7. **spicule** part of a country term, "Ah spiculr want to warsh up before dinner."
8. **rudaceous**: said of someone with bad manners
9. **risistivity method**: the way a pretty girl says no to a kiss without being deprived of it
10. **placederm**: (1) common term for an elephant (2) condition where a dental problem has spread to the skin

BOOK REVIEW

New book introduces hikers to Oregon's geology

Hiking Oregon 's Geology, by Ellen Morris Bishop and John Eliot Allen. Seattle, Wash., The Mountaineers. Soft cover, 221 pages, 51 hikes, 80 black-and-white photos, 10 page-size maps. Price $16.95.

This new book, *Hiking Oregon Geology*, was designed for the hiker who is interested in learning about geology. The authors are Ellen Morris Bishop, Lewis and Clark College Graduate School of Professional Development, and the late John Eliot Allen, Portland State University. Both authors are or were professional geologists, but they are also known to the general public for their numerous books. articles, and newspaper columns popularizing the geology of the state.

The book begins with a short nontechnical explanation of rocks and minerals, general geology, Oregon's geology, and general geologic terminology. The main part of the book is devoted to geologic information related to popular trails found in Oregon's various geologic provinces: the Klamath Mountains, the Coast Range, the Willamette Valley, the Columbia River Gorge, the Cascades, the Deschutes Basin, the High Lava Plains, the Basin and Range, the Owhyee and the Blue Mountains. Some of the sections are further divided—the Blue Mountains sections, for example, is divided into the eastern, central, and western Blue Mountains, each of which covers geologically· distinct areas. Trails are rated for difficulty, and information is included about the distance, elevation covered by- the trail, relevant topographic and geologic maps, sources of information, geology of the general area, and geology of the trail.

The book contains a geologic time chart, a glossary: of geologic terms. a list of recommended books, a list of geologic maps for geologic province, and the addresses of the Federal Forest Service and Bureau of Land Management offices. The book is also indexed.

The readers will be introduced to such interesting places as the seldom seen Coffeepot Crater at Jordan Craters near the Oregon-Idaho border, Spencers Butte near Eugene, the trail between Mariel and Illahee along the Rogue River, Latourell Falls in the Columbia River Gorge, and Sunset Bay to South Cove near Cape Arago on the southern coast. Not only will the readers learn about these places—they will also learn about the geology that makes each place unique and interesting.

This book does not present a mile-by-mile description of each trail. The serious hiker will still want the appropriate maps and trail guides for each trail. But this book comple ments the existing literature about trails. With this book bening as an introduction to the geology of the area, any hiker will have not only the pleasure of a good hike but also the fun of learning something new about the area. Now the hiker can found out why the trail is steep and slippery or beautiful, why it has rocks and cliffs that look the way they do, and what geologic forces shaped them

OREGON GEOLOGY, VOLUME 59, NUMBER 1, JANUARY/FEBRUARY 1997

SEDIMENTOLOGY, BEHAVIOR, AND HAZARDS OF DEBRIS FLOWS AT MOUNT RAINIER, WASHINGTON

By K.M. Scott, J.W. Valiance, and P.T Pringle

ABSTRACT

Mount Rainier is potentially the most dangerous volcano in the Cascade Range because of its great height, frequent earthquakes, active hydrothermal system, and extensive glacier mantle. Many debris flows and their distal phases have inundated areas far from the volcano during postglacial time. Two types of debris flows, cohesive and noncohesive, have radically different origins and behavior that relate empirically to clay content. The two types are the major subpopulations of debris flows at Mount Rainier. The behavior of cohesive flows is affected by the cohesion and adhesion of particles; noncohesive flows are dominated by particle collisions to the extent that particle cataclasis becomes common during near-boundary shear.

Cohesive debris flows contain more than 3 to 5 percent of clay-size sediment, The composition of these flows changed little as they traveled more than 100 kilometers from Mount Rainier to inundate parts of the now-populated Puget Sound lowland. They originate as deep-seated failures of sectors of the volcanic edifice, and such failures are sufficiently frequent that they are the major destructional process of Mount Rainier's morphologic evolution. In several deposits of large cohesive flows, a lateral, megalclast-bearing facies (with a mounded or hummocky surface) contrasts with a more clay-rich facies in the center of valleys and downstream. Cohesive flows at Mount Rainier do not correlate strongly with volcanic activity and thus can recur without warning, possibly triggered by nonmagmatic earthquakes or by changes in the hydrothermal system

Noncohesive debris flows contain less than 3 to 5 percent clay-size sediment. They form most commonly by bulking of sediment in water surges, but some originate directly or indirectly from shallow slope failures that do not penetrate the hydrothemally altered core of the volcano. In contrast with cohesive flows, most noncohesive flows transform both from and to other flow types and are, therefore, the middle segments of flow waves that begin and end as flood surges. Proximally, through the bulking of poorly sorted volcaniclastic debris on the flanks of the volcano, flow waves expand rapidly in volume by transforming from water surges through hyperconcentrated streamflow (20 to 60 percent sediment by volume) to debris flow. Distally, the transformations occur more slowly in reverse order—from debris flow, to hyperconcentrated flow, and finally to normal streamflow with less than 20 percent sediment by volume. During runout of the largest noncohesive flows, hyperconcentrated flow has continued for as much as 40 to 70 kilometers.

Lahars (volcanic debris flows and their deposits) have occurred frequently at Mount Rainier over the past several thousand years, and generally they have not clustered within discrete eruptive periods as at Mount St. Helens. An exception is a period of large noncohesive flows during and after construction of the moderm summit cone. Deposits from lahar-runout flows, the hyperconcentated distal phases of lahars, document the frequency and extent of noncohesive lahars. These deposits also record the following transformations of debris flows: (1) the direct, progressive dilution of debris flow to hyperconcentrated flow, (2) deposition of successively finer grained lobes of debris until only the hyperconcentrated tail of the flow remains to continue downstream, and (3) dewatering of coarse debris flow deposits to yield fine-grained debris flow or hyperconcentrated flow.

Three planning or design case histories represent different lengths of postglacial time. Case I is representative of large, infrequent (500 to 1,000 years on average) cohesive debris flows. These flows need to be considered in long-term planning in valleys around the volcano. Case II generalizes the noncohesive debris flows of intermediate size and recurrence (100 to 500 years). This case is appropriate for consideration in some structural design. Case III flows are relatively small but more frequent (less than 100 years on average).

SEDIMENTARY. BEHAVIOR AND HAZARDS OF DEBRIS FLOWS AT MOUNT RAINIER, WASHINGTON. U.S. GEOLOGICAL SURVEY PROFESSIONAL PAPER 1547

Correct defintions to **"COMPLETELY FRACTURED GEOOGY"** adapted from AGI Dictionary of Geological Terms, 3rd Ed. , Bates and Jackson by Evelyn Pratt.

1. **Ocean Crust**: crustral rocks underlying the ocean basins; sima
2. **Talus**: coarse, angular rock fragments lying at the base of a steep place from which they have been derived
3. **palingenis:** formation of a new magma by the melting of pre-existing magmatic rock in place
4: **Iceland spar**: pure, transparent calcite which cleaves into rhombohedrons which show strong double refraction

pediplain: a flat erosional surface produced in an arid region

5. **spicule**: part of a country term, " Ah
6. **astrobleme:** an ancient erosional scar on the earth's surface produced by the impact of a meteor or comet, usually characterized by a circular outline and shocked rocks
7. **rudaceous:** said of a sedimentary rock composed of fragments larger than sand, such as a breccia or a conglomerate.
8. **spicule**: one of the numerous tiny calcareous or siliceous bodies that support sponge tissues and are often found as fossils
9. **resistivity method**: any electrical exploration method in which current is introduced into the ground by two contact electodes and potential differences are measured between two or more other electrodes
10. **placoderm**: a Devonian fish with elaborate head and trunk armor

NOTICE

The following three pages are the conclusion to the article by Melvin Ashwill on "Chaney's Deschutes fossil flora site near Madras, Oregon revisited."

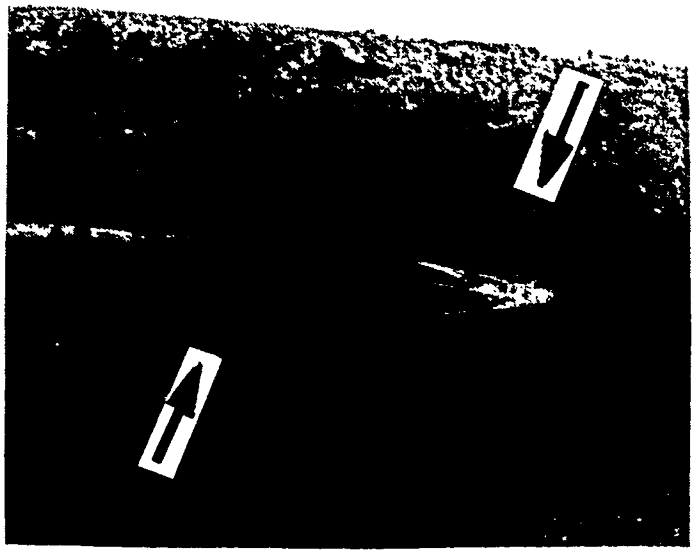

Figure 6. View of the landslide that forced a change in excavation plans. The entire slope of topsoil below the road began to creep as indicated by the visible cracks (arrows).

DISCUSSION

The new study of the Deschutes Flora fossil leaves, although involving a much larger sample size than Chaney had to work with in 1935, adds only a few species to the length of the fossil floral list for the site.

This new fossil floral list seems to suggest that the small grove of more or less drought resistant trees that gew along the ancestral Deschutes River 5.3 million years ago corresponds in general to the streamside floras found today in central Oregon, particularly at slightly higher elevations. The above is not an original observation, as Chaney cited the same thought more than fifty years ago.

The author's study has shown that the latest fossil flora so far found in the near vicinity with more than 10 species represented at one site is about 8 Ma. Several 5 Ma to 6 Ma fossil floras nearby all produce only four to eight species per site. All older fossil floras found to date in the central Oregon area contain more diverse floras and contain plants that today in order to survive, need considerably more summer rain than those of the Deschutes flora.The above mentioned approximately 8 Ma Gateway flora (Ashwill localities MSA/F-12) and MSA/F-25 contains 27 identified species (D. I. Axelrod, in press), compared to the more meager 15 in the Deschutes flora. Some not as yet identified event caused an abrupt climatic deterioration at about six or seven even million years ago.

TAPHONOMY (method of burial)

Trees growing on both banks of the ancestral Deschutes River were engulfed in a volcanic mudflow that filled the old river bed and drowned the lower 20 feet (6 meters) portions of their trunks. The very bottom of the mudflow rocks have some leaves, reflecting the leaf litter that was there at the tine. However, the richest deposit of leaves is found in a parting layer about a meter (3 feet) higher in the strata. This is in keeping with observations made of leaves deposited in recent volcanic mudflows in Central and South America (Burnham and Spicer, 1986). It appears that commonly, after an initial volcanic mudflow partially drowns vegetation, a later pumice fragments airfall knocks down the weakened leaves, which are then covered by subsequent waves of the mudflow.

At the Deschutes site, a grove of cottonwood, quaking aspen and willow trees on the east bank of the old stream was engulfed. The portion of the mudflow that lies atop the black sands of the river bed itself is mostly barren of fossils. About 180 meters (200 yards) west of the main stand of trees, on the opposite bank of the river, a small accumulation of cottonwood and oak leaves is evidence of another cluster of trees that were also trapped in the mud.

As to whether the fossil leaves found came from this site or may have been carried downstream some distance, studies show that most leaves in litter are from trees in the immediate vicinity (Burnham, 1989, Chaney, 1925),

A fuller treatment of the taphonomy at this site can be found in the paper "The Pliocene Deschutes Fossil Flora of Central Oregon: Additions and taphononic notes" in the November, 1998 issue of Oregon Geology (Ashwill, 1996).

ACKNOWLEDGEMENTSTS

Part of the research involved in the study of fossil floras of central Oregon was supported by a grant from Mazamas, a mountaineering club in Portland, Oregon.

Preserving the fossiliferous boulders described in this paper for the use of science and the enjoyment of the public was an acconplishnent. For their generous help in this cooperative effort, the writer wishes to thank the following individuals: County Judge Daniel J. Ahem and county commissioners Rick Alien and the late Carolyn Grote; Jefferson County Roadmaster Don Wood (now retired), :and Roads Department foreman Ron McDonald (now retired); Landowners Jim and Dianne mud.

Figure 8. Contractor's front end loader putting fossiliferous rocks onto a "Lowboy" truck of the Jefferson County Roads Department.

Ramsey and Dick Souers Middle Oregon Historical Society planning committee of the Confederated Tribes of the Warn Springs Reservation of Oregon; Dale Parker Confederated Tribes of the Warm Springs Reservation of Oregoon planning department; Herb Graebel, Utilities Department Confederated Tribes of the Warm Springs Reservation of Oregon; Brian Burke, one of the Architects for The Museum at Warm Springs; Gary Glowers, naturalist, and Bill Houts, businessman, both of Madras, Oregon; Oregon Department of Transportation personnel Jim Davenport, Art Steels, and Patty Jo Waters all of the Bend, Oregon office; Michael Moore, president of the J.C. Compton Construction Inc., and conpany personnel Bob Pitrak, Bob McNary, and George and Leona Lemmon The length of this list makes it apparent that an uncommon effort by many different individuals and agencies were needed in conserving the Deschutes Fossil Flora specimens.

Thanks to Dr. Steven R. Manchester, Wesley C. Wehr, Donald and Dorothy Barr, Donald Parks, and Mildred Phillips for helpful suggestions while reviewing this paper. Sadly, Louis Oberson, who was to be a reviewer also, passed away. Mr. Oberson sent me several long letters during the preparation of this paper, and contributed valuable historical information.

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The Geological Society of the Oregon Country members posed in the author's yard beside a large fossiliferous boulder from the Deschutes flora site in 1994. (left to right) Steve Sparkowich, Donald and Dorothy Barr. Phyllis Thorne, Walter Sunderland, Margaret Steere, Ken Yost, Don Parks, Rosemary Kenney, Booth Joslin, Esther Kennedy.

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FIELD TRIP GUIDES AVAILABLE

Price includes postage and handling. Order from THE GEOLOGICAL SOCIETY of the OREGON COUNTRY, P.O. BOX 907, Portland, OR 97207.

Field Guide to Geologic Sites in the Newberry Crater Area, 1976 -- - - -$1.60
Geologic Trip Log Through Eastern Foothills of Oregon Coast Range Between Vernonia and Banks, 1964 - - - .35
Geologic Trips in the Mitchell-John Day Area, 1969 - - - - 1.10
Columbia River Gorge and Grand Canyon of the Deschutes River, 1964 - - - - - - - - - - - - - .35
Lewiston, Idaho, 1984 - - - - - 2.60
Condon's First Island, Geological Trips in the Siskiyous and Along the Rogue, 1970 - - - - - - - - .60
Field Trips Along the Oregon Coast in Lincoln County, 1974 - - -1.10
Vancouver Island Field Guide, 1989 - - - - - - - - - - - - - - 5.10
Investigating the Geology of the North Cascades, 1977 - - - - 1.60
Sawtooth Mountains and the Stanley Basin, Idaho, 1978 - - - - -1.10
Central Oregon's Volcanic Wonder-land and How It Came To Be, 1982 - - - - - - - - - - - - -2.60
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Western Cascades, 1987 - - - - - 2.60

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THE GEOLOGICAL NEWSLETTER

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THE GEOLOGICAL NEWSLETTER

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ACTIVIES

ANNUAL EVENTS: President's Field Trip - summer; Picnic - August; Banquet - March; Annual Meeting - February. **FIELD TRIPS**: Usually one per month, private car, caravan or chartered bus. **GEOLOGY SEMINARS**; fourth Wednesday , except June, July, August. 8:00 p.m., Room S17, Cramer Hall, Portland State University. Library: Room S7. Open 7:30 p.m. prior to meetings. **PROGRAMS:** Evening: Second Friday evening each month, 8:00 pm, Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon. **NOON MEETINGS:** First and Third Fridays monthly at noon except holidays. Bank of California Tower, 707 SW Washington, 4th floor, California Room, Portland, Oregon. **MEMBERSHIP**: per year from January 1: Individual - $20.00, Family - $30.00, Junior (under 18) - $6.00. Write or call Secretary for application. **PUBLICATIONS**: THE GEOLOGICAL NEWSLETTER (ISSN 0270 5451), published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year. Individual subscriptions $13.00 a 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.

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Make check payable to: The Geological Society of the Oregon Country, P.O.Box 907, Portland, Oregon 97207----------

GEOLOGICAL NEWSLETTER

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

VISITORS WELCOME AT ALL MEETINGS — VOL. 63, No.6
INFORMATION: Clay Kelleher - 9AM-5PM, 321-6239 — JUNE 1997
after 5PM, 775-6263

SPECIAL NOTICE

Don Barr, our hardworking Newsletter Editor for 7 years, can no longer continue. THANKS from us all for everything you've done, Don! He suggests that the new Editor use a computer so she/he can format the newsletter easily, and can collect articles from Internet sources - USGS, GSA, CVO, and "Hazards" headings, et al. **WE NEED AN EDITOR - IT COULD BE YOU!!!** Think of how much power and influence you can wield as Newsletter Editor! (And you will get help.)
To take advantage of this opportunity, call Pres. Paul Brown, 227-2136, ASAP - thanks!

JUNE ACTIVITIES

FRIDAY NOON MEETINGS are on hold. The Bank of Calif. remodeled the 4th floor without notifying us. In the process, our projector & sound equipment disappeared. The President & Board of G.S.O.C. are working to get reimbursement for our losses. We need to find another noon meeting place - suggestions?

FRIDAY EVENING MEETING: 8:00 PM. Rm. 371 Cramer Hall, PSU

June 13 Evolution of Oceans
Dr. Curt Peterson, PSU Geol. Dept.
To our June cookie bakers Cecelia Crater and Booth Joslin, thanks!

Next WEDNESDAY EVENING SEMINAR : September 24?

June 21 FIELD TRIP: Markham Trail, Top to Bottom. Clay Kelleher and Evelyn Pratt will lead an all-downhill geological/botanical field trip from Council Crest to the Markham Trail Shelter. Council Crest can be reached by bus, or we can arrange a car shuttle for those who drove. Call Clay (see masthead) or Evelyn (see below) for details.

ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES MUST BE SUBMITTED TO THE CALENDAR EDITOR BY THE 15TH OF THE MONTH. Write or call Evelyn Pratt, 223-2601.

Elizabeth Orr, Co-author of *Geology of the Pacific Northwest* is gathering information on paleontologists of the Pacific Northwest. She would like to locate anyone who knew Irene Gregory, who was an expert on fossil wood identification. She also taught classes on the same study. Irene lived in the Salem area while working on the idetification . She had a daughter who had moved to the Forest Grove or Hillsboro area. Her name is unknown. A second person of interest is Rosco Stewart(spelling might be wrong. He retired from DOGAMI in 1959. If you have information about these two people please contact Elizabeth Orr at 541-346-4577

USGS CVO

USGS/Cascades Volcano Observatory
Vancouver, Washington

Miscellaneous Volcanic Facts

- What is a volcano?

