FEB 91

THE GEOLOGICAL NEWSLETTER

GSOC

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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1990-1991 ADMINISTRATION

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Freda and Virgil Scott 771-3646
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Volunteer Speakers Bureau
Robert Richmond 282-3817
Annual Banquet
Esther Kennedy 287-3091
Gale Rankin 223-6784

ACTIVITIES

ANNUAL EVENTS: President's Campout-summer. Picnic-August. Banquet-March.
FIELD TRIPS: Usually one per month, via private car, caravan or chartered bus.
GEOLOGY SEMINARS: Third Wednesday, except June, July, August, 8:00 p.m. Room S17 in Cramer Hall, PSU. LIBRARY: Room S7, open 7:30 p.m. prior to evening meetings
PROGRAMS: Evenings: Second and fourth Fridays each month, 8:00 p.m. Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon.
Luncheons: First and third Fridays each month, except on holidays, at noon, Standard Plaza Cafeteria, third floor, Room A, 1100 SW Sixth Avenue, Portland, Oregon.
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VISITORS WELCOME
INFORMATION PHONE 284-4320

VOLUME 57, NO. 2

CALENDAR OF ACTIVITIES FOR FEBRUARY, 1991

FRIDAY NIGHT LECTURE (Cramer Hall, PSU, Room 371, 8:00 P.M.)

February 8 — 'A Few Pictures of New England Geology', Speaker: Walter A. Sunderland, Vice President.

February 22 — 'The Sunshine (silver) Mine' in Kellogg, Idaho. Speaker: Walter A. Sunderland. Also, the ANNUAL BUSINESS MEETING.

FRIDAY LUNCHEON (Standard Plaza, 1100 S.W. 6th Avenue, Rooms A & B, Third Floor Cafeteria. Programs at 12:00 Noon)

February 1 — North Arctic Ocean, A slide presentation by Frances Rusche, member.

February 15 — To Italy with Music; Italian Scenes, background music No narration, Benton Dailey.

GEOLOGY SEMINAR (Cramer Hall, PSU Room S-17, 8:00 P.M.)

February 20 — Wednesday GOOD BOOKS FROM THE GSOC LIBRARY
Presentations by: Francis Rusche, Esther Kennedy, Helen Nelson, Virgil Scott, Don Parks,
Moderator: Robert Richmond

GSOC LIBRARY (Cramer Hall, Portland State University, Room S-7) Open 7:30 - 8:00 P.M. prior to evening meetings.

FIELD TRIPS The GSOC Board and Field Trip Committee request opinions, suggestions, and volunteer leaders for the 1991 season. No field trips have been planned for February.

ANNUAL BUSINESS MEETING (Cramer Hall, PSU, Room 371, 8:00 P.M.)
February 22 — and Friday Night Lecture, see above.

ANNUAL BANQUET (Grand Ballroom, Smith Memorial Center, PSU, Third Floor,
March 8 — 5:30 P.M. - Exhibits & Sales, and 6:30 P.M. - Dinner)
See page 11 of this issue for more information.

N E W   M E M B E R S

Gail Daggett 235-4329
452 SE 39th Ave.
Portland, Oregon 97214

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Los Gatos, California 95030

Roy & Fay Neal 649-2870
16135 SW Farmington Road
Beaverton, Oregon 97007

Ronald Pfeifer 829-8802
29311 El Rancho Road
Molalla, Oregon 97308

NOTICE OF MEETING

Oregon Department of Geology and Mineral Industries (DOGAMI) Open House and Information Exchange Session, February 6, 1991, 2 to 5 p.m. Standard Plaza Building 3rd floor meeting rooms A & B, 1100 SW 6th Ave., Portland, Oregon.

ATTENTION EVERYONE!

DUES FOR 1991

The Board of Directors, in accordance with Article IV, Section 1 of the Society's By-Laws, raised Individual Dues from $10 to $15 and Family Dues from $15 to $25, to be effective January 1991. Dues were increased due to higher operating expenses.

Those who have already sent in Individual dues of $10 and Family dues of $15 should send an additional $5 and $10, respectively.

Members who have not paid their dues should send them in now.

BANQUET SALES TABLE NEEDS GOOD MATERIAL

Proceeds from the sales table at the Annual Banquet go to help meet the expenses of the banquet. So please bring SALABLE material that will attract purchasers and be treasured by them. No large, heavy specimens, please. Limit your material to hand specimens or smaller. Suggested items: Minerals, slices, crystals, fossils, thundereggs, tumbled agates, geodes, worthwhile books on geology or natural history. If you need help in transporting your donations to the building, phone Archie Strong, 244-1488 or Harold and Patricia Moore, 254-0135.

PROVIDE A BANQUET EXHIBIT

Displays for the Annual Banquet on March 8 are eagerly solicited. Exhibits of rocks, minerals, fossils, books, pictures, or any hobby collection (geologic or otherwise) are suitable. Please call Rosemary Kenney, 221-0757, or Donald Turner, 646-3192, so space can be reserved. If possible, bring your own lamps and extension cords. The Exhibit Room will be open for setting up your material by 3:30 the afternoon of the banquet. Hand truck is available.

HELP!

Keep sending those camera-ready articles for The Newsletter to the Editor.

Said one earthquake to another:
"It's not my fault!"

55TH ANNUAL BANQUET NOTICE

PLACE: Grand Ballroom, third floor, Smith Memorial Center, Portland State University.

DATE: Friday, March 8, 1991. Put a mark on your calendar!!!

TIME: 5:30 pm. Grand Ballroom open for viewing exhibits and purchasing items from sales table.

6:30 pm. Dinner is served. Service begins PROMPTLY at 6:30 because of limited time allowance.

TICKETS: Ticket Chairmen, Virgil and Freda Scott, 8012 SE Ramona Street, Portland, OR 97206. Write or call them for reservations (771-3646). Or send check to GSOC, PO Box 907, Portland, OR 97207. Send a stamped, self-addressed envelope for return of tickets, or they will be held for you. Tickets are for sale at all GSOC meetings. Please purchase your tickets early.

PRICE: Cost of banquet tickets is $12.50 each. Bring tickets to the banquet; they will be collected at tables.

PARKING: The 5th floor of parking structure No. 1, 1872 SW Broadway, between SW Harrison and SW Hall Streets, has been reserved from 3:30 pm on, for GSOC members attending the banquet. BE SURE YOU PARK ON THE FIFTH FLOOR!!! Do not park in spaces marked "Handicapped" or "Reserved."

From the 5th floor structure, a short stairway leads to a footbridge across Broadway directly to the level of the banquet room in Smith Memorial Center.

Books for Geoscientists

Mineral Resources and the Destiny of Nations

By Walter Youngquist, National Book Company, 812 S.W. Washington, Portland, Oregon, 97205-3220, 1990, xii + 280 p., hardcover, (ISB 0-89420-268-5): $17.95 plus $2.00 S/H.

Exactly 40 years ago I taught a summer-session course at UC - Santa Barbara entitled "Minerals in World Affairs", using as text T. S. Lovering's (1943) remarkable book of that title. After I came to Portland State in 1956, I taught this as a "general studies" course for both majors and non-majors until my retirement in 1974. It was one of the most gratifying yet difficult courses I have ever taught; as Lovering became obsolescent and I changed to Flawn in 1966, it required more and more annual updating from Bureau of Mines yearbooks and other sources.

I am delighted that Youngquist has brought Lovering and Flawn up to date with this essentially non-technical but comprehensive treatise for students and laypersons alike, describing the network of synergistic impacts, past and present, that mineral resources have made upon world cultures.

Youngquist captures the essence of the relationships between mineral resources and geography, politics, economics, law, engineering, interstate and international relations and commerce, and war and peace. In twenty chapters, his lively account ranges in space across all continents and oceans, and in time from the more than 10,000 pre-historic paleoindian copper mines in Michigan to Gorbachev's cutting off energy supplies to Lithuania in April, 1990. A bibliography includes more than 200 references, and the index covers 18 pages.

The following (*) are notes I took while reading each chapter:

* Minerals move civilization. Our country's present high standard of living results from the former abundance of now dwindling energy and other mineral resources.

* The steps in the rise of civilization are named from minerals - the Stone Age, the Bronze Age, the Iron Age, the Oil Age, the Atomic Age. Throughout history, metals and other minerals have sparked geographic discovery, resulted in migration and settlement, built and conquered empires.

* The need for control of minerals to make armaments have again and again been the excuse for wars by Greece, Rome, Great Britain, Germany, USSR, Japan, Iran. During peacetimes, minerals are used for economic warfare by most great powers.

* The war between the states was won by the north's steel industry. The more recent rise of the south, especially Texas, was made possible by oil reserves. Montana and Wyoming now control 70 percent of the nations desireable low-sulfur coal. Alaska oil temporarily boomed its economy.

* Minerals are money. In the past silver supported Greece, lead, silver and salt were used by Rome, gold and mercury by Spain. Now gold upholds South Africa, "petrodollars" supply the Moslem states, and tin is the basis of Bolivian and Indonesian economy.

* Dozens of ghost towns across the American west suggest the fate of towns, states and nations who depend too much upon one soon-exhausted mineral resource. Michigan copper, Minnesota iron, Idaho silver, Alaska and Louisiana oil are all now mostly gone. Algeria, Angola, Bahrain, Brunei, Ecuador, Iran and Iraq all rely upon oil for more than 70% of their income. Youngquist continues this alphabetical list with 27 more nations who rely largely upon one mineral resource.

* Mineral deposits are non-renewable, but at least some of the "capital" derived from them has been spent in philanthropy. Carnegie iron built museums and libraries, Cecil Rhodes' gold funded the Rhodes scholarships, Rockefeller oil established the University of Chicago. The Univesity of Texas with $3 billion oil dollars is the worlds richest institution. Arabian petrodollars have built entire cities and reclaimed deserts.

* It took only 200 years for the United States to go from wilderness to the most powerful and affluent nation the world has ever known. The combination of the right time (the industrial revolution) the right place (3 million square miles of virgin land with tremendous variety and quantity of mineral resources) and the right people (poor but free and ambitious with highy educated leaders) produced a miracle.

* World oil production, rising from a few barrels a day in 1859 to the current 50 million barrels a day, has changed our earth more rapidly and profoundly than any other material in history. The oil age, now more than half over, has revolutionized transportation, space heating, and manufacture of plastics, fabrics, chemicals, etc. We started to mine oil early, and we have used it so rapidly that we must now import a substantial proportion of our needs. This 23 page chapter is the longest in the book, and goes into our dilemma in detail.

* Today, sixty five percent of U.S. energy now comes from oil (44%) and gas (21%). Alternative energy resources are coal (22%), hydro/misc. (4%), nuclear (5%) and solar/biomass (4 %). Other possible non-renewable sources are shale oil, oil and tar sands, nuclear fission and fusion and geothermal energy. Possible additional renewable energy sources are wood and other biomass, hydropower, solar energy, tidal power, geothermal, waves, wind, and ocean thermal gradients. Each of these possible energy sources are discussed.

* Minerals and mineral rights in and beneath the oceans include not only oil, but such things as diamonds, phosphate, tin, manganese, sand and gravel, and even the metal-rich brines in the bottom of the Red Sea. Some of these are not yet "ores", since the definition of an ore includes that it must be recovered at a profit. The role they will play is not yet defined.

* Water is a mineral, perhaps the most essential natural resource of all - I once gave a talk on water entitled "The Ultimate Resource". Ground water frequently is a non-renewable resource, and mining it too rapidly can cause water table draw-down, and even land subsidence and saltation. Southern California, Arizona and Texas have only begun to realize the problems they face in supplying adequate water to their growing populations.

* "Minerals and medicine" warrants 11 pages - how minerals can affect the health of individuals as well as nations. A number of health problems are due to mineral deficiencies, other minerals are poisonous (arsenic, selenium). Some minerals can act in both ways (fluoride). The fall of the Roman Empire has been attributed to drinking water carried by lead pipes. Radon gas from uranium can be a health hazard in parts of the country.

8 Strategic minerals are those which are important industrially, and for which, in general, no adequate substitutes exist - they are not readily available in most countries. Oil, of course, is strategic to those countries that have none. Most of the world's reserves of strategic metals are produced in South Africa and in the USSR. The concept of a strategic mineral stockpile is an outmoded anachronism.

* The mineral self-sufficiency of a nation depends upon the stage of its industrialization. An agrarian nation needs few minerals. No highly industrialized nation is mineral self-sufficient. As noted in the last chapter, the USSR and South Africa are almost the only nations largely sufficient in mineral resources. China lacks oil but has abundant coal and iron, although probably not enough for its 1.1 billion population. Brazil, western Europe and Great Britain, and Canada are fairly well-provided. India and Indonesia, like China, have populations too large to permit a rise in standard of living. Japan, the second largest industrial nation, with no mineral resources, lives by importing, upgrading to a finished product and exporting.

* According to Webster, a "cartel" is a "combination of independent commercial enterprises designed to limit competition" . Past international cartels have attempted to restrict wheat, sugar, coffee, uranium and tin. The diamond cartel has been effective, as has the oil cartel known as OPEC, the "Organization of Petroleum Exporting Countries". But cartels eventually break up, and seldom restrict free trade for very long.

* Minerals and the future. Everything we have, including ourselves, comes ultimately from the rocks and soil beneath our feet. Nature's storehouse of metals and minerals took billions of years to accumulate - we have used more of that store since 1900 than during all previous time. Energy resources are the key that opens that storehouse; at present 25 percent of our energy resources are used to produce more energy, and as we use up these resources, that percentage will rise. The nations producing raw materials can then take industries and jobs away from the mineral importing consumer nations who have used up their resources. The universal concern should be the development of an international economy based on renewable, recyclable natural resources that can sustain a stabilized world population in reasonable comfort.

* The ultimate resource - can it secure the future? Japan and Switzerland, without mineral resources, have high standards of living. They are free societies, with well-educated populations, and can get their needs by free trade. There must be a limit, however, to how much the educated human mind can compensate (by ingenuity) for scarcity or depletion of minerals. Only the future can tell. The frontiers are the frontiers of the mind.

The remarkably low price of Youngquist's book makes it affordable to students who are increasingly burdened by texts that can cost two or three times this amount. The financial decision by the author and publisher that made this possible was to forego glossy paper and leave out all illustrations. There are 8 simple statistical tables, but no other charts, graphs, diagrams, photographs or even maps, except for one tiny world map on the cover paper. This means you have to read the text - you can't skim the pages to get the illustrated gist!

I do sorely miss the famous "Hewitt Diagram" which Lovering used to show the rise and fall of national power and prestige as a function of mineral production and utilization. Walt, you should at least have mentioned it!

As to be expected from the author's many years in the oil industry, as well as its importance to our present standard of living, a perhaps disproportional number of pages are devoted to oil and natural gas. He has visited and collected information for this book in more than 70 countries during his 40 years a an economic geologist, a background that makes his words worth noting.

We still teach "Minerals in World Affairs" at Portland State, and I expect that Youngquist's book will be adopted. I wish that a similar course could be part of the <u>required</u> curricula, not only in geology, but also in the fields of social science, engineering, law and business mentioned above.

This highly readable book should be be in the library of not only every student, but of every goverment official, legislator and voter who needs to understand the ins and outs of this little known yet supremely important aspect of our fragile civilization.

References Cited

Lovering, T. S., 1943, Minerals in World Affairs: Prentice 394 p.

Flawn, Peter T., 1966, Mineral Resources, Geology - Engine(Economics - Politics - Law: John Wiley & Sons, Inc., New York, 406 p.

John Eliot Allen
Department of Geology
Portland State University
Portland, OR, 97207-0751

THE GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

AIMS AND OBJECTIVES

(1) To provide facilities and leadership for members of the Society to study geology, particularly the geology of the Oregon Country.
(2) To establish and maintain a library of geological publications.
(3) To support and promote geologic study and research, and to designate, preserve and interpret the important geologic features of the Oregon Country.

MEMBERSHIP QUALIFICATIONS

Members shall be persons who are interested in and support the aims and objectives of the Society and who have been recommended by the membership committee.

DUES

The annual dues shall be paid on or before March first of each year. Annual dues are:

Individual Membership: A person of age 18 or older, shall receive a Newsletter subscription and have one vote $15.00

Family Membership: Adult family members shall receive one Newsletter subscription and have two votes $25.00

Junior Membership: A person under age 18, not included in a family membership, shall receive a Newsletter subscription, but may not vote or hold elective office. . . . . . . $ 6.00

APPLICATION FOR MEMBERSHIP
THE GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

Date________________________

Name____ Spouse____________________

Children under age 18____

Address: Residence__________________________________ Phone______________

City, State, Zip____

Business:__________________________________ Phone______________

City, State, Zip____

Occupation:____

Geological Interests & Hobbies:______________________________________

Remittance of $____________ for dues is attached.

____
Signature of Applicant

Make check payable and mail to:
THE GEOLOGICAL SOCIETY OF THE OREGON COUNTRY
P.O. Box 907, Portland, Oregon 97207
Attention: Secretary

March 1991

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INFORMATION PHONE 284-4320

VOLUME 57, NO. 3

CALENDAR OF ACTIVITIES FOR MARCH, 1991

FRIDAY NIGHT LECTURE (Cramer Hall, PSU, Room 371, 8:00 P.M.)

March 8 — ANNUAL BANQUET 'Geology of Gold Prospects in Eastern Oregon'. Speaker: Dr. Michael Cummings.

March 22 — To be announced.

FRIDAY LUNCHEON (Standard Plaza, 1100 S.W. 6th Avenue, Rooms A & B, Third Floor Cafeteria. Programs at 12:00 Noon)

March 1 — 'Volcanic Soils of Chile and Ecuador'. An illustrated lecture by Dr. Bob Meurisse, Regional Soil Scientist for U.S. Forest Service.

March 15 — 'Overview of Israel'. An illustrated lecture by Phyllis Bonebrake, member.

GEOLOGY SEMINAR (Cramer Hall, PSU Room S-17, 8:00 P.M.)

March 20 — 'A Case for Plate Tectonics in Europe'. Illustrated presentation by Don Turner, Past President, GSOC.

GSOC LIBRARY (Cramer Hall, Portland State University, Room S-7) Open 7:30-8:00 P.M. prior to evening meetings.

FIELD TRIPS — No field trip planned for March due to banquet activities.

Bus tour to coast in early April. Cascade Head and Salmon River area. Will be looking at reclaimed wetlands and experimental forest. See April calendar for details.

Hancock Field Station Annual Trip April 19, 20, 21, and 22. More information to be in the April Newsletter.

NEW MEMBERS

Dennis Bronka
2670 SW Corona Ave.
Portland, OR 97201

Thomas B. Mansfield 246-3814
4354 SW Chesapeake Ave.
Portland, OR 97201

ADDRESS CHANGE

Bob Shoemaker
4719 NE 33rd Ave.
Portland, OR 97211

IDAHO'S CITY OF ROCKS

There are two City of Rocks in the southern part of Idaho. The Quiet City of Rocks and the Gooding City of Rocks. The geology of each is very different although both are of igneous origin.

The Quiet City of Rocks is part of the Cassia Batholith. This batholith covers more than 60 square miles of the southern part of the Albion Range. A shell of Pre-Cambrian quartzite covered the batholith at one time. As the protective shell of quartzite eroded away, the underlying granites were left open to erosion. In time 5000 feet of granite has been eroded leaving some high monoliths of granite with Cache Peak being the highest point above the basin floor. The jointing in the granites are an important control in establishing the basic forms of this City of Rocks. There are three intersecting joints--some close together and others wide apart. The arrangement of the joints allow for water to move into and through the joints causing the blocks of granite to develop through the action of weathering and erosion due to hot and cold temperatures, freezing and thawing of the moisture in the cracks and in the rocks, and abrasion caused by particles carried by the ever blowing wind. This erosion results in isolated tall monoliths such as spires and turrets. The Cassia Batholith contains rock ranging from granite to granodiorite. In the outer zones the batholith contain a gneissic texture.

The Almo pluton which contains the Cassia Batholith is determined to be 28.3 million years old. Scattered in the granitic rocks are pegmantite dikes that contain textures of coarse grained granite. The dikes range from small seams to large bodies 50 feet or more across and several hundred feet in length. One of the largest dikes found in the Quiet City of Rocks is about 250 wide and 500 feet long. The large crystals seen in these dikes are feldspars and muscovite surrounded by quartz.

It is the jointing that determines the general form of the granite outcrop, but it is the weathering that gives the varied and strange shapes to this large mass of rocks. Some chemical weathering occurs by solution that enters through cleavage cracks and between mineral grains. Also contributing to the development of the shapes is case hardening by deposition of other minerals such as iron oxides. The harder material on top of the softer material below contributes to other forms in the rock such as coves, niches, bathtubs and rock forms resembling toadstools and natural arches. Looking at the area from a distance, it would appear the rock shapes and the distance they are spaced apart gives the appearence of buildings in a city, hence the name City of Rocks.

Another City of Rocks in Idaho is called the Gooding City of Rocks. This group of rocks is part of the Bennett Hills that rise some 1600 feet above the Snake River Plain. The Bennett Hills consist of a horst (up lifted block of the earth's crust). The geology consists of a sequence of Miocene volcanic rocks which have been intruded by rhyolites of Pliocene age. The Gooding City of Rocks has landforms in highly dissected plateaus with deeply eroded rocks and deeply cut stream channels. These land forms occur in the City of Rock Tuff, a member of the larger Idavada Group. The deposits of tuff are believed to be part an eruption of dense clouds of glowing volcanic ash in a semi-molten state. In the Bennett Hills some obsidian has been found that appears to have weathered out of the tuff. The erosional features in the Gooding City of Rocks are pinnacles and hoodoos. They are the result of two forces: structural deformation and mechanical erosion that includes weathering processes such as freezing and thawing, hot and cold temperatures, and abrasive particles carried by the wind.

An interesting mineral, diatomite, is found on the western edge of the Gooding City of Rocks. The material is composed of millions of single-celled plants of plankton that lived in the lakes of the Snake River Plains during pre-historic time.

Another geologic feature in this general area is the Balanced Rock. It was formed by differential weathering of silic ash-flows of the Idavada volcanics. It is composed of the same volcanic material as the Gooding City of Rocks, but it is many miles removed from it.

All of these geologic features are located within easy driving distance of Idaho Falls, Idaho. The Quiet City of Rocks is situated 15 miles southwest of the town of Oakley and 4 miles west of Almo. The Gooding City of Rocks can be seen by driving 12.5 miles north of the town of Gooding. At 12.5 a sign will direct you to the area on a dirt road. <u>DON'T GO ON THIS DIRT ROAD IF WET.</u> The Balanced Rock is located 17 miles south of the town of Buhl. All areas are well signed. All features in each of these area are excellent for geology and photography.

Donald D.Barr
Past President

BOOK REVIEW

Volcanoes of North America, United States and Alaska, 1990, edited by Charles A. Wood and Jurgen Kienle, Cambridge University Press, 40 West 20th Street, New York, NY 10011, ISBN 0-521-36469-8, 354 p.

Wood and Kienle have accomplished a remarkable feat in persuading 81 authorities to write, especially for this volume, succinct descriptions of 262 volcanoes and volcanic fields, located in 12 states and Canada. Only those volcanoes that are morphologically distinct and younger than 5 million years are included.

An alphabetical index also lists in italic type the names of 458 additional volcanoes that are mentioned but not specifically described. An author index cites the contributions made by each writer.

The 8 1/2 x 11-inch sized pages of this hardback book allows maps and/or photographs which illustrate most of the descriptions. Text is in clean type-face and most maps are readable, a few have been reduced so much that some may need a magnifier. Some photographs are a little hazy, due perhaps to use of unglossed paper.

A general introduction by Wood explains the format, and separate regional discussions of volcano tectonics are presented for Alaska, Canada, the western United States and Hawaii, as well as several regional narrative descriptions within the Cacade Range, necessitated by the fact that the range contains more than 3,000 shield volcanoes and cinder cones, many of them not even named.

Each description begins with a block of statistical information in italicized type, usually consisting of name, geographic location, type, latitude and longitude, elevation, dimensions, eruptive history and composition - for example:

HOOD

Oregon

Type: *Stratovolcano*

Lat/Long: *45.37°N, 121.70°W*

Elevation: *1,250-3,426 m*

Eruptive History: *Quaternary*

Composition: *Andesite and dacite*

Next is a more detailed narrative description varying from 500 to 2,000 words, followed by a very handy paragrph on "***How to get there:***", and, finally, two bibliographic references considered by the writer to be most important.

Alaska, with 93 pages containing more than 100 descriptions (predominantly in the Aleutian Islands), has 2 to 3 times the 42 pages and 34 descriptions alloted to Oregon. Although the editors suggested that inevitably some volcanoes and fields may have been overlooked, no omissions are immediately apparent.

Dave Sherrod, who wrote 14 of the descriptions of volcanoes and volcanic fields in Oregon, tells me that he was unhappy to discover that 5 of the photographs supplied him by the Oregon Department of Geology and Mineral Industries had mistakenly been attributed to him.

John Eliot Allen

apr 91

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VOLUME 57, NO. 4

CALENDAR OF ACTIVITIES FOR APRIL, 1991

FRIDAY NIGHT LECTURE (Cramer Hall, PSU, Room 371, 8:00 P.M.)

April 12 — 'Blue Water Battle' Limnology of Crater Lake. Speaker: Doug Larson, Limnologist, Corps of Engineers.

April 26 — '1989-90 Eruption of Redoubt Volcano in Alaska'. Speaker: Cynthia Gardner, from the Volcanic Observatory.

FRIDAY LUNCHEON (Standard Plaza, 1100 SW 6th Avenue, Rooms A & B, Third Floor Cafeteria. Programs at 12:00 Noon)

April 5 — Speaker: R.E. "Andy" Corcoran, Past President, GSOC. Title to be announced.

April 19 — 'Geology of the Swiss Alps'. A slide presentation by Dr. Scott Burns, Professor of Geology, PSU.

GEOLOGY SEMINAR (Cramer Hall, PSU Room S-17, 8:00 P.M.)

Wednesday
April 17 — 'Good Books from the GSOC Library'. (Continued from February seminar). Presentations by Helen Nelson and Rosemary Kenney.

