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Main Office: 1005 State Office Building, Portland 97201, phone (503) 229-5580.

Baker Field Office: 2033 First Street, Baker 97814, phone (503) 523-3133.
Howard C. Brooks, Resident Geologist

Grants Pass Field Office: 312 S.E. "H" Street, Grants Pass 97526, phone (503) 476-2496.
Len Ramp, Resident Geologist

Mined Land Reclamation Program: 1129 S.E. Santiam Road, Albany 97321, phone (503) 967-2039.
Paul F. Lawson, Supervisor

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COVER PHOTO

Oblique aerial photograph, looking to the northwest, of the area around Mitchell, north-central Oregon. Cretaceous rocks found here and further to the south and east are discussed in the article beginning on the next page. (Copyrighted photograph courtesy Delano Photographics, Inc.)

DOGAMI releases new publications on Breitenbush Hot Springs and rotation of the Western Cascades of Oregon

The Oregon Department of Geology and Mineral Industries (DOGAMI) announces the release of two new publications: Special Paper 9, *Geology of the Breitenbush Hot Springs Quadrangle, Oregon*, by Craig White of Boise State University, and Special Paper 10, *Tectonic Rotation of the Oregon Western Cascades*, by James Magill and Allan Cox of Stanford University.

The Breitenbush Hot Springs area, the subject of Special Paper 9, is a region of recognized high geothermal potential that is currently undergoing cooperative investigation by DOGAMI, private utilities, and industry. The geologic map and 26-page explanatory text of Special Paper 9 will assist in the overall assessment of the resource.

The 67-page Special Paper 10 summarizes current paleomagnetic research in the Western Cascades. Geologists believe that large blocks of the earth's crust have moved in relation to each other. The boundaries between these blocks—or plates—may be regions of significant mineralization and high geothermal potential. The authors of Special Paper 10 postulate that western Oregon and Washington from the Klamath Mountains northward have been affected by plate tectonic motion during the last 50 million years. The movement occurred in two stages, with net clockwise rotation in both stages. Owing to the opening of the Basin and Range, movement in the last 20 million years has produced a net eastward displacement of the Coast Range and Western Cascades block. The eastern boundary of this block may lie beneath the High Cascades, a region of intense volcanism.

The price of Special Paper 9 is $4.00, that of Special Paper 10 is $3.00. Address orders to the Oregon Department of Geology and Mineral Industries, 1005 State Office Building, Portland, Oregon 97201. Payment must accompany orders of less than $20.00. □

CONTENTS

A major Cretaceous discontinuity in north-central Oregon

by Greg Wheeler, Geology Department, California State University, Sacramento, California 95819

ABSTRACT

The Cretaceous rocks of north-central Oregon are texturally and compositionally diverse. The Cretaceous rocks found farther to the east are less mature and do not contain the granite and greenstone clasts found in Cretaceous conglomerates near Mitchell, Oregon. The Cretaceous rocks are divided by a major unconformity between the Upper Cretaceous (Turonian) rocks exposed in the eastern outcrop area and the Lower Cretaceous rocks at Mitchell.