Volcanoes are mountains, but they are very different from other mountains; they are not formed by folding and crumpling or by uplift and erosion. Instead, volcanoes are built by the accumulation of their own eruptive products -- lava, bombs (crusted over lava blobs), ashflows, and tephra (airborne ash and dust). A volcano is most commonly a conical hill or mountain built around a vent that connects with reservoirs of molten rock below the surface of the Earth. The term volcano also refers to the opening or vent through which the molten rock and associated gases are expelled. -- *From: Tilling, 1985, Volcanoes, USGS General Interest Publication, p.3-8.*

- Where did the term "volcano" come from?

The word "volcano" comes from the little island of Vulcano in the Mediterranean Sea off Sicily. Centuries ago, the people living in this area believed that Vulcano was the chimney of the forge of Vulcan -- the blacksmith of the Roman gods. They thought that the hot lava fragments and clouds of dust erupting form Vulcano came from Vulcan's forge as he beat out thunderbolts for Jupiter, king of the gods, and weapons for Mars, the god of war. In Polynesia the people attributed eruptive activity to the beautiful but wrathful Pele, Goddess of Volcanoes, whenever she was angry or spiteful. Today we know that volcanic eruptions are not super-natural but can be studied and interpreted by scientists. -- *From: Tilling, 1985, Volcanoes, USGS General Interest Publication, p.3-8.*

- How much of the Earth is volcanic?

More than 80 percent of the Earth's surface -- above and below sea level -- is of volcanic origin. Gaseous emissions from volcanic vents over hundreds of millions of years formed the Earth's earliest oceans and atmosphere, which supplied the ingredients vital to evolve and sustain life. Over geologic eons, countless volcanic eruptions have produced mountains, plateaus, and plains, which subsequent erosion and weathering have sculpted into majestic landscapes and formed fertile soils. -- *From: Tilling, 1985, Volcanoes, USGS General Interest Publication, p.2.*

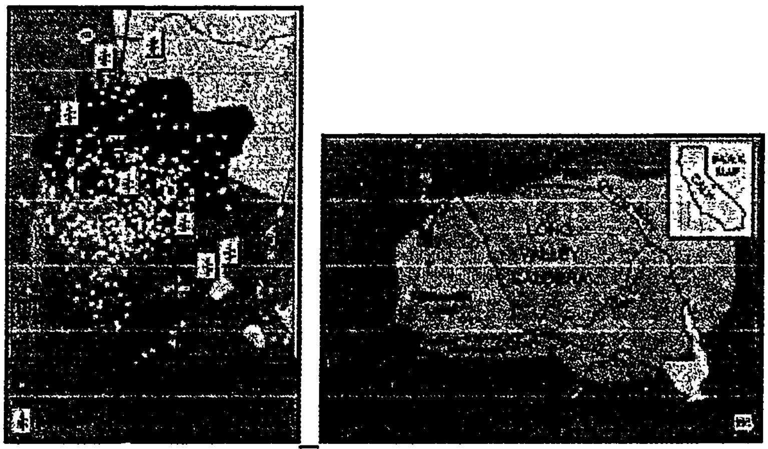
Invisible CO_2 Gas Killing Trees at Mammoth Mountain, California

Since 1980, scientists have monitored geologic unrest in Long Valley Caldera and at adjacent Mammoth Mountain, California. After a persistent swarm of earthquakes beneath Mammoth Mountain in 1989, earth scientists discovered that large volumes of carbon dioxide (CO_2) gas were seeping from beneath this volcano. This gas is killing trees on the mountain and also can be a danger to people. The USGS continues to study the CO_2 emissions to help protect the public from this invisible potential hazard.

Mammoth Mountain is a young volcano on the southwestern rim of Long Valley Caldera, a large volcanic depression in eastern California. The Long Valley area, well known for its superb skiing, hiking, and camping, has been volcanically active for about 4 million years. The most recent volcanic eruptions in the region occurred about 200 years ago, and earthquakes frequently shake the area. Because of this, the U.S. Geological Survey (USGS) operates an extensive network of instruments to monitor the continuing unrest in the Long Valley area.

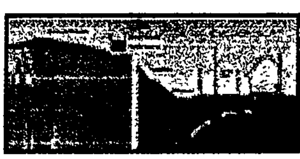
Mammoth Mountain, a young volcano in eastern California, rises above the floor of a large volcanic depression known as Long Valley Caldera. The scenic Long Valley area, popular with skiers, hikers, and campers, has been volcanically active for about 4 million years. High concentrations of CO_2 gas have been detected in the soil on Mammoth Mountain. This invisible gas, seeping from beneath the volcano, is killing trees on the sides of the mountain.

Numerous small earthquakes occurred beneath Mammoth Mountain from May to November 1989. Data collected from monitoring instruments during those months indicated that a small body of magma (molten rock) was rising through a fissure beneath the mountain. In the following year, U.S. Forest Service rangers noticed areas of dead and dying trees on the mountain. After drought and insect infestations were eliminated as causes, a geologic explanation was suspected. USGS scientists then made measurements and discovered that the roots of the trees are being killed by exceptionally high concentrations of CO_2 gas in the soil. Today areas of dead and dying trees at Mammoth Mountain total more than 100 acres. The town of Mammoth Lakes, just east of this volcano, has not been affected.



Areas of dead and dying trees at Mammoth Mountain volcano in eastern California total more than 100 acres. In 1990, the year after a persistent swarm of small earthquakes occurred beneath the volcano, U.S. Forest Service rangers first noticed areas of tree kill. When U.S. Geological Survey scientists investigated, they discovered that the roots of the trees are being killed by high concentrations of CO2 gas in the soil. The seepage of this CO2 gas from below Mammoth Mountain and the continued occurrence of local earthquakes are signs of the ongoing geologic unrest in the area. The upper part of the 11,027-ft-high volcano (above 9,500 ft) is shown in dark green.

Although leaves of plants produce oxygen (O2) from CO2 during photosynthesis, their roots need to absorb O2 directly. The high CO2 concentrations in the soil on Mammoth Mountain are killing trees by denying their roots O2 and by interfering with nutrient uptake. In the areas of tree kill, CO2 makes up about 20 to 95% of the gas content of the soil; soil gas normally contains 1% or less CO2.



CO2 gas seeping from the ground at Mammoth Mountain likely was derived from magma (molten rock) beneath the volcano. In 1989, rising magma may have opened cracks, allowing large amounts of trapped CO2 gas to leak upward along faults. High concentrations of CO2 in soil can kill the roots of trees. CO2 gas is heavier than air, and when it leaks from the soil it can collect in snowbanks, depressions, and poorly ventilated enclosures, such as cabins and tents, posing a potential danger to people.

When CO2 from soil leaves the ground, it normally mixes with the air and dissipates rapidly. CO2 is heavier than air, however, and it can collect at high concentrations in the lower parts of depressions and enclosures, posing a potential danger to people. Breathing air with more than 30% CO2 can very quickly cause unconsciousness and death. Therefore, poorly ventilated areas above and below ground can be dangerous in areas of CO2 seepage. Where thick snowpacks accumulate in winter, the CO2 can be trapped within and beneath the snow. Dangerous levels of CO2 have been measured in pits dug in the snowpack in tree-kill areas on Mammoth Mountain, and snow-cave camping in such areas is not advised.

Geologists have detected CO2 emissions, like those at Mammoth Mountain, on the flanks of other volcanoes, including Kilauea in Hawaii and Mount Etna in Sicily. Measuring the rate of such gas

Hawaii and Mount Etna in Sicily. Measuring the rate of such gas emissions on the flanks of volcanoes or within calderas is difficult and labor intensive. Readings must be made at many locations using small gas-collection instruments placed on the soil.

A preliminary estimate of the current rate of CO_2 gas emission at Mammoth Mountain is 1,300 tons per day. Similar rates of CO_2 emission have been measured from the craters of Mt. St. Helens (Washington) and Kilauea (Hawaii) volcanoes during periods of low-level eruptive activity. Past eruptions at Mammoth Mountain, such as the phreatic (steam-blast) eruptions that occurred about 600 years ago on the volcanoÕs north flank, may have been accompanied by CO_2 emissions. Scientists think that the current episode of high CO_2 emission is the first large-scale release of the gas on the mountain for at least 250 years, because the oldest trees in the active tree-kill areas are about that age.

In 1989Ð90, trees in this area on the south side of Mammoth Mountain volcano began dying from high concentrations of CO_2 gas in the soil. Although leaves of plants produce oxygen (O_2) from CO_2 during photosynthesis, their roots need to absorb O_2 directly. High CO_2 concentrations in the soil kill plants by denying their roots O_2 and by interfering with nutrient uptake. In the areas of tree kill at Mammoth Mountain, CO_2 makes up about 20 to 95% of the gas content of the soil. Inset shows U.S. Geological Survey scientists taking samples of soil gas in this tree kill area.

The characteristics of CO_2 and other gases seeping from Mammoth Mountain indicate that they were originally derived from magma. Large amounts of these gases probably were trapped beneath the volcano until 1989. In that year the magma rising through a fault may have opened cracks, allowing the gases to leak upward. Although infrequent small earthquakes continue to occur below the mountain, there is no evidence of current magma movement.

Earthquakes and CO_2 seepage beneath Mammoth Mountain are only two signs of volcanic unrest in the Long Valley area. Mammoth Mountain is the southernmost volcano in the Mono-Inyo Craters volcanic chain, and over the past 4,000 years, small eruptions have occurred somewhere along this chain every few hundred years. Scientists with the USGS Volcano Hazards Program are closely monitoring CO_2 emissions and other geologic hazards at Mammoth Mountain. Their continued studies in the Long Valley area of eastern California and in other volcanic regions of the United States, including Hawaii, the Pacific Northwest, Wyoming, and Alaska, are helping to protect the citizens of our Nation from geologic hazards.

Michael L. Sorey, Christopher D. Farrar, William C. Evans,
Michael L.Sory, Christopher D. Farr and others

U.S. Geological Survey

United States Department of the Interior
U.S. Geological Survey
119 National Center
Reston, Virginia 20192

Office of Outreach
Peter Lyttle
(703) 648-4460

For Release: UPON RECEIPT (Prepared March 5, 1997)

World's Earthquake Toll Already Exceeds All of Last Year

Earthquakes in Iran and Pakistan have already pushed the death toll for this year higher than all of 1996, according to Patrick Leahy, Chief Geologist, U.S. Geological Survey.

"While the primary responsibility of the USGS is to work with engineers and urban planners to reduce the human and economic losses from potential earthquakes in the United States, our program also works with more than 100 countries to monitor earthquakes around the world," Leahy said.

"The worldwide capability of the USGS not only helps the U.S. Government respond to international situations, but in the process helps us learn more about the geologic forces that may affect our own country. In addition, it is the basis for our ability to help monitor compliance with the International Test Ban treaty," Leahy said.

The National Earthquake Information Center of the USGS in Golden, Colo., serves as a worldwide data gathering source for both seismic information and official statistics on casualties. The USGS Center reported that 449 people were reported killed by earthquakes around the world in 1996. So far, the Center has received official reports of at least 965 people killed this year in Iran and at least 60 casualties in Pakistan.

Additional background on the recent earthquakes:

* Pakistan: On February 27, 1997, a magnitude 7.3 earthquake struck 70 miles ESE of Quetta (or 395 miles SW of Islamabad) killing approximately 60 people. In the subsequent 5 days there have been 3 aftershocks registering 6.3, 5.9, and 5.0. In 1935 a magnitude 7.5 earthquake struck 90 miles SW of this location and killed over 30,000 people.

* Iran: On February 28, 1997, a magnitude 6.1 earthquake struck northwestern Iran, 100 miles east of Tabriz, killing at least 965 people. Two days later an aftershock registering magnitude 4.8 struck the same area. Some newspaper reports state that the death toll has risen to more than 3,000 during the last few days, but these numbers have not been confirmed. In 1990, a 7.7 magnitude earthquake killed
have not been confirmed In 1990 a 7.7 magnitude earthquake killed 40,000 to 50,000 people in a region just 100 miles SSE of this week>s devastation

GEOLOGICAL NEWSLETTER

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

VISITORS WELCOME AT ALL MEETINGS
INFORMATION: Clay Kelleher - 775-6263

VOL. 63, No.7
JULY, 1997

A *BIG* THANK YOU!

Please welcome our new Newsletter editor, Marlene Adams!
Send news items and articles to her at 1809 NW 90th St., Vancouver, WA 98665-6757.

JULY ACTIVITIES

FRIDAY EVENING MEETING: 8:00 PM. Rm. 371 Cramer Hall, PSU

July 11 Atmospheric Pollution.
Dr. Aslam Khalil, widely-published author and research scientist
(Thank-yous to our July cookie bakers Rosemary Kenney & Lois Sato)

Efforts to find a place for FRIDAY NOON MEETINGS are continuing. So are attempts to get compensation from the Bank of California for our missing projector and audio system.

ITEMS TO BE PRINTED ON THIS CALENDAR OF ACTIVITIES **MUST** BE SUBMITTED TO THE CALENDAR EDITOR BY THE **15TH** OF THE MONTH. Write or call Evelyn Pratt, 223-2601.

We Are Pleased to ANNOUNCE

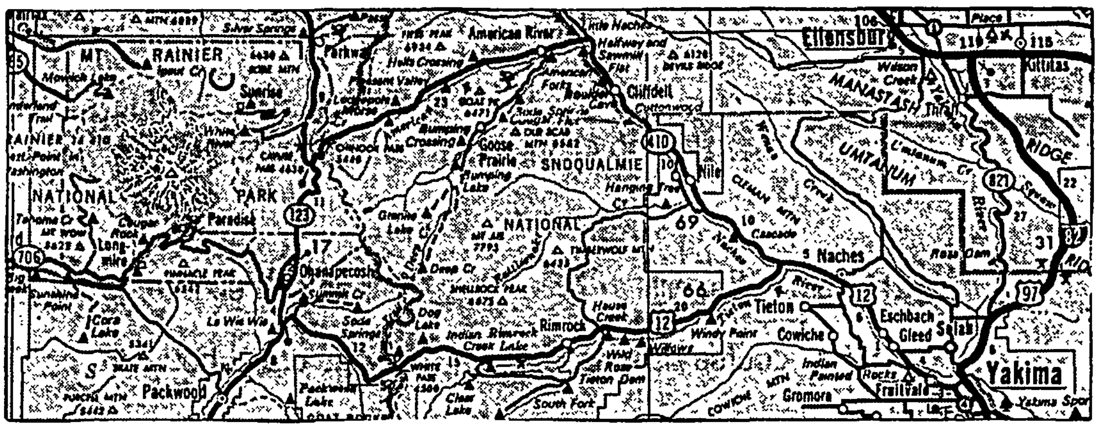
THE 1997 PRESIDENT'S FIELD TRIP

DATES: Sunday, September 7 through Friday, September 12

LOCATION: East Flank of MOUNT RAINIER and YAKIMA, Washington

Transition Zone Between Cascade Volcanic Arc and Columbia River Plateau

Major Travel Routes: Highway WA 410, along Naches River, to Chinook Pass
Highway US 12, along Tieton River, to White Pass
Yakima River Canyon, Highway WA 821



OUR TOUR GUIDE & EXPERT: Dr. Paul E. Hammond, P.S.U., retired

FEATURES: Columbia River Basalt Flows and Cascade Arc Volcanic Strata; Olympic-Wallowa Lineament [OWL]; Spectacular Water Gaps of the Yakima River; Rimrock Lake Inlier, [Jurassic to Cretaceous, and Oldest exposed rock in Cascades]; Bumping Lake Pluton and the only true Pink Coarse-Grained Biotite Granite; Largest Caldera in Cascade Range; Boulder Cave; Petroglyphs; Rimrock & Bumping Lake Dams; and Quaternary Glacial Deposits and Gigantic Landslides

FEES: Bus costs $100 per person. Motel Rooms: $45 for Single; $60 for Double; or $70 for Triple. Cost of Meals NOT Included. Camping Information to be Released.

TRIP DEPOSIT: Send $75 per person to: GSOC, P.O. BOX 907, Portland, OR. 97207. Make Check Payable to RAZ. First Come First Serve; Priority Given to GSOC Members.

CONTACT: Bev Vogt or Richard Bartels at 503/ 292-6939 for more information.
or Clay Kelleher - - 775-6263

FIELD GUIDES will be provided. See also Maps and Reading List in this Newsletter.

MORE REGARDING .... THE 1997 PRESIDENT'S FIELD TRIP

WELCOME TO OUR ANNUAL TOUR. The 1997 President's Field Trip will take us to the area east of MOUNT RAINIER NATIONAL PARK in the normally sunnier and drier Eastern Flank of the Cascade Range. All GSOCs are encouraged to attend and participate in discussions of this area's scenic and interesting geology and wildlife.

TRIP LOGISTICS. The 1997 Field Trip will be a series of daily bus trips conducted in a 40 passenger bus, leaving from our Yakima motel at about 8 a.m. and returning at about 6 p.m. One or more restaurants will be nearby. Those who prefer to camp and travel in private vehicles are welcome to accompany the bus and participate in the discussions at stops and outcrops. Trips will probably be run each day, although a "break" or rest day, possibly to enjoy some of the sights in Yakima, can be scheduled in the middle of the week.

OUR ROUTE. We will follow the Naches River and tributaries via Highway WA 410, to Chinook Pass, 5429 ft., at the eastern boundary of Mount Rainier National Park and the Tieton River, via Highway US 12, to White Pass, 4467 ft., and travel through Yakima River Canyon, via Highway WA 821. Other short side trips, some on gravel roads, are being considered.

OUR EXPERT AND GUIDE. We are happy to announce that Dr. Paul E. Hammond, P.S.U., retired, will be our guide. Several local and state geologists may be on hand to help point out and discuss geological features.

GEOLOGICAL DESCRIPTION. The area of our study lies within the TRANSITION ZONE of the eastern CASCADE (Range) VOLCANIC ARC and western COLUMBIA PLATEAU (basin).

Roughly 17 to 12 million years ago, during the middle of the *Miocene*, the COLUMBIA RIVER BASALTIC FLOOD LAVA FLOWS lapped into the ARC. Between 10 and 5 million years ago they were then uplifted with the arching of the CASCADE RANGE. The Columbia River basalt lava flows and volcanic strata of the arc are deformed into a series of broad west to northwest-trending folds called the YAKIMA FOLDS.

The northwest-trending OLYMPIC-WALLOWA LINEAMENT (OWL) is a series of aligned landforms—ridges and valleys—noted by cartographers early in the 20th Century, extending from the Olympic Mountains, in northwestern Washington, to the Wallowa Mountains, in northeastern Oregon. It is a structural zone about 50 km (35 mi.) in width. The Naches River, and a stretch of Highway 410, follow the southwest margin of OWL. The Yakima River, flowing south across OWL, has cut a series of spectacular WATER GAPS through the fold ridges.

About 40 to 25 million years ago, during the late *Eocene* through *Oligocene*, the distant WESTERN CASCADES, now buried on the western flank of the Cascade Range, erupted. Their volcanic deposits now constitute the oldest volcanic strata of the Washington segment of the Cascade Arc. Below these volcanic strata is a mica-quartz-feldspar-rich SANDSTONE equivalent to the coal-bearing sandstone in the Roslyn basin to the north and the Puget lowland basin to the northeast. Under this sandstone is the oldest rock exposed in the volcanic Cascade Range, dating 180 to 100 m.y.a, of late *Jurassic* to middle *Cretaceous* age, which forms part of the RIMROCK LAKE INLIER and consists of schist, gneiss and amphibolite, diorite, pillow lava, chert, and greywacke. [An inlier is an area surrounded by younger rocks.]