GSOC LIBRARY (Cramer Hall, Portland State University, Room S-7) Open 7:30 - 8:00 P.M. prior to evening meetings.

FIELD TRIPS

Saturday
April 6 — Bus tour to Cascade Head and Salmon River area. Pick up at 7:00 A.M., Broadway entrance, Cramer Hall. We will be visiting the Nature Conservancy, Sitka Center, a slide area, volcanics and more.

Bring lunch, beverage, cameras, rain gear, walking shoes etc. Some hiking.

$35.00 each for a minimum of 20 passengers. Return via Wilson River, arriving in Portland at 7:00 P.M.

Call Alta Fosback (641-6323) for reservations no later than March 22.

Make check payable to GSOC and mail to: Alta Fosback, 8942 SW Fairview Place, Tigard, OR 97223.

April 19-20-21 &22
Hancock Field Station Annual Retreat. Contact Don Barr (246-2785) for reservations. More information on page 22.

IN MEMORIAM

Dr. James Stauffer, 1902-1991. He was past president of the Geological Society of the Oregon Country. Dr. Stauffer received his bachelor's degree from the University of Michigan, his master's degree from Harvard University and his doctorate from Cornell University. He taught meteorology courses to service men during World War II and was a biology professor at Colgate University before joining the faculty of Lewis and Clark College in 1948 where he taught courses in biology and geology. After retirement Dr. Stauffer held classes in wildflowers and geology at Lake Oswego Adult Community Center. James Stauffer was an active member in Nature Conservancy and was one of its early presidents. He published several books of poetry and was involved in the Oregon State Poetry Association.

---Don Barr

Book Review CRYSTAL COMICS FROM CZECHOSLOVAKIA

Crystal Quest 1, 1991, by Marcel Vanek: Geoscience Press, 1040 Hyland Circle, Prescott, Arizona, 86303, 94 p., $9.95 paperback.

The cover blurb states: "It is said that Marcel Vanek picked up his first rocks as a baby in Bratislavia, Czechoslovakia in 1964. Today his vast mineral collection includes many fine specimens from classic Czechoslovakian localitites - and three fossils. If you care to count, he claims to have painted 673 mineral species into his 199 mineralogical cartoons."

Vanek may have started out as a mineralogist, but now he is a cartoonist, in the typical Central European style - mostly consisting of wordless, but highly sardonic (no pun meant!), biting, and sometimes risque comments on the human psyches, especially those of mineral collectors.

This little volume (8 1/2 x 5 1/2 inches) consists of 90 pages of one- or two-page cartoons, many of them in color; all of them commenting on the idiosyncracies of mineral collectors. I am sure that Agate and Mineral Society members would cringe when looking at his caustic visual comments, I am also sure that Gsockers will get many a chuckle.

Examples: * Vanek's little protagonist, who in every panel has a long nose, pop-eyes, and carries a g-pick and knapsack, tests by licking a mineral his girlfriend has picked up and tells her: "Na, Li, Mg, Al_6, $[(OH)_4,(BO_3)_3,$ Si_6 $O_{18}]]$". (The nearest I can come to this in Dana is tourmaline.)

* Two collectors, with G-picks in their belt holsters, are prepared for a high-noon standoff over who gets a giant amythyst geode.

* Two collectors with umbrellas, amid a swarm of falling meteorites; he yells "Chondrites!!"

* Collector in a cave breaks off a stalactite, and water pours out and sweeps him away.

* Collector about to hammer on a lady whose hat is decorated with amethyst crystals.

* Collector finds giant meteorite, labeled "Made in Saturn". On another page, the same collector has nailed down a giant horseshoe magnet, which is attracting the falling meteorites for him.

But I should give away no more of these, you should get a copy and see them for yourself. Actually, Vanek reminds me more of Gary Larson than of any other American cartoonist.

John Eliot Allen

HANCOCK FIELD STATION ANNUAL RETREAT

DATE: April 19, 20, 21, and 22

LEADER: Don Barr

DETAILS: Arrive on the afternoon of April 19. We will be taking short trips in the area looking at the geology and flowers. There will be some short walks.

HOW TO GET THERE: Leave Portland on Hwy. 26 through Government Camp to Hwy. 216. Turn left on 216 to Maupin. Cross the Deschutes River at Maupin and make a sharp left. About a third of a mile take the first road on the right and you will be on Bakeoven Road. It's about 27 miles to Shaniko. At the Texaco Station on the south side of the road make a right turn. Go through Antelope and Clarno. After crossing the bridge at Clarno (John Day River) the Camp will be about 2 miles. Watch for the sign Hancock Field Station on the north side of the road.

LODGING: Dormitory style A-Frames and a few places inside will be available. Bring sleeping bags, air mattresses and extra blankets. There are showers and toilets. There are places for R.V.s.

We will eat meals together that will be prepared by the camp cook. The cost for each day at camp will be $18.00. The first meal will be Friday evening, April 19, the last will be a lunch on Monday, April 22nd.

Bring towels, soap, and whatever else you might need. Good walking shoes are a must if you intend to hike in the area. Bring an assortment of clothing. Who knows what the weather is going to be. Hopefully it will be good weather.

Please call Don Barr at 246-2785 to make reservations.
We must have a good count so they can be prepared with food. RESERVATIONS NO LATER THAN APRIL 16.

RARE TREE DONATED TO UNIVERSITY

A rare dawn redwood tree is now growing in the grassy common area north of the School of Business/Education Building at Portland State University, much to the delight of PSU biology and geology professors. The seven-foot specimen of Metasequoia was donated to the University in April, 1990, by Louis Oberson.

Until 60 years ago, the dawn redwood was thought to be extinct. In the 1940's, living trees were discovered in Chinese temple yards in Szechwan Province. A Japanese paleobotanist also found trees, unlike any other known trees, and named them Metasequoia. Specimens were sent to Fan Memorial College at Nanjing, which in turn sent specimens to Dr. E. D. Merrill at the Arnold Arboretum, Boston, Massachusetts. Dr. Merrill immediately ordered seeds and distributed 600 small packets to arboreta, colleges, and individuals in the United States. From this consignment of seed, Metasequoia is now grown in many parks, aboreta, and gardens throughout the world. It is easily propagated by cuttings and grows rapidly. This tree, Metasequoia glyptostroboides, is not a close relative of the Sequoias, but has more in common with the genus Taxodium, baldcypress, also a deciduous conifer. It has been given a rather fanciful name of Dawn Redwood but it is generally known just as Metasequoia. Metasequoia differs from Sequoia by having deciduous rather than evergreen foilage and in having needles opposite rather than alternate along the axis.

In 1948, Dr. Ralph W. Chaney of the University of California and Mr. Silverman of the San Francisco "Chronicle" flew to China to see the trees in their native habitat. More than 1,000 trees were found distributed over a 8,000 square kilometer area in Central China. Thornton Munger, Director, Pacific Northwest Forest and Range Experiment Station, was given a tree by Dr. Chaney. The tree grew in his yard in Portland, Oregon, until the freeze of 1955 when it was killed. John Gribble of Medford, Oregon, gave Munger a cutting from a tree grown from seed sent to him by Dr. Merrill in Boston. When this tree was six years old, Munger made three cuttings and in 1964, he gave a two year old tree to Louis and Viola Oberson. The young tree was thirty inches tall in 1962, and 48 inches tall in 1966. At the age of 18 years (1980), it began to produce male cones each year. The first seedling grown from this tree was in 1981. In 1982, the seedling has numerous green leaflet buds, so was planted outside in the yard. This seedling, seven feet tall, was donated to Portland State University.

Metasequoia appeared in late Cretaceous, and were dominent in western North America flora in the first half of the Tertiary. Paleocene fossils show that Metasequoia was part of a forest complex that included birches, chestnuts, sweet gums, oaks and beeches. While climates were mild, these trees prospered far north of the Arctic Circle, shedding their needles and remaining dormant during the mild winters. As climates cooled and the Arctic forests moved southward, the trees disappeared from the West when summer rainfalls and dry winters were replaced by winter rainfall and arid summers. They survived only in the Szechuan region of China. Abundant plant fossils in the John Day Formation, Fossil, Oregon, are needles of the Metasequoia. Seed and pollen cones also occur.

Metasequoia needles grow in opposite pairs, the seed cones are borne on long, naked stems, and the needles are deciduous. For many years, these differences from the Sequoia were not recognized, and most specimens from Bridge Creek flora were incorrectly identified. After the living trees of Metasequoia were found, Dr. Ralph Chaney reassigned the fossils correctly.

Rosemary Kenney
January 1991

Louis Oberson and Metasequoia at Portland State University

RELATIVE DATING TECHNIQUES

Three fundamental laws or principles of geology form the basis for interpreting the relative sequence of geologic events in an area. The law of uniformitarism, proposed by James Hutton in 1795 and popularized by John Playfair in 1802 and Charles Lyell in 1830, states that the present is the key to the past (Stokes, 1966; Poort, 1980). The physical, chemical, and biological laws of nature that govern processes today controlled identical or similar processes during the past. Interpretations of the events of geologic history are based on analysis of modern day analogies.

The law of original horizontality, proffered by Nicolaus Steno in 1669, states that water-laid sedimentary rocks are originally horizontal, or parallel to the Earth's surface, because the sediments that compose them were deposited in horizontal layers on the bottoms of oceans, lakes, or rivers (Press and Siever, 1982). If a sedimentary rock unit is folded or tilted, it was disturbed after it was deposited.

The law of superposition, also proposed by Steno in 1669 and established by Hutton about 1795, states that in any undisturbed sequence of sedimentary strata, the oldest layer is at the bottom and the youngest is at the top (Poort, 1980; Press and Siever, 1982).

The law of faunal succession states that assemblages of fossil organisms (both plant and animals) preserved in rock strata succeed one another in a definite and recognizable order. Evolutionary changes and changes in fossil assemblages are preserved in successive layers of sediments. The older the rock is, the greater the differences between fossil species within the rock and living species.

An index fossil is a fossil from an organism that had a distinctive appearance, was widely distributed, and lived during a relatively short interval, such as an epoch or less. Trilobites and ammonites are used as index fossils. Sharks teeth are not useful in dating rocks because the species lived during too long an interval of geologic time. Many species left no record due to lack of hardened skeletons, destruction of their hard parts by predators or waves, erosion or metamorphism of the fossiled rock, or other factors. Scientists estimate that less than one percent of all species that ever lived have been identified (Sawkins and others, 1978).

Crosscutting relationships states that any rock unit or fault that cuts across other rock units is younger than the units it cuts. If fragments of one rock formation are contained within another, the former rock formation is older than the latter.

An unconformity is a surface that represents a break or gap in the geologic record due to erosion or nondeposition. These gaps have abrupt and striking changes in the composition or orientation of the rocks and there is a marked age difference between the rocks above and below the unconformity. Unconformities are commonly caused by uplift of an area, which induces erosion and removal of previously formed rock units.

There are three types of unconformities. A nonconformity is a break between eroded igneous or metamorphic rocks and younger sedimentary strata. Because igneous and metamorphic rocks form deep below the Earth's crust, a nonconformity indicates that deep or long-lasting erosion occurred before additional sediments were deposited (Poort, 1980).

An angular unconformity indicates that the underlying rocks were deposited, folded or tilted, uplifted, and eroded before the overlying rocks were deposited.

A disconformity is a surface that represents a gap between parallel sedimentary strata. A disconformity implies that the area was uplifted, but not severely deformed or metamorphosed (Poort, 1980).

The Earth is surrounded by a magnetic field believed to originate in the fluid part of iron core. Heat generated by radio-activity in the Earth's core stirs the fluid into convection motion. A weak magnetic field interacting with the moving iron fluid generates electric currents, creating a stronger magnetic field and a self-sustaining magnetic system (Press and Siever, 1982).

The Earth's magnetic field has a specific direction that is defined by the magnetic north and south poles. Geomagnetic north, the direction a compass needle points, is not the same as geographic or true north. True north coincides with the Earth's axis of rotation; geomagnetic north is presently inclined about 11° from true north. The direction of the geomagnetic field at any point on the Earth's surface includes its declination (its angle east or west of true north) and its inclination (its angle to the Earth's surface). Declination varies with both latitude and longitude. Inclination varies primarily with latitude. At the magnetic poles, the inclination is vertical; near the magnetic Equator, it is horizontal. The intensity of the geomagnetic field varies with latitude; it is strong at the poles, but relatively weak at the Equator. Both the intensity and the direction of the geomagnetic field vary gradually with time, a phenomenon called secular variation. Despite the deviation, the average position of the magnetic pole over millions of years has centered on the Earth's rotational (geographic) pole (Press and Siever, 1982).

When molten materials cool and harden and when sediments lithify, the magnetic iron minerals are "frozen" in place, pointing to the Earth's magnetic pole like a compass needle. This remanent magnetizism has a fixed direction that is independent of the current magnetic field. This remanent magnetization in rocks leaves a record of the Earth's ancient magnetic field.

Paleomagnetism, the study of the Earth's magnetic field during the geologic past, involves measuring both the direction and intensity of remanent magnetization in rocks. Evidence of continental drift was established by comparing the paleomagnetic properties of rocks of similar age on different continents.

Paleomagnetic studies of layered sequences of lava flows on land revealed that the geomagnetic field has reversed itself every few hundred thousand years, taking a few thousand years or so to change its direction (Press and Siever, 1982). Scientists compiled a time scale of magnetic reversals consisting of normal and reverse magnetic epochs. Each epoch lasted a few hundred thousand years or more, but included short-lived reversals, called magnetic events, that lasted from several thousand to 200,000 years (Press and Siever, 1982). The cause of the geomagnetic reversals is unclear.

Scientists have discovered bands of magnetic anomalies that parallel mid-oceanic ridges. Bands of normal and reversed magnetism in the rocks on one side of a ridge are mirrored in rocks on the opposite side. The theory of sea-floor spreading proposes that new oceanic crust solidifies from magma forced upward into the mid-oceanic ridges and spreads outward as it is pushed aside by new upwellings of magma. By comparing the magnetic anomalies on the sea floor with the magnetic reversals in lava flows on land, scientists were able to determine sea floor spreading rates.

One drawback of paleomagnetism is that magnetism in rocks is destroyed if they are heated above a certain temperature, called the Curie point. For most magnetic rocks and minerals, the Curie point is about 500°C (Press and Siever, 1982). If a rock has been reheated, its paleomagnetic properties reflect the Earth's magnetic field at the time the rock cooled below its Curie point, not necessarily the geomagnetic field at the time the rock was formed.

CONDENSED FROM "How Geologists Tell Time, Part 1: Introduction and Relative Dating Techniques," by Evelyn M. VandenDolder, Arizona Geology, published by Arizona Geological Survey, Tucson, AZ, Winter 1990.

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Rosemary Kenney
January 1991

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VOLUME 57, NO. 5

CALENDAR OF ACTIVITIES FOR MAY, 1991

FRIDAY NIGHT LECTURE (Cramer Hall, PSU, Room 371, 8:00 P.M.)

May 10 "A National Monument and the Public; Managing for the Benefit of Both". Speaker: Jim Gale, Interpretive Specialist (Extraordinare).

May 24 "Lavas of Michigan". Speaker: E.J. Warren, retired. Currently teaching part time at Newport High School.

FRIDAY LUNCHEON (Standard Plaza, 1100 SW 6th Avenue, Rooms A & B, Third Floor Cafeteria. Programs at 12:00 Noon).

May 3 "Groundwater Management in Oregon". Speaker: Dr. Dennis Nelson, Oregon State Health Division, Drinking Water Section.

May 17 "Geology of Southern Oklahoma" illustrated, by Clay Kelleher, GSOC Member and Graduate Student in Geology at Portland State University.

GEOLOGY SEMINAR (Cramer Hall, PSU Room S-17, 8:00 P.M.)

Wednesday May 15 "More Good Books from the GSOC Library" PLANET EARTH, by Jonathan Weiner, donated to library by Ken Phillips, reviewed by Frances Rusche.

GSOC LIBRARY (Cramer Hall, Portland State University, Room S-7) Open 7:30 - 8:00 P.M. prior to evening meetings.

FIELD TRIPS

Sunday May 26 K M MOUNTAIN LANDSLIDE: Caravan, preferably 4-wheel drive vehicles or Pick-ups. B.Y.O. Lunch, Beverage, Camera, Field Glasses, Hiking Boots and Gear! Copies of the Washington Geological Newsletter which contains a report by Steve M. Lowell, Chief Engineering Geologist, of the slide which occurred 2/10/90, has been requested for those who participate. He says, "The landslide involved an overall length of approximately 1,100 feet and a width that averaged 800 feet."
PLEASE, if you wish to participate, contact Alta Fosback, 641-6323, if you need a ride or are willing to have someone ride with you. LEAVING the Jantzen Beach Safeway parking area at 9:00 A.M. and return around 6:00 P.M. Destination Washington State Road 4, approximately 5 miles west of Skamokawa.

C H A N G E O F A D D R E S S

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Joline Alta Robustelli
May 16, 1939 -- January 31, 1991

Joline was born in Klamath Falls, Oregon, attended grade school and high school there. She played clarinet in the KUHS band. She was secretary for the Klamath County Public Welfare Commission from 1957 to 1966 when she moved to Portland. She worked for Unigard Insurance Group until 1980, and in 1981 she started with the Portland Develop Commission where she was employed until her death.

She took evening classes for many years in a variety of subjects related to her work in insurance and law. In 1969 she received her BS degree at Portland State University in History. She was recipient of a number of awards: Certified Professional Insurance Woman Award, Casualty Claim Law Associate and Casaulty - Property Claim Law Associate designation.

Joline's interests were varied and were represented by the clubs of which she was a member. These included service clubs--American Council of Venture Clubs, Soroptimist International(secretary of the Klamath Falls club, regional secretary and regional governor), Oregon Casualty Adjusters Association, Insurance Women's Association of Portland and American Records Management Association.

Other organizations include YWCA Tour Committee(planning and escorting tours), Oregon Historical Society, World Affairs Council of Oregon, Audubon Society, and The Geological Society of the Oregon Country.

She joined GSOC in 1980. She served on the hospitality committee, as treasurer, assistant newsletter editor, vice-president and president. For her campout which she called a geological tour, she wrote an excellent field guide. Her knowledge of insurance was most helpful to the club the many years she served on the board. She was always willing to do what ever needed to be done. Shortly before her death she took on the job of assembling the news letter for two issues alone.

I took a number of trips with Joline. One of the last ones was an Odyssey Club trip to Spanish Head for Christmas, 1989. Christmas, 1990 she was in the hospital, remembering the good time we had the Christmas before.

Ruth Keen.

Annual Banquet Highlights

Members and friends of the Geological Society of the Oregon Country gathered in the Smith Memorial Grand Ballroom, Friday, March 8, 1991, to install and welcome a new slate of officers and enjoy the fifty- sixth annual banquet of the Society.

Guests were greeted by host and hostesses Dorothy Waiste, Mildred and Brice Washburn, and Margaret Allen.

During the hours before dinner, dinners visited with friends, viewed the many interesting exhibits, or shopped the sales table. Business was brisk at the sales table manned by Archie Strong and Gay and Harold Moore.

Sales went well at the publications table, too. Margaret Steere and Lois Baettie lessened the load of material to be returned to storage in Margaret's attic.

Dinner call at 6:30 P.M. brought dinners to tables beautifully decorated with bouquets of spring flowers arranged in pieces of moss and lichen covered log containers made by Gale Rankin and Manuel Boyes. The individual favors at each place setting, a piece of gold bearing quartz rhyolite with an egret perched on top, were reminders of adventures encountered on the President's Campout.

Dr. Ruth Keen, outgoing president, welcomed guests and members. Reverend Franklin Evenson gave the invocation.

Ruth introduced the Master of Ceremonies, Donald Barr, who introduced the people at the headtable and recognized charter members, Mildred Phillips and Louis Oberson and the fifteen past presidents.

Ruth gave a brief review of events of her term of office and thanked the members of the board and the committee members who contributed so much to make it a successful year. She presented Frances Rusche and Gale Rankin with Fellowships in GSOC for outstanding service to the society.

The slate of officers for 1991 - 1992, President, Dr. Walter Sunderland; president-elect Evelyn Pratt; Secretary, Charlene Holzwarth; Treasurer, Archie Strong; Board members, Peter, Baer, Ruth Keen, and Rosemary Kenney were installed. Dr. Sunderland spoke of his interest in geology and outlined some of his plans for the coming year.

DR. Michael Cummings, speaker for the evening, presented a most interesting program on the research being done on gold mining in southeastern Oregon. Ruth presented Dr. Commings with an engraved G - pick.

Elizabeth Handler played the piano for the traditional singing of GSOC songs. President Sunderland then announced coming events, wished everyone a safe trip home, and adjourned the meeting.

by Esther Kennedy.

ANNUAL BANQUET EXHIBITS

A feature of the Historian's Exhibit at last year's GSOC Banquet was a display of banquet favors from 1963 to 1990. This year's display of banquet programs from the 3rd Annual Banquet in 1938 to the present was very interesting. The 3rd Annual Banquet was held at Reed College Commons. Nineteen books kept by the Historian were also on display. These included the Past Presidents' Books, Memorial Books, Society General Information Books and 12 picture albums. A number of earlier albums and a bust of Dr. Edmund Hodge, our founder, are in the Society's library.

Modern textiles, books, magazines, enamel on silver salt bowls and jewelry were gathered by Helen Nelson during her year of teaching in Tehran. She also displayed some Iranian copper pitchers, bowls, plates and tea glasses in metal holders used by Iranian villagers, Persian rugs, sheepskin jackets and chadores, the enveloping garment worn by woman.

Rosemary Kenney displayed sea oddities from the Southern and Indian Oceans, which she had collected while beachcombing. Among the items to be seen were a 13 inch long razor clam, a 12 inch long cuttle bone and an 11 inch long sea horse. There were also Triggerfish, Cow fish, Porcupine fish, and an egg case from Port Jackson shark.

The exhibit by Walter Sunderland was interestingly titled "What Did You Expect To See In a Fellow's Den?". The exhibit consisted of an old repainted homemade cabinet with three one gallon German beer cans on the top shelf; a pair of engineers boots, camp stove, sack of silver ore and two rock hammers on the bottom shelf. On the other shelves was a collection of books on geology, history, and murder mysteries as well as a melange of rocks, bottles, curios, mementos and desk-top paraphernalia. Framed mining stock and other certificates hung on the side of the cabinet.

Lew Birdsall's display included Oregon thunder eggs filled with agate, jasper, quartz crystals or chalcedony with calcite; also some unusual specimans. A cavity in volcanic tuff was shown, also a similar cavity apparently intruded by silica gel (Priday Porch Polkadot area). A Priday Blue Bed "egg" had been split in a fault before its silica gel had solidified. The shell of a thunder egg had apparently exploded, distributing fragments through surrounding material in a plastic state (Laton Point, near Buchanan, OR).

The display by Don and Dorothy Barr was of fossil material from two separate sites in the Parachute Creek member of the Green River formation. The material from the Soldier Summit, Utah, location displayed fossil bird tracks made on the shores of Eocene Lake Uinta. Some insect tracks were present. The fossils obtained at the Bonanza, Utah, site were of plants and insects. Among them were a fine crane fly, a Fagopsis (extinct) leaf, a Cardiospermum (balloon vine) leaf and an eight-inch seed pod of Gymnocladus Dioica (Kenturcky coffee tree).

Bob Richmond had a projector and screen set up to show 140 slides at five second intervals running continuously. The slides presented views of coastal and interior scenes of British Columbia, Washington, Oregon and northern California. We really do live in a scenic area.

The DOGAMI display was about gold mining in Oregon. It compared past and current mining techniques and past and current methods of exploration. It also stressed the importance of permitting and reclamation in a mining operation, with pictures of a mining operation before and during mining and after reclamation. The display described what a mining claim is and how one is staked. It also explained heap leaching and had pictures of heap leaching operations.

Dr. Ruth Keen's display consisted of four species of fossil fish from the Eocene Green River Formation of Wyoming. These were on slabs of fine grained stone. The largest fish, Diplomystus sp. was sixteen and one half inches by six and one half inches. Diplomystus and Knightia are herring, Mioplosus is a perch, and Piscacara is a chromid fish. Sometime during the Eocene times (57 to 36 million years ago) these fish were swimming around in a subtropical freshwater lake. At that time, the part of Wyoming where this freshwater lake occurred was in a much lower latitude and was subtropical.

Peter Baer's display was two very old maps, one of North America and one of South America.

Rosemary Kenney

President's Inaugural Address to the Geological Society of the Oregon Country March 8, 1991.

Honorable charter members, Dr. & Mrs. Allen, Dr. Ruth Keen, distinguished past presidents, officers and hard working committee people, members of the society and friends:
Thank you for asking me to be your president this term.

I have been interested in Geology since I was a small boy. My first experience of a geologic nature was finding a small round pebble and throwing it at my brother. We also would look for rounded flat pebbles that we could skip across water on a pond. My record was about five skips, but we had one local hero who could skip seven times.

In my father's cow pasture, my brother and I found an area of bare rock that contained small ripple marks which we immediately recognized as signs of a previous beach; but, this was solid rock. My brother wasn't disturbed; he just said it had turned to stone. We were not utilizing geological insight, but, rather just the magical reasoning of children. Magical thinking can solve many problems.

We had to pick stones from the fields as youngsters and pile the rocks on a stone wall. It may be a disappointment to you, but, those lovely Vermont stonewalls that you see on calendars are uncommon. Those poor back-broken farmers weren't the least interested in the beauty of a well laid wall. They just wanted to clear their fields.

There were two huge boulders in our pasture that weren't as angular as the other rocks; they seemed to be worn more rounded than the others. We noticed some large rocks on the stone wall that glistened in the sun. Also they had a great deal of pinkish-orange color and we remembered a tombstone at the cemetery that had the same color. My father said that a large boulder had been out in the hayfield when he was a child and our grandfather had blown it apart with dynamite so he could move it onto the stone wall. Picking stones wasn't much fun, but, all the farmers in New England had the same problem.