DESCRIPTION OF ROCKS

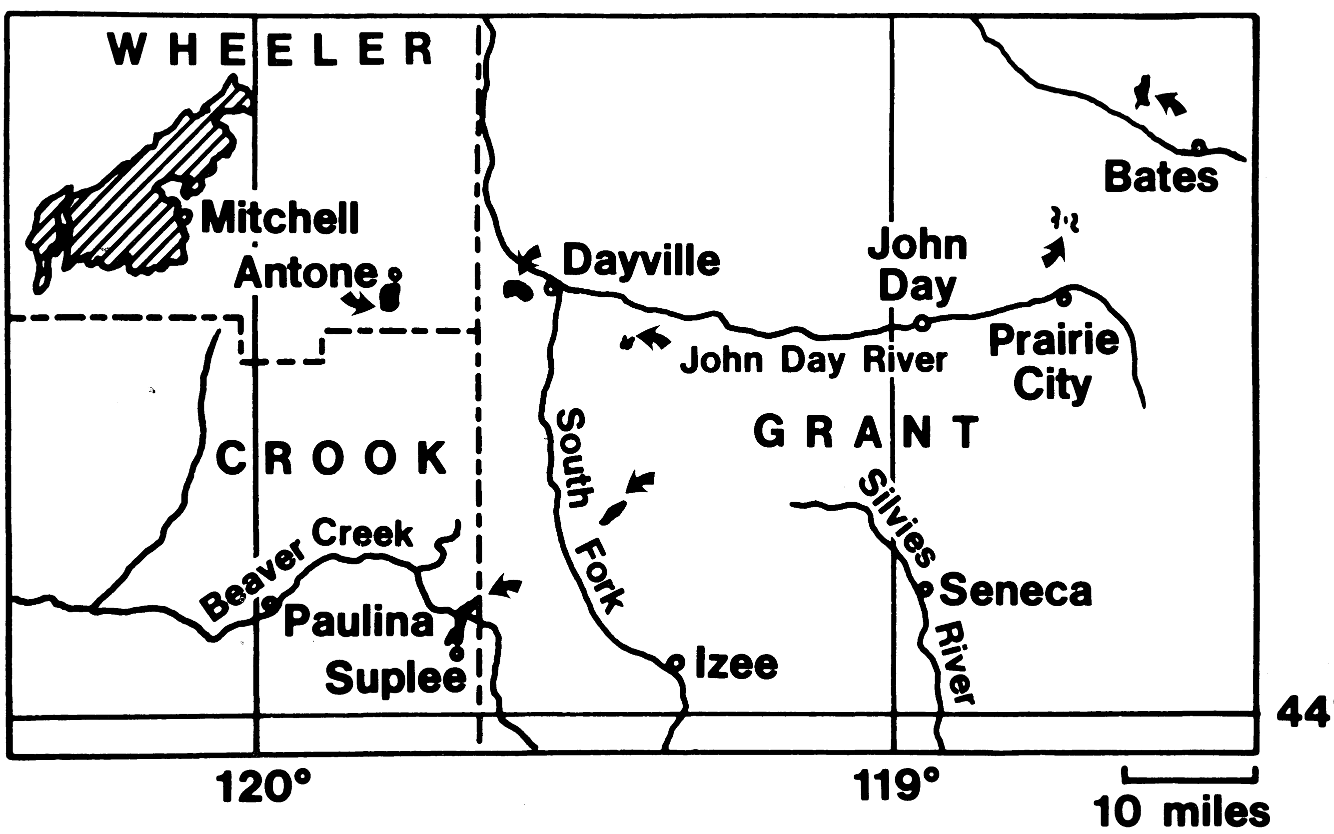
Numerous outcrops of Cretaceous rocks in north-central Oregon have been described by Packard, 1928; Popenoe and others, 1960; Wilkinson and Oles, 1968; Oles and Enlows, 1971; Dickinson and others, 1976; Wheeler, 1976; Mullen, 1978. Exposures of these rocks generally encompass only 2 to 10 km²; however, Cretaceous rocks covering 125 km² crop out in the Mitchell quadrangle near Mitchell, Oregon (Figure 1).

The Cretaceous rocks in the Mitchell quadrangle are exposed in the core of the Mitchell anticline. The rocks are divided into two main map units on the basis of lithology. The shale lithology is named the Hudspeth Formation (Figure 2), and the intertonguing conglomerate unit is named the Gable Creek Formation (Wilkinson and Oles, 1968, p. 133) (Figure 3). The Gable Creek Formation is described by Oles and Enlows (1971, p. 11) as containing clasts that are "rounded to subrounded, ranging in size from small pebbles to boulders," most commonly including "chert, quartzite, and granitic rocks," and minor amounts of "vein quartz, phyllite, greenstone, mafic volcanics, and sandstone." The cementing agent is calcite.

Cretaceous beds at Antone, Dayville, and north of Suplee in the Dayville quadrangle; north of Deer Creek in the Izee quadrangle; and along Dixie and Windlass Creeks in the Bates quadrangle are lithologically distinct from those further west at Mitchell. The most abundant rock type is sharpstone conglomerate with clasts 1 to 4 cm in size and a fine-grained groundmass. Medium- to fine-grained sandstone makes up 30 percent of the unit and shale and breccia less than 5 percent each. A typical hand specimen of sharpstone conglomerate contains 50 percent chert. The abundance of chert produces a rough, knobby surface, with clasts 2 to 4 cm in diameter protruding from a surface of less resistant groundmass and shale clasts. Red chert is the most angular type but is less common than grey, brown, and buff chert clasts, which are more rounded and usually larger.

Quartz, mostly as clear, rounded individual grains, makes up 25 percent of the rock. Some quartz grains are 0.5 mm in diameter, but most are somewhat smaller. The clarity and size of these quartz grains indicate a coarse-grained plutonic or

Figure 1. Index map of north-central Oregon showing location of Cretaceous outcrops. Lined pattern represents Lower Cretaceous (Albian-Cenomanian) rock outcrops. Arrows point to solid black areas that represent Upper Cretaceous (Turonian) rock outcrops.