About 25 to 20 million years ago, in the early *Miocene*, volcanoes, which are still partly preserved on the eastern flank of the arc, erupted. Their deposits consist of rhyolitic tuff (volcanic ash) and andesitic lava flows. Also to be seen on our trip are dacitic volcanic deposits, which were erupted from DOMAL VOLCANOES now found along the crest of the range and which were interstratified with flows of COLUMBIA RIVER BASALT to the east. Unique to this area are *Quaternary* age BASALT and ANDESITIC LAVA FLOWS and volcanic centers dating less than 2 million years. We will also see the only true pink (flesh colored) coarse-grained biotite granite, the BUMPING LAKE PLUTON (batholith), and the largest CALDERA in the Cascade Range.

Other features: *Quaternary* GLACIAL DEPOSITS and landforms; LANDSLIDES; PETROGLYPHS on Tieton andesite; BOULDER CAVE, in a Columbia River Basalt landslide; and dam structures at Rimrock and Bumping Lakes.

PLANNING TIPS. The weather can be pleasant but be prepared for cool temperatures, wind, and rain. Wear sturdy shoes or boots, providing good support and traction. No long walks or hikes are planned, although the walk to Boulder Cave is up a gentle slope about 0.25 miles in length, along a well-used wide trail.

BRING: Mosquito and Yellow Jacket Repellent, Field Glasses, Road Map, Camera, Film, Hammer, Hand Lens, and a Flashlight for seeing into short Boulder Cave. For those camping west of Yakima, fishing equipment may be useful. A FIELD GUIDE will be provided.

----Travel and Geological Text by Dr. Paul E. Hammond

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GENERAL READING TIPS FOR GEOLOGY FANS: The following books provide a basic understanding of some of the features we will be seeing and the geological processes that created them:

Northwest Exposures: A Geological Study of the Northwest, by David Alt and Donald W. Hyndman, 1995. Especially: Chap. 31, pp. 221-25, The Western Cascades; Chap. 34 pp. 241-53, Floods of Basalt; Chap. 39, pp. 283-87, Folds and Faults in The Columbia Plateau [very helpful in understanding the Olympia-Wallowa Lineament or OWL]; Chap. 43, especially pp. 307-14, The High Cascades.

Geology of the Pacific Northwest, by Elizabeth L. and William N. Orr, 1996. Discussion of the Western Cascades starts at p. 103. *See* p. 105 for the diagram of Tertiary stratigraphy, particularly that for Mt. Rainier -Tieton- Washington. Discussion of the Columbia River Plateau begins at p. 288. See p. 291 for its diagram of OWL.

Roadside Geology of Washington by David D. Alt and Donald W. Hyndman. NO substitute for Going There with the Expert, Dr. Hammond and the Fun Loving GSOC Gang, but pp. 145-155 describes some routes we'll be on.

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MAPS AND ADVANCE RESEARCH MATERIALS

Suggested by Dr. Paul E. Hammond

- Washington Atlas & Gazetteer, 1988 published by DeLorme Mapping, Freeport, Me., 120 p.
- Wenatchee National Forest Map, Washington: U.S. Forest Service.
- Campbell, N.P., 1975, A geologic road log over Chinook, White Pass, and Ellensburg toYakima Highways: Washington Division of Geology and Earth Resources Information Circular 54, 82 p.
- Fiske, R.S., and others, 1963, Geology of Mount Rainier National Park, Washington: U.S. Geological Survey Professional Paper 444, 93 p.
- Hammond, P.E., 1989, Guide to geology of the Cascade Range, Field Trip Guidebook T306, 28th International Geological Congress: American Geophysical Union, 215 p.
- Hammond, P.E. and others, 1994, Mid-Tertiary volcanism east of Mount Rainier: fifes Peaks volcano-caldera and Bumping Lake pluton-Mount Aix caldera, v. 2, ch. 2J, p. 2J-1 to 2J-19, *in* Swanson, D.A., and Haugerud, R.A., eds., Geological field trips in the Pacific Northwest: 1994 Geological Society of America Annual Meeting, Seattle, WA. Published by the Department of Geosciences, University of Washington, Seattle.
- Miller, R.B., 1989, The Mesozoic Rimrock Lake inlier, southern Washington Cascades: Implications for the basement to the Columbia Embayment: Geological Society of America Bulletin, v. 101, p. 1289-1305.
- Swanson, D.A., 1978, Geological map of the Tieton River area, Yakima County, south-central Washington: U.S. Geological Survey Miscellaneous Field Studies, Map MF-968.
- Vance, J.A., and others, 1987, Early and middle Cenozoic stratigraphy of the Mount Rainier-Tieton River area, southern Washington Cascades, *in* Schuster, J.E., ed., Selected papers on the geology of Washington: Washington Division of Geology and Earth Resources Bulletin 77, p. 269-290.
- Walsh, T.J., and others, 1987, Geologic map of Washington-southwest quadrant, scale 1:250,000: Washington Division of Geology and Earth Resources Geological Map GM-34.

You can now reach the new
Editor of
The Science Pages of The Geological Newsletter
by E-Mail at: GSOCnewsMA@aol.com

Mount Rainier Review

At 14,410 feet or 4,393 meters, Mount Rainier is the highest peak in the Cascade Range. It also is the most glaciated Cascade volcano. Its 26 glaciers contain more than five times as much snow and ice as all the other Cascade volcanoes combined. Mount Baker, is the second most glaciated of the Cascades, having 0.43 cubic mile of snow and ice.

Although Mount Rainier has not produced a significant eruption in the past 500 years, it is potentially the most dangerous due to its height, frequent earthquakes, extensive glaciers, and active hydrothermal system. If only a small part of its ice were melted during an eruption, enormous lahars could result.

Debris flows pose the greatest hazard to those living near the mountain. It is estimated that debris flows from Mount Rainier could travel the distance to the Puget Sound lowland in as little as 30 minutes to a few hours. About 100,000 people now live in areas that have been buried by debris flows in the past.

During the past 10,000 years, about 60 giant debris flows from Mount Rainier have filled river valleys to a depth of hundreds of feet near the volcano, and have buried the land surface under many feet of mud and rock 60 miles downstream. Seven debris flows large enough to reach Puget Sound have occurred in the past 60,000 years.

In comparison to Mount St. Helens, Mount Rainier has usually produced less volcanic ash during its eruptions. However, Mount Rainier's greater height and extensive glaciers would trigger far greater debris flows into areas that are more densely populated.

Note: "Lahar" is an Indonesian word including both mudflows and debris flows from a volcano. Debris flows are coarser and less cohesive than mud flows.

Text and information obtained from:
<http://vulcan.wr.usgs.gov/LivingWith/VolcanicFacts/mis_volcanic_facts.htm>

EDITOR CHANGE

The Geological Newsletter has had a change in editors. Donald Barr is retiring as Editor. The Editor composes the five Science Pages of our Newsletter. GSOC and The Geological Newsletter thank Donald for his many years of service.

Marlene Adams has volunteered to be the new Editor. If you have science articles for the Newsletter you can reach Marlene at:

Phone: 360/574-9650
Mail: 1809 N.W. 90th Street
Vancouver, WA. 98665-6757

e-mail: GSOCnewsMA@aol.com

Activity News for our Calendar of Activities should still be directed to Evelyn Pratt at 223-2601.

OLD FIELD TRIP GUIDES

What better way to explore the Pacific Northwest than with the help of Field Guides from prior GSOC Field Trips! Old Guides can be ordered from GSOC, P.O. Box 907, Portland, Or. 97207. Prices include postage and handing:

Vancouver Island Field Guide, 1989	$5.25
Lewiston, Idaho, 1984	2.85
Central Oregon's Volcanic Wonderland and How it Came to be, 1982	2.60
Sawtooth Mountains and the Stanley Basin, Idaho, 1978	1.25
Investigating the Geology of the North Cascades, 1977	1.65
Field Guide to Geological Sites in the Newberry Crater Area, 1976	1.65
Condon's First Island, Geological Trips in the Siskiyous and Along the Rogue, 1970	1.00
Geologic Trips in the Mitchell-John Day Area, 1969	1.10
Geological Guide Book for Central Oregon, Prineville, Paulina, Suplee, Delintment Lake, 1965	1.10
Geologic Trip Log Through Eastern Foothills of Oregon Coast Range Between Vernonia and Banks, 1964	.50
Columbia River Gorge and Grand Canyon of the Deschutes River, 1964	.50

AUG 97

THE GEOLOGICAL NEWSLETTER

GSOC

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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THE GEOLOGICAL NEWSLETTER

Editor: Marlene Adams 360-574-9650
Calender: Evelyn Pratt 223-2601
Business Manager: Rosemary Kenney, 221-0757
Assistant: Cecelia Crater 235-5158

ACTIVIES

ANNUAL EVENTS: President's Field Trip - summer; Picnic - August; Banquet - March; Annual Meeting - February. **FIELD TRIPS**: Usually one per month, private car, caravan or chartered bus. **GEOLOGY SEMINARS**; fourth Wednesday , except June, July, August. 8:00 p.m., Room S17, Cramer Hall, Portland State University. Library: Room S7. Open 7:30 p.m. prior to meetings. **PROGRAMS**: Evening: Second Friday evening each month, 8:00 pm, Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon. **NOON MEETINGS**: First and Third Fridays monthly at noon except holidays. Bank of California Tower, 707 SW Washington, 4th floor, California Room, Portland, Oregon. **MEMBERSHIP**: per year from January 1: Individual - $20.00, Family - $30.00, Junior (under 18) - $6.00. Write or call Secretary for application. **PUBLICATIONS**: THE GEOLOGICAL NEWSLETTER (ISSN 0270 5451), published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year. Individual subscriptions $13.00 a 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.

APPLICATION FOR MEMBERSHIP
THE GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

Name:--Spouse

Children under age 18:--

Address:-- City:------------------------

----------State------------------------Zip---------------------------

Phone:---

Geological interests and hobbies:---

Individual: $20.00-----------------------------------Family: $30.00--------------------------

Junior, under 18, not included with family membership: $6.00--Make check payable to: The Geological Society of the Oregon Country, P.O.Box 907, Portland, Oregon 97207-----------

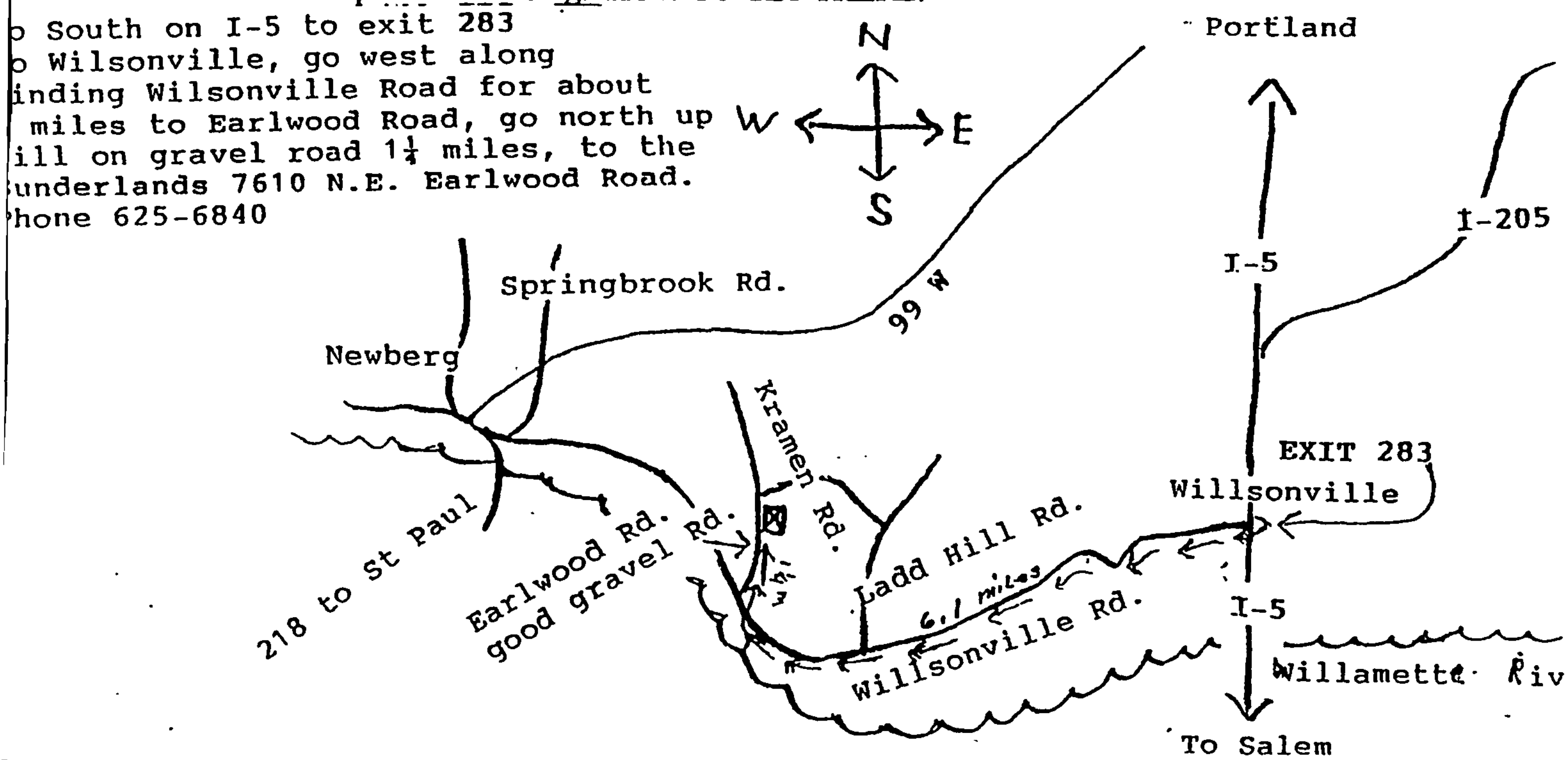
NEWSLETTER

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

VISITORS WELCOME AT ALL MEETINGS — VOL. 63, No.8
INFORMATION: Clay Kelleher - 775-6263 — AUGUST, 1997

AUGUST ACTIVITIES

August 24, 2 PM on, the **annual picnic POTLUCK** will be at Dr. Walt & Katherine Sunderland's place in Newberg. HOW TO GET THERE:



NO FRIDAY EVENING MEETINGS in August or (Pres. Field Trip) in September.

FRIDAY NOON MEETINGS start September 5 at the Central Library, 801 SW 10th, first floor, U. S. Bank Room. Cecelia Crater says we'll usually meet at noon, first Friday of the month. If holidays intervene, we'll meet on the third Friday of the month.

Sept. 5, 12-1:30 PM: A View of Big Bend National Park, by Rosemary Kenney

PRESIDENT'S FIELD TRIP: Sun., Sept 7-Fri, Sept. 12; **final payment due Aug. 4!**
Make out checks to RAZ Transportation Co.; send checks to GSOC Box 907 (see above)
Total cost:

single motel room, bus, guide, dirt roads @ $2/mi.:	$475 - $75 deposit = **$400 each**
double " " " " " " " :	$400 - $75 deposit = **$325 each**
triple " " " " " " " :	$367 - $75 deposit = **$292 each**

If you've paid your deposit, you have a reserved room in the Red Carpet Motel, Yakima.
To reserve a room after Mon., July 14: call Brenda De Lorenzo, 684-3322, ext. 727.
Campers, RV's welcome; there'll be a daily charge for field guides and bus.

Calendar items MUST be given to Evelyn Pratt by the 15TH of the month. 223-2601

WECOME NEW MEMBERS

Jan Hinkston
Joseph Traciatti
Fritz Buehler
John Pratt
Frances Pearson

COMPLETELY FRACTURED GEOLOGY

by Evelyn & Ralph Pratt

1. **exfoliate**: a plant that has migrated from another country
2. **abyssal plain**: an abolutely awful Boeing 747
3. **transform fault**: when an enchanted frog is turned into a prince—except for his tongue
4. **en echelon**: French for "This is where I keep my etchings."
5. **Ferrel's law**: A ruling regarding domestic animals that have run wild
6. **Cascadia channel**: A new Pacific Northwest cable TV offering
7. **fanglomerate**: A group of businesses dealing in low-tech air conditioning
8. **permissive intrusion**: "Pardon me, may I come in?"
9. **pisolite**: "Mmm, delicious! This cherry pisolite it could float off the plate!"
10. **rock bolt**: A senior citizen's action when hearing a hard rock concert in the park

GSOC will be assisting at the American Engineering Geologists (A.E.G.) Annual Convention in Portland from Saturday, September 27th through Friday, October 3rd. We need: (a) Hosts for the hospitality room and for field trips which have already been organized, and (b) Chairmen for field trips and hospitality. This is a good way to meet new and interesting people, and to acquaint non-geology spouses and AEG adjuncts with the Portland area. For details, please call: Clay Kelleher, 775-6263.

Reminder: The Gobi Dinosaur Exhibit will be leaving OMSI soon. Try not to miss it.
Dinosaur Trivia: Did you know that T-Rex suffered from gout, a form of arthritis? This probably resulted from T-Rex's consumption of red meat, which is high in purines.

TIPS FOR MARS FIELD TRIP:

- Bring Warm Clothing. Mars can get pretty cold at any time of year. Expect an average global temperature of -60°C, and lowest winter temperatures at the poles down to -140°C.
- Bring Oxygen for Respiration. Bring pressurized space suit to avoid boiling off of blood.
- Bring Sunblock with Maximum UV Protection. Mars has no Ozone Layer. Mosquito repellent will not be needed at any time of year.
- Do NOT Bring Compass. Lack of an iron core results in Mars' near absence of a magnetic field. Mars' magnetic field is less than 0.004 times that of Earth's. [Please remember this for future Venus Field Trip. Venus has no magnetic field due to its slow rate of rotation.]
- Bring Magnet if you wish to play in the dirt. Maghemite, a magnetic mineral, is estimated to compose 3 to 7 % by weight of Martian regolith. Caution: Do not eat or orally sample dirt. Dirt contains peroxides.
- Do not wear red or orange clothing. We don't want to lose anyone in an iron oxide-colored Martian dust storm, now do we?
- Bring food and water. Unfortunately there won't be any chance to have campfires, since there's no wood or oxygen to support combustion. This is a pity, since Mars is one place that could benefit by a global warming.
- Carrying of gear and supplies should be no problem on Martian surface as Mar's gravity is only 0.38 that of Earth's. So feel free to take as many geological rock samples as you wish. Do not expect to find fossils.

Cost of Trip: $20 Billion. Return fuel not included.
Suggested Pre-Trip Reading List: *The Case for Mars* by Robert Zubrin; *Red Mars* by Kim Stanley Robinson; *Mars* by Ben Bova; U.S.G.S. *Mars Atlas*; and *The High Frontier: Human Colonies in Space* by Gerard K. O'Neil. Highlights of Trip: Valles Marineris [3000 km long canyon system]; Polar Ice Caps; Sites of ancient floods; Olympus Mons [Mauna Loa, Mars style]; meteor craters; global-wide dust storms. —Ink A.

J Harlan Bretz was a fortunate man. He may be the only geologist who ever lived to see his work help explain the natural history of not just one, but two planets.