When we needed sand, we drove with our father to the sandpit which was in a ridge; the cemetery was on the same ridge about 3/4 of a mile away. I thought my father quite clever to know where to find already sorted sand. When we wanted coarser gravel with stones in it, we went to the bend of a local river.

Many farmers had one or more acres of pasture called "The Rock". This was an area with almost bare bed rock with a lot of blueberries growing in the cracks. We felt sorry for the kids who didn't have a blueberry rock.

All the neighborhood had been to Lake Champlain during summers. We liked to go to a small state park located on land that jutted into the lake where the Little Ausable River ran into the lake very near the park. I remember gathering a handful of black sand from the very edge of the beach.

Once I went with my brother and others to a place called "The Gulf". It was a gorge right on the border of northern New York State and Quebec, Canada. The gorge was only about 1.5 miles long and 75 feet deep from the top of the ridge to the top of the water. The water was also about 75 feet deep.

As boys would, we rolled rocks down the steep slopes crashing into the water. Later we went swimming.

We knew the Adirondack Mouintains and their foothills were old because of what our mother said. If I spoke of what Rudy Vallee was singing or what some friend had said she would say, "Oh, that is as old as the hills." I could see Ellenburgh Mountain afar and the top was worn smooth and round. We were quite proud of Lyon Mountain because it had an iron mine which yielded ore used in the making of the cables for the Golden Gate bridge over San Francisco Bay.

My father must have known a great deal, since he told the drillers right where to put a new well we needed. Right near the house where it would be convenient. He hadn't called for as water witcher either, but, my mother said he knew where the underground river was running and that the neighbors had been pumping too much water for their cattle which dried up the other stream. Their son eventually became a water witcher, but; I didn't think too highly of him. In the thirties, the local farm road was tarred and for a while it was sticky. This cousin got tar on his shoes, so he sat down in the road and got tar on his trousers, scraped the tar off his shoes and got it on his fingers, stood up, then wiped his hands on his shirt got it dirty started bawling and ran home.

My sister knew things too. One day in our one room school she pointed to the map on the wall and said,"See, South America fits right up against Africa. It's as plain as the nose on your face." She was eleven and I was seven, so, I knew she was wiser and it must be so. Besides it really looked reasonable.

The pot bellied stove in the railroad station had small Isinglass windows in the door and we children could look into the fire box. My aunt had a stone rectangular hot plate to put sadirons on and the oven in her stove was lined with the same type of stone. It retained heat well and never split apart.

Well, I grew up, got wiser, or so I thought, and joined the army after graduation from high school. In Kokobunji, Japan, I could hang out the barracks window and see Mt. Fujiyama about 40 miles away. It was beautiful with its ice cream cone top; I appreciated the Japanese love for it and knew it was an old volcano. I had heard that there were many volcanic mountains in Japan, earthquakes and tidal waves. Also that Frank Lloyd Wright showed them how to build structures that wouldn't collapse during the quakes.

I enjoyed other geologic sights. The army, in its wisdom, sent our outfit to Guadalcanal where we saw more volcanic islands, some spouting a little steam, smoke and ashes. There were offshore reefs, sleepy lagoons, bananas and beautiful butterflies. If it weren't for the crocodiles, mosquitoes, malaria and terrible heat, it would have been paradise. I remember the temperature on the day before Christmas 1947 was 127 degrees!

In the Hawaiian Islands I enjoyed the vibrations of a few tremors. They weren't frightening until another fellow who was older than I, explained that the islands were hollow in in many places and undercut by huge submarine caves! I wasn't sure how much was geology and how much was fable, but, was glad to survive without accident, return to San Francisco and get out of the army in July 1949.

I visited my aunt in Berkeley, California,and remembering the San Francisco earthquake of 1906, I was concerned about a recurrence. I had seen movies where volcanoes blasted orange molten rock high into the skies, the earth spread asunder and natives hurling spears fell into the crevasses along with beautiful women in sarongs whereafter the earth crunched together squashing everyone into Hungarian goulash!

Nothing happened and I went up to Wardner, Idaho,to visit Uncle Walter who was named after me. He took me down into the Bunker Hill & Sullivan mine several thousand feet. I had long known it was a rich silver mine because he had sent us samples of ore many years before and told us about it. It was then that I went through my first great geologic disappointment-I learned my uncle was a hard rock miner and just worked there! All those years I thought he owned the mine!

When I got back to New York State, I started college and took one semester of geology. The school was new having been started after the war for the influx of veterans. To people of my age, the 'war' means the second world war. The school lacked much equipment and the geology department didn't have any rocks. Professor Widmer decided to teach the second semester first which was geomorphology.

We learned about laccoliths, lopoliths, continental ice sheets, streams, deserts and erosion. Everything started to fall into place. The skipping and throwing pebbles were round because they were water worn; the huge boulders in my father's pasture were glacial erratics. Also the pinkish orange shattered rock on the wall was potassium feldspar granite (as was the tombstone) and probably came from a site near Montreal, Quebec, Canada.

I drove home from college one Friday afternoon, went through a roadcut near Ellenburg Depot, gave out a blood curdling scream and drove into the ditch! I had recognized an esker. It held the sandpit we had dug in as children as well as the cemetery. Other experiences became more interesting. The Isinglass was muscovite mica and my father knew about the water table. My aunt's hot plate was soapstone.

However, the 'old as the hills' Adirondack Mountains weren't smooth topped because of age even though they are a billion years old; they had been scraped down by the ice sheet with two to five thousand feet of ice over their tops.

The little park near Lake Champlain was on the delta of the Little Ausable River and the black sands were magnetite from the nearby iron ore mines.

I went on through college and medical school and 37 years later I retired. I drove up to Kellogg, Idaho to visit my cousin, the son of the uncle named after me, and went down several thousand feet into the Sunshine silver mine which is one of the richest silver mines in the world. I enjoyed the tour and read about the mine afterward. It was then that I went through my second greatest geological disappointment.

It seems that the silver lode had been located in 1884;

several other mines opened up the same and next year. All were rich producers EXCEPT the Sunshine Mine which was just marginal for fifty years. In 1931 the stock was selling for 25 cents a share when at the 1700 foot depth a fabulously rich vein was struck. Within five years, the Sunshine mine was shipping more silver than any other mine in the world and the stock had jumped to $25 per share - a thousandfold increase and my uncle had not purchased any stock!

Well, I came back to Portland and entered Portland State University to study a couple more terms of geology. Now I have learned about plate tectonics and life is even more interesting. My sister was right about South America and Africa fitting together; Japan has volcanoes, Oregon has the Cascades and the Solomons are volcanic because of plate tectonics, sea floor spreading and subduction zones. The terrible earthquakes in California relate to a transform fault and the Hawaiian Islands have risen while an ocean plate is moving over a hot spot, a plume from the mantle.

Each increment of geologic knowledge has made life more interesting. I think geologists have an interesting life; I believe the best thing I can do as president of the society is to continue to stimulate interest in and teaching of geology just as this Society has done since its inception 55 years ago.

Ladies and Gentlemen - thank you!

Walter A.Sunderland, M.D.
President 1991

Walter Sunderland giving address.

Walter Sunderland's exhibit titled "What did you expect to see in a fellow's den?"

Dr. Ruth Keen. Happy !!!

The Presidents Pick is a heavy responsibility.

"With this - I call the meeting to order?"

Ruth receives engraved G-Pick from Don Barr.

Executive Board 1991-1992:
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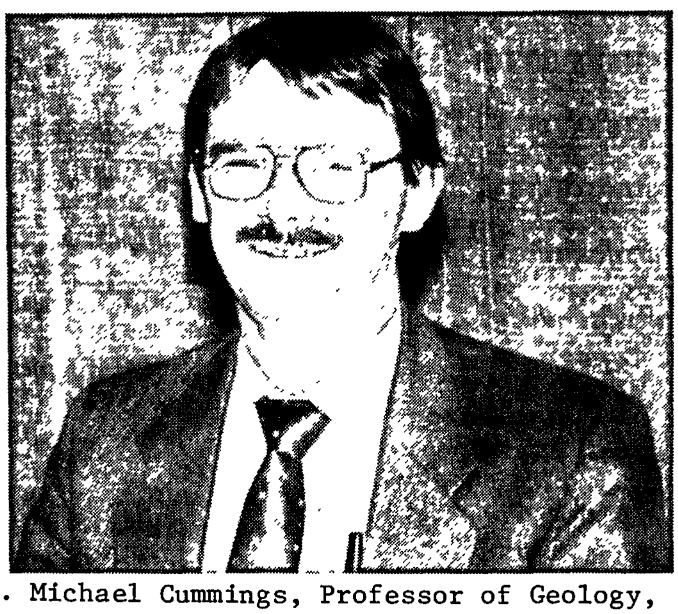
Dr. Ruth Keen, Past President
Evelyn Pratt, Vice President
Peter Baer, Director
Charlene Holzwarth, Secretary
Archie Strong, Treasurer
Rosemary Kenney, Past President

Frances Rusche & Gail Rankin receive Fellows Award.

Esther Kennedy, Co-Chairman, Banquet Committee

Past Presidents

Archie Strong at sales table.



Dr. Michael Cummings, Professor of Geology, PSU, speaker, 'Gold Deposits In Eastern OR.'

Gathered round sing-a-long.

June 91

THE GEOLOGICAL NEWSLETTER

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

GEOLOGICAL SOCIETY
OF THE OREGON COUNTRY
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ACTIVITIES

ANNUAL EVENTS: President's campout-summer. Picnic-August. Banquet-March. Annual Meeting-February.
FIELD TRIPS: Usually one per month, via private car, caravan or chartered bus.
GEOLOGY SEMINARS: Third Wednesday, except June, July, August, 8:00 p.m. Room S17 in Cramer Hall, PSU. LIBRARY: Room S7, open 7:30 p.m. prior to evening meetings.
PROGRAMS: Evenings: Second and fourth Fridays each month, 8:00 p.m. Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon.
Luncheons: First and third Fridays each month, except on holidays, at noon, Standard Plaza Cafeteria, third floor, Room A, 1100 SW Sixth Avenue, Portland, Oregon.
MEMBERSHIP: Per year from January 1: Individual, $15.00, Family, $25.00, Junior (under 18), $6.00. Write or call Secretary for membership applications.
PUBLICATIONS: THE GEOLOGICAL NEWSLETTER (ISSN 0270-5451) published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10 a year (add $3.00 postage for foreign subscribers). Individual subscriptions at $13.00 a year. Single copies $1.00 Order from Geological Society of the Oregon Country, PO Box 907, Portland, OR 97207.
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THE GEOLOGICAL NEWSLETTER

The Geological Society of the Oregon Country
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VISITORS WELCOME
INFORMATION PHONE 284-4320

VOLUME 57, NO. 6

CALENDAR OF ACTIVITIES FOR JUNE, 1991

FRIDAY NIGHT LECTURE (Cramer Hall, PSU, Room 371, 8:00 P.M.)

June 14 — "Volcano Scapes - Pele's March to the Pacific". Emmy-award-winning video film provided by Hugo and Eleanor Pankow.

June 28 — "Impact of Moving Plates and Spreading Ice on Early Man". Speaker: Betty Pope, PCC Anthropology Department.

FRIDAY LUNCHEON (Standard Plaza, 1100 SW 6th Avenue, Rooms A & B Third Floor Cafeteria. Programs at 12:00 Noon).

June 7 — "Colorado Plateau of Southwestern United States" Slide presentation by Frances Rusche, GSOC member.

June 21 — To be announced.

GEOLOGY SEMINAR (Cramer Hall, PSU, Room S-17, 8:00 P.M.)

Wednesday June 19 — No Geology Seminars in the months of June, July, and August. Annual picnic will take the place of the seminar in August. Watch for details in future issue.

GSOC LIBRARY (Cramer Hall, Portland State University, Room S-7) Open 7:30 - 8:00 P.M. prior to evening meetings.

FIELD TRIPS

Monday June 24 — Auto caravan to Wilson River Slide area. Anyone interested call Alta Fosback (641-6323) or Charlene Holzwarth (284-3444) for meeting time and place.

August 18-28 — Annual President's Campout. Watch for details in July issue.

GREAT SALT LAKE

Don Barr, Past President, GSOC

Within the past 12,000 to 20,000 years, much of western Utah was covered by a large, fresh-water body of water now referred to as Pleistocene Lake Bonneville. The boundaries of this early lake and the Great Salt Lake are shown in Figure 1. This ancient lake was inhabited by fish and had an animal population around it including buffalo, bighorn sheep, very large bears, camels, musk ox, horses, and deer. There is also evidence that the lake and its surrounding marshes were inhabited for many years by several groups of prehistoric peoples.

Ancient Lake Bonneville covered some 20,000 square miles and reached a depth of at least 1000 feet. The water weighed so much that the bed of the lake sank 240 feet into the ground. Since the end of the Ice Age and the coming of a much drier climate the lake has shrunk to what is now Great Salt Lake. Because of the dry climate and lack of water the landforms have eroded very little over the years. During the Ice Age there was considerably more moisture and it was a great deal colder. Glaciers formed in the mountains. As the area began to warm the weather produced more moisture and the glaciers began to melt, pouring water into the basin and Lake Bonneville was formed.

The receding lake water left a number of terraces in the surrounding hills that provide evidence to the water levels of the lake at various times in its history. Experts having studied the lake for years indicate that there were four periods when the lake stood at comparable level and cut a terrace at each level. The oldest was the Stansbury Period 20,000 to 22,000 years ago, the Bonneville Period (about 16,000 years ago) , the Provo Period (about 13,500 years ago), and the fourth period is referred to as the Gilbert Period (about 11,500 years ago). Each period was different. The Stansbury reached a depth of 430 feet and covered about 10,000 square miles. The Bonneville was the largest, covering 20,000 square miles and reached a depth of 1000 feet. It was during this time the weight of water caused the lake bottom to settle some 240 feet. During the Provo Period the lake reached a depth of 800 feet and covered 14,000 square miles. The Gilbert Lake Period was the smallest with a depth of 130 feet and covered about 7,000 square miles. Lake Bonneville ceased to exist about 10,000 years ago. The remnant of Lake Bonneville is now called the Great Salt Lake.

The transition of Lake Bonneville to the modern day remnant of Great Salt Lake has taken place during the last 14,000 years. During the Bonneville Period the lake reached an overflow level. An immediate drop of 350 feet in water level during the Bonneville Period was caused by the breaching of relatively unconsolidated sediments at the lake's only outlet near Red Rock Pass in southern Idaho. This breaching is referred to as the Bonneville Flood. Great quanities of water poured through the pass in a relatively short time ending up in the Snake River. As the climate changed to warm weather the lake began to give up its water due primarily to evaporation. During the past 137 years the Great Salt Lake has fluctuated a vertical distance of around 20 feet at an elevation of 4200 feet above sea level to an all time high of 4211.85 feet in 1983. During this time the railroad and highway through the lake area had to be elevated. A number of industries near the lake were abandoned or moved to higher ground. As with industries, farming and recreational facilities were affected by the great rise of the water. The state began to look at options on how to control the excess water. To compound the rising lake-level problem, a difference in surface elevation developed between the north and south portions of the lake. A causeway had been built through the center of the lake in 1900, partially as an open, wooden trestle in an attempt to keep the north and southern portions of the lake level. By 1955 the trestle had deteriorated, blocking the free flow of water between the north and south parts of the lake. In 1955 a new solid rock-filled structure was built that did not allow water passage from the north to south parts of the lake. In 1983 more than average moisture fell in the region draining into the southern portion of the lake, causing a great difference in elevation between north and south. The north part also became more salty.

After a 5 foot rise in the lake from 4200 to 4205 feet in 1983, the state began to plan for controlling its level. In August 1984 the railroad causeway was breached allowing both north and south portion of lake to begin to stabilize. It took several months for the southern portion to drop a foot while the north rose somewhat. The entire lake continued to rise to a maxium elevation of 4211.85 feet in 1986. Fearing the lake would continue to rise, it was decided to set up large pumping stations to pump water out on the West Desert. A 320,000 acre pond was created and contained by a dike that keeps the freeway and Bonneville Lake protected. It was calculated that the pumps would lower the lake by one inch a month. It was also determined that the lake would hold 825,000 acres of lake brine. Surface evaporation would account for 989,000 acre feet each year. Since 1986 the climate has changed and the area has become drier. The lake has been dropping each year. At this time the lake has not yet returned to the normal 4200 foot elevation.

An interesting aftermath of the rising and lowering of the Great Salt Lake waters is that great number of burial sites of Native Americans have been located. These sites have been uncovered due to lake wave action either as the lake was in rising or falling phases. Some of the grave sites are 2000 to 3000 years old. For hundreds of years, the marshy areas where rivers and streams entered the Great Salt Lake were the most densely populated. The marshes were among the most productive in the world, supporting plants and animals that were plentiful and available throughout the year. Some of these sites are being studied, but others are falling into the hands of vandals and those searching illegally for artifacts.

There are a number of industries that depend on the lake for the brine saturated water. The Morton Salt Company is the oldest salt company on the lake. It produces salt from the waters of the lake through the process of solar evaporation. Another company produces 6 to 8% magnesium chloride brine through a process of sequential solar evaporation. This brine is purified and processed to a dry form of magnesium metal and chlorine gas. These are but two of the companies that use the brine contained in the waters of Great Salt Lake.

It is estimated that the waters of the lake contain some 1.5 billion tons of salt. A chemical break down of this salt reveals that it contains the following general composition (dry-weight percent basis).

Sodium (Na) 32.0
Potassium (K) 1.85
Magnesium (Mg) 3.24
Calcium (Ca) 0.18
Sulfate (SO4) 6.35
Chloride (CL) 56.38

Will the Lake rise again to cause concern to the population of Salt Lake Valley as it did in 1983 to 1986 ? It has happened at least four times in the last 30,000 years.

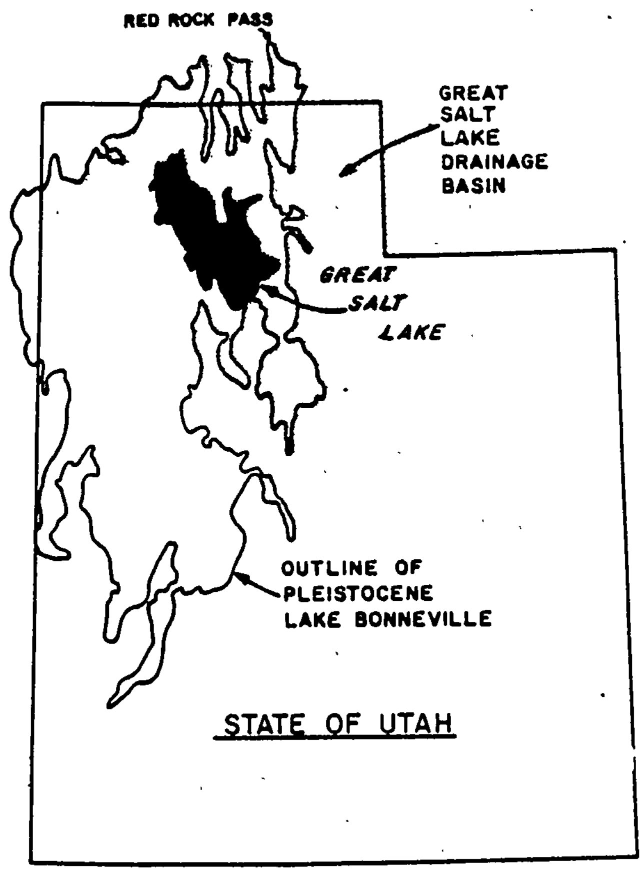

Figure 1. Map showing outline of Lake Bonneville, the Great Salt Lake and its drainage basin.

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HOW GEOLOGISTS TELL TIME

PART ONE

Rosemary Kenney, Past President GSOC

One of the most important contributions to modern scientific thought is the concept of geologic time. Humans have pondered the age of the Earth and its rocks for thousands of years. Eastern and western cultures, however, have held very different concepts of time. The Hindus view time as cyclical, a continuing process of birth, life, death, and rebirth. Judeo-Christian cultures generally conceptualize time as linear, with a beginning and an end. Ancient Hindu philosophers believe that one cycle of the universe equaled one day in the life of Brahma, the creator god, or approximately 4.3 billion years. Hindu scriptures postulated that the Earth was almost halfway through one cycle, or two billion years old (Sawkins and others, 1978). This ancient estimate is amazingly close to the actual age of the Earth.

The ancient Greeks deduced that geologic processes took considerable amounts of time. Xenophanes of Colophon (570-470 B.C.) was the first of the early Greek philosophers to recognize the antiquity of fossils and sedimentary rocks. Around 450 B.C., Herodotus, the Greek historian, concluded that the Nile Delta was built from the deposits left by countless floods and thus took thousands of years to form.

Despite the insight of these early thinkers, the concept of geologic time remained as the western notion of linear time for several centuries. During the late Middle Ages, theology permeated scientific thought in Europe. The age of the Earth was determined by one "proof," the book of Genesis. In the mid-1600's, Archbishop James Ussher of Ireland and Dr. John Lightfood of England, concluded from scriptural analysis that the Earth was created at 9:00 a.m. on October 26, 4004 B.C. (Stokes, 1966; Press and Siever, 1982). Before 1750, most scientists believed that all sedimentary rocks were deposited during the Great Flood of Noah's time. Other surface features such as mountains were believed to be the result of intermittent catastrophies (Faure, 1977).

During the 18th and 19th centuries' scientific observations, depositional rates of sediments and the salinity of oceans gradually increased age estimates of the Earth to 100 million years (Stokes, 1966; Press and Siever, 1982). In 1859, Charles Darwin published On the Origin of Species by Means of Natural Selection. Fossils were used to calibrate a stratigraphic time scale. Chronological assessments were based on evolutionary theory. Darwin estimated that it had taken 300 million years for complex life to evolve.

In the mid-18th century, Comte de Buffon of France calculated the age of the Earth to be 75,000 years, based on the assumption that the Earth was solid and had cooled from a molten state. Believing that the Earth's interior was iron, he used measurements on the melting and cooling rates of iron balls to calculate how long it took the molten Earth to cool to its preent temperature (Press and Siever, 1982).

In 1854, Herman von Helmholtz theorized that the Sun's light was created by gravitational contractions of the Sun's mass. He estimated that the Sun began to collapse 20 to 40 million years ago (Press and Siever, 1982).

In the late 19th century, William Thompson (Lord Kelvin) applied Buffon's estimates of the Earth's cooling rate to Helmholtz's theories on the Sun's luminosity and decided that the Earth would have been too hot to support life before the Sun began to collapse (Sawkins and others, 1978; Press and Siever, 1982).

In the 1890's, three physicists made discoveries which dramatically changed the way scientists viewed the natural world: Antoine Henri Becquerel discovered radio-activity in uranium, Willhelm Roentgen discovered x-rays, and Marie Sklodowska Curie discovered radium. Ernest Rutherford was the first to suggest that radioactive minerals could be used to date rocks. Scientists, using a mass spectrometer, estimated that the Earth is 4.5 billion years old (Newman, 1988). The earliest life forms preserved in the Earth's rock record (bacteria and blue-green algae) are about 3.5 billion years old (Lambert and the Diagram Group, 1988).

Geochronology, the study and measurement of time as it relates to the history of the Earth, is based on two scales, relative and absolute. Relative time scales arrange events in order of occurrence, based on fossils in sedimentary rocks. Absolute time scale is measured in years before present, based on radioactive decay of elements, provides dates for igneous and metamorphic rocks.

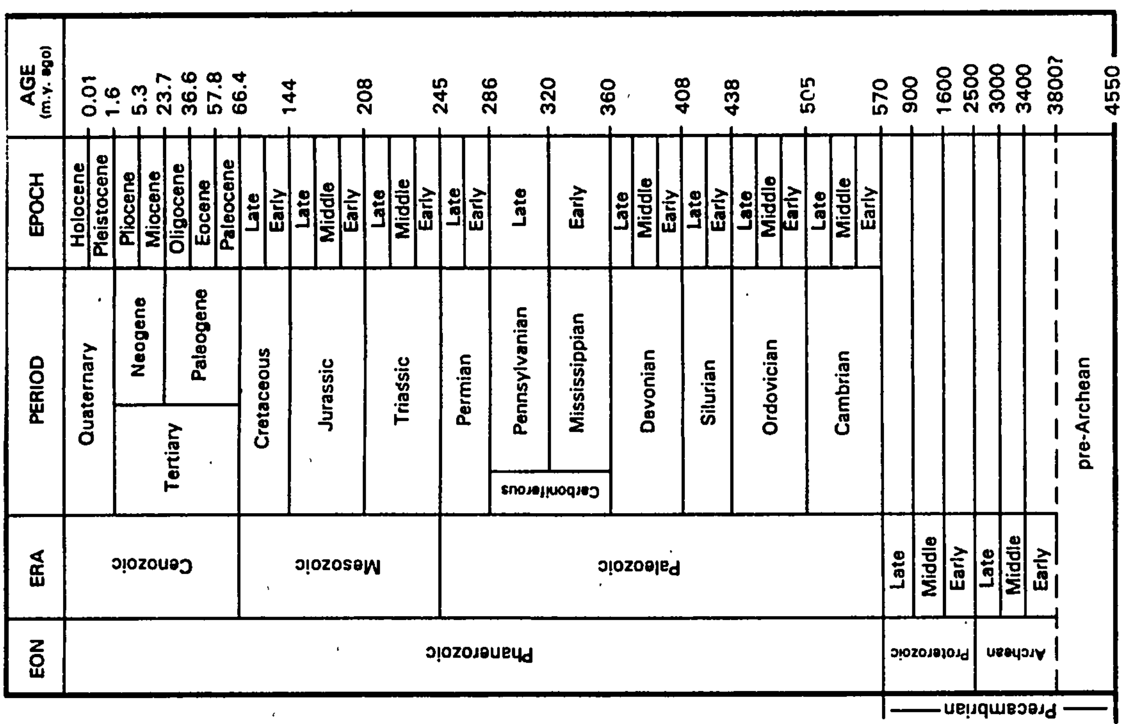
Geologists divide geologic time into eons, eras, periods, epochs, and ages. Each of the three eons are distinguished by the general character of life that existed then. The Archaen ("ancient") Eon is the earliest when the first micro-continents formed and primitive life forms appeared. The Proterozoic ("former life") Eon comprise more than 85% of geologic time, brought the first large continents and soft bodied animals. It is also known as Pre-Cambrian. Phanerozoic ("visible life") Eon is dated mainly from fossil-bearing sediments. It is sub-divided into Paleozoic ("ancient life"), Mesozoic ("middle life") and Cenozoic ("recent life") Eras (Lambert and the Diagram Group, 1988).