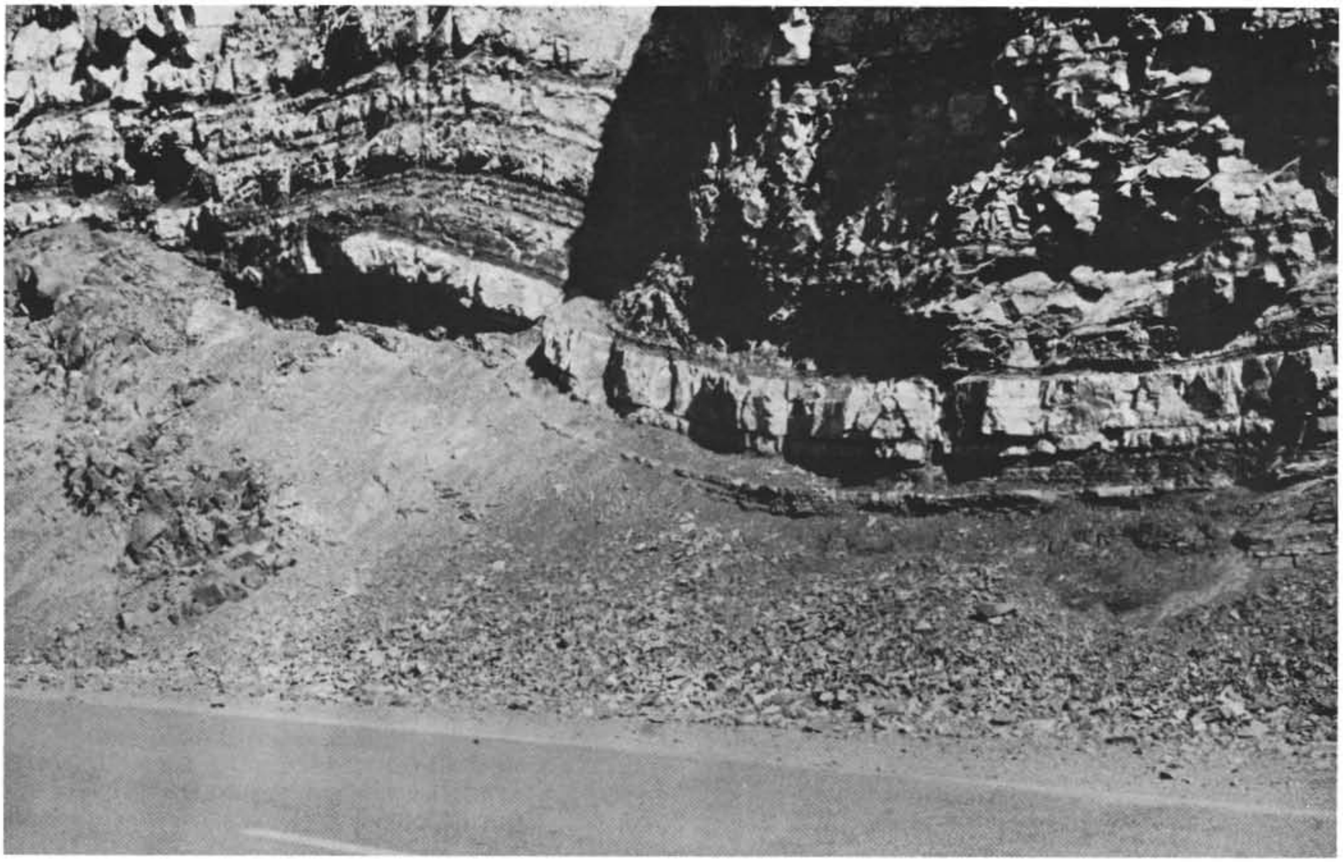


Figure 2. Fault offset in bedded shale and sandstone of Hudspeth Formation just east of Ochoco Summit on U.S. Highway 26.

vein source. A few quartz crystals have resorbed margins and remnant bipyramidal shape indicative of volcanic quartz. Quartzite clasts present in some thin sections indicate that a sedimentary source also donated quartz to the depositional basin. The remaining 20 to 25 percent of the sharpstone conglomerate is made up of fine-grained sand and siltstone clasts. The siltstone clasts, which have indistinct boundaries with the sandy matrix, appear to be "rip-up" clasts from the finer-grained beds. Greenstone clasts are present but are quite rare in most outcrops.

The finer grains have essentially the same composition as the coarser material, except that the quartz content increases relative to chert as grain size decreases. The roundness of the quartz decreases, and the sphericity increases in the finest grained sediment.