Catastrophic Floods in Washington, U.S.A, Earth. The channeled scablands of eastern Washington presented geologists of the early 1900s with some problems. At that time it was the accepted view that all geological change was the product of long, drawn out, gradual processes. Thus, conventional theory held that the relatively weak process of normal river erosion had gradually carved out the deep channels or coulees from the basalts of the Columbia Plateau. But some features weren't consistent with this theory. Why do these deep stream beds cut across tall divides? Why were there high hanging valleys where tributaries ran into the main channels? How could the hard basalt rock be so deeply, and freshly, gouged and scoured by running river water? What accounted for the deposits of erratics, rocks foreign to the area?

In 1923, J Harlen Bretz shocked the geology community by suggesting that a catastrophic flood, which he called the Spokane Flood, had rapidly scoured the scablands and coulees of eastern Washington.

Such a proposal was scientific heresy. The geology profession had labored long and hard to convince people that the Earth's features were not created in such rapid fashion. Many Christians held the view that the Bible should be taken literally and that the Earth's age could be computed by adding up all the Bible's "begats". This had resulted in a religious picture of a very young Earth, one which Bishop James Ussher viewed as being created precisely on October 23, 4004 BC. The best counter argument was to stress how gradual geological processes required millions of years to work. Now, a geologist proposes a Noah like flood! What an outrage!

As it turned out, Bretz did have one major evidentiary hole in his theory. He didn't have any idea where the water for his flood had come from. J.T. Pardee would supply both the evidence and the water. Back in 1878, the first geologist in Missoula, Montana, identified lake shore lines in the surrounding hills. In 1910 Pardee had described Lake Missoula in great detail. Pardee returned to his study of Lake Missoula to see if it could be the source of the Spokane Flood. Pardee's most convincing evidence of a flood was found in Camas Prairie, west of Flathead Lake in the form of gigantic gravel ridges tens of feet high and hundreds of feet apart. They apparently were ripple marks, ones that only a huge flood could produce. Pardee published his results in 1943. Debate raged on for years, but by the late 1960's his theory was generally accepted. It was greatly supported by satellite photos of the Washington scablands showing wave ridges similar to those discovered by Pardee.

It is now well accepted that sometime between 15,000 and 12,500 years ago, during the Pleistocene Epoch, glacial Lake Missoula did undercut and breach its ice dam where the Clark Fork River now flows into Pend Orielle Lake. Flood waters did rage across the Columbia Plateau carving channels into Miocene basalts; carving the major river channels so far below their tributaries that hanging valleys and waterfalls, like Multnomah Falls, were created at their junctions; and carrying Pre-Cambrian mudstones and sandstones from their Rocky Mountain homes hundreds of miles down river, via icebergs.

Bretz's original theory did have one thing wrong. There

Earth or Mars? This is the Grand Coulee, of the Scablands in Eastern Washington, U.S.A., Planet Earth was not one flood but several, perhaps 40 or more of them, possibly timed with each partial melting and small retreat of the local ice lobe of the Cordilleran Ice Sheet that covered the northern part of the North American continent.

At its highest level, glacial Lake Missoula is said to have risen to an elevation of some 4,350 feet, with a water depth of 2000 feet at the dam, and containing 400 cubic miles or more of water, about as much as Lake Erie or Ontario. It is estimated that the biggest flood was 450 times greater than the maximum flow ever recorded on the Mississippi, more than the combined flow of all the Earth's rivers, and might have moved at a speed of 45 miles per hour.

In the 1970s photos taken by Mariner 9 and Viking I and II revealed features on Mars that were described as dried up valleys and channels and which were specifically described as looking like those of the scablands of Washington back on Earth. Bretz was 96 years old when he joked about now being recognized as a "semi-authority on extra-terrestrial processes and events". He had lived to be vindicated on two separate worlds!

Catastrophic Floods in Ares Vallis, Chryse Planitia, Mars. The Mariner 9 and Viking photos were used to carefully choose the Pathfinder landing site. Ares Vallis, 19.33°N, 33.55°W, at the southern end of Chryse Planitia (Golden Plains), and southeast of the Viking I site, was very consciously chosen. It was determined that "landing downstream from the mouth of *a giant catastrophic outflow channel* (Ares Vallis) offers the potential for identifying and analyzing a wide variety of crustal material, from the ancient heavily cratered terrains to intermediate-aged ridged plains to reworked channel deposits." Or, more simply, it was hoped to provide a "grab bag" of rocks washed down from many different areas of Mars, much like the Lake Missoula floods had carried many rocks from the Rocky Mountains down to the Washington scablands and beyond.

Its interesting that ridges, approximately 10 feet high and 70 feet apart, can be seen southwest of the Pathfinder landing site, and are cited as evidence of Martian flooding, similar to Pardee's wave ridges. Other evidence of flooding or the presence of water action found by Pathfinder includes: some rounded rocks; tilting of the area's rocks and trails of debris behind pebbles, both in a consistent direction indicating a flood source to the southwest; crusty patches that may be salty residues left when puddles evaporated; and horizontal bands on the face of one hill, which could have been water deposited. It has been noted that the Martian flood would have been many times greater and older, with a 1 to 3 billion year range offered.

Marsquake Alternative Theory. The major significance of a Martian flood is that it provides evidence that liquid water may once have existed on the surface of Mars, which in turn might indicate that Mars once enjoyed a far warmer climate than today, and in turn, may have been home to ancient life forms. Actually, for those who hope to prove such a theory, the less catastrophic the Martian floods and the longer the water stayed on the Martian surface, the better. For, it is theorized that a truly catastrophic Martian flood could have occurred even under present cold climatic conditions by the catastrophic melting and release of groundwater triggered by large meteorite impacts or "marsquakes".

More Evidence. Ancient valley networks at other Mars' sites, shown on old Mariner and Viking photos, show gradual erosion by running water, supporting the idea of the ancient presence of surface water. Morphology exists suggesting formation by groundwater sapping, i.e. when a river is fed by a spring and the valley grows by headward erosion. Other formations have been interpreted as produced by precipitation runoff.

Almost all of these valley networks are limited to ancient upper highlands, which, based on the quantity of impact craters, have been dated at 3.5 to 4.0 b.y.a. This has been taken to be the dates of warmer Martian climate. Also supportive of a warmer ancient past is the presumed higher ancient erosion rate, which some scientists think are evidenced in the highly degraded craters and surface features dating 3.8 billion years old and older. Terrain formed later appears to show a much lower rate of erosion.

What happened to change Mars from a planet warm enough to have liquid water on its surface, about 0° C, to a planet with an average temperature of approximately -60° C?

Loss of Ancient Greenhouse Gases. The most likely explanation is that the ancient warmer and wetter Mars had a larger greenhouse effect. For the inner planets of the solar system, Mercury, Venus, Earth and Mars, the greenhouse effect increases their average surface temperatures by an estimated 0°, 500°, 35° and 7° C respectively. Mercury has no appreciable atmosphere. Venus has an extremely dense atmosphere (90 bar surface pressure) of carbon dioxide. Earth has a moderately dense atmosphere (about 1 bar) which includes very small amounts of water vapor, carbon dioxide, and other greenhouse gases. Today, Mars has a very thin atmosphere (0.006 bar or 6 mb), which is 95% CO_2 and thus has a modest greenhouse effect. (The Martian atmosphere is also quite dry, containing only 1-2 km^3 of water ice, compared to about 13,000 km^3 of equivalent water in the Earth's atmosphere.)

It was once calculated that a 5 bar CO_2 Martian atmosphere could have supported a warm enough climate for liquid surface water, although there are doubts about the validity of this number. But there is still the problem of how Mars lost its atmospheric pressure and so many of its greenhouse gases and what triggered it to go into a colder climate.

Rapid Cooling of Planet and its Crust. It has been suggested that the body of Mars may have cooled off too rapidly early in its planetary history. Mars has only a little more than ½ the radius of Earth's. Using the formula for volume of $V=\Pi r^3$, it would be expected that Mars would have a little more than $1/8^{th}$ the value of Earth's mass. However, Mars only has about $1/10^{th}$ of Earth's mass, due, apparently, to its lower average planetary density. Smaller planets would be expected to cool off more rapidly than larger ones.

Consistent with the idea that Mars cooled off rapidly is the apparent lack of current volcanic activity or active volcanoes, even though volcanic rocks cover 60% of the Martian surface. Volcanic activity is thought to have peaked 3 to 3.5 b.y.a.

No Plate Tectonics. Mars may have cooled so rapidly that plate tectonics stopped early in its history or never developed at all. Its crust is thought to have hardened up totally. Lack of plate tectonics is also supported by the absence of mountain ranges.

An Old Stationary Plume. Mars' largest volcano, Olympus Mons is 24 km high, making it nearly three times as high as Mauna Loa, which measures 8 km from the ocean floor. Olympus Mons measures 600 km in diameter and covers an area about as big as the state of Missouri. Its thought that Olympus Mons owes its incredible size to the fact that the plume which produced it is stationary or stuck underneath the planet's crust. Unlike the Hawaiian Island volcanoes or the Yellowstone and Idaho area, Mars' crust is not moving over the plume, so that Mars creates one or a few huge volcanoes rather than a string of many moderate-sized ones as it would on Earth. Olympus Mons is clustered with a few smaller volcanoes on the Tharsis Rise, a huge bulge in Mars crust just north of Mars' Equator. The entire bulge may indicate a huge ancient site of upwelling magma, now long cooled off. Some speculate that Tharsis Rise may have originally bulged out as a reaction to a huge asteroid impacts on the opposite side of Mars' surface.

Carbon Dioxide Trapped as Carbonates. Finally, the lack of plate tectonics is thought to have trapped much of the CO_2 of Mar's atmosphere deep within Mars' crust in the form of carbonates. It is speculated that CO2 came out of Mars' atmosphere dissolved in rainfall and formed carbonate minerals, as it does on Earth. However, on Earth these carbonates get recycled via plate tectonics, and re-emitted to the atmosphere in the form of volcanic eruptions, along with water vapor, sulfur dioxide, and other gases. With no plate tectonics on Mars, the carbonates, along with the carbon dioxide, became locked up in the planet's crust.

Problems have been noted with this theory, principally the lack of any evidence that there is a global layer of carbonates. It has been estimated that an 80 meter thick layer of calcite would be necessary to account for Mars' "lost" carbon dioxide in this fashion.

However the initial loss of its greenhouse gases occurred, once Mars lost enough of its ancient greenhouse gases and its climate started cooling, it is easy to see where some residual CO_2 gas and most remaining water vapor went. It is assumed that substantial amounts of water ice is located in Mars' polar caps and, at lower latitudes, deeper under the Martian surface. Frozen CO_2 or dry ice is also assumed to be present in the polar ice caps.

—Marlene K. Adams

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Gould, Stephen J. 1980. *The Panda's Thumb: More Reflections in Natural History.* New York: W.W. Norton & Company.

Orr, E. L. and W. N. 1996. *Geology of the Pacific Northwest.* New York: McGraw-Hill Companies, Inc.

Web Site: http://humbabe.arc.nasa.gov/mgcm/faq/faq.html

Evidence of Life in a Martian Meteorite? In August, 1996, a research team announced that they had evidence from a Martian meteorite that micro-organisms may once have existed on Mars. The meteorite, ALH84001, is one of 12 Martian meteorites known to exist on Earth, and was found in Antarctica. ALH84001 was probably launched into space from the surface of Mars by a meteorite impact event, and drifted in space for some 16 million years, before landing on Earth some 13,000 years ago. The rock was confirmed to be of Martian origin when a chemical analysis of the gas trapped in it matched that of Martian air conducted by the Viking landers. The rock itself was determined to have solidified from Martian magma 4.5 billion years ago. The purported chemical and mineral traces of life were estimated to have been deposited in some fractures some 3.6 billion years ago.

The principle evidence for life consisted of polycyclic aromatic hydrocarbons (PAHs) and carbonate globules, with secondary mineral and textural characteristics. PAHs are large, complex organic molecules commonly found in some interplanetary dust particles, interstellar dust, and many organic-rich meteorites from our asteroid belt. The researchers argued that the carbonate globules were like those seen forming in the laboratory and in freshwater ponds as bacteria alter the environment. Moreover, the large globules were detected to have magnesium-containing cores and concentric rings of iron carbonate and iron sulfides, pointing to possible past bacterial metabolism. The team also noted the presence of the iron oxide mineral, and the iron monosulfide, pyrrohotite. The highly magnetic magnetite was claimed to have a strong resemblance to the "magnetofossils" left by Earth bacteria in sediments and created by them to navigate in Earth's magnetic field. Finally, in their most daring claim, the researchers suggested that they could see traces of the bacteria themselves in the form of "ovoids", which were only 20 to 100 nanometers in length, making them 100 times smaller than the smallest microfossils ever found of Earth bacteria.

It was acknowledged that the research team studying ALH84001had taken adequate precautions against Earth contaminants, thus avoiding the embarrassment that befell a team in the1960's, which had accidently based its finding of alien life on Earth pollen contaminants. However, many experts believed that there were too many non-biological mechanisms that could explain the presence of these chemicals and minerals in AHL. Paraphrasing Carl Sagan, critics noted that the researchers simply had not presented the "extraordinary evidence" required by "extraordinary claims". – MKA

Official Definitions to COMPLETELY FRACTURED GEOLOGY
Adapted from AGI Dictionary of Geological Terms, 3rd Ed., Bates & Jackson

1. **exfoliate**: (Random House Dictionary) To separate into rudely concentric layers or sheets, as certain rocks during weathering
2. **abyssal plain**: A flat region on the ocean floor formed by sediments that have obscured the pre-existing topography; sloping less than 1:1000; includes some of the flattest areas on earth.
3. **transform fault**: A special kind of strike-slip fault along which the displacement suddenly stops or changes form; often associated with midocean ridges
4. **en echelon**: Said of geologic features such as faults which are in a step-like arrangement
5. **Ferrel's law**: A statement that the Coriolis force deflects currents of air or water to the right in the northern hemisphere and to the left in the southern
6. **Cascadia channel**: A 1200-mile-long deep sea channel from the continental shelf northwest of the Columbia River mouth to south of the Cape Blanco fracture zone
7. **fanglomerate**: An accumulation of varied sediments that were originally deposited in an alluvial fan and have since become cemented into solid rock
8. **permissive intrusion**: The emplacement of magma in spaces created by forces other than its own; also, the rock body so in placed
9. **pisolite**: Limestone made up of cemented pea-size accretions
10. **rock bolt**: Anchor inserted into pre-drilled hole in mines, tunnels, etc., to strengthen the rocks

SEP 97

THE GEOLOGICAL NEWSLETTER

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THE GEOLOGICAL NEWSLETTER

ACTIVITIES

ANNUAL EVENTS: President's Field Trip - summer; Picnic - August; Banquet - March; Annual Meeting - February. **FIELD TRIPS** Usually one per month, private car, caravan or chartered bus. **GEOLOGY SEMINARS**; fourth Wednesday, except June, July, August 8:00 p.m., Room S17, Cramer Hall, Portland State University. Library: Room S7. Open 7:30 p.m. prior to meetings. **PROGRAMS**: Evening Second Friday evening each month, 8:00 pm, Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland Oregon. **NOON MEETING**: First Friday monthly at noon except holidays. Central Library, 801 SW 10th, 1st floor, U.S. Bank Room Portland, Oregon. **MEMBERSHIP**: per year from January 1: Individual - $20.00, Family - $30.00, Junior (under 18) - $6.00. Write or ca Secretary for application. **PUBLICATIONS**: THE GEOLOGICAL NEWSLETTER (ISSN 0270 5451), published monthly and mailed t each member. Subscriptions available to libraries and organizations at $10.00 a year. Individual subscriptions $13.00 a year. Single copie $1.00. Order from Geological Society of the Oregon Country, P.O. Box 907, Portland, Oregon 97207. **TRIP LOGS**: Write to the sam address for names and price list.

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VISITORS WELCOME AT ALL MEETINGS — VOL. 63, No.9
INFORMATION: Clay Kelleher - 775-6263 — SEPTEMBER, 1997

SEPTEMBER ACTIVITIES

****

PRESIDENT'S FIELD TRIP: Sun., Sept 7-Fri, Sept. 12. Meet at PSU at noon on the north side of Cramer Hall. Coffee will be provided for coffee/snack breaks in mornings and afternoons. **Fieldtrippers, please bring snacks** (healthy and otherwise) to share!

For last-minute room reservations, call Brenda De Lorenzo, 684-3322, ext. 727. Campers and RV's are welcome; expect a daily charge for field guides and bus.

****

FRIDAY NOON MEETINGS start September 5 at the Central Library, 801 SW 10th, first floor, U. S. Bank Room. Cecelia Crater says we'll **usually** meet at noon, first Friday of the month. If this time is not possible, we may meet at 11 AM or on the third Friday of the month.

Sept. 5, 12-1:30 PM: A View of Big Bend National Park, by Rosemary Kenney

NO FRIDAY EVENING MEETINGS in September because of President's Field Trip.

WEDNESDAY SEMINAR: Sept. 24, 8:00 PM. Rm. S-17, Cramer Hall
Topic: The Late Cretaceous in the Northern Rocky Mts., pp 115-149 in "Northwest Exposures" by Alt & Hyndman. Presenter: Richard Bartels

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Hands-on CLASSES, credit & non-credit, will be offered to geology teachers on Wed. Oct. 1 at the Assoc. of Engineering Geologists' national meeting at PSU. Topics include earthquakes, Mts. Rainier & Hood hazards, groundwater, stream erosion control, plate tectonics, & hydrothermal vents,. Non-teachers may enroll, & will be accepted depending on space availability. For more information & a registration form call Mark Darienzo, 735-4068.

Calendar items MUST be given to Evelyn Pratt by the 15TH of the month. 223-2601

COMPLETELY FRACTURED GEOLOGY

by Evelyn & Ralph Pratt

1. ***tidal bore***: A nerd at the beach
2. ***perovskite***: What a Russian mother says to her child: "The yellow kite is yours and the blue one is Perovskite."
3. ***core complex***: What a girl who will only date Marines has
4. ***friable***: Able to be cooked in hot oil
5. ***petrologist***: Fancy name for a British gas station attendant
6. ***datum plane***: As in "Pretty girls are too conceited. I like to datum plane."
7. ***flocculation***: Term used to describe how a border collie rounds up sheep
8. ***percussion mark***: Scar where an orchestra member dropped his bass drum on his foot
9. ***phanerite***: As in, "Waving your hands doesn't cool the baby enough. You need to phanerite."
10. ***talus***: Describes an animal such as an ape or a Manx cat, which lacks a caudal appendage

 We would like to thank the Mammoth Trumpet for the use of this article and Evelyn Pratt for suggesting it.

Correct definitions to "**COMPLETELY FRACTURED GEOLOGY**"
Adapted from AGI Dictionary of Geological Terms, 3rd Ed., Bates & Jackson

1. tidal bore: A wall-like wave of water produced as an incoming tide rushes up a shallow, narrowing estuary or bay
2. perovskite: (Random House Dictionary) Calcium titanium oxide, found as yellow or brown cubic crystals in metamorphic rocks
3. core complex: (Alt & Hyndman) An assemblage of rocks that typically has a mass of granite near its center, and a mass of older rocks that moved off to one side along a fault
4. friable: Said of a rock or mineral that is easily crumbled, such as a poorly cemented sandstone
5. petrologist: One who studies rocks, especially igneous and metamorphic rocks
6. datum plane: A permanent horizontal surface, such as sea level, to which water depths, elevations, and tidal data are referred
7. flocculation: The process by which minute suspended particles in a liquid are held together in clots or granules as they settle out
8. percussion mark: A crescent-shaped scar produced on a hard, dense pebble by a sharp blow
9. phanerite: An igneous rock with mineral grains large enough to be seen without a lens
10. talus: Coarse, angular rock fragments lying at the base of a steep slope or cliff from which they came

DON ALAN HALL

Workers excavate faunal material from scoops of peat strata laid out by a backhoe. The field crew at Mammoth Park included students from Saturday Academy, Portland Community College and Oregon State University. Experienced, well-trained volunteers from the Oregon Archaeological Society served as team leaders for groups of individual students.