A period is a shorter span of time. The name of each period is derived either from the geographic locality where formations of that age were first studied or are well exposed, or from a particular characteristic of those formations. The Pennsylvanian Period is named after the state of Pennsylvania where rocks of this age are well exposed. The Cretaceous Period, derived from the Latin word for "chalk" (creta), is named after the white chalk cliffs along the English Channel (Newman, 1988).

The names of epochs within the Cenozoic Era are based on the similarity of fossil molluscs to living molluscs. The Pleistocene Epoch is derived from the Greek words "Pleistos" (most) and "kainoa" (recent) and includes rocks that contain 90-100 percent modern mollusc species. The Paleocene Epoch, derived from "palaios" (ancient) and "kainos", does not contain modern mollusc species (Stokes, 1966).

Ages within each epoch are named after geographic localities in which rocks of those ages are especially well exposed.

Each unit of geologic time, from eons to ages, may be partitioned into sub-units through the use of the prefixes "early," "middle," and "late."



Geologic time scale. Age estimates of time boundaries are in millions of years (m.y.). Ages (subdivisions of epochs) are not shown. Sizes of time "slots" do not reflect proportionate lengths of time intervals. Rocks older than 570 m.y. are called Precambrian, a time term without specific rank. Geologic time prior to 3,800 m.y. ago is called pre-Archean, a term also without specific rank. The Mississippian and Pennsylvanian Periods, recognized in the United States, are collectively referred to as the Carboniferous Period, a term commonly used by geologists in other parts of the world. The Neogene and Paleogene are subperiods of the Tertiary Period.

T O B E C O N T I N U E D

July 91

THE GEOLOGICAL NEWSLETTER

GSOC

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ACTIVITIES

ANNUAL EVENTS: President's campout-summer. Picnic-August. Banquet-March. Annual Meeting-February.
FIELD TRIPS: Usually one per month, via private car, caravan or chartered bus.
GEOLOGY SEMINARS: Third Wednesday, except June, July, August, 8:00 p.m. Room S17 in Cramer Hall, PSU. LIBRARY: Room S7, open 7:30 p.m. prior to evening meetings.
PROGRAMS: Evenings: Second and fourth Fridays each month, 8:00 p.m. Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon.
Luncheons: First and third Fridays each month, except on holidays, at noon, Standard Plaza Cafeteria, third floor, Room A, 1100 SW Sixth Avenue, Portland, Oregon.
MEMBERSHIP: Per year from January 1: Individual, $15.00, Family, $25.00, Junior (under 18), $6.00. Write or call Secretary for membership applications.
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CALENDAR OF ACTIVITIES FOR JULY, 1991

FRIDAY NIGHT LECTURE (Cramer Hall, PSU, Room 371, 8:00 P.M.)

July 12 "Ginko State Park". Illustrated presentation by Frances Rusche, GSOC member.

July 26 Speaker: Walter A. Sunderland, M.D., President, GSOC.

FRIDAY LUNCHEON (Standard Plaza, 1100 SW 6th Avenue, Rooms A & B Third Floor Cafeteria. Programs at 12:00 Noon).

July 5 No meeting due to holiday weekend.

July 19 Discussion by Walter A. Sunderland, M.D., President, GSOC concerning the Annual President's Field Trip in August.

GEOLOGY SEMINAR

No Geology Seminar in July.

GSOC LIBRARY (Cramer Hall, Portland State University, Room S-7) Open 7:00 - 8:00 P.M. prior to evening meetings.

FIELD TRIPS

Wednesday July 17 Auto caravan to areas near Mount Hood will be led by Don and Dorothy Barr. We will be looking at points of geologic interest and hopefully see many wild flowers.

There will be some short walks, so bring good walking shoes, insect repellent, plant I.D. books, appropriate clothing and plenty of food and coffee. Call Don or Dorothy at 246-2785 if you plan to go.

Meet at 9:00 A.M., Mall 205 - Northwest corner of the parting lot of the old Mall at 99th and Washington.

PLEASE NOTE: Reservation deadline for the Annual GSOC President's Field Trip is July 15, 1991. For additional information, call Walter A. Sunderland, Pres. (625-6840) or Alta Fosback, GSOC Tours Chairman (641-6323).

Auto caravan to Wilson River Slide area on Monday, June 24 was cancelled due to limited parking space.

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ESTABLISHMENT OF A GEOLOGIC FRAMEWORK FOR PALEOANTHROPOLOGY

Printed by Geological Society of America, Inc., Boulder, Colorado
Edited by Leo F. Laporte

Papers submitted by Donald K. Grayson, University of Washington, "Establishment Proper Order of Human Antiquity," and William R. Farrand, University of Michigan, Ann Arbor, Michigan, "Origins of Quarternary Pleistocene-Holocene, Stratigraphic Terminology." four other Geologists' papers were on sites in Africa, Java, China and New Mexico.

The finding of early hominids with bones of extinct animals posed the question, "Did they live at the same time, or were the artifacts moved over the years?" Geologists were able to identify and date the stratigify of the sites.

The papers are very technical and refer to the earliest writings on the subjects. Each have a page or two, listing in fine print their Bibliography. They explain the geology of Olduvai Gorge, the Island of Java, dating the site of Homo Erectus at Zhoukoudian, China, and Paleoindian Geochronology in North America (New Mexico and Arizona).

Reviewed by Helen E. Nelson.

HOW GEOLOGISTS TELL TIME (continued from June issue)

PART TWO: Absolute Dating Techniques — Rosemary Kenney, Past President GSOC

Nature records time by two absolute methods: astronomically through tree rings, growth rings, and varve sequences, and atomically through radioactive decay.

Tree rings are the most well-known seasonal records preserved in living organisms. The width and density of the rings depend on the temperature and the amount of light and moisture present when the plant cells were formed. During the spring and summer growing season, new layers of cells are produced underneath the bark of the tree. Seasonal variations are evident in early or "spring" wood, which consists of large thin-walled cells, and late or "summer" wood, which consists of smaller cells with thicker walls. One annual ring includes one layer each of spring and summer wood.

Dendrochronology, the study of tree rings, has been used to date archaeological sites. In living trees, the outer ring was formed during the current year. By counting the total number of rings, scientists can establish an age for the tree. Because living trees in the same area share a common environment, their rings exhibit a similar pattern of wide and narrow bands. If the inner-ring pattern of a living tree matches the outer-ring pattern of an ancient tree that grew in the same area, the rings were formed during the same time, so are the same age. Through such cross-dating, dendrochronologists can determine when the ancient tree was cut. By piecing together tree-ring data from various parts of the world, scientists have extended continuous chronology to 7938 B.C. (Stuivar, 1990).

Some aquatic organisms record seasonal variations in temperature and food supply. Fresh-water clams grow annual bands that resemble tree rings. Dark narrow bands indicate colder weather, when scarce food restricted shell growth. Lighter and wider bands indicate a warmer season and more abundant food supply (Stokes, 1966). These rings are also evident in fossil shells. Fish scales, both modern and fossilized, show tiny, annual growth rings, called "annuli". Corals record daily growth rings. By studying the rings of fossil corals from the Devonian Period (about 375 million years ago), geologists concluded that there were 400 days a year and inferred that days were shorter during this time (Stokes, 1966).

A varve is a sedimentary layer deposited in a body of still water, such as a lake, within a single year. The term "varve" specifically refers to an annual layer deposited in a glacial lake by meltwater streams. A glacial varve included two layers: a lower "summer" layer composed of coarse-grained light-colored sediments, such as sand or silt, formed by rapid melting of ice and vigorous runoff during the warmer months; and an upper, thinner "winter" layer composed of very fine grained, often organic, darker clay sediments, produced when suspended particles were slowly deposited while the streams were ice bound and the lake was quiet. Hundreds of years have been recorded within the varves of a single lake or pond (Stokes, 1966). Geologists have counted and correlated varves to determine the ages of Pleistocene glacial deposits and the time when the last ice sheets retreated from Europe and North America.

The nucleus of an atom contains two kinds of particles: neutrons, which are electrically neutral, and protons, each of which has an electrical charge of +1. The number of protons is equal to the number of electrons that surround the nucleus. An electron has an electrical charge of -1. The atomic number is equal to the number of protons, which defines an element, and establishes its place among the 103 known elements on the Periodic Table of Chemical Elements. Each element consists of several isotopes, which have the same number of protons but different number of neutrons. Some isotopes are unstable and spontaneously disintegrate to form atoms of different elements, releasing energy in the process. Isotopes radioactively decay through one of three nuclear processes: by emitting alpha particles, which are helium nuclei and becomes another element; by emitting beta particles, or high-energy electrons and becomes another element; or by capturing electrons and also becomes another element.

The initial atoms of a radioactive isotope are called parents; the new atoms produced after a decay are called daughters. One daughter atom is produced by the decay of one parent atom. By determining the ratio of daughter atoms to parent atoms still in a sample, scientists can determine the original amount of parent atoms in the rock or mineral. Knowing the rate of decay, they can determine the age of crystallization of the rock or mineral. The nuclear reactions within radioactive isotopes occur almost instanteously. The rate of decay of a specific quantity of atoms is determined by the number of atoms that disintegrate in a specific period of time relative to the total number of atoms of that isotope in any given amount of material (Press and Siever, 1982). This rate of decay is fixed and invariable for a given isotope. Rates of decay are defined in terms of half-lives. The half-life of an isotope is the time required for half of the original number of atoms (parents) to decay. The remaining parent atoms disintegrate at the same rate, being diminished by half during each half-life period until their number approaches zero. Half-lives range from a fraction of a second in some isotopes to billions of years in others. ^{14}C (carbon 14) has a half-life of 5,730 years, whereas ^{87}Rb (rubidium) has a half-life of 50 billion years. The half-life of a radioisotope determines the number of years it may effectively date. ^{14}C is used to date objects up to 60,000 years old (P.E. Damon, oral commun., 1991). ^{87}Rb may be used to date the oldest rocks on Earth, which are almost 4 billion years old.

When dating rocks and minerals by radiometric methods, geologists make three major assumptions. First, the rate of decay is accurately known and constant. Second, the daughter atoms are solely the product of radioactive decay of the parent. Third, the rock or mineral being dated has remained the same; no changes such as reheating has occurred. Such changes would reset the radiometric clock (Faure, 1977).

To count the atoms of a radioisotope, scientists use a mass spectrometer. A mass spectrometer produces a beam of electrically charged atoms from a rock or mineral sample. These atoms are deflected by electrical and magnetic fields according to their atomic masses, thus are separated and counted (Press and Siever, 1982).

Several Radiometric dating techniques are used today. The most common are the K-Ar, Ar-Ar, U-Pb, Th-Pb, Rb-Sr, ^{14}C, and fission-tracked methods. Potassium (K) is one of the eight most abundant elements in the Earth's crust and a major constituent of many rock-forming minerals (Faure, 1977). The K-Ar technique (Stokes, 1966) is used to date potassium-bearing minerals and rocks that retain radiogenic argon at low temperatures. These include biotite and muscovite (both micas) and hornblende in plutonic and metamorphic rocks, as well as feldspar in volcanic rocks. The K-Ar method cannot be used to date sedimentary rocks because minerals that were transported and deposited are generally older than the sedimentary rocks that contain them, and minerals that did form at the same time as the rocks are commonly affected by the processes that turn sediments into rocks. Because absolute measurements of potassium and argon concentrations are unnecessary in the Ar-Ar method, it is used to date very small or valuable samples, such as lunar rocks or meteorites.

Uranium (U) and thorium (Th) radioactivity was the first to be used in dating rocks and minerals (Faure, 1977). Because they have similar electron configurations, these two elements have similar chemical properties and decay schemes. Two radioisotopes of uranium and one of thorium disintegrate to lead. As molten magma cools and crystallizes, uranium and thorium become concentrated in the more silica-rich components. Only minerals that retain uranium, thorium, their intermediate daughters, and lead may be effectively dated by U-Pb and Th-Pb methods. Zircon is the best choice for these techniques.

Radioactive rubidium (^{87}Rb), disintegrates to strontium (^{87}Sr). Because the half-life of ^{87}Rb is so long (about 50 billion years), the Rb-Sr method cannot be used to date young rocks, but it may be the most valuable method for dating metamorphic rocks.

When a plant is alive, it incorporates into its cell structure carbon molecules from CO_2, through photosynthesis. When a plant dies, photosynthesis and CO_2 intake cease. As the age of the dead organic material increases, the amount of ^{14}C in that materials decreases, whereas the amount of ^{12}C does not. The $^{14}C/^{12}C$ ratio in the plant material provides a measure of the time that has elapsed since the organism died (Faure, 1977). The ^{14}C method is used to date charcoal, wood, fabric, seeds, nutshells, paper, hide, rope, bone, ivory, and pottery. About 20,000 years ago, the ^{14}C content of the atmosphere was 40 percent higher than it is today (Levi, 1990). This variation is mainly due to changes in the Earth's magnetic dipole, which 30,000 years ago was only about half its current strength and allowed more cosmic rays to penetrate the atmosphere at the midlatitudes and generate more ^{14}C (Levi, 1990). ^{14}C levels decreased from 19th to the 20th century, possibly because of combustion of fossil fuels during the Industrial Revolution. They have risen since 1945 because of the development of the atomic bomb, nuclear reactors, and particle accelerators (Faure, 1977). Because these variations may affect the accuracy of radiocarbon dates, studies of tree rings and varve sequences are commonly used to check and correct ^{14}C dates of sample materials.

Uranium isotopes generally disintegrate by emitting an alpha particle, but sometimes undergo an alternate mode of decay: spontaneous nuclear fission. The nucleus spontaneously breaks into two charged particles that travel in opposite directions, leaving trails, or fission tracks, of molecular destruction as their energy is transferred to the atoms of the mineral. The fission-track method can provide information about the thermal histories of rocks. A fission-track date is the cooling age, not necessarily the crystallization age of the mineral. If the mineral cooled rapidly and was not reheated, the date is the actual age of the mineral. The fission-track method is used to date apatite, micas, sphene, epidote, garnet, zircon, tektites, volcanic glass, and synthetic glass, including some archaeological objects (Faure, 1977). Samples from one decade old to the oldest rocks on Earth may be dated by this technique (Jones, undated).

Several other techniques have been used to date certain rocks and minerals that cannot be dated by the conventional methods. The most promising methods are based on beta decay of the naturally occurring radioisotopes or rhenium and lutetium to osmium and halfnium. The Re-Os method is used to date iron meteorites, molybdenite-bearing vein deposits, and rhenium-bearing copper-sulfide ores. The Lu-Hf method is used to date apatite, garnet, and monazite in igneous rocks. The decay of ^{40}K to ^{40}Ca is used to date minerals high in potassium and low in calcium, such as micas in pegmatite and sylvite in evaporite rocks (Faure, 1977). Tritium, which decays to stable helium (^{3}He), has a short half-life of about 12.5 years (Stokes, 1966; Faure, 1977) and is used to determine the flow rate of ground water and the circulation rate of deep ocean currents.

By dating rocks and minerals, geologists can clarify the chronology of geologic events, relationships between rock units, sources of rock materials, and timing of metamorphic and mineralizing events. Because age determinations are so important and complex, dozens of new radiometric dates are generated each year. Relative dating methods such as those based on sedimentary sequences, fossils, and cross-cutting relationships, as well as other absolute dating methods, such as those based on tree rings, provide geologic information and insights that radiometric dates cannot offer. By using radioisotopes, geologists can link ore deposits with specific intrusive episodes and formations. By dating Quaternary materials, such as terrace (flood-plain) deposits and sediments that are cut by or overlay faults, geologists can determine the potential for flooding, earthquakes, and other geologic hazards of an area. As the population of cities continues to grow, along with the demand for mineral resources and responsible city planning, the need for reliable geologic mapping, including accurate age determinations of rock units, will become increasingly important.

CONDENSED FROM "How Geologists Tell Time, Part 2: Absolute Dating Techniques", by Evelyn M. VandenDolder, Arizona Geology, published by Arizona Geological Survey, Tucson, AZ, Spring 1991.

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GOLD BUGS

Don Barr, Past President, GSOC

The most important workers at the Tonkin Springs Gold MIne close to Eureka, Nevada are bacteria. There are billions of them in large tanks containing a gray liquid and eating dissolved ore and releasing gold into the water. As long as their environment is appropriate they are happy and the happier they are the more gold they release.

The mine operators of the U.S.Gold Corporation are two brothers, William Reid, President and David Reid, Exploration Chief. The brothers and their bugs are attempting to unlock gold from the rust-colored, sulfurous dirt of the central Nevada hills. The Reids took on a new venture partner, Homestake Mining Company, that will help supply money to help in the development of this process. If this experiment in so-called bio-leaching works the companies will have opened a modern-day alchemy. U.S.Gold is a small company when compared to the nation's large gold miners, but the process they are working on if successful will be very important to the gold mining industry.

It has been estimated that only 10% of the worlds gold supply has been found. This 10% of gold was obtained by early miners working streams for nuggets and flakes. Most of the placer and alluvial gold played out by the 1950's. Some areas are being reworked today with better equipment with some success. Now most of what gold is left is trapped in so-called refractory ores, in which gold is chemically bound with iron and sulfur. Much of the ores that is now mined is by using the cyanide leaching process. This cyanide leaching process was developed by the U.S. Bureau of Mines during the Depression of the Thirties to help miners pull microscopic gold ore from oxidized ores. The cyanide leaching process is being used again to pull gold from the ores. A number of other processes to extract the gold are pressure-cooking refactory oresin autoclaves and roasting refractory ores but these processes work with highest grade ores and are costly. After the price of gold went up the interest in gold mining was renewed. Extracting of ores by the cyanide leaching method is now going on in Nevada and other places in the the West. It is proposed that the process be used by some mining companies in southeastern Oregon.

The bio-leaching approach if proven successful to mining gold would be much more environmentally compatible and it is predicted that it would be cheaper to process. There are a number of mining companies that have lab scale bio-leaching experiments underway. U.S. Gold took the plunge 3, years ago on a large scale.Bioleaching mimics weathering as Natures own way of oxidizing ores. The bacteria break down the sulfur and iron molecules, turning sulfide ore to oxidized ore and releasing a rotten egg odor.The mining operation of U.S. Gold speeds the process up by placing the bacteria and the ore in a controlled acid and wet environment with plenty of oxygen. The experiment using ore and bacteria is contained in three 600 gallon tanks at the Tonkin site. Three tanks contain 3,500 tons of ore with the bacteria, plus the right environment, that allows the bacteria to eat the ore and release the gold in about 60 hours. The process works fine but with any brand-new process, there have been plenty of surprises. During one period, the bugs suddenly multiplied fast and quit eating the iron and sulfur. It turned out that there was a drop in the acid level in the tanks and the bacteria began eating other substances. Other problems associated with the new process are that costs are much more than first estimated with machinery breaking down and constructions problems. These all cost money.

There is plently of gold left in the ground, but in very fine particles. The big problem is getting it out at a reasonable cost. U.S. Gold and their new partner, Homestake Mining Company with its addition of needed capital, are hoping that this bio-leaching process will do the trick. This is one of many ideas for extracting gold from the rocks and soils.

CONDENSED FROM "Brothers Are Betting Gold Bugs Will Strike Pay Dirt", Marj Charlier, Staff Reporter of The Wall Street Journal. Sepember 20, 1990.

Thanks for those Newsletter items! Got any more?
Thanks for those Newsletter items! Got any more?
Thanks for those Newsletter items! Got any more?

THE GEOLOGICAL NEWSLETTER

The Geological Society of the Oregon Country
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VOLUME 57, NO. 8

CALENDAR OF ACTIVITIES FOR AUGUST 1991

ANNUAL PICNIC

August 9 TIME: 6:30 P.M.
LOCATION: Alpenrose Dairy picnic area, 6149 SW Shattuck Rd. (½ mile south of Beaverton-Hillsdale Highway).
BRING: Main dish, salad or dessert for three or more people and yourself. Bring your own table service including serving utensil. Beverages (coffee and juice) will be provided.

FRIDAY NIGHT LECTURE (Cramer Hall, PSU, Room 371, 8:00 P.M.)

No Friday night lectures during August.

FRIDAY LUNCHEON (Standard Plaza, 1100 SW 6th Avenue, Rooms A & B Third Floor Cafeteria. Programs at 12:00 Noon).

August 2 "Gardening for Birds". A presentation by Betty Ferguson of The Leach Botanical Gardens.

August 16 To be announced.

GEOLOGY SEMINAR (Cramer Hall, PSU, Room S-17, 8:00 P.M.)

No Geology Seminar in August

GSOC LIBRARY (Cramer Hall, Portland State University, Room S-7) Open 7:00 - 8:00 P.M. prior to evening meetings.

ANNUAL PRESIDENT'S FIELD TRIP

August 18-28 Central Washington

FIELD TRIP

Tentative auto trip to Bohemia Mining area in Sept. Date to be established. Please call Alta Fosback (641-6323) or Walter A. Sunderland, Pres. (625-6840) for details.

The GSOC Board voted to assess each person $1.00 on car field trips. The money is to be used to compensate field trip leaders for reconnaisance mileage. A suggested fee of 10¢ per mile per person to be paid to the driver.

HANNAH O. RUHMANN

Hannah O. Ruhmann, wife of William, died May 10,1991. She was born February 22, 1908 in Hanford, Washington, and first moved to Portland in 1927, later lived in Coquille for 23 years, and returned to Portland in 1971. Mrs. Ruhmann had worked as a secretary for a number of years. During the first United Nations conference in San Francisco, in 1945, she took dictation for a number of visiting dignitaries, including Lord Halifax of Great Britain. William and Hannah joined GSOC in 1974. He survives, along with a niece, a great niece and a great nephew.

------Dorothy Waiste.

QUARTZ MOUNTAIN GOLD PROSPECTING

Walter Sunderland,MD, President GSOC

On September 9, 1990, the Geological Society of the Oregon Country arrived at Quartz Mountain, Lakeview County, Oregon, as part of the 1990 President's Campout led by Dr. Ruth Keen. Mr.Kevin Russell met us there and gave us an informal talk on gold prospecting and the geology of Quartz Mountain.

In a nearby trench were many sacks of drill cuttings saved for repeat assays if necessary. There is another gold deposit nearby on Quartz Butte which was previously a mercury mine that yielded a few flasks. A third site further to the east is on another old mercury mine that yielded more mercury, though still not much. Little money was made from the mercury, but the mercury presence is important to geologists searching for gold. There is a close association between mercury and gold.

Archie Strong said that he was here from 1935 to 1943 and there were many mercury test holes about the mountain.

Prospectors have been looking for gold in this area since 1980. A big discovery of gold by Homestake near Clear Lake, California, prompted the search here. The gold was discovered at a former mercury mine which had been shut down for more than 35 years. It is now an operating gold mine with about 20 million tons of good grade material yielding 0.2 troy ounces of gold per ton of rock. Although this doesn't seem like much, it yields $80.00 a ton.

Homestake prospected at Quartz Mountain; they were the first to appreciate the correlation with mercury and gold, but apparently they didn't believe that Quartz Mountain was rich enough. This is a marginal gold deposit that will yield about 0.3 to 0.4 troy ounces per ton and will entail movement of large volumes of rock. Fortunately, the deposits are relatively shallow and accessible; several hundred thousand ounces ultimately may be recovered. Many modern mining operations extract material with lower head grades that we would have at Quartz Mountain.

Quartz Mountain sits on a major west-northwest fault/fracture zone in basalt. Along this fault rhyolite bodies came up though the basalt country rock.

Basalt is a mafic rock and contains about 48% silica plus a high concentration of iron, magnesium and calcium. Hawaiian lava flows are basalt. Rhyolite is a felsic rock and contains up to 72% silica, more sodium and less iron and calcium than basalt. Silica is made of silicon and oxygen, the two most abundant elements in the earth's crust.

Imagine a plateau of basalt with structural fault; as rhyolite rises in the fracture, it heats the ground water causing explosive eruptions. The crater created from the explosions than filled with tuff and rhyolite lava. Rhyolite lavas typically don't flow very far due to high viscosity.

Mineral bearing epithermal waters flowed through faults, fractures, and permeable beds and deposited the ores. Gold is associated with quartz veins and sulfides in the rhyolite domes. Near the top of the dome is a late stage mercury zone which brought the prospector here in the first place.

Gold in quartz veins at Quartz Mountain is very fine grained; visible gold is very rare. Quartz veins are also deposited from hot water. At this trench, Mr. Russell pointed out quartz material that was shaped like some calcites. It was originally a carbonate, probably calcite, that was replaced by quartz forming "psuedomorph quartz after calcite". The quartz Mountain area contains a number of fossil hot springs. The hot springs in Lakeview are not depositing gold.

Hot spring typically deposit various minerals including silica, carbonates and sulfides and sometime gold or mercury. The hot springs that deposited the ores at Quartz Mountain are now cold and hot water is not even encountered in drilling. Some epithermal gold-silver mines in Nevada ran into a great deal of hot water, e.g., the Comstock Lode Mines.

Delineation mapping of the deposits is based on information derived from test drilling. The drill holes are spaced 100 feet apart and are as much as 800 to 1000 feet deep.Most of the gold bearing ores are no deeper than 400 feet.

There are about 500 test holes so far on Crone Hill and most are of the reverse circulation type. Water is used to flush the chips from the holes and they are collected for analysis. There are some core drill holes. These yield samples 2 1/2 inches in diameter and cost $25.00 per foot. Reverse circulation drilling yields more material from a 6 inch hole, but the material consists of chips and sludge and provides less geologic information.