-UPDATE-

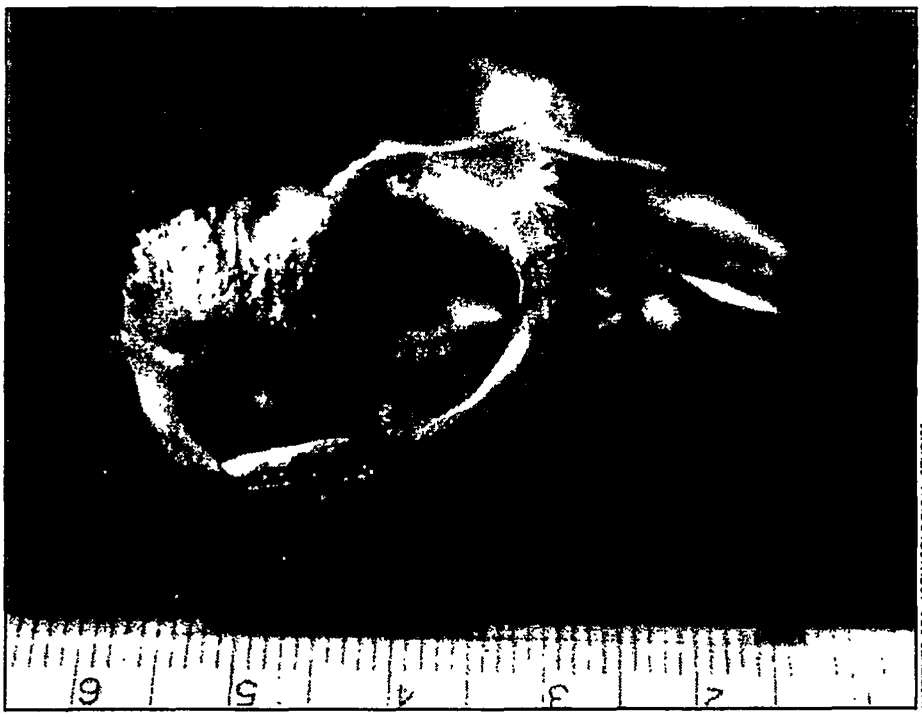
Bog Holds Details of Pleistocene

Excellent Preservation Means Opportunity for Archaeologists

Continuing investigation of a deeply buried bog on public school grounds in Woodburn, Ore., is revealing an environmental record that extends back to the time of the last Ice Age. Woodburn is an agricultural community in the Willamette Valley between Portland and Salem.

The site, known as Mammoth Park because of the bones that were discovered there a decade ago, was the focus of a testing program in 1996. Excavations revealed a variety of well-preserved faunal material ranging from insects to small and large mammals, and plant remains including pollen, seeds, and wood. Additionally, some lithic flakes, leftovers from the manufacture of stone tools, were found in lower levels of extensive peat deposits suggesting early presence of humans.

The character of the site that has as-



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Preservation of bones of the site's many small animals is remarkable. Delicate sutures and other details in this rodent's cranium are readily available for study. The scale is centimeters.

DON ALAN HALL

Left, Archaeologist Chuck Hibbs examines a student's discovery that has been carefully washed, bagged and labeled to record the provenience of each object. Students were taught to document all observations before removing any specimens.

Below, archaeologist Alison T. Stenger, right, examines materials remaining after field washing on public school grounds in Woodburn, Ore. With her are, from left, Alan Schneider, Gene Edinger, and Charlene Stevens of the Oregon Archaeological Society.

sured excellent preservation of plant and faunal materials makes archaeological investigation of Mammoth Park extremely difficult. A seasonal stream flows through the site between banks of earth that were filled in as part of drainage and landscaping work. Because of the depth of the deposits—some more than 20 feet below the surface—and the wet, unstable nature of the peat soil, excavations are unsafe for field workers to enter. Therefore, last season's field work involved the examination of materials brought to the surface, stratum by stratum, by backhoes. Traditional in-the-pit archaeology would require shoring of side walls and pumping.

Below approximately three feet of fill, there is a layer of heavy blue clay that has sealed approximately eight or nine feet of peat. Beneath this stratified peat lies two or three feet of organic silty sand, and below that is a stratum of very fine, light-gray sand, that could be evidence of one or more catastrophic floods caused by the failure of ice-dams that had retained enormous glacial lakes far to the east in the Rocky Mountains and Great Basin.

Alison T. Stenger, project instructor of the investigation that is being sponsored by the CSFA at Oregon State University, the City of Woodburn, and the Woodburn School District, is enthusiastic about the variety of animal and plant remains and the high quality of preservation. Paleontologist William Orr says it is the best-preserved peat site he has ever seen. Orr, director of the Condon Museum of Natural History at the University of Oregon, supervised the study of the site's megafauna brought up during installation of a sewer line in 1987. He notes that the plant remains and small animal remains can reveal more about the Pleistocene environment than the bones of megafauna that the site has yielded.

In exploratory excavations made during 1996, teams carefully recovered samples of biological materials from the sediments. Continuing analyses of the site are being made by paleontologists, paleoecologists, entomologists, and archaeologists.

The lowest of the site's three peat levels proved to be richest in bones of small mammals and birds, while the upper peat level was rich in woody materials, some bearing the tooth marks of beavers. Field workers found little or no bone in the upper two peat layers, but the lowest layer yielded many bones, and the fine silt below that was even richer in bones.

The biggest backhoe employed in 1996 could dig no deeper than about 19 feet, which reached approximately the top of the fine gray sand. The excavations brought up no bones of megafauna and only fragments of the bones of large animals. Field volunteers and students jokingly suggested that the site should be renamed "Rodent Park." Investigators, including Stenger and archaeologist Robson Bonnichsen, director of the **Center for the Study of the First Americans,** are confident that there are more bones of megafauna to be found deeper in the Pleistocene sediments.

Paleontologist Orr: "It's the best-preserved peat site I've ever seen."

Neither the precise location of megafauna unearthed in 1987 during installation of a sewer line, nor the depth of that excavation is known for certain. At least some of the large animal bone is believed to have come from deep beneath the highway immediately south of the site. And though Orr studied much of the material, sewer workers are believed to have taken some as souvenirs before scientists were notified. A teacher at the nearby high school and city officials noticed and saved some of the bones for scientific examination.

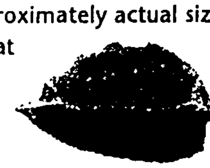
Orr soon identified mammoth, mastodon, giant sloth, dire wolf, and bison. Several of these bones are on display at Woodburn's City Hall along with some found in the 1996 excavations, including the perfectly preserved skulls and jaws of rodents. Though faunal analysis is continuing, tentative identifi-

DON ALAN HALL

DON ALAN HALL

Above, a student learns how to water-screen soils and extract small specimens that would be easy to miss.

Left, archaeologists exposed clean surfaces of excavated strata near the backhoe trenches to document the microstratigraphy of each stratum. Because of the nature of the soils, stratigraphic context remained evident. The surface of the chocolate-brown peat gradually turned black in the summer sun. Woody stems preserved in the peat appeared quite fresh.



This jasper flake, shown approximately actual size, was one of a few artifacts that transformed Mammoth Park from a paleontological to an archaeological site.

INSTITUTE FOR ARCHAEOLOGICAL STUDIES

cation of small mammals includes squirrel, shrew and rabbit. Bird species seem to include migratory species as well as birds of prey.

More than 20 species of extinct animals have been identified, and bones of deer and elk have been found in the most-recent Pleistocene deposits.

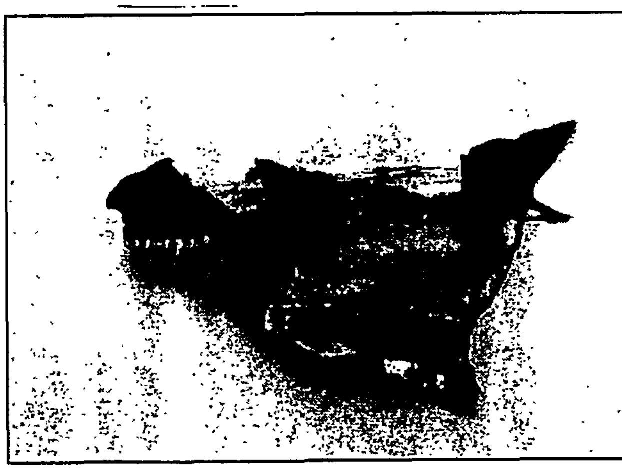
Paleoecologist Cathy Whitlock of the University of Oregon has already found abundant evidence of bog birch (*Betula glandulosa*) in samples from the lower levels of peat. This is a bushy shrub now found in mountain meadows; but elevation in Woodburn is less than 200 feet above sea level. Dr. Whitlock found that the upper peat bears evidence of dogwood (*Cornus stolonifera*) and bigleaf maple (*Acer macrophyllum*), trees common to the region as well as common wetland plants such as sedges, buckbean, spatterdock and spirea.

Remains of insects from the site are being analyzed in cooperation with Donald Schwert and Jennifer Lundberg of the Quaternary Entomology Laboratory at North Dakota State University. The preservation of chitin, skeletal remains of the many arthropods recovered, is excellent; coloration and sculptural details are intact. Dr. Schwert says the site represents one of the richest sites in North America in terms of the quality of chitin. "Remains of insects, particularly beetles (*Coleoptra*) are visible on almost every peat surface." Most are marsh-loving varieties, although Schwert and Lundberg have found a carrion beetle and a fly pupa.

Most of the archaeological material at the site is associated with a stratum that has been tentatively dated to Pleistocene time.

In the shade of a willow tree, students learn how to water-screen blocks of soil to achieve maximum recovery of small specimens.

Below, the delicate sternum of a bird is almost perfectly preserved in Mammoth Park's peat. The specimen is approximately 10 cm in length.



Workers at the site in 1996 included many volunteers from the Oregon Archaeological Society and Saturday Academy, as well as students from Portland Community College and Oregon State University. Work at Mammoth Park is continuing this summer.

by Donald Alan Hall

-DAH

OCT 97

THE GEOLOGICAL NEWSLETTER

GSOC

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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THE GEOLOGICAL NEWSLETTER

ACTIVITIES

ANNUAL EVENTS: President's Field Trip - summer; Picnic - August; Banquet - March; Annual Meeting - February. **FIELD TRIPS**: Usually one per month, private car, caravan or chartered bus. **GEOLOGY SEMINARS**: fourth Wednesday, except June, July, August. 8:00 p.m., Room S17, Cramer Hall, Portland State University. Library: Room S7. Open 7:30 p.m. prior to meetings. **PROGRAMS**: Evening: Second Friday evening each month, 8:00 pm, Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon. **NOON MEETING**: First Friday monthly at noon except holidays. Central Library, 801 SW 10th, 1st floor, U.S. Bank Room, Portland, Oregon. **MEMBERSHIP**: per year from January 1: Individual - $20.00, Family - $30.00, Junior (under 18) - $6.00. Write or call Secretary for application. **PUBLICATIONS**: THE GEOLOGICAL NEWSLETTER (ISSN 0270 5451), published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year. Individual subscriptions $13.00 a 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.

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Address:-- City:--State-
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GEOLOGICAL NEWSLETTER

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

VISITORS WELCOME AT ALL MEETINGS
INFORMATION: Clay Kelleher - 775-6263

VOL. 63, No.10
OCTOBER, 1997

OCTOBER ACTIVITIES

FRIDAY NOON MEETING: Central Library, 801 SW 10th, first floor, U. S. Bank Room

Oct. 3, **11 AM [Note time change!]:**
Old Volcanoes and Young Basalt Folds: President's Field Trip
Evelyn Pratt & other GSOC trip participants

FRIDAY EVENING MEETING: Rm. 371 Cramer Hall, PSU

Oct. 10, 8 PM:
Old Volcanoes and Young Basalt Folds: President's Field Trip
GSOC trip participants

WEDNESDAY SEMINAR: Rm. S-17, Cramer Hall, PSU

Oct. 22, 8:00 PM.
Topics: Late Cretaceous Paleogeography and an Outline of the Tertiary
Presenter: Richard Bartels
Read pp 151- 160 & 167-190 in "Northwest Exposures" by Alt & Hyndman.

Thanks to everyone who helped at the Assoc. of Engineering Geologists' national meeting!

Calendar items MUST be given to Evelyn Pratt by the 15TH of the month. 223-2601

********* ********* *********

THE GEOLOGICAL MUSE

Who says Science and Art don't mix? The 1997 President's Camp Out, September 7th - 12th, was positively inspirational, at least for Gloria Misar and Kenneth Yost. Ken's poetic tribute to Rose's Café will appear in next month's newsletter. Here's Gloria's view of the overall field trip experience:

9/11/97 Poem by Gloria Misar

We have joined the GSOC Campout
To increase our geology lore.
We have ventured into mountains,
Where we've never been before.

We have studied faults and synclines
And graywacke, sills and tuff;
And we've gathered rocks and splinters,
Like we'll never have enough.

At Paul's call of "Let's get out here!"
We would all jump to our feet;
And fifteen minutes later,
We'd assemble on the street.

Right away we'd hear the clinking
Of rock hammers making dirt.
We have helped the highway department,
Squashing fill for roadway work.

Both the Rose Café and Goody's
Found it very hard to cope,
When our Twenty-Seven descended,
Full of hunger and of hope.

Lovely vistas we have visited
How much smarter we've become;
And the glow of friendships fashioned
Will live on when we are home.

********* ********* *********

NOTICE: TRIP NOTES DUE

The detailed notes of the Official Notetakers from The 1997 Camp Out are needed by October 12th. If you haven't sent your notes to Marlene Adams yet, or if you'd just like to share remarks or artistic endeavors regarding the trip, please mail to: 1809 N.W. 90th Street, Vancouver, Wa., 98665-6757. Or E-mail to: GSOCnewsMA@aol.com

COMPLETELY FRACTURED GEOLOGY

by Evelyn & Ralph Pratt

1. hadal: as in, "Tell me the truth - I hadalie!"
2. listric: (1) a beauty aid used to color women's lips (2) a practical joke played on Elizabeth Taylor
3. phonolite: (1) illumination on a book that teaches about sounds (2) reduced fat telephone
4. umbo: What a Cockney said about his friends; "They got plenty o' money, but their 'ome's very 'umbo."
5. pedology: the study of sore feet
6. bathyal: sales pitch used on a grubby little boy; "A bathyal be LOTS of fun!"
7. xerophyte: an air battle against World War II Japanese fighter planes
8. peridots: (1) a couple of spots on a Dalmatian (2) what Pericles' friends called his wife Dorothy
9. firn line: (1) a border of green non-flowering plants (2) refers to an argument offered by a non-native: "Sounds like a firn line to me!"
10. euphotic: a way of addressing an arthropod that is one's enemy; "I'm going to spray you with poison, euphotic!"

See Page 64 for Official Definitions

GEOLOGISTS AT THE MOVIES

Dante's Peak: A 1997 Universal Studios release starring Pierce Brosnan and Linda Hamilton. Now available in video stores. It depicts the re-awakening and eruption of a northern Cascades volcano.

Dante's Peak is certainly not Oscar material. Its characters are simplistic. Its plot formualistic. And most average viewers could probably come up with a much more convincing plot devise for placing both adult and juvenile protagonists further in harm's way than rescuing a stubborn grannie who irrationally clings to her high mountain peak home. Guess we have to pretend that we never heard of Harry Truman and Mount St. Helen's, which might actually very well apply to the under-Age 18 crowd who skips science class the day the teacher covers volcanoes.

Dante's Peak can be an entertaining way to assess your VQ—Volcanology Quotient. Both amateur and professional geologists have the opportunity to flaunt their technical expertise by keeping score of how faithful to real science the movie is. This can be especially theraputic for those of us who have become particularly confused on geology field trips. Betcha Pierce Brosnan wouldn't know rhyolite from basalt! Not to mention his pahoehoe from his aa!

By the way, Dante's Peak does (did) physically exist, though a tad smaller than other Cascade peaks and is man-made. It is "a 100 square foot by 35 foot high wood and steel structure built on a sound stage in Los Angeles and wheeled onto a tarmac to be shot against the sky and later composited with live action footage shot on location (Wallace, Idaho). Computer-generated smoke, ash and lava were created as special effects." (Universal Pictures Marketing information) .

The following Dante's Peak FAQ's were taken from a USGS web cite which cyperfans can access at: http://vulcan.wr.usgs.gov/News/ DantesPeak/dantes_peak.html#general

Q: Is the eruption depicted in Dante's Peak realistic?

A: In many but not all respects . . .Stratovolcanoes in the Cascade Range and Alaska erupt explosively and produce pyroclastic flows, clouds of volcanic ash, and debris flows (lahars) that behave much as shown in the movie. Lava flows at these volcanoes, though, are usually thick and slow moving, unlike the fluid flows in the movie. Fast-flowing flows of basalt lava are common in Hawaii, though. . . (Mixing shots of stratovolcanic with Hawaiian volcanic events is misleading. Also, if movie goers can no longer be sufficiently awed by the power of a "normal" stratovolcano eruption, perhaps the action thrillers have gone a bit too much.)

Q: Can eruptions really threaten helicopters, as in the movie, and other aircraft?

A: Yes. . . Jet engines and other aircraft components are vulnerable to damage by fine, abrasive volcanic ash, which can drift in dangerous concentrations hundreds of miles downwind from an erupting volcano. During the past 15 years, at least 80 aircraft have accidentally encountered volcanic ash clouds, and in 6 cases jet engines temporarily lost power (A cool fact we picked up from a marathon of volcano documentaries on The Learning Channel: Radar often can't detect the ash clouds.)

Q: Can the temperature of hot springs near a restless volcano change quickly enough to injure bathers?

A: Temperature changes can and do occur, but usually more slowly than shown in the movie... Increases in water temperature, when they do occur, usually take days or weeks to develop, rather than a few seconds as shown in the movie. In rare cases, earthquakes can suddenly disrupt a volcano's hot groundwater system, changing its temperature. And earthquakes have been known to temporarily increase the flow of water from hot springs, sometimes causing geyser-like activity that could threaten bathers. (My 16 year old's reacton: Lighten up. This is "Movie Time". Geologically speaking, it reminded me of the effect of a 1980's earthquake on Old Faithful's plumbing, making it not so faithful.)

Q: Do earthquakes large enough to collapse buildings and roads accompany volcanic eruptions?

A: Not usually. Earthquakes associated with eruptions rarely exceed magnitude 5, and these moderate earthquakes are not big enough to destroy the kinds of buildings, houses, and roads that were demolished in the movie. The largest earthquakes at Mount St. Helens in 1980 were magnitude 5, large enough to sway trees and damage buildings, but not destroy them. During the huge eruption of Mount Pinatubo in the Philippines in 1991, dozens of light to moderate earthquakes (magnitude 3 to 5) were felt by several hundred thousand people. . .Stronger earthquakes sometimes DO occur near volcanoes as a result of tectonic faulting. For example, four magnitude 6 earthquakes struck Long Valley caldera, California, in 1980, and a magnitude 7.2 earthquake struck Kilauea Volcano, Hawaii, in 1975. Both volcanoes were quiet at the time. The Hawaii earthquake triggered a small eruption at the summit of Kilauea. No eruption has yet occurred at Long Valley. . .

Q: Can a town's water supply become contaminated when a volcano is restless?

A: Yes, but probably not as quickly as shown in the movie. . . Some volcanic gases such as sulfur dioxide can dissolve in groundwater, making the water acidic. Sulfurous odors, however, are caused by hydrogen sulfide gas, which smells like rotten eggs.

Q: Do scientists drive across moving lava flows?

A: No. . . With a temperature of 1,700 degrees Fahrenheit or higher, fresh lava will quickly melt rubber tires and ignite gas tanks. . . (In addition to this r lava gaffe, I have a similar beef with the ash that keeps falling on the actors giving them an Xmas look. Shouldn't the ash be a lot hotter?)

Q: Can carbon dioxide gas from volcanoes kill trees and wildlife?
A: Yes. At several volcanoes around the world, carbon dioxide gas released from magma has accumulated in the soil in sufficient concentrations to kill vegetation or has collected in low areas and suffocated animals. At Mammoth Mountain in California, carbon dioxide has killed about 100 acres of trees since 1989, and visitors to this area have occasionally suffered symptoms of asphyxiation when entering cabins or below- ground excavations. USGS scientists have concluded that the gas is escaping from a magma body beneath Mammoth Mountain. The magma itself is not moving toward the surface...

Q: Can volcanoes suddenly become restless and erupt within one week of the first signs of activity?

A: Yes. The first steam eruption at Mount St. Helens on March 27, 1980, was preceded by only 7 days of intense earthquake activity. The climactic eruption, on May 18, followed seven weeks later. An eruption of Redoubt Volcano in Alaska on December 13, 1989, was preceded by only 24 hours of intense earthquake activity... (But it really varies.)

Q: Are robots used by the USGS to monitor volcanoes?

A: No. Human scientists and instruments such as seismometers, tiltmeters, Global Positioning System (GPS) receivers, gas sensors, mudflow (lahar or debris flow) sensors, and temperature probes are used. NASA has tested a robot named Dante at Mount Erebus volcano in Antarctica and Mount Spurr volcano in Alaska. (TLC included footage of this experimental Dante. "He" looked quite clumsy and far less likely to succeed in his rough Earthly terrain than Pathfinder in "her" specially selected gentle Martian topography.)

Q: Can volcanoes produce large explosive eruptions and rivers of fluid lava at the same time?

A: Not usually. During a single eruption, a volcano CAN produce both lava flows and ash, sometimes simultaneously. The red, glowing lava fountains and lava flows in Dante's Peak (including the active flow across which Harry Dalton drives) are characteristic of a fluid magma, called basalt. In contrast, explosive gray ash columns and pyroclastic flows shown in other scenes are characteristic of more viscous magmas, called andesite, dacite, or rhyolite. It's uncommon for a volcano to erupt magmas of widely different composition at the same time.

Q: Can lakes near volcanoes become acidic enough to be dangerous to people?

A: Yes. Crater lakes atop volcanoes are typically the most acid, with pH values as low as 0.1 (very strong acid). Normal lake waters, in contrast, have relatively neutral pH values near 7.0. The crater lake at El Chichon volcano in Mexico had a pH of 0.5 in 1983 and Mount Pinatubo's crater lake had a pH of 1.9 in 1992. The acid waters of these lakes are capable of causing burns to human skin but are unlikely to dissolve metal quickly. Gases from magma that dissolve in lake water to form such acidic brews include carbon dioxide, sulfur dioxide, hydrogen sulfide, hydrogen chloride, and hydrogen fluoride. However, the movie's rapidly formed acidic lake capable of dissolving an aluminum boat in a matter of minutes is unrealistic.

Q: What is volcanic tremor, and how does it differ from earthquakes?
A: Tremor is a seismic vibration, similar to a volcanic earthquake, but of longer duration and more continuous than earthquakes of the same amplitude. Volcanic tremor can last from minutes to days. It may be caused by magma moving through narrow cracks, boiling and pulsation of pressurized fluids within the volcano, or escape of pressurized steam and gases from fumaroles.

Q: Do volcanoes produce different kinds of earthquakes?

. . . AT THE MOVIES (Conclusion)

A: Yes. A variety of earthquake types can occur at a volcano that is getting ready to erupt. These include earthquakes caused by rocks breaking along faults or fractures, termed tectonic-type earthquakes. Another common type a long-period or volcanic earthquake. These can occur when bubble-filled magma is on the move beneath a volcano. In Dante's Peak, Harry Dalton states in one scene that he has felt some volcanic earthquakes. In fact, the differences between tectonic- type and volcanic-type earthquakes are so subtle that they can be distinguished only by using seismometers. (Yeah, but Pierce Brosnan is really James Bond, so should we really be surprised?)

Q: What kinds of hazards were depicted in the movie, and what part have they played in real volcanic eruptions?

A: Debris flows, or lahars, are slurries of muddy debris and water like the one that carried away Paul Dreyfuss in Dante's Peak. They are caused by mixing of solid debris with water, melted snow, or ice. Lahars destroyed houses, bridges, and logging trucks during the May 1980 eruption of Mount St. Helens, and have inundated other valleys around Cascade volcanoes during prehistoric eruptions. Lahars at Nevado del Ruiz volcano, Colombia, in 1985, killed more than 23,000 people. At Mount Rainier, lahars have also been produced by major landslides that apparently were neither triggered nor accompanied by eruptive activity. Lahars can travel many tens of miles in a period of hours, destroying everything in their paths.

Tephra (ash and coarser debris), like that which buried the town of Dante's Peak, is composed of fragments of magma or rock blown apart by gas expansion. Tephra can cause roofs to collapse, endanger people with respiratory problems, and damage machinery. Tephra can clog machinery, severely damage aircraft, cause respiratory problems, and short out power lines up to hundreds of miles downwind of eruptions. Explosions may also throw large rocks up to a few miles. As in Dante's Peak, falling blocks killed people at Galeras Volcano in Colombia in 1992, and at Mount Etna, Italy, in 1979.

Pyroclastic surges and flows, called "pyroclastic clouds" by Harry Dalton in Dante's Peak, are hot, turbulent clouds of tephra (known as surges), or dense, turbulent mixtures of tephra and gas (known as flows). Pyroclastic flows and surges can travel more than a hundred miles per hour and incinerate or crush most objects in their path. Though most extend only a few miles, a pyroclastic surge at Mount St. Helens in 1980 extended 18 miles (28 km) and killed 57 people. Pyroclastic surges at El Chichon Volcano in Mexico in 1982 killed 2000 people, and pyroclastic flows at Mount Unzen, Japan, in June, 1991, killed 43 people. Contrary to the movie, speeding vehicles cannot outrun a pyroclastic flow or surge.

Lava flows erupted at explosive stratovolcanoes like those in the Pacific Northwest and Alaska are typically slow-moving, thick, viscous flows. Kilauea Volcano on the island of Hawaii has produced thin, fluid lava flows like those depicted in Dante's Peak throughout its history, and almost continuously since 1983. Lava flows destroyed a visitor center at Kilauea in 1989 and overran the village of Kalapana on the volcano's southeast flank in 1991. . . Adapted by M.A.

Correct definitions to "COMPLETELY FRACTURED GEOLOGY", adapted from AGI Dictionary of Geological Terms, 3rd Ed., Bates & Jackson; et al

1. hadal: of or pertaining to the greatest ocean depths, below ~20,000' (6500 m)
2. listric (Geology of the Pacific Northwest, by Orr & Orr): pertains to a series of concave faults which have a high angle at the surface but which are nearly horizontal at depth
3. phonolite: an extrusive rock composed of alkali feldspar, iron- and magnesium-rich minerals, and rare low-silica feldspar-like minerals
4. umbo: the hump by the hinge of a clam shell
5. pedology: the study of soils
6. bathyal: pertaining to the ocean and its life at depths between 660 to 13,000 feet (200-4000 m)
7. xerophyte: a desert plant
8. peridots: August birthstones; peridot is the gem variety of olivine
9. firn line: the summer snowline on top of a glacier
10. euphotic: referring to that part of the ocean in which there is enough light to support photo-synthesis - average depth is about 260 ft. (80 m).

NOV 97

THE GEOLOGICAL NEWSLETTER

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ACTIVITIES

ANNUAL EVENTS: President's Field Trip - summer; Picnic - August; Banquet - March; Annual Meeting - February. **FIELD TRIPS**: Usually one per month, private car, caravan or chartered bus. **GEOLOGY SEMINARS**; fourth Wednesday, except June, July, August. 8:00 p.m., Room S17, Cramer Hall, Portland State University. Library: Room S7. Open 7:30 p.m. prior to meetings. **PROGRAMS**: Evening: Second Friday evening each month, 8:00 pm, Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon. **NOON MEETING**: First Friday monthly at noon except holidays. Central Library, 801 SW 10th, 1st floor, U.S. Bank Room., Portland, Oregon. **MEMBERSHIP**: per year from January 1: Individual - $20.00, Family - $30.00, Junior (under 18) - $6.00. Write or call Secretary for application. **PUBLICATIONS**: THE GEOLOGICAL NEWSLETTER (ISSN 0270 5451), published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year. Individual subscriptions $13.00 a 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.

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P.O. BOX 907, PORTLAND, OR. 97207

VISITORS WELCOME AT ALL MEETINGS
INFORMATION: Paul Brown, 227-2136
Evelyn Pratt, 223-2601

VOL. 63, No. 11
NOVEMBER, 1997

NOVEMBER ACTIVITIES

FRIDAY NOON MEETING: Central Library, 801 SW 10th, first floor, U. S. Bank Room

Nov. **21, 12:30 PM [Note time and date!]**
Spectacular Geology of the Colorado Plateau
Don Barr, past GSOC president

FRIDAY EVENING MEETING: 8:00 PM, Rm. 371 Cramer Hall, PSU

Nov. 14: Secrets of the Solar System
Don Botteron, past GSOC president
7:30-8:00 PM: A board member will be in the GSOC Library to help you check out interesting and timely reading material. You don't even need a computer...
Our thanks to cookie providers Kenneth Yost and Rosemary Kenney.

WEDNESDAY SEMINAR: 8:00 PM, Rm. S-17 Cramer Hall, PSU

Nov. **19: [Note date]** Outline of the Tertiary, continued
Presenter: Richard Bartels
Read "Northwest Exposures" by Alt & Hyndman; Tertiary of Washington, Oregon, and Idaho

---

Advance notice: If you have your 1998 calendar, be sure to mark "GSOC Annual Banquet" on March 13!

Calendar items MUST be given to Evelyn Pratt by the 15TH of the month. 223-2601

REPORT ON THE 1997 PRESIDENT'S FIELD TRIP

An Educational Journey

The President's Field Trip is an annual educational journey, where participants get to travel with old friends and new acquaintances through both time and geography. The 1997 Trip was conducted in considerable comfort. We traveled in an air conditioned bus, and were driven by a professional and friendly driver. There were pre-scheduled stops, where we listened to geology talks from experts, took notes and photos, and collected rock and mineral samples. In 1997, as in recent years, we stayed at a motel, rather than camp out as in the "old days". Some wilderness-types might call this a bit soft on our part, but clean motel amenities and a bus with a nice operating restroom can be great boons to enjoying any vacation, no matter what your age or background. This year there were 27 souls who agreed that this is truly the Cadillac Tour of Geology.

Geological Features of 1997 TRIP

The 1997 field trip was held in the area East Of Mt. Rainier and West Of Yakima, plus the Folded Basalts Between Yakima and Ellensburg, WA. Highlighted were:

- The older WESTERN CASCADES of Oligocene Age
- The COLUMBIA RIVER BASALTS of Miocene Age
- The younger HIGH CASCADES of Pliocene, Pleistocene & Holocene times
- The Olympic-Wallowa lineament (OWL)

We were also treated to some "old" accretionary wedges or what Dr. Hammond called "tortured" rocks, dating back to the Mesozoic Era.

TIME TRAVEL

Geology is time travel. Knowing where you are is partly a function of knowing how old the rocks are around you. How old was this? Well, old is relative in geology, as it is anywhere. On the trip, Dr. Bob Bently, a sexagenarian, described himself as old; Archie Strong, an octogenarian, couldn't help finding this an odd statement for such a young man! The "oldest" rocks on Earth date back to some 3.9 billion years ago (b.y.a.). Thus, the "old" Mesozoic rocks we saw on our field trip were, at most, "middle aged", or younger than 245 million years when that era began.

Geologic Time Charts have been included this month for your convenience. Please note, they are not to scale.

New to Geology or To the Pacific Northwest?

Do you have to be a geology expert to go on an annual field trip? While it helps to be a rock fanatic, no, of course you don't have to be a geologist. People have enjoyed themselves on these trips if they have "only" a love of learning, a love for nature, or a passion for bus trips. This is why we pack a human geology expert, who in 1997, was Dr. Paul Hammond, retired geology professor from PSU. Dr. Hammond was helped by: Pat Pringle and Wendy Gerstel, both Washington State geologists; Newell Campbell, formerly of Yakima Community College; and Dr. Bob Bently, retired from Central Washington University. Also helping us were other highly knowledgeable "recreational" and retired geologists.

Is this a Trip for Children ?

Though it helps to be young at heart, any geology field trip can be intense and may not appeal to youngsters. Also, the 1997 Trip, like some others in the past, occurred after the beginning of the public school year. But take heart and get the maximum enjoyment out of your GSOC membership/newsletter fees: Along with many other GSOC members who did not physically attend this trip, you have the opportunity to study the geology first and travel the same routes later, at your leisure & in your own style. To this end, you might want to :

- Read the following Daily Trip Diaries in this and upcoming Geological Newsletters.
- Purchase The 1997 GSOC Field Guide
- Add these reference books to your personal library:

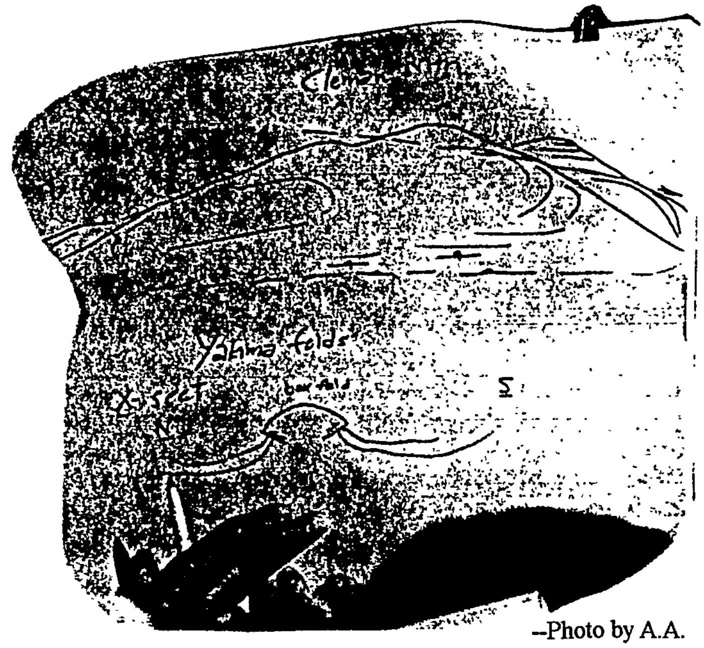
  A Geology Road Guide to Mt. Rainier, by Pat Pringle, Wendy Gerstel, and Rebecca Christie, will soon be available from Washington State's Department of Natural Resources.

  Roadside Geology of Washington, by David Alt and Donald Hyndman, is available from Mountain Press Publishing Company.
- Come to meetings to ask questions and get travel tips.
- In the future, you might want to attend Slide Shows of the Field Trip following our return. [The 1997 Trip Slides were shown in October.]
- Finally, if you really catch the geology bug, consider past years' GSOC President Field Trip Guides.

ROCK TYPES

If you are a geology beginner be sure to get a rocks and minerals guide. On the 1997 Trip we focused greatly on flood basalts and volcanic rocks. Remember that the basic "extrusive" igneous or volcanic rocks are, from darkest [most iron and magnesium rich] to lightest [most silica rich]: BASALT, ANDESITE, DACITE, and RHYOLITE. Tieton Andesite was a contender for 1997 Celebrity Rock. TUFFS, which act as Marker Beds in Dating were thankfully plentiful. A bed of Mount Mazama Ash was noted. PILLOW LAVAS, originally formed by lava flows in oceans, fascinated us. The Bumping Lake GRANITE, an intrusive igneous, was a lovely example of solidified magma chambers called PLUTONS. Naturally, we met some nice GNEISS. [Have you ever met any other kind?] Gneiss is an example of a METAMORPHIC rock. On this trip we found metamorphic rocks in the Mesozoic-aged accretionary wedges. Here we found CHERT, which was formed from the silica bodies of long departed microscopic ocean organisms called RADIOLARIANS. Some charred wood remains caught in ash or tuff layers, were the only visible fossils on this trip, except maybe for us humans on the bus!

The great thing about any journey is that long after we have returned, we can all keep savoring our travels by the retelling of our stories again and again. Here are some of our geological and personal adventures. . . —M.A.



--Photo by A.A.

DAY ONE: MONDAY, September 8, 1997

Day 1 Field Trip Reporters, Bev Vogt and Richard Bartels (Bart) are serious geologists, with strong professional backgrounds. Bev takes the notes and photos. Bart collects rock and mineral samples. You can rely on their report for geological accuracy.

[Order of guidebook stops: #26, #D-1, D-2, D-3, D-4, D-5, D-6, D-7, 39, 40, 41, 37, 36, 35, 34, 32, 30, and 27.]

TIETON ANDESITE and THE ELLENSURG. We left Yakima and headed west on US 12 along the Natchez River valley. This moderately broad valley is bordered on the north by a low lying ridge of Late Miocene to Pliocene Ellensburg sediments and lahars and on the south by a long sinuous ridge consisting of the Quaternary Tieton Andesite (1.0 m.y. old). This andesite originated from the Goat Rocks just south of the Rimrock Lake area and represents one of the world's longest andesite flows. The Tieton Andesite was an intercanyon flow that occupied the ancestral Tieton and Lower Natches Rivers, covering up the coarse bed load of gravels. I would assume that these ancestral rivers immediately cut into the softer Ellensburg sediments and since that time has widened its valley, leaving the Tieton Andesite as a ridge between the modern day Natches River on the north and the smaller Cowiche Creek to the south.

CLEMAN MOUNTAIN. Looming up ahead was Cleman Mountain consisting of Late Miocene Grande Ronde basalt. At Stop 26, Paul Hammond illustrated the development of this mountain's structure as an anticline (or draping structure) with a thrust fault wrapping around the toe of the structure on the SE end and up the Natches River. The overriding plate is brecciated on the bottom and is plastered against the side of Cleman Mountain parallel to the fold axis. A combination of uplift in the OWL and north-south compression seems like one of several possible causes.

At road junction US 12 / WA 410, we entered into the lower Tieton River Valley, which rapidly became a narrow gorge. This is probably due to the fact that both the Grande Ronde and the Tieton Andesite are equally resistant to erosion. Today's Gorge probably resembled the 1 m.y. old gorge in which the Tieton Andesite flowed down. The river remained entrenched and cut down through the Tieton Andesite, leaving small sections in nooks and crannies along the Lower Tieton River Gorge.