State agencies require that ground water be characterized before mining can begin. Eighteen monitor wells have been drilled and background studies continue. The water table is variable, but typically is 50-150 feet below the surface.

There are several veins visible on either side of the prospect trench visited. These veins cut tuff breccia. The tuff contains varisized pieces of rock and could be termed an agglomerate. Green and blue clays, some of which is celadonite are also noticeable. Other clays are illite, montmorillinite and smectite. Montmorillonite and smectite will undergo significant expansion when wetted.

Iron oxides color the veins a muddy orange-brown. Traces of sulfides are present in these mostly oxidized exposures. Sometime pyrites are associated with or contain gold, and much pyrite is present in Quartz Mountain sulfide ores. Marcasite (called white iron pyrite) has the same chemical formula as fool's gold, but a different crystal structure and different properties. It is an orthorhombic dimorph of iron pyrite. Pyrrhotite is also an iron sulfide with a different ration of its elements and is not magnetic. All these sulfides were deposited with hot waters. The gold is especially associated with marcasite and pyrrhotite although pyrite is more abundant.

Sulfides are unstable under surface (oxidizing) conditions. They are stable in reducing conditions. When oxidized, the sulfur combines with oxygen and other elements produce acids and sulfate minerals. Gypsum and anhydrite are examples; these are rare or absent here, but jarosite, alunite and iron oxides are abundant.

Most of the sulfides have been converted to sulfates and oxides. The gold has been liberated from sulfides and formed microscopic specks in the rock. The veins are significant because they contained the greater percentage of sulfides and subsequent gold; they have the most rusty color in the rock. If you could selectively mine the veins, you could get up to 0.1 troy ounce of gold per ton. A bulk sample of this cut would assay at .02 of an ounce per ton of gold.

Heap leaching is the process most often used for open pit low grade ores. This rock is mined, hauled and crushed. The resulting 1/2 to 3/4 inch pieces are agglomerated with lime or cement to make them more porous and piles on a pad for leaching. A sprinkler system on top of the pile washes the crushed rock with a weak sodium cyanide solution that leaches the gold from the rock. The resultant liquor trickles down to the pad for collection and further refining .

Most people express a fear of cyanide pollution. Leaks are a possibility but are rare; moreover cyanide breaks down very readily. There are many cyanide mines in active production in the Western United States right now and this process has been used for nearly a century. Actually the companies are especially interested in collecting ALL the liquor since it contains gold. Leach processing is a cheap and effective means of gold retrieval and is better than amalgamation and cheaper than smelting.

THE GRAND CANYON: A YOUTHFUL LAND FORM

John L. Whitmer

When the Rocky Mountain Section of the Geological Society of America met in Flagstaff, Arizona in 1986 there was a choice of many superb field trips in a land of spectacular beauty and world-class geology. I choose Field Trip 9: STRUCTURES AND GEOMORPHOLOGY OF THE WESTERN COLORADO PLATEAU IN THE GRAND CANYON REGION expecting to get pictures of well-exposed structures and classic landforms, but no surprises or new geologic concepts. After all, was not the geology of the famous area thoroughly worked out decades ago? There were many surprises, and I learned that much mystery remains to challenge future geologists who seek to understand the history of the Grand Canyon. The zenith of the trip was a stop at the escarpment of the Hualapai Limestone, at the Meadview, Arizona airport, where we could look down at the Colorado River emerging from the Colorado Plateau into the Basin and Range Province. It was a magnificent and photogenic view, which fully justifies my trip there. Even more exciting than the view, however, was the learning experience. We were actually seeing a major bolson (interior basin) neatly dissected by the Colorado River. I, of course would not have realized that without the gracious and well-informed interpretation of our leader, Ivo Luccitta and his wife who also is a notable geologist. The basal fanglomerate of the basin, plainly visible nearly 2000 feet below the viewpoint, has been exhumed by the river to reveal that it consists of coalescing alluvial fans, containing boulders as much as 30 feet in diameter. These boulders appear to be derived from igneous and metamorphic rock in the southern Virgin Mountains, 12-13 miles to the west. Layer after layer of fine-grained sediment, tuff, gyspum and carbonate is stacked between and above the alluvial fans, culminating in the Hualapai limestone upon which I stood. This sequence tells the story of Basin and Range extension encroaching upon the Colorado Plateau with the Grand Wash fault, a down to the west displacement, forming a half- graben to expose the west edge of the Colorado Plateau in the Grand Wash Cliffs. Giant debris flows had carried the boulders eastward into this half-graben from the Virgin Mountains to construct the fans which make such an imposing part of the view from the Meadview airport. Subsequent down-to-the-west movement of the Wheeler fault, a few miles to the west, formed a new graben to receive the clastics shed from the Virgin Mountains, leaving the original half-graben without a significant course of alluvial sediment, and exposing its western, up-turned edge to form a spectacular hogback called Wheeler Ridge. Playas formed between the fans, filling the basin with carbonate and gypsum sediments, augmented by tuffs from numerous volcanic eruptions in the area. The Hualapai Limestone resulted from this process and its surface represents the lakebed which existed at the time the Colorado River extended into it by headward erosion. Thereafter, the river rapidly bisected and dissected the basin fill and extended into the Colorado Plateau to form the Grand Canyon. At this one viewpoint, we not only see the anatomy of the bolson beautifully exposed, but we see evidence that there could have been no lower Grand Canyon while the lake existed in the interior basin. Radiometric dates indicate that sedimentation occurred atop the basin fill as recently as 5 to 8 million years ago. Apparently, cutting of the Grand Canyon, proceeding at a much faster pace than earlier geologist ever imagined.

This poses another puzzle, which has not yet been solved: where did the water of the upper Colorado River go in the tens of millions of years before the Grand Canyon existed? No one knows for sure. Perhaps to a large, undrained basin in eastern Arizona. A paper by W.R. Hansen in the Mountain Geologists vol. 22:192-204, (1985) indicates that the Green River flowed into interior basins, and sometimes into the North Platte River, diverting it into the Colorado drainage until about 600,000 years ago, when headward erosion from the Uinta Basin in Utah, invigorated by subsidence from Basin and Range extension and faulting, captured the Green River, diverting it into the Colorado. Since the Green River is the largest tributary of the Colorado,---larger than the Colorado River upstream from the confluence, the Colorado River was a much smaller stream during nearly all of its history than it is now..

1. Lucchitta, Ivo and Young, R.A., STRUCTURE AND GEOMORPHIC CHARACTER OF THE COLORADO PLATEAU IN THE GRAND CANYON--LAKE MEAD REGION, in GEOLOGY OF CENTRAL AND NORTHERN ARIZONA, FIELD TRIP GUIDE, GSA ROCKY MOUNTAIN SECTION MEETING, FLAGSTAFF, ARIZONA, 1986, pp. 159-176.

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BEGINNING GEOLOGY

Walter Sunderland, President GSOC

Geology is " the study of the earth" as explained in the simplest form in many dictionaries. The science treats the origin of the earth, the rocks and formations that make up the earth and the past changes in the earth as well as those occurring presently. Geology includes the study of past life exemplified by fossils. A full definition would require a 600 word essay.

The earth has, in an intellectual sense, aged profoundly in the past 335 years. It was in 1654 that Bishop Usher, an Irish Devine, announced that the earth was created in 4004 B.C., about 6000 years ago.

This date was refined by John Lightfoot, a learned Hebrew scholar at Cambridge University, who stated God created Adam out the earth's dust at 9:00 AM the morning of Friday, September 17th.

The English were already familiar with these general dates; Shakespeare, in "As You Like It", has Rosalind saying, "The poor world is almost 6000 years old and..." The play was produced in 1599, more than 50 years before Bishop Usher's pronouncement.

Today, astronomical research, studies of meteorites and the radioactive decay of varies elements indicate the earth, and almost surely the entire solar system, is about five billion years(5,000,000,000) B.C.E. years old. Some aging! Colophon and Herodotus of Halicarnasus (600-500 B.C.E.)** noted such details such as inland marine fossils which indicated a great or different extent of previous oceans, and different layers of landforms related to different times.

Pliny, the Elder, a Roman, wrote about the nature of the physical universe, mineralogy, geography, and many other topics. He was asphyxiated while watching (too closely) the eruption of Mt. Vesuvius in 20 C.E.

Leonardo da Vinci (1452-1519) also recognized that fossils were relicts of previous living animals, and that marine fossils inland meant that the oceans were in that area at one time.

But all these intellectuals were mainly noted for work in other fields, and the science of geology only really started to crystallize (no pun) in the 17th century when Nicolaus Steno published his 'observations' on geology. He studied crystallography, emphasized that fossils were remains of earlier organisms, and that some rocks resulted from sedimentation. Also he realized that a history of the earth was contained in the crust; he proposed that a study of such layers and fossils would reveal that history. He did, however, place all geologic events within the popular 6,000 year timetable.

After Steno came the intellectual battles among the theorists of vulcanism, Neptunism and Plutonism; catastrophists fought the uniformitarian concept while the Noachian Diluvialists felt superior to all.

References: Encyclopedia Brittancia, 1986, 15th Edit., Chicago
Portland State University lectures: Drs. Beeson, Cummings and others.
White, J.F., edit., Study of the Earth, 1962, Prentice Hall

* Dr. Keen, GSOC president, suggested that an uncomplicated essay be printed in the Newsletter each month. Present articles are rather sophisticated, but some of us are amateurs who don't have the background to appreciate them. So, with a mixture of 'amateurish' timidity and temerity, I accepted the task.

** B.C.E. (Before the Common Era) and C.E. (Common Era) are scholarly alternate designations corresponding to B.C. and A.D.. --Biblical Archeology Review.

Sept 91

THE GEOLOGICAL NEWSLETTER

GSOC

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ACTIVITIES

ANNUAL EVENTS: President's campout-summer. Picnic-August. Banquet-March. Annual Meeting-February.

FIELD TRIPS: Usually one per month, via private car, caravan or chartered bus.

GEOLOGY SEMINARS: Third Wednesday, except June, July, August, 8:00 p.m. Room S17 in Cramer Hall, PSU. LIBRARY: Room S7, open 7:30 p.m. prior to evening meetings.

PROGRAMS: Evenings: Second and fourth Fridays each month, 8:00 p.m. Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon.
Luncheons: First and third Fridays each month, except on holidays, at noon, Standard Plaza Cafeteria, third floor, Room A, 1100 SW Sixth Avenue, Portland, Oregon.

MEMBERSHIP: Per year from January 1: Individual, $15.00, Family, $25.00, Junior (under 18), $6.00. Write or call Secretary for membership applications.

PUBLICATIONS: THE GEOLOGICAL NEWSLETTER (ISSN 0270-5451) published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10 a year (add $3.00 postage for foreign subscribers). Individual subscriptions at $13.00 a year. Single copies $1.00 Order from Geological Society of the Oregon Country, PO Box 907, Portland, OR 97207.
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THE GEOLOGICAL NEWSLETTER

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VOLUME 57, NO. 9

CALENDER OF ACTIVITIES FOR SEPTEMBER, 1991

FRIDAY NIGHT LECTURE Cramer Hall, PSU, Room 371, 8:00 P.M.

Sept. 13 "Rock Ain't Rock". Dick Angstrom, Managing Director of OCAPA (Oregon Concrete Aggregrate Producers Association).

Sept. 27 Review of the President's Summer Field Trip through central Washington by individual slide presentation.

FRIDAY LUNCHEON (Standard Plaza, 1100 SW 6th Avenue, Rooms A & B, Third Floor Cafeteria: Programs at 12:00 Noon).

Sept. 6. Hydrogeology of Blue Lake Gravel Aquifer, Speaker: James Wilkson, USGS Water Resources Division, Portland.

Sept. 20 "Oregon's Oldest Tertiary Fauna, Tectonic Implications". Speaker: Richard Thoms, PSU.

GEOLOGY SEMINAR

Seminars are cancelled until further notice.

GSOC LIBRARY (Cramer Hall, Portland State University, Room S-7 Open 7:00 - 8:oo P.M. prior to evening meetings.

FIELD TRIP

GSOC Field Trip to Bohemia Mining District, September 21, Camp at Cedar Creek Campground; drive south on I-5 to first exit at Cottage Grove. Take the road to Dorena Dam, and Culp; follow Brice Creek Road to Forest Service Cedar Creek Campground between mileposts 4 & 5. Camp, tent, camper or motel in town. Check with Alta Fosback about riders and auto. PU truck or 4-wheel drive can climb up the mountain, but not others. We will provide shuttle service as needed. Meet at 10:30 A.M. Saturday, 21st! Day 1 =tour mines, mills, ghost town, geology. Sunday, Day 2 = flowers and trees. Sunday noon burger barbecue at Guy Leabo's. Bring other meals plus salad or dessert for the barbecue. Utensils provided. Hiking clothing, camera, glasses, flower and tree books, ? mosquito repellant. WEATHER: snow, heavy rain or wind - rare, but could cancel. Phone 641-6323 or 625 6840.

The GSOC Board voted to assess each person $1.00 on car field trips, the money to be used to compensate field trip leaders for reconnaisance trip mileage. Also a suggested fee of 10 cents per mile per person to be paid to the driver. The 10 cents per mile may be adjusted at the descretion of the driver.

Heap Leach Mining
Story by Pat Wray, Managing Editor
Oregon Wildlife

Oregon's modern gold rush had its beginning in a March, 1983 study of mineral deposits conducted by the Oregon Department of Geology and Minerals Industry geologist Jerry Gray. "There were four representatives of major mining companies sitting outside my office waiting for the report," said Gray. "They had people in eastern Oregon the next day setting claims with helicopters."

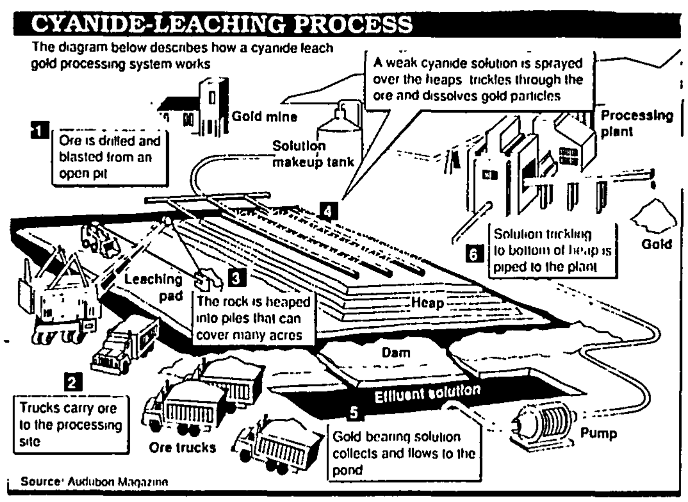
The same frenzy for buried minerals has continued through the present and shows no signs of abating. Almost 64,000 claims have been made in Oregon, a near doubling of total claims in the past five years.

New technology allows the profitable mining of ore, or rock containing lucrative amounts of gold, which would not have been economical during the mining heyday of the later 19th century. Gold deposits of as little as .02 ounces per ton of ore can be profitably extracted using new techniques.

One of the new techniques, called heap leach mining, is planned at a proposed mining site on Grassy Mountain, 25 miles southwest of Vale on Bureau of Land Management land. Atlas Precious Metals, Inc., of Denver, Colorado is requesting a permit for a mine which will cover approximately 2,836 acres, of which 895 acres will be distributed or altered in some way.

Heap leach mining is extremely efficient method of mineral extraction but has caused significant environmental damage in other states. The potential for similar damage in Oregon concerns the Oregon Department of Fish and Wildlife(ODFW). ODFW encourages interested citizens to become familiar with the mining issue and take an active part in the public review process.

The actual heap leach mining process begins with preparation of a foundation for a large leaching pad. After construction, the foundation consists of a one-foot thick pad of dense soil layer through which liquid cannot drain faster than 0.1 foot per year. On top of this semi-permeable soil layer, and 80-mil synthetic liner is installed. The liner is than covered and protected by a two-foot thick layer of crushed rock. Millions of tons of ore are then heaped on the pad. Plans for the Grassy Mountain Mine call for 17 million tons of ore spread over a 63 acre leach pad. The ore will ultimately be piled to a height of 150 feet.



To mine the ore, surface soil and barren rock, known collectively as overburden, are removed and piled out of the way. Eighty-two million tons of overburden will be removed in the Grassy Mountain Mine. An additional 12 million tons of low-grade ore, which is not economically feasible to process at this time, will be removed and piled separately in a 100-acre storage area.

Ore will then be extracted, crushed and moved to heaps, leaving in its place a large, deep pit. Upon closure of the Grassy Mountain Mine, estimated to occur ten years after mining operations begin, the largest pit remaining will be circular, covering 83 acres, with a diameter of 2,200 feet, and be 800 feet deep. The pit walls will slope 37 and 43 degrees.

Heap leach mining uses sodium cyanide to dissolve and remove the gold from the ore. A dilute sodium cyanide solution is sprayed onto the heaped ore. As it percolates through, the solution dissolves and combines with gold and other precious metals, removing them from the ore and carrying them downward to the lining and then into collection ditches and pipes. The solution follows the ditches into a nearby open pond, called a pregnant, or precious metals bearing, pond. The solution is treated to remove the gold, then recycled to be used again. (See illustration.)

A second gold mining process is also planned for the Grassy Mountain Mine. It is called milling. Milling involves the wet crushing of high grade ore into a muddy slurry, which is then treated by a dilute cyanide solution. Gold and other precious metals are removed and the remaining slurry , called tailings, is collected in a lined storage facility. The Grassy Mountain Mine plans calls for five million tons of slurry to be deposited in a 120-acre tailings pond one and one-half miles from the pit.

Oregon Fish and Wildlife biologists have several concerns about the process of heap leach mining and milling and their effects on surrounding fish and wildlife habitat.

1. LEAKAGE--The possibility of sodium cyanide solution leaking through breaks in linings of the leach pads, pregnant pond or tailings pond is worrisome. Should the layer tear or break, even the semi-permeable layer of compacted soil beneath will only slow the cyanide solution's progress toward nearby groundwater; it will not stop it. Present plans call for the pregnant pond to be cradled in a double-layered lining with a leak detection system incorporated. The heap leach pad will only receive a single layer lining with no leak detection system. The Department of Fish and Wildlife supports amendment of thosee plans to include a double layered liner for the heap leach pad as well. It should also include a leak detection system.

It is important to remember that leak detection systems are simply warnings. Even after a leak is discovered, much work must be done to effect repairs. The pregnant pond might need to be drained. Hundreds of thousands of tons of ore might have to be removed from the leach pad. How much time will it take? How much solution will leak?

2. TOXICITY--Ponds containing sodium cyanide/gold solution are extremely toxic. The location of these ponds in relatively dry areas make them attractive to waterfowl and shorebirds. Thousands of migratory waterfowl and some animals died on similar mining ponds in Nevada.

The department recommends that all ponds, channels, ditches or drains which contain processing solutions be covered or physical barriers designed to exclude birds and other wildlife species. " Combinations of netting , screening and hazing have not been effective in protecting wildlife at other mine locations," said Gail McEwen, staff habitat biologist. "We are looking for techniques that will lead to zero loss of wildlife as a result of construction or operation of the mine." Exclusion systems should also extend over adjacent mudflats and moist areas, which are attractive to many species of birds.

Fencing should be designed to exclude small mammals as well as big game, and should conform to ODFW specifications.

Disposal of mill tailings is also important to biologists, who recommend the removal of water from the slurry and its disposal in dewatered form.

3. TRANSPORTATION--Transportation of chemicals is involved in the heap leach process presents a danger to fish and wildlife resources offsite as well as at the mine. A chemical truck enroute to a mine site in Nevada overturned near Oregon's John Day River last year, killing thousands of fish with its resulting spill of hydrochloric acid. A increase in mining effect will likely result in a concurrent increase in transportation of hazardous chemicals. Risks to the environment will increase as well.

4. LOSS OF HABITAT/MITIGATION--Physical scars left on the land at the conclusion of mining activity may reduce its capacity to support numerous species of wildlife. While reclamation to the site's pre-mining condition is probably unrealistic,"the department is definitely looking for an in-kind mitigation of wildlife habitat," said McEwen. "The mitigation could take several forms, potentially even a habitat improvement program apart from the mining site," she said.

5 WATER--Heap leach mines may require significant quantities of water. Plans for Grassy Mountain mine currently call for around-the-clock use of 500-800 gallons per minute from wells to be constructed in support of mine operations. The possibility exists that deep wells sunk in support of the mine may reduce or eliminate water feeding nearby springs. "There are several springs near Grassy Mountain that get a lot of wildlife use," said Malheur County district biologist Bill Olson. " On the basis of studies conducted thus far we can't be certain that water used by the mine will not adversely impact those springs."

6. ALKALINITY--The relative acidity or alkalinity of a compound is expressed by a numerical value called pH. pH values from 0 to 7 indicate acidity, while values from 7-14 indicate alkaline or basic solution. Sodium cyanide, while very stable at high pHs, become vaporous when the pH is allowed to drop to 7 or below, releasing toxic hydrocyanic acid (HCN) as a gas in the atmosphere. Constant treatment of the cyanide with lime or caustic soda is often required to maintain the alkalinity of the solution.

7. SULFURIC ACID--One of the most disturbing possibilities comes from a seemingly benign source. The extraneous rock, dirt and non-ore which has been piled at a convenient distance from the mine often contains sulfides. This material is capable of developing a strong acid upon its exposure to oxygen and water. Acid mine drainage is a common problem in gold mining activities. In some mines, the sulfuric acid developed in this peripheral fashion has been strong enough to burn flesh. Its potential inclusion into the ground water is dangerous to fish, wildlife and humans alike.

8. HUMAN PRESENCE--The continuous presence of an estimated 190 mine workers cannot help but effect the fragile ecosystem surrounding Grassy Mountain. Support roads must be widened and improved; the resulting in increased vehicular traffic may have an adverse impact on the nearby wildlife populations. Once nearly uninhabited, the area surrounding Grassy Mountain will soon support relatively heavy human use. The near-around-the-clock operation of the mine will add to a cumulative pressure on wildlife that must be carefully evaluated.

9. POWER--A 6.7 mile long power line is scheduled to connect the Grassy Mountain mine to the Owhyee Dam substation at the north end of the Owhyee

Reservoir. The power may be disruptive to different wildlife species. Of particular concern is the potential for death and injury to raptors, or birds of prey, that accompanies the construction of such a power line.

ODFW recommends that construction of a new power line follow an already existing power line corridor as far as possible to avoid further disruption to the surrounding environment.

10. RECLAMATION--Upon closure of the mine, the site and surrounding area should be returned as closely as possible to its original condition, "Reclamation is one of those relative concepts," said Allen Throop, Reclamation for the Oregon Department of Geology and Mineral Industries. "When Grassy Mountain closes down, heaps of rock and ore will be contoured, topsoil will be replaced and revegetated. Roads will either be removed or returned to their former size. Buildings will be removed. The pit will probably remain a pit. Reclamation can emphasize a number of different uses, but in that desert country your choices are limited. If you want to make good, rocky, marmot habitat, that's easy. If you want to make a gold course, you got a problem."

The process by which permits are granted for mining activity involves a number of local, state and federal agencies and provides several opportunities for public review and imput. The Oregon Fish and Wildlife urges interested members of the public to take part in the process. A draft Environmental Impact Statement(EIS) is presently being prepared by the Bureau of Land Management on the proposed Grassy Mountain Mine. Interested citizens are invited to submit their ideas and concerns to the Bureau of Land Management, Attn: Mike Hobert, 100 Oregon Street, Vale, OR 97918. The next formal opportunity for public imput will occur when the Draft (EIS) is completed tentatively scheduled for April 1991. Public comment will also be invited as part of the permitting process of the Department of Geology and Mineral Industries(DOGAMI) and the Department of Environmental Quality(DEQ).

FROM BROBDINGAGIAN LAVA FLOWS TO SURGING GLACIERS
THE 34TH ANNUAL MEETING OF PACIFIC NORTHWEST REGION OF THE AMERICAN GEOPHYSICAL UNION

The most pleasant and informative indoor meeting which I attended in 1987 was the AGU meeting in Olympia last September. A day and a half of lectures and poster sessions was followed by a one day field trip to the ocean shore of the Quinault Indian Reservation north of the Quinault River, where non-members of the Quinault Tribe are not permitted except on official business. Weldon Rau, the noted stratigrapher, who did pioneering work on the Washington Coast, recognizing melanges and other remnants of subduction, led us to evidence of that melange, after being over-ridden by the edge of our continent, had pierced its way upward as a diapir through the overlying sandstone. GSOCs who attended the 1975 President's Campout at the Olympic Peninsula will remember him for his outstanding explanation of the Hoh Melange and its accretion to the edge of the continent. He rememberers that afternoon with the GSOCs with warm regards.

In the scientific sessions, we heard from seasoned geologists in their prime, such as Dr. Paul Hammond, and from rising geologists reporting on Master's or Ph.D study areas, nearly all of which were in GSOC country. Especially interesting and helpful to me was Dr. Hammond's talk about the Ohanapecosh Formation, which he considered to be an accumulation of pyroclastic flows, lahars and a few lava flows forming an apron around several different volcanic centers similar to what surrounds our major Cascades volcanoes today.

Partly owing to my abiding interest in glaciers, and partly to the enthusiasm and love for glaciers manifested by the speaker, I particularly enjoyed the talk by Melinda M.Brugman of Western Washinton University who reported on her research on surging glaciers as compared to those which do not surge. Anyone who has climbed Mount Rainier has suffered thirst, for liquid water is not found on the surface of glaciers. Although glacial water is abundant, it flows into the glacier through cracks and crevasses, then through a network of tunnels, some entirely in ice, and some partly in ice and partly on the till. In winter, these tunnels become smaller, as ice freezes, and water flow diminishes. Some tunnels become completely plugged with ice and sediment. With spring melting, the tunnels become engorged with water, and drainage is impaired. Glaciers confined to narrow valleys offer fewer routes for water to escape than do broad valley glaciers. When conditions are right, hydrostatic pressure builds under such glaciers, lifting them and lubricating their sliding surfaces, leading to surges. Her research involved analyzing the flow of tracer dyes in water to the Variegated Glacier in Alaska and Findelen Glaciers in Switzerland.