At Stop 27 excellent exposures of Tieton Andesite displayed its typical structure consisting of an upper shattered entablature and a lower long colonnade. It was overlying imbricated boulder gravel carried by the ancestral Tieton River. This section of the Tieton River has downcut approximately 20 feet in one million years.

The South side of this steep gorge (Divide Ridge) has almost 3000 feet of relief and contains up to fifteen Grande Ronde flows. But the most spectacular outcrop of the day was the pillow basalt at Stop 30. These elongated pillows were obviously flowing westward into a body of water during the Late Miocene time. Interbeds in the Grande Ronde here contains a pyroclastic component typical of Cascade volcanism, that lies to the West.

TIETON VOLCANO. Further west, at a photo stop we observed the contact of Grande Ronde basalt flows over older eroded rock [Ohanapecosh or Fifes Peak?] with a series of andesitic ridges of Early Miocene Age [Stop 31?]. These dikes and perhaps the host rock are rocks of the Early Miocene Tieton Volcano. As we drove west there was a continuous sequence of dikes 5 to 15 feet wide that form a radial swarm that if projected would intersect at the volcanic center north of the canyon. Unfortunately, because of the canyon walls, this Early Miocene volcano's extent and shape could not be observed. The Grande Ronde Basalts flowed around this volcano, which probably aided in its preservation.

As we approached Rimrock Lake, the gorge of the lower Tieton River opened up into the Tieton topographic basin. We learned that this was due to a sequence of softer and more easily eroded rock units.

RIMROCK LAKE INLIER. We were entering an area consisting of pillow basalts, graywackes (impure sandstones), and argillites (originally muds) who's age was Jurassic to Early Cretaceous. This inlier of much older rocks was surrounded both east and west by other younger rocks.

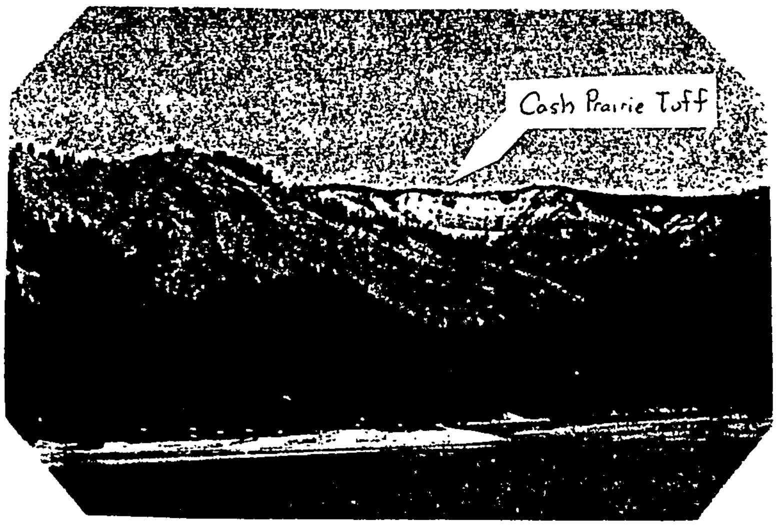
WILDCAT CREEK BEDS. The first sequence of rocks consisted of the Wildcat Creek beds of Oligocene age. These drab colored rocks are tuffs and tuffeceous sedimentary rocks. They were observed at Stop 34 where they gently dip to the east. They may represent the distal facies of the coarser Ohanapecosh tuffs that we observed near Mt. Rainier. (Stop #1)

The Wildcat Creek beds appear to overlie older Eocene units which also dip gently to the east. At Stop D-2, we saw the Eocene Spencer Creek Tuff. These welded quartz-vitric tuffs are rhyolitic in composition and predate Cascade Arc volcanism. These younger units unconformably overlie the Rimrock Lake Inlier.

DIORITE PLUTONS. A linear belt of medium-grained hypersthene diorite plutons lines the contact between the Rimrock Inlier rocks and the Wildcat Creek beds. The most notable plutons occur at Westfall Rocks (Stop 35), Goose Egg Mtn (Stop D-1) and the photogenic Kloochman Rock. All are approximately 22 millon years old. The significance of their location can only be guessed at. Perhaps a NW trending fault at the edge of the Tieton Inlier localized these magmas. Such a fault would be compatible with the nature of the rocks of the Rimrock Lake Inlier. The wider valley at Rimrock Lake provided our first opportunity for looking back and seeing relationships not observable in the narrow Tieton River Gorge.

TUFF MARKER BEDS. The Cash Prairie Tuff (almost white in color) could be seen underlying the Timberwolf volcano but became interbedded with the active Tieton Volcano. Such observations give us relative ages of the Fifes Peaks volcanoes (i.e., Fifes Peak, Edgar Rock, Tieton, and Timberwolf). Also, it points out the value of tuffs in mapping as "marker beds" because they represent a single explosive event that covers a wide area and hence documents the location of the surface of the earth at a moment in geologic time. As we found out the next day, the Bumping River Tuff marks a time boundary that seems to separate the Ohanapecosh from the younger Fifes Peak volcanoes and seems to be related to the Mt. Aix Caldera formation.

The Divide Ridge section of Grande Ronde Basalts was also clearly visible and these flows covered part of the Wild Creek beds, which were largely covered by more recent landslides from Divide Ridge.



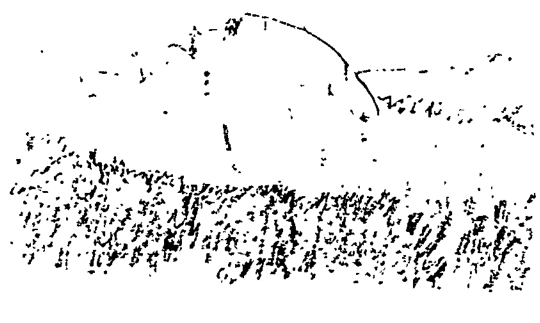
–Photo by A.A.

GOAT ROCK VOLCANO. The Tieton Andesite which we last observed within the Tieton River Gorge suddenly reappears as the cap on Pinegrass Ridge south of Rimrock Lake. A similar relationship to the one back in the Natches River Valley occurs here. The area south of Pinegrass Ridge is the oldest High Cascade Volcano—the Goat Rock Volcano—and is the source area of Tieton Andesite. Here we have a stratovolcano similar to Mt. Hood on Mt. Rainier that was actively eroded in the last million years. The Tieton Andesite Intercanyon flow is left high on a ridge as the tributaries of the modern Tieton River downcut on both sides.

RUSSELL RANCH FORMATION. The Rimrock Inlier rocks consist primarily of a clastic section called the Russell Ranch Formation. Stratigraphic continuity seems non-existent within the Russell Ranch due to tectonic mixing of its components. Indeed, the tectonic mixing seemed to occur within single outcrops (boudinaged and fragmented impure sandstones and cherts within an argillite matrix) to larger tectonic fragments that make up the entire outcrop (pillow basalts, cherts, tonalites, and gneissic tonalites as individual blocks within a matrix of the fragmented sandstone-argillite "soup". Other characteristics of the Russell Ranch are important. The pillow basalt has a chemistry similar to mid-ocean ridge basalts (MORB) and is more often associated with adjacent bedded cherts consisting of radiolaria ranging in age from Jurassic to Early Cretaceous. This combination is diagnostic of young oceanic sections. The clastic section was originally muds and impure sands that would have been derived from a continental or fringing volcanic arc terrane. All these characteristics, rock type associations and chemistry plus the style of tectonic disruption all point to a subduction zone complex that has to have formed no earlier than the age of the fossils it contains. Therefore, this must have been a subduction zone complex that formed during Cretaceous times.

The tonalite & gneissic tonalites are Jurassic in age as determined from radiometric dating methods. It is likely that these rocks, of the Indian Creek complex, represents tectonic slivers of older pre-existing magmatic belts that were incorporated into the complex by lateral movements of slivers due to oblique subduction.

Although a stratigraphy is hard to define, there seems to be two belts consisting primarily of the Indian Creek complex and pillow basalt-chert: one at the east end of Rimrock Lake; the other at the Westend of Rimrock Lake. The two are separated by the argillite-sandstone "soup". The argillite-sandstone "soup" also occurs to the west clear to White Pass. This section west of Rimrock Lake presented our final investigation of the day—a look at High Cascade Volcanism!



Rimrock Lake [illegible] Rock
-Drawing by E.P.

HIGH CASCADE VOLCANISM. We normally think of High Cascade Volcanism in terms of stratovolcanoes whose immense size overpowers any landscape. The area between Rimrock Lake and White Pass was the site of numerous smaller volcanic cones each producing basaltic to andesitic lava flows within the last one million years. Their freshness and the numerous source areas allows for reconstruction of the stratigraphy. Since they covered the easily erodable Russell Ranch argillite-sandstone "soup". The result is spectacular waterfalls, extremely dangerous landslide potential, and wonderfully fresh, young volcanic centers.

[Bart's use of the term "soup" is obviously in the sense of a rich minestrone or clam chowder. Some might prefer "stew. Is this how inconsistent geological terminology arises?]

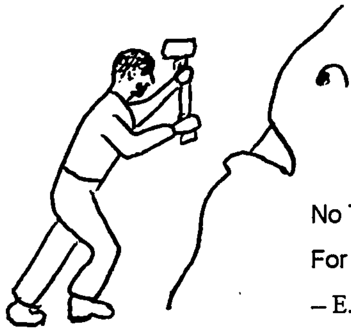
SPIRAL BUTTE. On Route US 12, west of Rimrock Lake, we encountered hazardous rock fall and landslide areas where Spiral Butte Andesite forms a cliff face adjacent to US 12. At Stop 39 (lunch stop) the Deer Lake Mountain hornblende andesite formed the top units of Clear Lake Falls. The base of the falls and its splash pool is cut into the Russell Ranch "soup". Views downriver to the east displayed spectacular views of the Rock Fall areas of US 12, a glaciated U-shaped valley, Pinegrass Ridge, which is capped by the Tieton Andesite, Round Mountain, also capped by andesite, and Clear Lake.

At Stop 40, we saw the very fresh Spiral Butte cone and the source of the Spiral Butte Andesite back in the Rock Fall area. This is the youngest of the volcanic cones in this area. The growth of the cone probably dammed the drainage creating Dog Lake. The name Spiral Butte is derived from the map pattern of the andesite flow from the center of Spiral Butte.

At White Pass (Stop 41), Paul Hammond showed us maps of the area that revealed the nature of High Cascade volcanism in this area. Directly south of White Pass and up the ski slope we have Russell Ranch clastics, which are overlain by andesites and basalt flows. The Tumac Mountain Plateau to the north produced large quantities of basaltic lava flows that formed an intercanyon flow west toward Mt. Rainier in the Cowlitz River drainage, north into the Bumping River area, and east into Indian Creek. The Deer Creek Andesite has its source NW of White Pass.

It was a great day, but we wished we had "one more stop". --Bart & Bev

MESOZOIC 245 m. y. a.	TRIASSIC 208 m.y.a.	
	JURASSIC 144 m.y.a.	
	CRETACEOUS	
CENOZOIC 65 m. y. a.	TERTIARY	PALEOCENE 58 m.y.a.
		EOCENE 36 m.y.a.
		OLIGOCENE 24 m.y.a.
		MIOCENE 5 m.y.a.
		PLIOCENE 2.5 m.y.a.
	QUATERNARY 2.5 m.y.a	PLEISTOCENE 10 000 y.a.
		HOLOCENE



No Tuff's too tough

For Richard !

– E.P.

1997 GSOC Field Trip Poem

A bunch of GSOCers, known also as rock knockers,
Tried to whoop it up at a place called Rose's Café.
When the very first sight presaged a night
That was bound to end in dismay.

All of us
From the baby-blue bus
Immediately filled the room
And Rose was able
To count each table
And predict the fall of doom!

Amateur waitresses changed their dresses,
And arrived to "save the day".
While we sat, "fingerlickin"
That the clock was still tickin'
The hungry day away.

Local would-be diners
Became turned away whiners
And quickly started home to vow;
Hereafter to eat under no rafter but their own chow!

Those seated near the kitchen
Avoided itchin'
By service right away.
When one asked for a menu
It was then when you learned you
Were there to stay.

Rose meant no offense,
But in self defense
Negated your wishes
For popular dishes,
Smiling your protests away!

© Ken Yost 1997

WELCOME!!!!!!WELCOME!!!!!!!!WELCOME

New GSOC Members: Nancy Robinson, Robert Shoemake, Alta Fosback, Irving Ewen, Robert & Louise Gamer, and Nikolay Senchilo

---

IN MEMORIAM

May Robinson Dunn

May R. Dunn, an early member of G.S.O.C., died on September 5, at age 90. She served our society in a number of ways, including Secretary in 1947/48, Vice-President in 1951/52, and Assistant Editor in 1953/54. In 1950 at our 15th Annual Banquet held at Mt. Tabor Presbyterian Church, she directed the "skit" which used to be a part of the program. May's main interest was in building the society's library, and she worked ceaselessly in assembling material which was stored in Baldwin's attic and basement—later moved to the Central Library were we met prior to moving to P.S.U. In 1991/92 and again in 1972/73 May was Librarian, and in 1974/75 she chaired the Book Purchasing Committee. A memorial service was held on September 14 in the Baptist Manor Chapel, where May had been residing the last several years.

----Submitted by Phyllis Bonebrake

From The Oregonian, . . . May was born Feb. 17, 1907, in Broadview, Saskatchewan. She lived in Portland since 1939. She worked for Bonneville Power Administration, retiring in 1972 as office manager.

Catherine Dobbin Evenson

Catherine Dobbin Evenson died Sep. 13 at age 88. She was born April 18, 1909, on a ranch between Enterprise and Joseph. She graduated from Enterprise High School, earned a teaching certificate from Washington State Normal School, and earned both bachelor and master's degrees from the University of Washington, in 1932 and 1933, respectively. She earned a doctorate in zoology from Cornell University in 1939. After teaching for four years at Smith College in Northampton, Mass., she married L. Franklin Evenson. She taught at Lewis & Clark College, Portland, before retiring, then was a wildlife biologist with the Outdoor School of the Multnomah Educational Service District. She was a past chair of the Oregon Chapter of Nature Conservancy. She and Franklin were active members of the Geological Society of the Oregon Country for many years.

----Submitted by Rosemary Kenney

THE GEOLOGICAL NEWSLETTER

GSOC

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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Editor: Marlene Adams 360-574-9650 Business Manager: Rosemary Kenney, 221-0757 Calender: Evelyn Pratt 223-2601
Assistant: Cecelia Crater 235-5158

ACTIVITIES

ANNUAL EVENTS: President's Field Trip - summer; Picnic - August; Banquet - March; Annual Meeting - February. **FIELD TRIPS**: Usually one per month, private car, caravan or chartered bus. **GEOLOGY SEMINARS**; fourth Wednesday, except June, July, August. 8:00 p.m., Room S17, Cramer Hall, Portland State University. Library: Room S7. Open 7:30 p.m. prior to meetings. **PROGRAMS**: Evening: Second Friday evening each month, 8:00 pm, Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon. **NOON MEETING**: First Friday monthly at noon except holidays. Central Library, 801 SW 10th, 1st floor, U.S. Bank Room,. Portland, Oregon. **MEMBERSHIP**: per year from January 1: Individual - $20.00, Family - $30.00, Junior (under 18) - $6.00. Write or call Secretary for application. **PUBLICATIONS**: THE GEOLOGICAL NEWSLETTER (ISSN 0270 5451), published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10.00 a year. Individual subscriptions $13.00 a 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.

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GEOLOGICAL NEWSLETTER

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

VISITORS WELCOME AT ALL MEETINGS
INFORMATION: Paul Brown, 227-2136
Evelyn Pratt, 223-2601

VOL. 63, No. 12
DECEMBER, 1997

DECEMBER ACTIVITIES

FRIDAY NOON MEETING: Central Library, 801 SW 10th, first floor, U. S. Bank Room

Dec. 5, 12:00 noon: Mt. Everest: The People Who Live In Its Shadow
Dr. Barbara Brower, Geography Dept., PSU

FRIDAY EVENING MEETING: 8:00 PM, Rm. 371 Cramer Hall, PSU

Dec. 12: Mars, the Red Planet
Dr. Melinda Hutson, prof. of astronomy & introductory geology, PCC

7:30-8:00 PM: A board member will be in the GSOC Library this month and next to help you check out interesting and timely material.
BE SURE TO CHECK IT OUT - lots of good reading!
Our thanks to cookie providers Cecelia Crater and Betty Botteron.

NO WEDNESDAY SEMINAR in December

****

HAPPY HOLIDAYS! **DUES ARE DUE DECEMBER 31!**

****

Advance notice: If you have your 1998 calendar, be sure to mark "GSOC Annual Banquet" on March 13. Dr. Scott Burns, always a crowd-pleaser, will be our speaker.

Calendar items MUST be given to Evelyn Pratt by the 15TH of the month. 223-2601

ANNOUNCEMENTS

GSOC NOMINATIONS. The GSOC Nominating Committee presents the following slate for 1998. All have been contacted and have accepted the nomination:

President:	Dr. Walter Sunderland	
Vice President:	Beverly Vogt	
Secretary:	Phyllis Thorne	
Treasurer:	Phyllis Thorne	
New Director:	Richard Donelson	(3 years)

1998 Voting Ballots will be mailed out to GSOC members in January. Ballots will be counted and the results announced at the Annual Meeting in February.

LOST AND FOUND. Dr. Hammond still has a BLUE PLAID JACKET and a BLUE THERMOS that was left on the bus from this September's 1997 President's Field Trip. If they are yours please claim them. Thanks.

TYPOS AND ERRORS. Some subscribers/members may have received a flawed Page 67 in the November issue of The Geological Newsletter. We have good copies for those who need them. Call Rosemary at: 221-0757. If you are in Clark County, WA, save yourself a toll call by calling Marlene at: 574-9650. Write GSOC at: P.O. Box 907, Portland, Or. 97207 or e-mail us at: ArnoldA100@aol.com.

Sorry for the two page 65's in our November issue. Not to worry, it will be magically remedied in the 1997 Index.

Professional style rules regarding capitalization were violated when typing out Richard Bartel's DAY ONE from the President's Field Trip. Marlene will try to do better in the future, but will not issue any iron clad promises on this score. She is a terrible procrastinator and already causes Rosemary monthly heart failure in delivering readable copy either just minutes before or hours after the generous deadline Rosemary sets. Now that Bev Vogt has taken away the excuse of ignorance in geology style rules by loaning The Geological Newsletter technical and style manuals, new excuses will have to be invented for future style faux pas. Seriously, though, thanks to both Rosemary and Bev with trying to keep Marlene on the straight and true.

NEW MEMBER INFO. We are sorry that we cannot include address and phone information for new members listed in The Newsletter. The Geological Newsletter has a wider and more public distribution than our yearly Membership Directory. Hence our rule. New members might want to keep this in mind, e.g., if that nice GSOCer you met at the last meeting is not calling you it might be because he/she doesn't have your number!

^^

MERRY CHRISTMAS AND HAPPY HANNAKUAH

^^

NEW GRAPHICS? Ken Yost noted that the graphics in The Newsletter could use some spiffing up and volunteered to help us out. Thanks Ken. Let's get together about this. Sorry, for the delay in getting back to you officially.