There were many fine exhibits at the poster session, but one of them was a sensation--truly world-class. Covering about 32 square feet, it contained a separate map for each of the major units of the Columbia River Basalt, with new estimates of their extent and volume. Prepared by Terry Tolan, S.P.Reidel, Marvin Beeson, J.L.Anderson, Karl Fecht and Don Swanson, it generated lots of excitement. It was very enlightening to listen to the discussion it inspired, and to understand a little more about the awesome size of the flows and devastation which they caused. Particularly amazing to me was that it is now known that at least one of the flows invaded sediments at the mouth of the Columbia and spread as a dike under 5000 feet or more of sediments a distance of twelve miles into the ocean. Saddle Mountain. a favorite GSOC climb south of Astoria, apparently is the cast of a funnel through which the basalt poured into the submarine sediments. Equally surprising to me is that Coriba flows similarly invaded sediments in the Northwest Columbia Plateau, near Wenatchee.

Truly, the more we learn about the crust of the earth, the more astounding it is. The AGU provided me with much inspiration, and the opportunity to learn from men and women who arduous, painstaking, often hazardous work to accumulate the data and make sense of it.

JOHN H. WHITMER
November 9,1987

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Sandra Anderson, Editor of the GSOC Newsletter for the last several years, has resigned. She has done a wonderful job and the Society is grateful. It takes great deal of time for the Editor to put the publication together each month. The Editor has to gather articles and select appropriate ones to be included in the GSOC Newsletter. Sanda has had help with Cecelia Crater responsible for the front page, Reba Wilcox for the Calender of Activities, and Rosemary Kenney and Margaret Steere for putting the Newsletter together and taking it to the Post Office for mailing.

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COMING EVENTS: October field trip--Geology of the Lake Oswego and West Linn area.

Oct 91

THE GEOLOGICAL NEWSLETTER

GSOC

GEOLOGICAL SOCIETY OF THE OREGON COUNTRY

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OF THE OREGON COUNTRY
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ACTIVITIES

ANNUAL EVENTS: President's campout-summer. Picnic-August. Banquet-March. Annual Meeting-February.
FIELD TRIPS: Usually one per month, via private car, caravan or chartered bus.
GEOLOGY SEMINARS: Third Wednesday, except June, July, August, 8:00 p.m. Room S17 in Cramer Hall, PSU. LIBRARY: Room S7, open 7:30 p.m. prior to evening meetings.
PROGRAMS: Evenings: Second and fourth Fridays each month, 8:00 p.m. Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon.
Luncheons: First and third Fridays each month, except on holidays, at noon, Standard Plaza Cafeteria, third floor, Room A, 1100 SW Sixth Avenue, Portland, Oregon.
MEMBERSHIP: Per year from January 1: Individual, $15.00, Family, $25.00, Junior (under 18), $6.00. Write or call Secretary for membership applications.
PUBLICATIONS: THE GEOLOGICAL NEWSLETTER (ISSN 0270-5451) published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10 a year (add $3.00 postage for foreign subscribers). Individual subscriptions at $13.00 a year. Single copies $1.00 Order from Geological Society of the Oregon Country, PO Box 907, Portland, OR 97207.
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THE GEOLOGICAL NEWSLETTER

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VOLUME 57, NO. 10

CALENDAR OF ACTIVITIES FOR OCTOBER, 1991

FRIDAY NIGHT LECTURE (Cramer Hall, PSU, Room 371, 8:00 P.M.)

Oct. 11 "Nuclear Reactors and Geology". Speaker: Michael Pollock, in charge of Nuclear Reactor at Reed College.

Oct. 25 "Containing Oil Spills; Valdez, Kuwait and Washington". Speaker: John Peterson of Riedel Environmental Technology.

FRIDAY LUNCHEON (Standard Plaza, 1100 SW 6th Avenue, Rooms A & B. Third Floor Cafeteria. Programs at 12:00 Noon).

Oct. 4 "Bathurst Inlet, Canada". Speaker: Betty Ferguson, affiliated with Leach Botanical Gardens, Portland.

Oct. 18 "Rocks That Sing". Speaker: Ralph Mason, Oregon State Geologist, retired, DOGAMI.

GEOLOGY SEMINAR (Cramer Hall, Portland State Univ.,Room S-17, 8: p.m.

October 15 Features of Glaciation, illustrated review by Walter Sunderland, M.D.

GSOC LIBRARY (Cramer Hall, Portland State University, Room S-7. Open 7:00 - 8:00 P.M. prior to evening meetings).

FIELD TRIP: GEOLOGY OF LAKE OSWEGO AND WEST LINN

LOCATION: TRYON CREEK STATE PARK NATURE CENTER
11321 SW Terwilliger Blvd.
MEET IN THE BUILDING.

DATE: October 19, 1991.

TIME: 9:00 A.M. Trip will take the better part of the day.

LEADER: DON BARR

PROGRAM: A slide program on the Bretz Flood will introduce the day's activities. After the slide show the participants will tour many spots showing the geology of the area.

BRING: CLothing for the day, LUNCH and what ever else you might need.

NOMINATING COMMITTEE APPOINTED

The Board of Directors has appointed the following GSOC members to serve on the nominating committee this year: Clara Bartholomay (1990 Chairperson), Margaret Steere, Losis Sato, Gale Rankin and Catherine Evenson, This committee will nominate one GSOC member for each of the following; President, Secretary, Tresurer, and a 3-year term Director. If you are willing to serve in one of these positions, please contact a committee member. The report of the nominating committee will be published in the November 1990 Newsletter and ballots will be mailed to all GSOC members the first week in December.

PRESIDENT'S SUMMER FIELD TRIP TO CENTRAL WASHINGTON, AUGUST 1991, PRESIDENT DR. WALTER SUNDERLAND, M.D.

Day 1-Portland to Ellensburg
Don Turner

On August 8, 1991, even after seeing to the loading of 28 people led by Dr. Sunderland, our GSOC driver, Guy Leabo and our escort Alta Fosback managed to leave the Lloyd Center Red Lion Hotel at the scheduled time of 8:00 A.M. Then they, with excellent skill, found the way to I-84. Passing Troutdale, we entered the mighty Columbia River Gorge that has exposed three massive sets of flood basalts. During the Mid-Miocene the medium sized Wanapum member of the Columbia River Basalts spilled down the Columbia River. The basalt came from dikes near the Oregon, Washington, and Idaho borders. Next, in the lower Miocene the Grand Ronde, the largest of the flows, flowed over a large area including the Columbia River channel. The channel changed many times as the various flows of basalt moved the river to new locations. Mount Hood possibility rests on one of the early channels of the river.

First stop-- Cascade Locks--not the Bonneville slide, but at the CharBuger for rest rooms and snacks. Before leaving Cascade Locks, the Bonneville Slide and the Bridge of the Gods (with legend) were discussed. Figures of the Weeping Maiden (Greenleaf Peak and Table Mountain), and later the face of the great God Tahmahnawis in Wind Mountain were pointed out. Leaving Cascade Locks, we next passed what remains of Government Island, which is connected to Shell Mountains by a sill. Shell Rock and Wind Mountain (Washington) at one time were possibility one mountain that was cut in two by the Missoula (Bretz) Floods. Wind Mountain and Mitchell Point (Oregon side of river) are on the lines that divide the weather and growth patterns between Eastern and Western Oregon.

As we entered the Dalles area, Dr. Sunderland led an excellent discussion concerning the scablands and the Ice Age Missoula Floods. Leaving the Dalles, we crossed the newer bridge--the original bridge construction was proved a mistake. The original leg of the bridge was utilized during dam construction. Upon reaching Washington's Highway 14, we drove past the old railroad town of Wishram--where we talked about railroads in the Deschutes River Canyon. After turning onto U.S. 97 we came to Pat's Ranch Market for a rest stop. As the bus got to the top of the grade we got a beautiful view of Mount Adams. Also along U.S. 97 we passed Goldendale with its new Observatory State Park, Three Creeks Lodge, Brooks Memorial State Park and passed through the Yakima Indian Reservation. Dr. Sunderland told us about the rim-rocks and recommended a good book (on local history) by Dorothy Lawson McCall-"Under the Rim-Rocks". On the route the bus passed several geologic points of interest on the way to Yakima--the Toppenish Anticline and Union Gap. Before our lunch stop at Eschback County Park with its 100 degree temperature we stopped at the park's " Indian Art " exhibit. The "Indian Art" is in inverted topography of the Tieton Andesite Flow that came from Goat Rocks located some 55 miles west of the park. On Highway 12 we made a picture stop for the Fred Redman bridge (the longest and highest concrete arch span in North America). As the weather was hot and the passengers hotter we stopped first for some cooling watermellon and then to read the sign explaining Umtanum Ridge and the Columbia River Basalts. Traveling Highway 821 we avoided several large anticlines, but did have a beautiful drive along the Yakima River. The GSOCs got to Ellensburg at 4:15 P.M. stopping for the day at the I-90 Inn with its air conditioning.

Thanks to our leader, Dr. Walter Sunderland, our able and efficient "nursemaid" Alta Fosback, and our OWN Guy Leabo, who drove (not crazy). We had a wonderful time.

Day 2 Ellensburg Area
Ralph Pratt

As we came out to the bus in the morning, Sam, the local pigeon, was patrolling outside the hacienda in Ellensburg waiting for its breakfast, which was contributed by one or more than one GSOC'er.

On the bus, we were joined by Dr. Donald Ringe, of Central Washington University Geology Department, and we headed northwest on I-90. The valley is in Columbia River Basalt, about 5000 feet thick, and extending north to Wenatchee Ridge, an anticlinal fold.

About eleven miles out, we passed the Thorp formation (gravels) on the right. Ahead, we rose to a hummock area which is the terminal moraine of the Pleistocene Yakima Valley glaciers. The Mount Stewart batholith was visible at about two o'clock. It is late Cretaceous, about 88 millions old, and became the source of the ice age glaciers extending to this area. There has been no successful mining in the batholith.

After a stop at Indian John Hill rest stop, we passed through Cle Elum to Roslyn, both old coal mining towns. Mining in Roslyn was active from 1886, declining rapidly after WW II as the railroads converted to diesel, and coming to a halt in 1963. Roslyn is also the site of "Roslyn's Cafe " in the TV show "Northern Exposure", and several films have been made there.

The coal had been formed on the North Cascades micro-continent about the time it attached to the North American Plate (about 50 MYA). As the coal was formed, sediments from the micro-continent mountains washed down to the swamps where the coal was forming, and became interlayered with the peat which was becoming coal. With heat and pressure, the resulting Roslyn formation included white arkosic sandstone, shale, conglomerate, and many seams of coal. The sub-bituminous coal was mined underground for the most part.

Rosyln was a typical mining town, very familiar with booms and busts, hard work and mining accidents. The town's population was 4000 in 1915 and 1200 in 1971. Its cemetery is divided into 24 or 25 separate areas, each for a separate nationality, race, religion or lodge (IOOF), Moose, Foresters, Rebekah, Eagles, Redmen). A number of headstones are engraved in foreign languages, since many miners were immigrants. The cemetery has fallen into disrepair, but in recent years has been cleaned up. It is still active, and there were many fresh flowers left by visiting families on Sunday (the day before).

With many immigrants, education was held in high regard. There were no problems in passing school levies, and even a few remaining old-timers still turn out to help them pass.

We moved on to the neighboring settlement of Ronald, where we looked through mine tailings for leaf fossils, with limited success.

Heading back toward Ellensburg on Highway 10, we passed Lookout Mountain, which is the western edge of Columbia River Basalt. We stopped to look at some mud flows--the location of large slumps which had caused the Yakima River to alter its course.

After lunch in Ellensburg, we headed East on I-90 to Vantage where we toured the Ginkgo Pertified Forest State Park. The museum had good exhibits, and a slide show explaining that the area had been a swamp or shallow lake. The trees became buried in the mud at the bottom of the lake, and thus were preserved when covered by the Columbia River Basalt. Over the subsequent millions of years they became petrified.

After a tour of the nearby gem shop, we drove to the outside trails of the park. With temperatures over a 100 degrees, not many of us hiked very far, but we viewed at least a few of the examples of the in situ pertified wood before returning to Ellensburg for a little exploration and dinner. Dr. Sunderland added this to Ralph's report.

"Ralph neglected to mention that he found a great way to keep cool on a hot day---soak your shirt in a lawn sprinkler".

Day 3- Ellensburg to Wenatchee
Esther Kennedy-Phyllis Thorne

Prior to our 8:15 A.M. departure from Ellensburg we interviewed Homer, a mostly genteel pigeon, the Motel I-90 Mascot, who was called from his perch by Don Parks, the harmonica bird man. Homer expressed his gratitude to Archie who generously distributed crackers and other goodies from the bountiful snack table of Gale and Manuel.

Our first stop of the day was Johnston Upholstery. A smiling Dr. Ruth Keene returned from the shop with a large foam rubber pillow to sit on so she could see out the window.

Now on our way to Wenatchee, Gale collected the postage sized bit of paper she distributed earlier with instructions to write complaints on one side only and sign our names. Winner for the best complaint or worst be awarded a prize--the back seat of the bus by the toilet. Next time the winner will no doubt sign someone elses name.

We traveled north on Highway 97 through the Kittitas Valley, a synclinal downfold on the western edge of Columbia River Basalt. The valley is filled with sand, silt and gravel to a depth of 400 meters. This erosional material from the anticlinal arches on either side, with irrigation, produces green fields of hay and meadows for grazing. About 15 minutes from Ellensburg the highway climbs up gravel ridges most likely left by glaciation before the last ice sheet, then drops down through an area of ponderosa pines. Crossing Swauk Creek one begins to see the great piles of dredging debris left by the mining operations . Swauk Creek and its tributaries were dredged in the 1870's. Todays miners are scanning these piles of gravels and rock with metal detectors and it is said they do find gold nuggets.

Almost immediately after entering Wenatchee National Forest we turned right to the historic gold mining town of Liberty, the oldest continuously occupied mining town in Washington with a permanent population of four with seasonal variations. The residents keep watch over the old buildings, a model of arrastra, an ancient device for crushing rocks to release gold, and old gold mining equipment rusting in fields of knapweed and wormwood.

Continuing north on 97, the roadworthy through basalt. A mixed forest of pine, larch, fir line the highway. The understory consists of willow, ceanothus and ocean spray. It is evident that there are many wildflowers too.

At Swauk Pass, 4100 feet elevation the highway cuts through the Swauk formation of sandstone, shale and pebble conglomerate and sediments. From the pass we dropped through beautiful mixed forest. The understory growth was much heavier on the north side of the pass.

We stopped at the old town site of Blewett where the remains of an old arrastra can be seen on the banks of Peshastin Creek.

Serpentine, formed when the mantle peridotites was subducted into the Okanogan Trench and metamorphosed, was exposed in the road cuts from old Blewett townsite to Ingells Creek. Serpentine, commonly called soapstone is black or green and glossy and a great carving material.

At Cashmere, a town noted for aplets and cotlets, we ate, shopped and visited the outstanding Historical Museum.

Next stop was the Ohme Gardens, nine acres of mountain beauty. The Ohme family started the gardens in 1929 on high rocky outcroppings where only sage brush grew. Over the years, they planted trees, shrubs, flowers and lawns. They built pools and winding pathways with stone benches for resting places. The Ohme Gardens is a place of beauty, a place for viewing the Wenatchee Valley, and the Cascade Mountains.

In the shade of the trees at the gardens we feasted on watermelon, cantaloupe and salted nuts. Then the heat took over and a number of the GSOCs played in the sprinklers. Were we wet? Cool? Yes!!!!.

So on to our motel in Wa-Nat-Chee = Robe of the Rainbow.

Day 4 Wenatachee to Lake Chelan
Vincent E. Sunderland

Party left Wenatchee at 0815 A.M. and arrived at Rocky Reach Dam in 15 minutes. We toured the museum viewing the exhibits on Indian anthropology. pioneering history, geology, fish ladders, power production and a very large exhibit on electricity.

To the east of the river were naked cliffs of Columbia River Basalts and to the west are mixed formations of various intrusions that present an identification problem for geologists. Early mining history and other type ventures were explained.

At 0945 we pushed north on 97, making Earthquake Point our next stop. In 1872 a rockfall blocked the Columbia River temporarily. An Indian seer took credit for the prediction thereof. There are still some boulders on the western side of the river remaining from the fall.

Continuing north we entered the Navarre Coulee which is about seven miles long U-shaped and flat bottomed. At the upper end is a plunge pool from a waterfalls created when the obstructed Lake Chelan spilled over the ridge. Lake Chelan's outlet was moved three times as the Okanogan Lobe of the Canadian Cordilleran Ice Sheet moved first down the Columbia River Gorge then back flowed up the lake. Driving along the south side of the lake for 11 miles we arrived in the City of Chelan by 1100--time to break for lunch, shopping and touring. At 1300 Mr. Wally Miller arrived to tour guide us for the afternoon. After taking us to the dam which controls the lake water level, we drove up the north terraces which were impressively high. Miller point out a huge basaltic erratic deposited by the lake-invading ice lobe.

Mr. Miller, a volunteer from the Chamber of Commerce, lectured on local history and geology. Chelan is the deepest lake in Washington and third deepest in the United States (Crater Lake being first and Tahoe second). It was gouged out Fjord-fashion by glaciers from the Cascade Mountains.

Thereafter we drove into the valley to see the present lake outlet gorge and view the huge moraine deposits which blocks the old outlet from the lake. Don Turner, Alta and Walter watched for traffic and directed people across the highway so as we see the old road past the gorge.

Driving along the north side of the lake we passed Wapato Point which is really a morainal deposit left at the uppermost ascension of the lobe from the Canadian Ice Sheet. At this area the lake is divided into two parts with the upper being very deep--several hundred feet below sea level and the lower portion shallow at about 145 feet deep.

We continued to Manson and drove about the area of three small post glacial lakes, sand ridges and badly eroded hills. All this way is irrigated and converted into fruit orchards. Temperature was very warm at 95 degrees. Driver parked the bus in the shade of a tower during the lecture insofar as the airconditioner could only cool the bus 20 degrees below the outside temperature.

We returned to the motel and scattered for diner. An earthquake was planned but deferred for technical reasons.

Day 5 Lake Chelan
Helen Nelson

Rise early at our Chelan Motel. The bus leaves at 7:40 to drive across the glacial moraine at the end of the glacial plowed 55 mile valley that Lake Chelan now occupies. We boarded the "Lady of the Lake" to enjoy a serene, scenic, informational and delightful cruise over the mile to 5 mile wide, up to 1500 foot deep lake.

A gangplank slid over the boat's bow let people off and others on the East side of village, Manson, the first stop. The boat pulled up next at 25 Mile Creek State Park dock where geologist, Fred Miller boarded. No lakeside roads beyond this point

Lake Chelan is located about 125 miles due east across the Cascades from the northern city limits of Seattle. Its western shore is the high ridges of the Chelan mountain range. A few evergreens cling to it's steep, rocky bluffs. A more rounded, tree-covered ranges, form the eastern border. The Chelan Mountains are magnetite, a mixture of igneous and metamorphic rocks. Most of the igneous rock is pale gray granite with black crystals, hornblende, quartz, flaky biotite mica and milky feldspar, crystallized 60 -70 years ago.

Igneous magma is the first to melt under metamorphic stress. It picks up the more heat resistant rocks to make the streaky, swirling, magnetite, that looks like twirling together shades of oil paint on water.

More ancient history. The Okanogan trench, to the east of Lake Chelan was at one time a sea and the terrain west of it an island. Slowly the island approached from the southwest, glided up to the land and docked about 50 million years ago, eliminating the sea. The once Pacific island contained volcanoes with dense vegetation on the lower slopes. They were the first of two series of volcanoes. The glacier covered peaks we viewed from the bus are the second volcanic series that form the high Cascades of unsurpassing beauty. They began erupting about 20 million years ago, forming the line of volcanoes of black basalt, rhyolite and andesite, from Canada to Mount Shasta. Here the Pacific plate dives under the continental plate.

We next docked at Lucerne for the traffic to and from the abandoned mine site of Holden, reached by a fourteen mile road along Railroad Creek. What they mined, I've forgotten. The village is now operated by the Lutheran Church as a retreat for various groups.

Two hikers sprang down the bow gang plank at Prince Creek, so named for an early prospector's horse that feel into the creek and died there. The Okanogen National Forest borders the east lake shoreline to Manson and Glacier and Wenatchee Wilderness and West side almost to Chelan. The North Cascades Park surrounds the Northern end. The lake was glacier gouged about 12 to 14 million years ago.

Stehekin, lunch stop for those who had not either brought a lunch or bought a lunch on the boat. An irrigation dam built in 1926 at Chelan raised the level of the lake 20 feet made a mudflat of the northern prairie where the original hotel stood. I went by bus to view Rainbow Falls. We passed the small log schoolhouse for about 10 winter students. A snow plow keeps some of the 26 miles of roads open during the winter. The boat arrives about once a week bringing mail and grocery orders that were carried by the captain the week before. Snow and wild animals help entertain the residents in the winter.

Our return was smooth, with occasional flag and regular stops. A woman and a man on water scooters, played around our boat like porpoises do at sea; greeted our return. So ended a good field day.

<u>Day 6-Chelan to Okanogan</u>
<u>Rosemary Kenney</u>

We left Chelan, on time, with packed lunches. There had been a weather change and we enjoyed the cooler weather.

We headed north on Highway 97, which follows the Columbia River as far as Brewster, \\en north along the banks of the Okanogan River. The highway follows the boundary between the Columbia Plateau to the east and the North Cascade sub-continent to the west. The river flows along the low outermost edge of the highlands. This area was buried under the Okanogan lobe of the big ice sheet during the last ice age. We still see kame terraces , some 500 to 600 feet high. We took a side trip up MacNeil Canyon to the Waterville Plateau to see the huge glacial erratics. These erratics were plucked from the edge of the Columbia Basalt Plateau by the glacier and carried by ice until it scattered them as it melted. The erratics vary in size from a few feet in diameter to the size of a house.

Continuing north on Highway 97, we saw two kettles near Azwell. A kettle is formed when a large block of ice is buried by sand when a glacier is retreating. After the ice block melts, it leaves a depression in the ground. The basin may be so symmetrical as to appear man-made. Some kettles become ponds fed by springs, swamps, or just a dry hole and may be a few to hundreds of feet deep and up to 6 - 7 miles in diameter. (Cf Walden's Pond).

We are still seeing apple orchards. Any

area where there is top soil and available water, apple trees have been planted. The green orchards dotted with red fruit look lovely and refreshing against the yellow-brown hills.

Dr. Sunderland stated a use for sage brush that his grandmother used: sage tea for "what ails you". "You always got better because it was better to get better than to drink another cup of sage tea". There is plenty of sage brush here to make tea!

The Columbia River has cut down through the plateau into older igneous and metamorphic rocks of the North Cascades sub-continent, which were exposed along the road. Bedrock below the basalt is usually crystalline gneisses, phyllites, greenstones and schists.

We travel on Highway 215, climbing more than 300 feet to the top of a kame terrace, one-half mile wide, then on to Ruby. Ruby is now a site without buildings but at one time was a roaring silver mining town, with more than forty silver mines within a fifteen-mile perimeter.

On to Conconully which was also an old mining district with silver, lead, and copper mines. After a picnic lunch at Conconully State Park where we celebrated Rowena Hoven's birthday, we continued on following Conconully Lake and Fish Lake among glaciated hills and kame terraces back to Highway 97.

Before joining Highway 97, we met John Ward Lynch, an artist who has a workshop in Okanogan. He led us to where we collected samples of serpentine, so, once again we added more weight to the bus.

Day 7-Okanogan to Republic
John Bonebrake

On Saturday, August 24, a beautiful day, we left the Cedars Motel in Okanogan at 8:08 A.M. for a great exploring day to finish at Republic. We followed 97 north up the Okanogan trench, 100 million year old granites pretty well covered by glacial refuse. Saw various ancient channels of the Columbia River, some with kames, accumulations of sand, gravel and boulders, formed by the outwash from under glaciers. The abbreviation for Okanogan is (OK).

At Riverside, about twelve miles north of Okanogan we turned left following an old glacial channel. Considerable talus and huge boulders were evident to the left - glacial sand and water to the right. A small lake called a "kettle" to the left was caused by swirling water along-side of the glacier. A large pile of beautiful white limestone on the right at the railroad ending was awaiting shipment. We stopped for samples seen in the ditch. Turning around, we drove about 15 miles farther north to Tonasket, then east on highway 20, then uphill to the left viewing terrific glacial outwashes and soil removal down to solid basalt. Erratics were visible, a sand wash to the right.

We stopped by a gneiss cliff on the left, badly worn by glaciers along Bonaparte Creek. Next was Aeneas Valley, and a sign reading "Thou shalt not trespass". We crossed through an "esker", then a large "kettle". Archie Strong was a yellowjacket casualty. Walter Sunderland described this land as "Kettle" and "Kame" topography. A long discussion settled that elephants have four knees, not two. We saw lateral moraines, glacial benches, and a 15,000 foot filled graben, then drove over Wauconda Pass(4500 feet) and into a beautiful conifer forest which inspired a lengthy discussion about the budworm. Soon we saw a sign "Welcome to Republic". We stopped at midday at Frontier Inn, visited the city museum and had lunch.

After lunch we visited the Echo Bay Exploration Company mine operations about six miles out of town. Mike, a qualified geologist, working on a degree program from the University of Washington lectured to us. There are essentially three kinds of rocks in this 20-mile wide downdrop graben. They date in the Eocene, some 35 to 50 million years old. He spoke of ancient greenstones, many Cambrian and Precambrain (300 to 600 million years old) limestones, black-not pretty rock in which their main gold is found and various volcanics which they are mining. He went on describing the subduction process, the older rocks are found on top of younger ore intrusions and how hydrothermal plumes at the ancient sea floor contributed to the formation of gold and that pryites and magnetites appear to be holding minerals.

After Mike's quick run-through of their mining process to our attentive crowd, he asked for questions:

--- Scarn-garnet and others, magnetite, pyrite, etc. formed at 700/200 degrees C.

--- Why is gold in the graben? Trapping of fluids, mineralization, etc. seems to be the answer. They find 1/6, 1/3, 1/2 oz. gold sometimes 3 or 4 oz.

--- Magnetite was originally mined for gold and silver.

--- They sometimes throw out ores that might be rich. They go into fills and stockpiles so that they may be recovered in the future.

--- The greenstones commonly rest on top of the old ocean crust.

--- The mill capacity is 2000 tons of ores per day. At present their cut-off is 0.07 oz gold per ton of ore.

--- Questions about how they do the mining brought very descriptive and interesting answers. Workings in the mine are 24 feet wide and 18 feet high so that 70 ton trucks can maneuver throughout. He mentioned pure olivine in the mine.

--- A carbon leach system floats out the gold.

--- They have to install huge concrete columns for support to prevent frequent collapse of the mine.. Generally waste material fills in the excavated tunnels. They recover 75% of gold bearing ore.

Next, we were conducted to the mill, a huge refining structure. Tom Scheffel, mill superintendent, after thoughtful consideration for a period, decided that we were not dressed properly to enter the mill. Hard hat and safety glasses are required by the management; thus he took us around various areas where he was allowed to take such visitors and gave us a very good description of what was going on.

They use the cyanide process. The ore is crushed very fine (279 mesh), aerated and leached in a carbon tank. Cyanide is costly so it is practically all recovered. It is a carbon loop system employing 120 degree F in kiln. Of the valuable minerals recovered 18% is gold and 60% is silver. The cyanide released is 10 ppm (parts per million), much less than the 40 ppm allowed by code.

In the rod mill, 4 inch diameter by 14 feet long steel rods, roll and tumble the ore and in the ball mill a similar tumbling of 2 inch diameter balls reduce the ore to about the consistency of face powder. The many tumbling rods in the rotating cylinder wear out at the rate of 2 pounds of steel per ton of ore. Our time at Echo Bay Exploration Company was an educational treat. Their efforts to inform us of their modern mining process was extremely well received.

We retired to Patterson Park in the town of Republic for sliced fresh peaches and ice cream.

Day 8 - In and Around Republic

Evelyn Pratt

As we were joined by John Sweetman - geologist, tax assessor and walking encyclopedia of Republic geology and gold mining lore - his wife Sandra, librarian and local historian, and their 11 year old son. Republic, John told us , is the only incorporated town in the 2000 -or-so square mile Ferry County. Okanogan climate gives rise to the saying, "Rare as a Red Ferry County tomato". Fall begins around Labor Day, and snow will be flying a few weeks later. Many of the thousands of gold mining claims here have been warm-season operations to avoid winter's -30 to -40 degree temperatures.

The local township map is plastered with mining claims - even our motel sits on one. Originally the area was part of the Colville Indian Reservation. As often happened, native Americans were allowed to keep their tribal lands until white Americans found something profitable in them. In 1896 Republic opened to mining. Tunnels, adits, and glory holes soon peppered the countryside.

It is hard to tell just how much gold was taken out in the early 1900's, since many of the operations were episodic, and much of the ore was sent to Trail and Greenwood, British Columbia. (For many years Republic was one of two places in the U.S. that had a working Royal Bank of Canada). Around 1900, between 5000 to 8000 people lived here. Today all of Ferry County holds less than 6000 people.

TILL we KAME to Republic, everything has been so easy and GNEISS that we took it all for GRANITE.. . . We've been traveling west of here on the 50 million year old North Cascades microcontinent, seeing granitic bedrock to the west and Pleistocene kame terraces on either side of the Columbia and Okanogan Rivers. Now we're on the Okanogan Trench. 100 million years ago the buckled-up coastal plain of westward-moving North America squished into the Okanogan subcontinent. North-south faults formed, and a trench opened on the west side of the subcontinent. Whatever was on either side of the trench, then and then later on, eroded into it. Groundwater, superheated by magma and volcanic action, carrying metallic sulfides and gold, forced its way into rocks as they buckled and bent and fractured and fell. On John's geologic map the results looked like a cross-section of chopped turkey sandwich - a big white slice of North Cascades granite to the west, another slice of granitics to the east, and a filling of gneiss and rhyolite chunks and greenstone pickles peppered with serpentine, all mixed with mineralized groundwater mayonnaise. Geologists call this filling the Republic Graben. ("Graben = German trench"). It is more or less the same as the Okanogan Valley. Its geology is similar to that of the Klamaths, Siskyous, and parts of the John Day country, and may even be a continuation of them.

On our way to the Hecla Company's mine , John told us how this silver mining company acquired a Washington gold mine.. Seems they and another firm argued for years over who owned certain properties. Finally Hecla solved the problem by buying out the other company. It was a package deal, so they had to take over the other firm's "played-out" gold claims. Early in the century these claims had been so rich that the company managers brought the the ore out of the tunnels each day to keep the miners from smuggling nuggets home in their lunch boxes. Two million ounces of gold were taken out of the Knob Hill shaft in the '30's. But by 1984 Hecla was ready to close the mill. John's friend and fellow geologist Ron Short was told, "Find good ore close to the mill, and find it fast!" The miner drilled 60 feet straight down under the mill and opened up the Baily Vein, Since then they've taken 90,000 ounces of gold and 500,000 of silver out of the vein and nearby deposits.

We took pictures of the new mill and a Sunday baseball game going on beside it. John told us back when gold was $32 an once, folks weren't too careful with lower-grade ores; now many of the county roads are literally paved with gold. He said this as we were standing on Hecla's new roadbed to the Golden Promise mine - lovely white chucks of Scatter Creek calcite and rhyodacite waste ore. When we left, Guy's bus seemed considerably heavier than when we arrived.

As we drove north along the country roads west of Lake Curlew, we got the impression of an ancient Yellowstone whose mineral-laden magmatic steam forced its way into everything from Permian-Triassic limestones and conglomerates to Tertiary intrusions and 100,000-year-old glacial till. The picture is so complex that geologists work beside miners, checking core samples and plotting where to drill. Mining techniques vary accordingly, and byproducts include garnets, galena, magnetite, silver - you name it. Mines work from 50 to 2000 tons of ore a day, and virtually ignore anything less that 0.3 % - an unusually high cut off rate. At Alpine Lake a couple of pumps and some underwater tailings have yielded 5000 ounces of gold. A few old timers have supported themselves by panning, but placer mining has been pretty much ignored. Peaty bogs over faults and water-indicating aspen groves are probably worth looking into.

Ferry County seems to be aware of the other form of gold, the tourist dollar. Most of the country side looked clean and unspoiled by all the activity underneath it. Lovely fault and glacier-derived Curlew Lake has a few summer homes on one shore and an uncrowded (on a sunny August Sunday !) state park on the other.

Because high-country terrain here is rugged, only one power line was built through Sherman Pass to Republic. In 1988 a forest fire nearly took it out, which would have left the county seat with no electricity. The year after the burn, bumper crops of morel mushroom grew between the still-standing dead trees.

We crossed Republic graben's eastern fault on the way up Sherman Pass. At 5500 feet we sat on big quartz monzonite (granitic) boulders, and admired the wildflowers. John and Sandra were great hosts on this tour. They obviously love NE Washington and were eager to share that love with us.

Back in Republic GSOC'es R & R in various ways: shopping at the little Stone Rose Museum; finding leaf fossils in Eocene lakebed rock piles; counting the "For Sale" signs along Republic's hilly streets; and resting homesick eyes on a tiny layer of columnar basalt in back of the Ferry County P.U.D. We rounded out the day with a dinner at either Golden Nugget, or the Other Place, or (best of all in my opinion) the Somewhere Else Restaurants.

Day 9 - Republic to Mosses Lake
John and Elizabeth King

In chilly morning air at 8:00 AM, the happy bus load of GSOC'ers headed south from Republic on Highway 21 along the San Poil River. Interesting note: the highway in that area is constructed upon on old railroad bed, one of the three railroads serving Republic during its glory days.

As we traveled along, a lively ceremony errupted honoring Yalta Fosback for her never-ending efficiency, courtesy and good humor as our "Wagon Master Supreme". Following the presentation of a card and honoarium Alta promised hugs to all. All GSOC'ers responded with a rousing rendition of "For She's a Jolly Good Fellow". One sly member , however, collected his hug later in the darkened auditorium of the Visitor Center of the Grand Coulee Dam as we watched a film showing the history of the construction and use of the dam.

After "meandering" down a long hilly road with hairpin turns into Nespelem, our bus stopped in front of an old historic Catholic Church adjacent to the Indian Cemetery in which Chief Joseph is buried. This picture stop promised many interesting photos. A brief stop at this monument erected by Washington University Historical Society provided an opportunity for more pictures.

On the road again we headed south on Highway 155 toward Elmer City where we enjoyed views of the Columbia River flowing northward. After crossing a high bridge over the Columbia River the bus parked at Grand Coulee Dam Visitor Center to permit a lengthy visit to the educational exhibits and dam structure; we saw an interesting slide program, visited the book shop, obtained souvenirs and took pictures, Most of the members, to learn more about the operation of the dam, descended 329 feet on Elevator No. 5 into the inner chambers of the Third Power Plant. We observed one of two large generators in operation at the time and were interested to learn that these two Francis Turbines were manufactures in Portland, Oregon by Willamette Iron and Steel Company. Each generator is rated at 600 megawatts of power. The No. 3 power plant is used primarily for peak load conditions. Construction of Grand Coulee Dam began in September 9, 1933. The great Columbia River, memorialized by A. Guthrie as the " wild and wasted water", now produces power and irrigation for one million acres of parched barren lands.

Leaving the dam, the bus took us by the pumping station which lifts water through a dozen large penstocks into Banks Lake to be stored for agricultural irrigation.

We stopped in Grand Coulee for lunch at 12:15 noon. Off again at 1:15 PM we drove along the west bank of Banks Lake through the Grand Coulee, stopping for pictures and rock gathering at Steamboat Rock. After driving through Coulee City we turned west on Highway 2 and then north on a side road to see Moses Coulee for a smaller but similar geologic experience. A stop at a tiny lakeside resort at the end of Moses Lake Road really surprised the resort owner who said this was the first occasion that a tour bus had visited his resort.

An afternoon of traveling through miles of coulee valleys gave us much time to see more and more of "loess" and" loess" as we "kame" back through the scoured channel toward Dry Falls. By prearrangement the Museum at Dry Falls State Park was especially opened for our group and we enjoyed seeing the excellent display of artifacts and information concerning the formation and history of the spectacular dry rocky cliffs.

Continuing south we stopped next at Soap Lake. Some of us dipped our hands in the water to experience the extraordinary qualities of the lake, Hands felt soapy but no healing miracles were noted. We hastened on to Moses Lake and checked in at Travel Lodge at 6:00PM.

As a fitting climax to this "looooong" day (see page 19 of "President's Summer Field Trip"), a wine and cheese party was hosted by the Pratts and the Kings in the City Park behind the motel, thus ending the ninth day of our tour, and the King's responsibility as "Scribe for the Day".

Day 10 - Moses Lake to Home

Walter A. Sunderland

Enroute home!. We left Moses Lake at 7:50 AM and went west on I-90. Passing the area of Ritzville we noted a white flurry stirred up on the frontage road by traffic. These were the ash deposits from the eruption of Mount St. Helens; there was upwards of 10 inches of ash deposited here at the time. Farther west the terrain was flat being derived from the Spokane Flood deposits when the water bonded here as part of Lake Lewis before boiling through the Wallula Gap.

Nearing Vantage, we stopped to admire the cast iron horses artwork on the ridge termed "Grandfather Lets Loose Horses". I have noted the erection of a few more each time passed during the recent year.

Crossing the bridge to Vantage we had brunch (for some) and then we recrossed the river to continue south. Passing the Saddle Mountains that pushed the Columbia River eastward we crossed the Vernita Bridge before returning to Toppenish.

By 1220 we were at Three Creeks Lodge for a tasty lunch whereafter we continued home without stopping. We ran into typical Oregon rain as the bus came down the Columbia Gorge toward Portand. Total distance traveled was 1650 miles. "And a good time was had by all."

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Ira A. William's "COLUMBIA RIVER GORGE-ITS GEOLOGIC HISTORY" Reprinted

The Oregon Historical Society Press republished Ira A. Williams' THE COLUMBIA RIVER GORGE - ITS GEOLOGIC HISTORY" in June 1991. It has an attractive new cover and new name, 'GEOLOGIC HISTORY OF THE COLUMBIA RIVER', a glowing tribute to Mr. Williams on the cover, and two excellent introductions by John Eliot Allen and SueAnn Murry Reddick. The original text has been reproduced in its entirety, the photos often enhanced by being lightened. and there is a beautiful foldout map and Gorge cross section. Ira A. Williams wrote this survey to coincide with the Columbia River scenic highway in 1916 for the Oregon Bureau of Mines and Geology. It was then reprinted by the Bureau in 1923. Now, it is again offered in an exciting new format.

We can thank Dr. Allen for instigating and promoting this reprinting by the Oregon Historical Society Press. The Williams family appreciate his efforts and are delighted with the new book.

Paul Pintarich chose the book for his "Critic's Choice" in June 16 Oregonian and quoted Dr. Allen thus: "Ira Williams, a Iowa engineer-geologist who came West to teach at Oregon State College, made one of the first definitive studies of the gorge, tracing and naming many of its formations,and providing a narrative that celebrated the region's nature wonders".

Mr. Williams' two sons, Lloyd (Portland) and David C. Williams (Colorado Springs) and his daughter, Rhoda Irene Lewis (Portland and GSOC member) attended the publication party on June 15th at the Vista House in conjunction with the Silver Jubilee (75th) anniversary of the opening of the Columbia River Gorge Scenic Highway. It was a memorable day for us all and wonderful to have our father's accomplishments remembered in such a fine manner.

-------Rhoda L. Lewis

nov 91

THE GEOLOGICAL NEWSLETTER

GSOC

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ACTIVITIES

ANNUAL EVENTS: President's campout-summer. Picnic-August. Banquet-March. Annual Meeting-February.
FIELD TRIPS: Usually one per month, via private car, caravan or chartered bus.
GEOLOGY SEMINARS: Third Wednesday, except June, July, August, 8:00 p.m. Room S17 in Cramer Hall, PSU. LIBRARY: Room S7, open 7:30 p.m. prior to evening meetings.
PROGRAMS: Evenings: Second and fourth Fridays each month, 8:00 p.m. Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon.
Luncheons: First and third Fridays each month, except on holidays, at noon, Standard Plaza Cafeteria, third floor, Room A, 1100 SW Sixth Avenue, Portland, Oregon.
MEMBERSHIP: Per year from January 1: Individual, $15.00, Family, $25.00, Junior (under 18), $6.00. Write or call Secretary for membership applications.
PUBLICATIONS: THE GEOLOGICAL NEWSLETTER (ISSN 0270-5451) published monthly and mailed to each member. Subscriptions available to libraries and organizations at $10 a year (add $3.00 postage for foreign subscribers). Individual subscriptions at $13.00 a year. Single copies $1.00 Order from Geological Society of the Oregon Country, PO Box 907, Portland, OR 97207.
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THE GEOLOGICAL NEWSLETTER

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VOLUME 57, NO. 11

CALENDAR OF ACTIVITIES FOR NOVEMBER, 1991

FRIDAY NIGHT LECTURE (Cramer Hall, PSU, Room 371, 8:00 P.M.)

Nov. 8 "Diamond Craters Outstanding Natural Area". Speaker: Dr. Ellen Benedict, instructor at Malheur Field Station.

Nov. 22 "Build We Must---But Where". Speaker: Bill Freeman, Building Bureau of the City of Portland.

FRIDAY LUNCHEON (Standard Plaza, 1100 SW 6th Avenue, Rooms A & B. Third Floor Cafeteria. Programs at 12:00 Noon).

Nov. 1 "Australia - Tenting in the Outback". Speaker: Helen Nelson, Member GSOC.

Nov. 15 "The Wilson River Landslide, April 4, 1991: A Case History". Speaker: Sue D'Agnese, Project Geologist for Oregon State Highway Division.

GEOLOGY SEMINAR Cramer Hall, PSU, Room S-17, 8:00 P.M.)

Tuesday Nov. 19 Everyone attending the seminar is asked to bring four slides related to geology. Ruth Keene will give instructions at the meeting.

GSOC LIBRARY (Cramer Hall, Portland State University, Room S-7. Open 7:00 - 8:00 P.M. prior to evening meetings).

FIELD TRIP University of Oregon Museum of Natural History and Art Museum.

MEET: at Broadway entrance to Cramer Hall, Portland State University

TIME; 7:30 A.M.

LEADER: Dr. William Orr, University of Oregon
10:15 A.M. Dr. Orr will lead a tour of the Museum of Natural History. Break for lunch about noon. A visit to the Art Museum in the afternoon.

NEW GSOC MEMBERS

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THE PREHISTORIC DOGS OF OREGON
BY
Robert L. Gamer

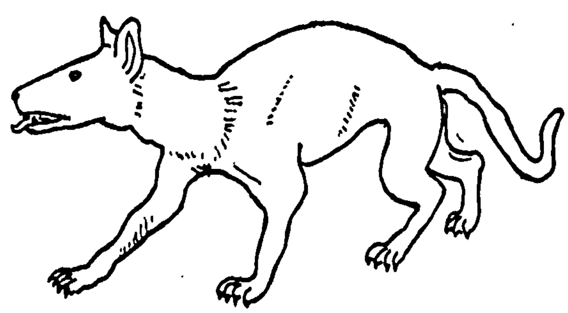
Fossils laid down in the rocks of Oregon over the past 25 million years reflect the evolution of the dog. These evolutionary changes are not as pronounced as those of some other Oregon animals such as the horse, the elephant, or the rhinoceras that occur within the same time frame. Nevertheless, they are significant. The principal change in the dog evolution is the increased size and convolutions of the brain. It shows how a simple, primitive meat-eating creature improved its life style over the years by developing into the intelligent, affectionate, loyal animal that the dog is today.

Miacid gracilis
Ancestor of dogs from the Eocene of Utah
Not an Oregon fossil.

About 38 to 40 million years ago the transition from the Eocene to Oligocene was marked by drastic climatic changes. The fossil record of Oregon shows the types of plants and animals also changed in adapting to a colder climate. The lower Clarno beds were laid down during a colder, more temperate climate. This cooling caused the extinction of some heat loving animals; others, adapted to the new environment, evolved into new species that could stand the cold. This was the time the canisters (dogs,wolves,ect.) first appeared in North America. Much later they moved into Asia and Europe.

Cynodictis is the oldest known Oregon canid. It was closely related to Hesperocyon, the ancestor of dogs. This line can be traced back to another older family, the Miacids. Indeed, except for some details of skull and limbs, Hesperocyon was not much different from the late Eocene animal, Miacid gracillis.

Cynodictis is found in the Turtle Cove member of the late Oligocene to the early Miocene age John Day Formation. Cynodictis had a long flexible body, short legs, five toes, retractable claws and canine teeth (used for stabbing its prey). It also had carnassal teeth. These consist of upper pre-molars and lower first molars, which are used to tear meat into shreds so that it could be easily swallowed. Cynodictis was about the size of a small fox. It was contemporary of the three-toed horse, Mesohippus. Cynodictis preyed on early mice, beavers, squirrels, birds and other small animals.



Cynodictis
From Oregon's Haystack Valley Member of the John Day Formation.

Mesocyon appears upon the Oregon scene next. Mesocyon was descended from

Cynodictis. It is found in the Turtle Cove and Bridge Creek members of the John Day Formation. The Bridge Creek member is located at the Painted Hills National Monument about 7 miles northwest of Mitchell. Mesocyon was about the size of a coyote but had a long body and short legs. Like all dogs it had a strong canine and carnassal teeth. Mesocyon was a ancestor of Cynoesmus. Cynodesmus is not found in Oregon.

After Mesocyon, Enhydrocyon is next on our genealogical list of Oregon dogs. Engydrocyon was descended from Cynodictis. It is found in the Turtle Cove and Haystack members of the John Day Formation. Haystack Valley is about 10 miles south of Madras in Jefferson County. Enhydrocyon has typical canine teeth. It was about the size of a coyote. It had a short face but a long cranium.

We come now to Leptocyon, a very important link in the evolution of the dog. Leptpcyon's ancestry goes back to Cynodictis. Leptocyon is not found in Oregon. However, it is found in nearby Utah, and, although it undoubtedly crossed state boundaries, Oregon cannot claim it as a state fossil because it was never found here. Leptocyon fossils occur in Oligocene and Miocene rocks. It was smaller than Mesocyon. Leptocyon is the ancestor of both the present day dogs (canis) and foxes (Vulpes). The Leptocyon line was small but it had great potentialities. Eventually, about 9 million years ago near the end of the Miocene, the descendants of Leptocyon began to diversity, and soon wolves, foxes, racoon dogs, bush dogs, African Hunting dogs, ect. appeared on the scene.

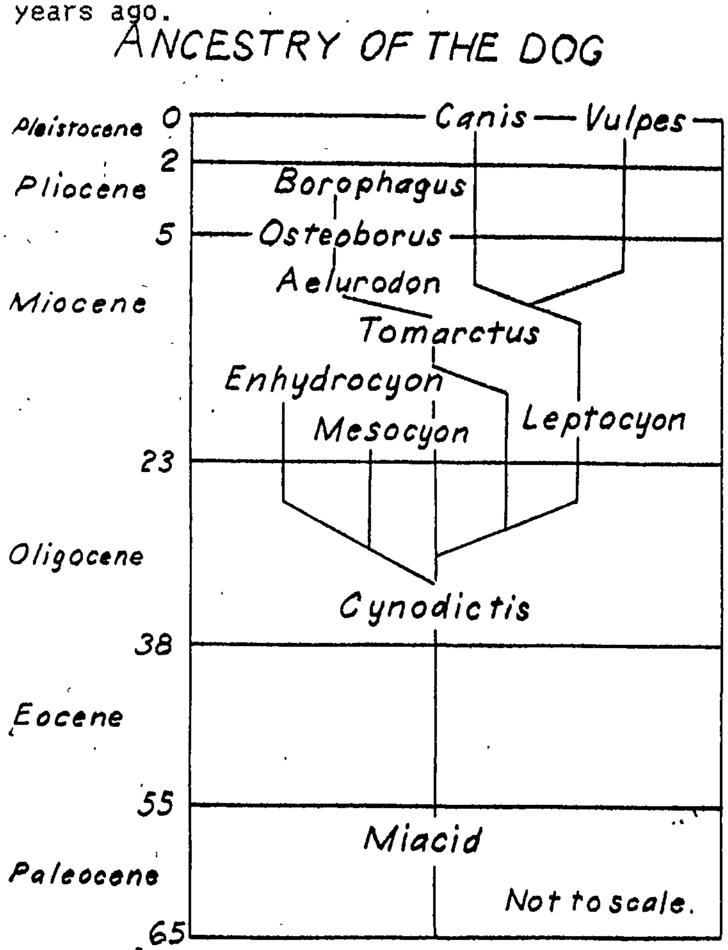
The dire wolf (Canis dirus) fossil occur in the Pleistocene deposits of Fossil Lake, about 10 miles northeast of Christmas Valley in northern Lake County. The dire wolf was the size of a timber wolf (about 55 inches long) but with a much heavier build. They had a large head, but a small brain case. It also had large shoulders and strong jaws and teeth. It traveled with packs that weren't afraid to attack a lion or bear. The dire wolf had weak legs and was not a good runner. Animals trapped in the tar pits of Rancho la Brea in Los Angeles especially tempted the dire wolf with an easy meal. In their lust for fresh meat they often got stuck in the tar themselves. Then they drowned and became fossils. Over 1646 dire wolf skeletons have been dug out of the tar pits.

Other more modern dogs fossils (wolves and foxes) have been found in Fossil Lake. The wolves include Canis lastes and Canis occidentlis; the foxes include Vulpes cascadensis.

While modern dogs were evolving from their ancestors, another line, the borophagines, showed up. These include heavy dogs with bone-crushing teeth. Sometimes they are called "bear dogs". "Bear Dogs" in Oregon begin with Tomarctus. Tomarctus probably descended from Cynodictis. Tomarvtus fossil are found in the Middle Miocene Mascall Formation at the old Schneider Ranch near John Day River and the town of Dayville. They are also found in the Red Basin beds of the Butte Creek Volcanic Sandstone of Middle Miocene age near Juntura. Some species of Tomarctus were as large as a grizzly bear and probably every bit as ferocious.

Aelurodon followed Tomarctus in the list of Oregon dogs. They were located about 3 miles north of The Dalles in Wasco County where Chenoweth Creek leaves its canyon and enters the Columbia River Valley. This place is a fossil plant locality. Aelurodon bones are also found at Juntura, Mascall and Troutdale fossil localities. Aelurodon was reasonably large (about the size of a timber wolf). It had feet, body and limbs similar to those of the wolf. It skull was short and massive. It ancestor was probably Hyaenohyathus (another Oregon dog fossil but not reported here). Some authorities think Aelurodon was the ancestor of Osteoborus.

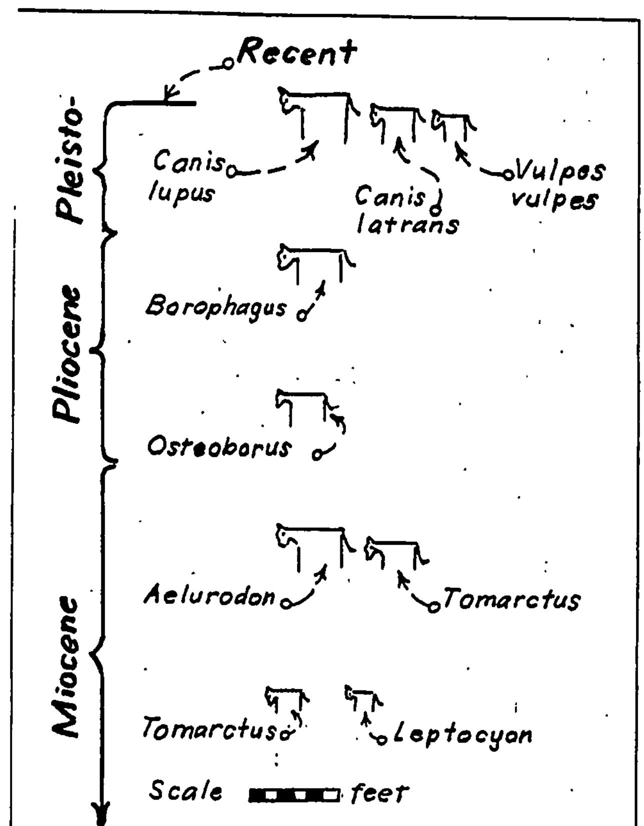
Osteoborus descended from Tomarctus, probably through Aelurodon. Osteoborus fossil are found in the Rattlesnake Formation south of Picture Gorge in Grant and Wheeler Counties. It is also found in the Drinkwater fauna of Drewsey Formation 5 miles south of Drewsey and in the McKay reservoir a few miles south of Pendleton in Umatilla County. Osteoborus was a hyena-like scavenger. It had a bulbous forehead and strong jaws. Osteoborus lasted into the Pliocene about 5.5 million years ago.