HELP WITH PHOTOS. If a GSOCer has any expertise in black & white photo work suitable for reproduction in our Newsletter, we wouldn't turn down your offer of help. We'd like to give our members and subscribers the most bang for their membership/subscriber bucks. So don't be shy in volunteering. While we are on the subject...

FAME AND GLORY AWAIT! The Geological Newsletter is always interested in featuring your scholarly articles, informal nature or wilderness stories, science or natural history essays, and related drawings. Heck, if you are a fiction writer or poet, and can somehow connect your unpublished masterpiece to earth sciences or our field trips, walks, or lectures, we'll be honored to read and consider it. Since we can't pay you, we will be glad to recognize your personal copyright if you so desire.

Write: Marlene Adams, 1809 N.W. 90th Street, Vancouver, Wa. 98665-6757 or e-mail: ArnoldA100@aol.com

-M.A.

IN MEMORIAM

LOIS STEERE BEATTIE died November 9 of lung cancer. She was born February 14, 1928, and raised in Ann Arbor Michigan. She lived in Portland since 1978. Her survivors include her sons Allan L., Jr. of North Bend, Washington; David J. of Denver, Colorado; and Jay W. of Portland, Oregon; daughter Dorothy A of Santa Rosa, California; mother, Dorothy A. Steere of Bronxville, New York; sister Alice H. Coulombe of Pasadena, California; and brother William C. Steere, Jr., of Darien, Connecticut.

Although Lois was a member of GSOC for only a few years, she was a long time friend and helper to our organization. She was a wonderful gourmet cook. Many GSOC'ers will remember her as a co-hostess with Margaret Steere at the Christmas pot-lucks for the GSOC seminars. For many years, she could be seen at the Annual Banquets helping Margaret Steere with the Publications Table. -RK.

REPORT ON THE 1997 PRESIDENT'S FIELD TRIP [INSTALLMENT TWO]

DAY TWO: TUESDAY, September 9, 1997

Day 2 Field Trip Reporter, Marlene Adams knows just enough geology to be dangeous. She has a B.S. in Chemistry and the equivalent of a Geology Minor, though the latter course work was acquired helter skelter in Wyoming and Utah. She remembers few geology basics and knows virtually nothing of Pacific Northwest geology. Arnold, a mechanical engineer with Pacificorps, suffers gladly his wife's rock frenzies, whilst quietly clicking the camera away and trouble shooting computer gaffes at home. They are happy to announce that, upon returning home from this field trip, their house was still standing with house-sitting teen and three cats all alive and well.

BACK TO ROSE'S. Co-guiding us today is Newell P. Campbell, retired from Yakima Community College. Among his handouts is the article he co-authored with Stephen P. Reidel of WSU, "Further exploration for gas warranted in Columbia basin". On the way back to Rose's Café, we pass by tomorrow's pictograph stop, which is located in Tieton andesite, the world's longest andesite flow, formed in an old river channel. It is 550 feet thick.

We are driving in an old river channel of the Naches River, which was carved out of older Columbia River basalts. The oldest flows of the Columbia River Basalts went the furthest west. As we drive to the west we see older and older flows until only the Grand Ronde is left. The accumulation of so many feet of basalt was made possible by the uplift of the Cascades and the subsidence of the Columbia River Basin. Only a few vents were responsible for all this basalt.

We pass by 5-9 million year old mud flows found in the Ellensburg formation. This is 1200 feet of mud flow, stream gravels, ash, and tuff. This flow is very extensive in the East-West direction but not the North-South.

KARMA CONFLICT. We are again darkening the door of Rose's Café. Not to eat but to soak in the geology. We timed our early morning start perfectly with that of the local sanitation crew. Rose and we somehow are just not meant to be! Over the roar of the garbage truck, we are told we are human nose to anticline nose with Cleman Mountain. Cleman Mountain is a folded thrust, having been thrusted, folded, and thrusted again. Thick layers were involved, resulting in the brecciation of the upper basalt plate.

SANFORD PASTURE LANDSLIDE. Our audio luck is consistent. A caterpillar is noisily gobbling up much geology near the Gravel Pit we've stopped at. I am impressed with the Sanford Pasture Landslide. As I understand it, the slide took place on a thrust fault which coincided with the interbedding between two Grande Ronde layers. Undoubtedly I would be even more impressed if I had the vaguest idea of how to decipher Figure 10.

Back on the bus, our leaders talk about: How the CR basalt flowed around the older Edgar Volcanic Cone; and that the folding and faulting in the lower formations is not the same as in the new flat basalt flows. Shell, in its local drilling operations, apparently spent a lot of money to discover the latter fact. That and the geology basic that oil is not found in basalt! Humm....even I knew that.

N2, R2, BUT NO D2. [Credit R Pratt with this pun.] To keep themselves from going stark raving mad from the sheer abundance of basalt here, local geologists distinguish different layers of the Grande Ronde basalts based upon their magnetic polarity. N = Normal polarity; R = Reversed polarity. The order of the flows or layers are, from youngest [top] to oldest [bottom]: N2, R2, N1, R1.

We pass through brecciated volcanics, lava pillows formed in an ancient dammed up river, and slide material.

ON THE C ROUTE. [See Dr. Hammond's Field Guide] The photogenic cliff formers here are the lahars of the Upper Ellensburg Formation. There are 6-7 different sources for the Ellensburg in the Cascades. The top of the basalt here is N2 and apparently from old Scab Mountain.

The movie *The Hanging Tree* was filmed at Hanging Tree Campground. Speaking of movies, was anyone else reminded of the movie *Elephant Walk*, starring Liz_Taylor and Richard Todd, during camera ops when those in the back of the bus stampeded over the slower people in the front of the bus?

Paul Hammond mentions his tale of the absent minded geologist the point of which is: If you want to have a happy life as a geology professor, don't forget to return with the children of your university's president from all field trips.

Newell Campbell relates how he convinced the town of Yakima not to build a water reservoir here at a basalt slide block that had slid and temporarily pinched off the canyon. He points out to us both the 15 degree dip and the N2-R2 interface, with sand in between. The road would have slid if a reservoir was placed here. Drilling done here indicated stream gravel, which would not have held. Its also noted that Ellensburg hornblende dacite weathers fast.

WORKING IN THE QUARRY. We wack away at the rubbly material in this thick lava flow, which is up to 300 meters. Noteworthy are the shiny plagioclase crystals, approaching the grain size of those in igneous intrusions.

MOUNT AIX VIEWPOINT. Helped by the placard and Dr. H, we can distinguish from the panorama: Timberwolf, with only its guts left; Bismark Peak, the margins of the Mt. Aix Caldera, Dog Mountain, Nelson Butte, and Meeks Table. Two questions are posed: What keeps the isolated basalt flow block, known as Meeks Table, which is surrounded by landslides, in place? and Did Nelson's Butte feed the Ellensburg 2 million years ago? It is noted that Mount Aix got its name in 1858, from the two Catholic priests who on the first wagon train to pass by. Aix is French for slate, which is what it was thought to resemble.

Back on the main road, and after much talk of dikes and sills, Arnold argues for the term, dill. Marlene dutifully giggles.

SACK LUNCH AT WHISTLING JACK. Judging from the cost of the tee shirts in the gift shop, it is probably just as well that we brought our own lunches. It is a pretty place, though, with nursery story bear chairs and a wooden baby bear fisherman for those who choose to explore.

Back on the bus, the syncline in CR basalt is noted. And Paul H. tells us the horrific tale of the people killed in the freak wind storm on Aug. 26, 1997, as we pass storm-downed trees in the stream. Nature takes its all too real toll, without the help of any mythical boogie men.

At the next stop, some great tree-fragments are collected in early Ellensburg pumice-rich tuff.

ON THE A ROUTE. The Drunken Forest, which can be seen in aerial photos, gets its named from the tilted trees in the fan deposits of a landslide. Much as we have seen dikes and sills [variously of hornblende, andesite, basalt, olivine, dacite] in abundance, now we hear no end of the word bumping, related to how the Bumping River bumps up and down. We first see the Bumping River Tuff, thought to have been exploded from Mount Aix.

As we pass Goose Prairie, the former summer home of William O. Douglas, Dr. H tells how Justice Douglas walked from Goose Prairie to Cliff Dale to phone in the order to stop Nixon's bombing of Hanoi.

We are riding on a glacial terrace formed in the last glacial period, 15-20 thousand years ago.

BUMPING LAKE & DAM. We have spent much of our day traveling from a distant view of the margins of the Mount Aix Caldera to being inside the very same caldera, where the lake and dam are located. This has been an impressive trip! We get an on the site lecture regarding the problem of erosion at the dam. It was discovered that much of dam fill was rotten logs mixed with fifty feet of ash and lapillae derived from a Mt. Rainier event. This is a Roller Core Dam. It was necessary to replace the apron on both sides. The ash came from Deep Creek. Five hundred years ago, a large fire occurred and then Mt Rainier erupted and then flooded in a spring run off. A debris flow with 30% logs and lapillae on top resulted.

Dr. Hammond discussed the panorama, which included: Nelsen Ridge; Copper Creek; Dacite Peak; Chinook Pass Anticline; and Craig Mountain, with its big sill.

The Committee of Four, plus helpers, collected Bumping Lake Pluton Granite for this spring banquet's place settings. And, provided a much needed and enjoyed coffee break to boot. Napoleon may not have had his Waterloo were he so well cared for!

THE RETURN TRIP. Back on the road, we collect, andesite of, what else?-- Bumping Crossing. The fanlike plumos—as in bird plume—fracturing from contractual cooling is pointed out to us, as in the tinnier sound resulting from the higher silica content.

At another stop, Dr. H and some GSOCers took samples for magnetic testing. We pass the memorial marker to W.O. Douglas. And Paul Hammond and Newell Campbell relate how Edgar Rock got its name from time when Indians tied a nasty pioneer with that moniker to the rocks.

Cooling lava rock forms radial joints
-Ev Pratt

My last entry for the day records our stop at a most interesting prismatically jointed boulder spotted high on a cliff. This pattern indicates that it was deposited hot then cooled possibly in a water channel.

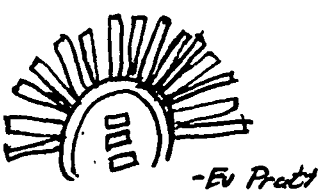
Tuesday Evening Supper was taken in the place of your choice in downtown Yakima. Everyone was content with this freedom of choice. We returned to our motel tired, but stuffed with both food and geology! And both She and He survived her second gruesome day on the crimson trail, on an Advil high,, with narry a mention of homicide or divorce between them. - *M.A. & A.A.*

HAPPY HOLIDAYS

DAY THREE: WEDNESDAY, September 10, 1997

Day 3 Field Trip Reporter, Evelyn Pratt, is a serious and seasoned geology fan. She is a former GSOC Vice President and President, and has carefully planned a previous President's Field Trip. She is conversant both in N.W. geology and botany, and has taught courses in natural history on the community college level. She is a rock collecting dynamo who must be seen to be believed. Husband Ralph quietly aides and abets her endeavors.

PICTOGRAPH STOP. Esback Pack, Yakima, highlights Native American pictographs. It is at the end of the reverse-topography Tieton (TY-tun) andesite flow, which is much younger than Tieton Volcano, and has absolutely nothing to do with it. Ken Yost commented on the pictographs' excessive use of white over red, and lack of a sense of family or religion." The city removed present-day graffiti. You have to wonder how rock art in such an easily-accessible place can be protected?



EDGAR ROCK & FIFES PEAKS VOLCANO. So far we have seen two examples of the older "Fifes Peakes" Formation, which is composed of tuffs, flows, and lahars, and dates back 26-24 million years. Seen on the prior days were Tieton and Timberwolf Mountain volcanoes. Today we drove northwest on WA 410 to see two others: Edgar Rock and the largest, Fifes Peaks Volcano, probably the type section.

As before, we paralleled the Tieton andesite flow, and saw: Cleman Mt.'s familiar anticlinal curve, pale beds of Ellensburg Formation, the alluvial-fan house, and the basement-of-the-rockslide house. Sumac shrubs reddened on the dry slopes of 12-mile-wide, so far undated, Sanford Pasture Landslide. Much of the Naches Valley bottom was flooded last year. Why did all these folks who cleaned flood mud from their homes build there? Flat ground, "It can't happen" here'ism, and/or fertile river silt? Elderberry bushes this year are loaded with fruit.

We skirted the west edge of OWL, that mysterious line running from the Olympics to Wallowas. On a geological map, Edgar Rock Volcano looks like a fried egg, with an anticline pushing up older 38-30 million year old Ohanapecosh Formation "yolk" in the middle. In one of "Messy Edgar's" mudflows, hot rocks developed radial cracks as they cooled. Below this formation Edgar dikes arose through "abused" & "tortured" GOLD CREEK rocks of uncertain age.

UP THE LITTLE NACHES WITH PAT & WENDY. Pat Pringle and Wendy Gerstel, who are working on a Washington State geological road guide for Mt. Rainier, joined us at Cliffdale. We left WA 410 and followed the little Naches River up F.S. Road 1900. Road and river are in the axis of a Grand Ronde (N2?) basalt syncline. That syncline and Cleman Mountain and Edgar Rock anticlines parallel the west edge of the OWL. This lava flow is probably the same we saw Tuesday at Rattlesnake Creek.

THE FISH LADDER. This area is heavily managed, according to Pat and Wendy. BPA provided cash for a decorative fish ladder giving spring chinook access to the upper Little Naches. A few feet downstream a many-ton, barrel-shaped, finely-columned chunk of Grande Ronde basalt is anchored in concrete. Beyond lies a blue-green pool—great for cooling off on a hot day. A few big chinook swam in shallows above the ladder, and ouzels "dipped" on midstream rocks. It's a nice place for folks as well as for fish.

WEST TOWARD CHINOOK PASS. The last OWL stop featured at least five Grande Ronde N2 basalt flows, with maybe a 10,000-year average between flows and with various types of interbeds—ash, sediments, etc. In one contact between a flow and an interbed we found pieces of charcoal. West of here a major OWL-paralleling fault divides younger CRB from the older Western Cascades.

FIFES PEAKS VOLCANO VIEWPOINT. Sheer cliffs and spires of breccia rose over 3000 feet above us. Fred Becky, the author of a little book mountaineers call "Becky's Bible", which shows climbing routes up practically every height in the Northwest, tackled these challenging rocks all by himself. To each his own...

Development of this formation was fairly complex, the steps of which were:

1. Magma absorbed water. As it rose and pressure lessened, the magma built up a head of steam and exploded. Tuff blasted skyward and fell, like soot coming out a chimney, and then coating the roof around it.
2. Next, blocky andesite lava flowed out six times or more, forming low-angle aprons. Breccia would form at the base of a flow. In time, a bed of sediments, tuff, or whatever, would be laid down on top. Then another flow would cover that bed.
3. Eventually, the craters from these flows coalesced, resulting in a cored-out caldera roughly the size of Crater Lake, but much more irregular. This is in

contrast to Mt. Aix and others which formed when single magma chambers emptied out, leaving circular collapse calderas.

4. Thick units of cross-bedded breccia filled in the caldera. The whole mountain may once have been as extensive as today's Mt. Rainier. This could be deduced by taking samples from both base and summit. Hummm...How high was it at its highest? Fred Becky, where are you when we need you?
5. Lastly, erosion removed all but the brecciated caldera filling.

Ohanapecosh formation andesites, scoria, and partly-welded lithic fragments extend from Mt. Rainier to the Gorge. Green and purple alteration seems to be its trademark. To the west, minerals have been oxidized by hot water to red- and yellow-brown silica and iron pyrite. This hydrothermal alteration increases to below the Crystal Mt. Ski Area.

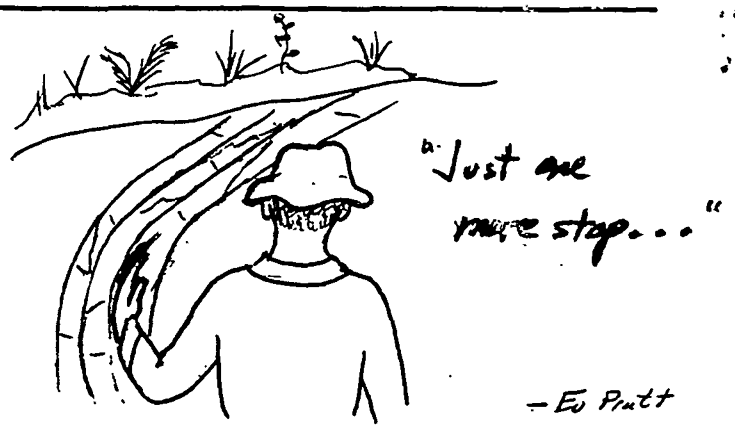
Just east of Chinook Pass is the north end of Bumping Lake Pluton, (more of a baby batholith, both in size and age, being a bit over 100 square km and only 25 million years old). Its sparkling white granite speckled with big biotite crystals lines the roadcuts. Dr. Hammond wonders why this pluton has no large recrystallization zone or pink color along its margin.

Chinook Pass is in a north-south syncline, with Naches Peak on one side and Yakima Peak on the other.

INSIDE MT. RAINIER NATIONAL PARK. Inside the National Park, clouds veiled Nt. Rainier's top and accentuated Little Tahoma's sharp peak, which is higher than Mt. Hood. We lunched at beautiful Tipsoo Lake, where thanks to a late growing season at least 22 species of wildflowers still bloomed. Marlene remarked," All rocks have been inventoried. If you take one a beeper goes off." Poor Bart, he couldn't hack at a single outcrop!

WENATCHEE NATIONAL FOREST OVERLOOK BY CHINOOK PASS. This is a good place to look east into the American River's classic U-Shaped glaciated valley. Light-colored dacitic Gold Hill, one source of the Ellensburg formation, rose on the left, and Goat Peak, an andesite plug and former volcano, on the right. Beyond the peaks Dr. Hammond pointed out horizontal Grande Ronde basalt flows of Menashtash Ridge, west boundary of OWL.

GOLD HILL QUARRY. On the return trip fewer people left the bus for Dr. Hammond's "just one more stop". But even lowering clouds didn't keep us from our cookie-coffee break beside the bus. As we gathered, nice hornblende dacite samples from a GOLD HILL QUARRY, pikas "zzzt'ed" at us taking *their* rocks.



Pat's handheld GPS calculator gave our geographic position within 300'. Amazing! Pat cored a tree and explained how the thin core would be glued down, sanded, and sliced to show large dark rings (good growth years) and small ones. The last few years have been good. In 1601 trees had very little dark wood because there'd been a big volcanic eruption and poor growing conditions.

WENDY'S DISCUSSION AT UNION CREEK. Ten miles east of the pass at Union Creek, Wendy explained cosmogenic dating of one surface deposit. Finding ripples and fine ash may indicate a former landslide-damned lake, a delta, or reworked till. Pat dug into it, and yellowish sediment flowed down like water.

HEADING BACK. About sixteen miles east of the pass, we drove through AMERICAN RIVER GLACIER'S last TERMINAL MORRAINE, less than 25,000 years old. From there on, about all one heard were raindrops spattering the windshield and a few snores hitting the ceiling as Bob drove us back to Yakima and supper. -- *E.P.*

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The final installment of *Report on the 1997 President's Field Trip* and The 1997 Index will appear in our January issue.

AND HAPPY NEW YEAR from GSOC !