Borophagus descended from Osteoborus. Borophagus bones are found in the Black Butte fauna of Juntura Formation of late Miocene age about 4 miles southwest of Juntura in Malheur County. It is also found in beds of Pliocene Age near Hagerman, Idaho. Borophagus is a bit larger than a coyote but with short legs. It had strong jaws and bone-crushing teeth. It also had a swollen, rounded forehead. Borophagus was the last of its kind. With its demise the borophagines became extinct.

Oregon fossils of Amphicyon are found in the Rattlesnake Formation of Mio-Pliocene age and the Mascall Formation of Middle Miocene age. There is considerable controversy surrounding Amphicyon. Experts are divided into two opposing schools of thought about this animal. The literature on the species Amphicyon is confusing. Consequently, we will report on the genera amphicyonine rather than the species Amphicyon. Some of the amphiconines were the largest carnivores in Mascall time. They more closely resemble a bear in appearance than a dog. Their legs are comparatively short. They had massive bodies and long tails. They had five toes. The amphicyonines were simply large. They over-shadowed the true wolves in Miocene and drove them from the Great Plains of Nebraska; but the wolves returned during the Pliocene. The amphicyonines belong to the same group as the African Hunting Dog (Lycon) and the Bush Dog (Icticyon) of Brazil.

Between 37 and 38 million years ago dogs lived only in North America. They crossed the Bering land bridge into Asia and Europe at various times during the Miocene, Pliocene, and Pleistocene Periods. Thus, the dogs of Europe and Asia are emigrants from Oregon. Conversely, they were also immigrants into Oregon.



Comparative body sizes of borophagine dogs of Oregon.

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LITTLE BUTTE VOLCANIC SERIES

by

Rosemary Kenney

Little Butte Volcanic Series includes all, or parts of the Pre-Butte Creek Lavas, Mehama Volcano (or Eagle Creek Formation), Breitenbush Series, Butte Creek Beds, and Molalla Formation.

Materials that compose the Little Butte Volcanic Series were erupted from several vents in the foothills of the Western Cascade Range. Lava flows and pyroclastic debris were deposited on land, also carried westward and deposited in a marine environment adjacent to the erupting volcanoes. The volcanic flows and tuffs have been dated from late Eocene to Pliocene. The best exposures extend from Molalla south to Scotts Mills and from Silverton west to Marquam.

The Little Butte Volcanics range from 3000 to 15,000 feet thick and contain a variety of flows and tuffs. Five floral zones can be recognized, ranging from middle Oligocene through early Miocene. All Little Butte flora, except the early Collawash, indicate a sub-tropical climate.

In the Pre-Butte Creek Lavas, the oldest formation, is a lava series covering an extensive area northwest of Wilhoit and the ridges along the Molalla River. The lava is predominately platy porphyritic andesite. In these lavas, the mafic minerals have altered to chlorite. Amygdules of calcite, epidote, and zeolites are common in the vesicular phases. The entire thickness of the series is not known but approximately 1500 feet are exposed and the thickness increases to the southeast. To the west, the lavas are unconformably overlain by marine sandstones and tuffs of the Oliogcene or lower Miocene Age.

Butte Creek Beds rest conformably on the Pre-Butte Creek lavas, are approximately 1200 feet thick, cover an extensive area southeast of Marquam and are exposed along Butte Creek and Abique Creeks. The Beds are composed of well-bedded tuffaceous marine sandstone which intervals with terrestrial sediments ranging from conglomerated to fine-granted tuffs and ash. The volcanic rocks were deposited in or at the edge of a marine embayment.Near the edge of the basin, the sedimentary materials were occasionally overrun by lava flows and volcanic debris. At other times they were deposited upon those volcanic materials. The shore line of the sea shifted back and forth many times. Marine beds containing shells were laid down over plant remains, possibly from a Miocene Astoria seaway which entered the Willamette area from the north.

After the sea withdrew for the last time from the Molalla area, due to the uplift of the land and folding of the strata, stream erosion carved valleys in the Butte Creek Beds and older rocks. In the Middle Miocene, lava oozed up through weak places and filled the valleys; forming a solid blanket of basalt over everything except the highest features. Nearly every outcrop in the hills between Wilhoit and Scotts Mills location contains fossiliferous sandstone. Most of the shells are crushed and flattened, forming beds 9 feet thick in places. They have been determined as lower Miocene in age. Thin coal beds and carbonaceous shales are numerous. Block jointing is developed in the massive sandstone and spheroidal weathering is common. Several wells that penetrate the marine tuff and sandstone beneath the valley plane have been drilled deeper that 400 feet and all have produced salty water.

Stayton Lavas unconformities overlie the Butte Creek Beds. They are Oligocene or lower Miocene Age, and are composed mainly of dark gray to black aphanitic or finely porphyritic basalts. The lavas poured out on an erosional surface and vary in thickness from 200 to 400 feet in the Waldo Hills to 700 feet along Abique and Butte Creek.

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Utah Geological Association Newsletter, September 1991 contained an article by David D. Gillette, State Paleontologist of Utah titled HIGH TECH, LOW TECH, AND ALL THE NEWS THAT'S FIT TO PRINT ON SAUROPOD DINOSAURS.

Experiments using ground based remote sensing at the type locality of the supergiant sauropod Siesmosaurus in New Mexico include ground-penetrating radar, proton free precession magnetometry, scintillation counting, and acoustic diffraction tomography. The techniques are prototypes developed by Los Alamos, Sandia and Oak Ridge National Laboratories designed to improve shallow resolution of buried bones, archaeological features, and hazardous waste products in landfills.

Peripheral studies on the chemistry of preservation of bones of Seismosaurus and other dinosaurs indicate preservation of original bone including residual concentrations of organic molecules (bone proteins) and nearly perfect preservation of hydroxyapatite (a mineral group of apatite). Preservation does not involve " molecule by molecule replacement" as popularly conceived, but instead occurs through a process of sealing the bones from diagentic alteration, perhaps by the introduction of flourine in ground water.

The Seismosarurus excavation commenced in 1985. To date, approximately half the skeleton has been recovered. The projected length for the relative of Diplodocus and Apatosaurus is 140 feet.

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The Editor needs articles for the Newsletter. How about it, GSOC ?

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DEC 91

THE GEOLOGICAL NEWSLETTER

GSOC

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ACTIVITIES

ANNUAL EVENTS: President's campout-summer. Picnic-August. Banquet-March. Annual Meeting-February.
FIELD TRIPS: Usually one per month, via private car, caravan or chartered bus.
GEOLOGY SEMINARS: Third Wednesday, except June, July, August, 8:00 p.m. Room S17 in Cramer Hall, PSU. LIBRARY: Room S7, open 7:30 p.m. prior to evening meetings.
PROGRAMS: Evenings: Second and fourth Fridays each month, 8:00 p.m. Room 371, Cramer Hall, Portland State University, SW Broadway at Mill Street, Portland, Oregon.
Luncheons: First and third Fridays each month, except on holidays, at noon, Standard Plaza Cafeteria, third floor, Room A, 1100 SW Sixth Avenue, Portland, Oregon.
MEMBERSHIP: Per year from January 1: Individual, $15.00, Family, $25.00, Junior (under 18), $6.00. Write or call Secretary for membership applications.
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VOLUME 57, NO. 12

CALENDAR OF ACTIVITIES FOR DECEMBER, 1991

FRIDAY NIGHT LECTURE (Cramer Hall, PSU, Room 371, 8:00 P.M.)

Dec. 13 "An environmental view of cyanide heap-leach mining". Speaker: Marc Liverman, Conservation Director - Portland Audubon Society.

Dec. 27 No lecture scheduled due to holiday season's activities.

FRIDAY LUNCHEON (Standard Plaza, 1100 SW 6th Avenue, Rooms A & B. Third Floor Cafeteria. Programs at 12:00 Noon).

Dec. 6 " Geology on Idaho Byways, Illustrated" by Virgil Scott, GSOC.

Dec. 20 "Engineering Geology at the Bonneville New Navigation Lock Site". Speaker: Jim Griffiths, Chief of Geology Section of the Army Corps of Engineers - Portland District.

GEOLOGY SEMINAR (Cramer Hall, PSU, Room S-17, 8:00 P.M.)

Tuesday Dec. 17 Everyone attending the seminar is asked to bring four slides related to geology. Ruth Keene will give instructions at the meeting.

GSOC LIBRARY (Cramer Hall, Portland State University, Room S-7. Open 7:00 - 8:00 P.M. prior to evening meetings).

FIELD TRIP

A field trip has not been scheduled for December due to the activities of the holiday season.

Future Field Trips being planned include:
- Ralph Mason--City Tour of Building Faces
- Yaquina Bay area with leader from Hatfield Marine Science Center
- Molalla-Estacada area in spring
- Bohemia Mining area

NEW MEMEBER

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Portland, OR 97201
Phone-227-6066

NOMINATIONS FOR 1992

The Nominating Committee, consisting of Clara Bartholomay (Chairperson)Margaret Steere, Lois Sato, Gale Rankin and Catherine Evenson presents the following nominees for the offices indicated. All have agreed to serve if elected.

President:	Evelyn Pratt
President Elect:	Esther A. Kennedy
Secretary:	Shirley O'Dell
Treasurer:	Archie Strong
Director (3 years):	Donald Botteron

Other nominations may be made from the members of the Society by filing with the Secretary on or before the 10th day of December, 1991. Such nominations must be accompanied by the signatures of ten members of the Society.

Ballots will be enclosed with this December Newsletter and should be returned to the Secretary before the January 10, 1992 general meeting. Where there are two voting members in a family a separate ballot will be mail early in December, 1991.

State's Plant Species Affected by Variety of Geologic History

by
Stuart Garrett, M.D.
Native Plant Society of Oregon
(High Desert Chapter)

Many Oregonians take our native plant species for granted. They assume that our plant communities have always existed as they currently do and always will. However, on a geologic time scale the distribution of vegetation and the types of plants will vary greatly. In Oregon, geologic factors have played a major role in these changes. Some of these changes were gradual while others were cataclysmic.

A partial listing of these geologic occurrences over the last 150 million years in Oregon(which includes the time-span for the evolution of flowering plants) would include:
--The erosion and formation of major mountain ranges such as the Cascades.
--The extensive eruption of the Columbia River Flood Basalts.
--The astonishing Bretz Floods through the Columbia River Gorge.
--Glacial advance and retreat over the Cascades and other areas.
--The rafting and attachment of foreign parts of the earth's crust to the coast.
--Volcanic eruption such as Mount Mazama.
--The formations of vast inland seas.
--Extension and faulting of southeastern Oregon in the Basin and Range Province.
--Erosion of unusual rocks which left behind atypical soils.

All of these occurrences have left a legacy of modern plants which are struggling to adapt to a new environment. New species are evolving to meet the changing conditions while older species are disappearing because they can not longer survive the changing environment. Let us examine some specifics.

The most obvious effect of Oregon's geology on its plant geography is the division of the state into "wet" and "dry" sides by the Cascade Range. This geologically recent botanical division has important economic and cultural consequences for all Oregonians. Changes in climate and rainfall are responsible for Oregon's most famous endemic plant--the Redwood.

An endemic plant is a plant that is restricted to a particular geographic locality. Once found over much of the state in warmer and moister times, it is now limited to a narrow strip along Oregon's southern coast.

Just inland from this area is an accumulation of serpentine soils in the Klamath Mountain. This area supports Oregon's largest collection of rare plants. Plants growing in these soils have adapted to high level of metals such as iron and magnesium found in them. Species such as Koekler's rockcress, racemed goldenweed, Howell's mariposa lily, Vollmer's lily, Purdy's levisia, Western bog aster and others are not found elsewhere in the state.

Further to the east in Southern Oregon we enter the Basin and Range Province. Extension of the earth's crust for the last 17 million years has created unusual habitats for plants. Oregon's only true biologic deserts are found here. They harbor Mormon tea greasewood, salt brush, and other plants able to tolerate the alkaline conditions of southeastern Oregon's deserts.

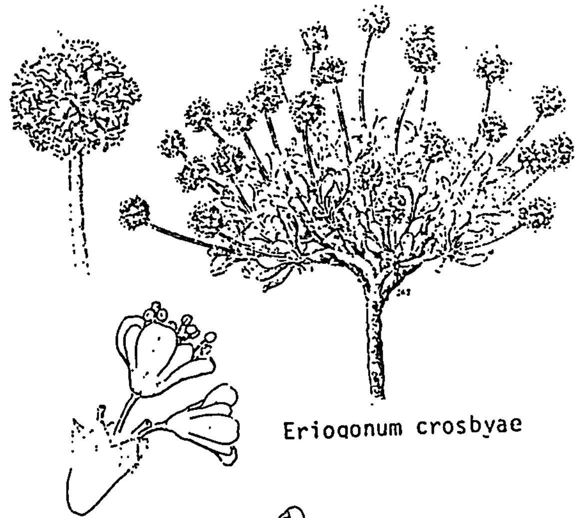
The low level elevation non-desert areas here support Crosby's buckwheat, Cusick's lupine, Columbia cress, and Cusick's buckwheat. In the high mountains are found relict populations of plants that remain after the retreat of the glaciers. These include Steen's Mountain paintbrush, golden buckwheat, and Steen's Mountain thistle.

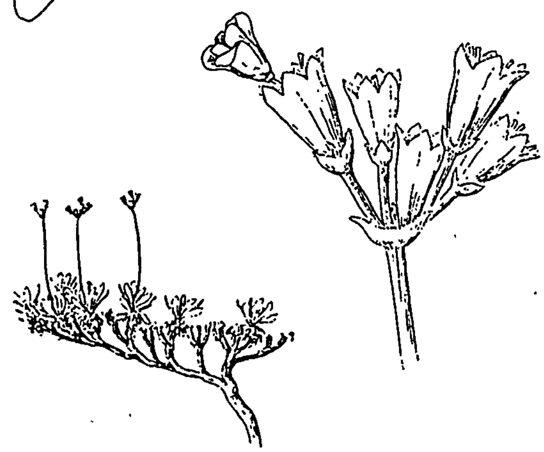
In far southeastern Oregon lie the Qwhyee Uplands. Areas such as Leslie Gulch show the remnants of this area's violent geologic past. The tuffaceous and rhyolitic rocks and soil in this area harbor Packard's mentzelia and grimy ivesia, whose range includes adjacent Idaho.

The Blue Mountains are home to a variety of older marine rocks which are remnants of the oceans that once covered Oregon. In the Wallowas we find fraternal paintbrush, Greenman's lomatiun, and dwarf golden-daisy which are only found in north-eastern Oregon.

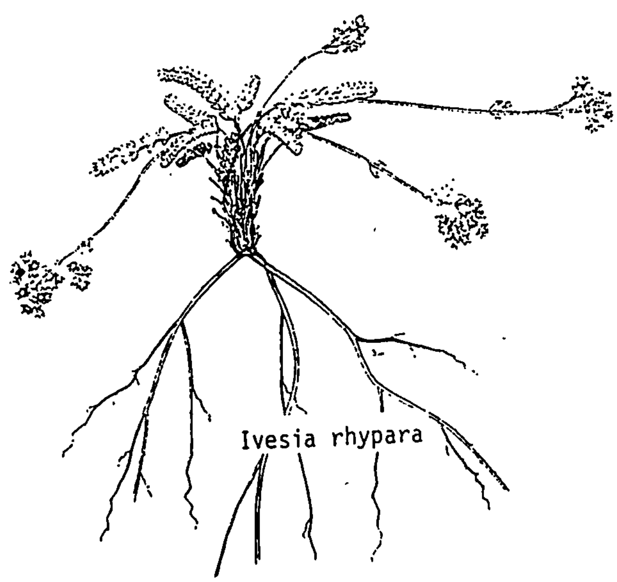
The John Day Valley volcanics are home to three endemic plants. The volcanic ash in this area grows yellowhaired paintbrush, John Day chaenactis and John Day cinquefoil.

The vast eruptions of the Columbia River basalts which flooded eastern Oregon and eastern Washington in Miocene times now cover northeast Oregon with thousands of feet of lava. Their erosion can leave a characteristic biscuit- scabland topography which is home to the Tygh Valley locoweed,

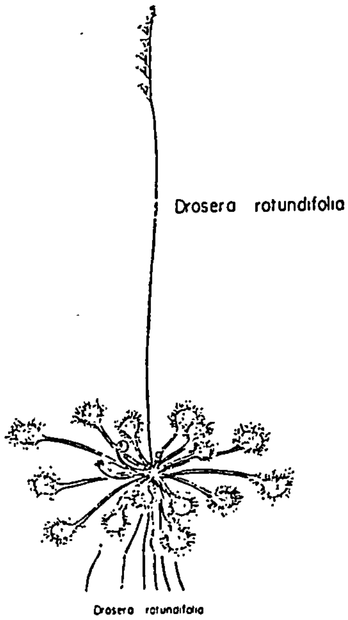


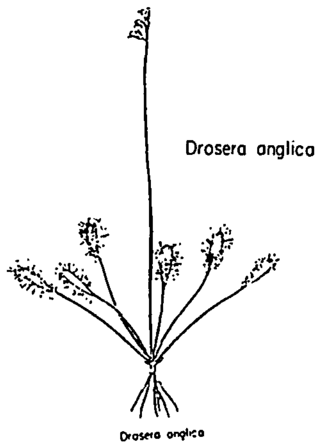


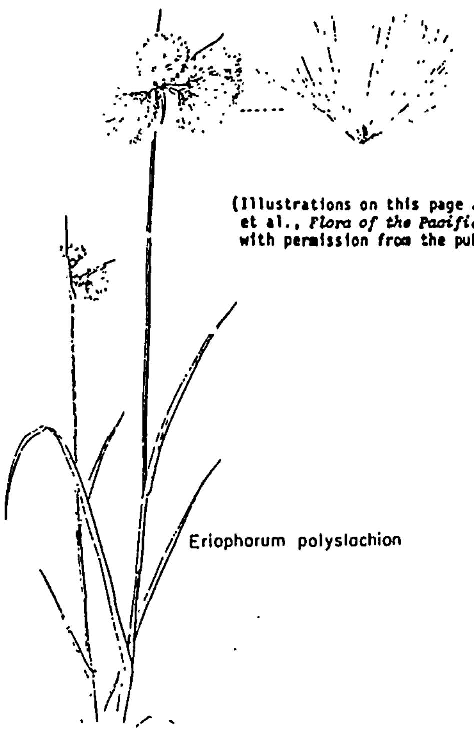
E. cusickii



(Illustrations from Threatened and Endangered Vascular Plants of Oregon: An Illustrated Guide.)







(Illustrations on this page are from Hitchcock et al., *Flora of the Pacific Northwest*; used with permission from the publisher.)

obscure buttercup and umbellate spring beauty.

The Columbia River Gorge is the only sea-level passage through the Cascades. Both northern and southern species reach their limits here. Some plants are left from the retreat of the Ice Age and the only other place they are found is on alpine peaks. Some plants are found only in the Gorge. Barrett's penstemon, Howell's bentgrass, gorge daisy, and long-bearded hawkweed belong in this category.

The eruption of such volcanoes as Mount Mazama, South Sister, and Newberry Crater has mantled Central Oregon with pumice. Peck's penstemon, Oregon moonwort, Crater Lake rockcress and Mount Mazama collomia are found in this region and nowhere else in the world.

The retreat of the glaciers in the Cascade Range has left a series of bogs which contain remnants of a now more northerly biota. Arctic birch and cottongrass are some examples.

Changes in sea level on the coast have left boggy areas which support not only the rhodendron and Sitka spruce but also insect-eating sundew and the rare carnivorous pitcher plant.

The alpine areas of the high Cascade peaks in recent geologic times have seen the retreat of the glaciers and now support sparse vegetation. Plants limited to these sometimes soil-less areas include the silvery raillardella, Cascade aster, Cascade smelowskia and golden alpine draba.

The relationship of Oregon's geology to its native plant life is not always obvious. It is, however, very important to our everyday lives and is fascinating in its complexity.

This article was published in the April 16, 1987 issue of the Oregonian and in the Native Plant Society of Oregon Newsletter.

(Editor's note regarding the above article: the pictures of plants shown are botanical names. Some plants have local common names. Listed below are both--botanical and common names.

Eriogonium crosbyae	Crosby's buckwheat
Eriogonium Cusickii	Cusick's buckwheat
Ivesia rhypapa	Grimy ivesia
Drosera rotundifolia	Rounf-leaved sundew
Drosera anglica	Long-leaved sundew
Eriophorum polystachion--Cotton-grass	

THE BONNEVILLE FLOOD WAS LARGER THAN WE THOUGHT

by

John H. Whitmer, M.D.

The effects of the Lake Missoula Floods are so wide spread and so prominent that it is easy to forget that an entirely different catastrophic flood entered the Oregon Country about 15,000 years ago. That was the Lake Bonneville Flood, which began when the level of that Pleistocene lake reached Red Rock Pass between Logan, Utah and Pocatello, Idaho. Rock units in the pass could not withstand the flow of a new stream flowing across them; they yielded to catastrophic erosion, unleashing a flood that lowered the level of Lake Bonneville 108 meters (345 feet), releasing 4,700 cubic kilometers (1128 cubic miles) in somewhat more than 8 weeks. Geologic mapping between 1979 and 1983 revealed previously unrecognized features of this flood in the Bruneau Canyon of the Snake River, near Mountain Home, Idaho. Scabland on a bench 133 meters (436 feet) above the River showed that the flood waters attained at least that depth there. Measurements at that site and at several nearby sites enabled geologists to compute the maximum flood discharge rate of the Bonneville Flood at 935,000 cubic meters per second (33,014,850 cubic feet per second). This ranks the Bonneville Flood as the second largest known flood anywhere in the world, exceeding only by the Lake Missoula Flood in peak flow rate. The largest known historic floods (Amazon River, 1953 at 385,000 cubic meters per second; Mississippi River, 1927 at 70,010 cubic meters per second) failed to approach either the size or the duration of the Bonneville Flood (1).

1. Jarrett, RD; Malde, HE; 1987; Paleodischarge of the late Pleistocene Bonneville Flood, Snake River, Idaho, computed from new evidence. GEOLOGICAL SOCIETY OF AMERICA BULLETIN 99:127-134.

FROM EVELYN PRATT

A TRIP DOWN MEMORY LANE: HIGHWAY 101

For the 1992 President's Field Trip, I am proposing we go from Long Beach to Cape Mendocino in early September. As familiar as many of you are with parts of the coast, with your help I should be able to put together an outstanding trip for us all. Please take a few minutes to give whatever information you can on:

AREA	"MY GEOLOGICAL SITE"	CONTACT PERSON/PLACE	RAINY-DAY ACTIVITY	GOOD PLACE TO EAT	GOOD PLACE TO STAY
PORTLAND TO LONG BEACH, SEASIDE					
SEASIDE TO NEWPORT					
NEWPORT TO FLORENCE					
FLORENCE TO BANDON					
BANDON TO BROOKINGS					

ATLAS OF THE WORLD

An <u>Atlas of the World</u> with geophysical boundaries, showing oceans, continents, and tectonic plates in their entirety, is available from the <u>American Philosophical Society</u>. This atlas includes 29 color maps and many black and white versions showing continental shorelines as natural boundaries, composite maps with continental shorelines as natural boundaries and tectonic plate margins as natural boundaries.

This work began in 1942 when Athelstan Spillaus devised the first map that presented a projection of the world showing the ocean in its entirety, uncut by the ocean to see the land, Spilhaus cut the land to see the ocean. The <u>Atlas of the World</u> uses the same type of projection of the land masses through geological time.

For more information, contact the American Philosophical Society, P.O. Box 40098, Philadelphia, PA, 19106. Copies of the <u>Atlas of the World</u> are available for $30:00.

MELVIN S. ASHWILL, GSOC RECEIVED THE HAROLD L. STIMPLE AWARD

Melvin S. Ashwill was awarded the Harold L. Stimple Award as the <u>NATIONAL AMATEUR PALEONTOLOGIST OF THE YEAR</u>. The Award was presented to him on October 22, 1991 at the meeting of the Paleontological Society. Melvin has been a GSOC for a number of years. He lives in Madras, Oregon. He has taken the GSOCs on a number of trips both fossil and geologic. Mel has his own museum with fossils specimens of all ages represented in Oregon. Along with his fossil collecting and writing, he finds time to take school children on fossil trips. One of his excellent articles will appear in the January and February issues of THE GEOLOGICAL NEWSLETTER. The Society extends congratulations to Melvin Ashwill on his AWARD.

Don Barr

BROOKINGS TO CAPE MENDOCINO					
BROOKINGS, CRESCENT CITY, GRANTS PASS					
SISKIYOU MTS. & NAT'l FOREST					
OTHER					

COMMENTS:

NAME: ____________________

TELEPHONE: ____________________

GOOD TIME TO CALL: ____________________

<u>PLEASE RETURN BY JANUARY 1 TO CLAY KELLEHER OR ME AT FRIDAY MEETINGS OR MAIL TO EVEYLN PRATT, 2971 SW CANTERBURY, PORTLAND, OR 97201.</u>