As the sharpstone conglomerate grades into breccia, the amount of sandy matrix decreases. Some parts of the rock are calcareous, but calcite is not a common cement either in the coarse or fine samples.

Graded bedding is common but usually indistinct. Most sharpstone conglomerate beds contain shale clasts in distinct layers a few centimeters thick. Cross-bedding is present in a few of the sandstone outcrops. The matrix is often stained with limonite.

The sharpstone conglomerate is well represented on the ridge east of Windlass Creek in secs. 26, 27, 34, and 35, T. 10 S., R. 34 E., northwest of Bates, Oregon. These rocks form prominent, chocolate-brown weathered outcrops enclosed in deep regolith. Freshly broken surfaces are yellow-brown.

In contrast to the Cretaceous rocks of the Mitchell area, rocks in the areas farther to the east contain no granitic and only a few greenstone clasts. Much less chert is found in the Gable Creek Formation than in conglomerates to the east. The presence of shale clasts, angularity of all clasts, and poor sorting indicate that the Cretaceous rocks in the Dayville, Izee, and Bates quadrangles are texturally less mature than the western rocks. The compositional and textural differences of the eastern Cretaceous rocks may be partly due to their proximity to pre-Tertiary rocks in the Blue Mountain uplift that may be the common source of north-central Oregon Cretaceous rocks (Wheeler, 1976, p. 31).

AGE OF ROCKS

The Hudspeth and Gable Creek Formations and Cretaceous rocks farther to the east rest unconformably on older rocks. The Bates rocks rest on a Jurassic-Cretaceous pluton. Those in the Dayville and Izee quadrangles overlie sedimentary and metasedimentary rocks which are Jurassic and older.

Fossils such as ammonites in the Hudspeth Formation and a few pelecypods in the upper Gable Creek Formation led Wilkinson and Oles (1968, p. 135, 136) to conclude that these rocks range from early to late Albian. Later, the age of these beds was extended to include the Cenomanian (Oles and Enlows, 1971, p. 11). The only other early Cretaceous beds in eastern Oregon are Albian in age; they contain *Tempskya* sp. fern and are located near Greenhorn, Oregon (Ash and Read, 1976).

Popenoe and others (1960, p. 1531-1532) consider the eastern Cretaceous rocks as Cenomanian or possibly lower Turonian, based on a "fairly large molluscan fauna." Although the molluscan species are generally considered Cenomanian, all but the subgenus *Pseudouhligella* are known in younger rocks. Fossils collected along Dixie Creek in the southern half of the Bates quadrangle by Mobley (1956) were identified by John Reeside as "Upper Cretaceous, probably Turonian, and equivalent in age to the Chico Formation of California" (Mobley, 1956, p. 39).

CONCLUSION

Peterson (1967) recognized an Upper Cretaceous stratigraphic discontinuity in northern California and southwestern Oregon. This unconformity, which is sub-Turonian in age, underlies the type Chico (Peterson, 1967, p. 567), and its existence beneath the rocks of Turonian or "Chico" age in north-central Oregon would explain the lithologic and age variations discussed. The Gable Creek and Hudspeth Formations are below the unconformity, while the Cretaceous rocks in the Bates quadrangle are clearly above. The Dayville and Izee quadrangle rocks are lithologically similar to those at Bates, and fossil evidence permits their placement above the sub-Turonian unconformity. The age assignment and lithology of conglomerates near Greenhorn indicate that these conglomerates represent rocks below the unconformity.

Figure 3. Gable Creek Formation, near Mitchell.(Oles and Enlows, 1971).

The broad regional extent of this discontinuity may be a result of the Coast Range Orogeny suggested by Irwin (1964). Recently developed plate tectonic models (Avé Lallemant and others, 1980) do not easily explain such a wide-spread unconformity. Whatever the origin, recognition of this major unconformity is essential in assembly of the Cretaceous history in Oregon.

ACKNOWLEDGMENTS

Part of the field work upon which this paper is based was supported by a Geological Society of America Penrose Grant in 1971 and 1973 and by the Oregon Department of Geology and Mineral Industries. The manuscript was critically reviewed by D. McGeary.

REFERENCES

Ash, S. R., and Read, C. B., 1976, North American species of *Tempskya* and their stratigraphic significance: U.S. Geological Survey Professional Paper 874, 42 p., 13 pl.

Avé Lallemant, H. G., Phelps, D. W., and Sutter, J. F., 1980, ^{40}Ar-^{39}Ar ages of some pre-Tertiary plutonic and metamorphic rocks of eastern Oregon and their geologic relationships: Geology, v. 8, p. 371-374.

Dickinson, W. R., Helmold, K. P., and Stein, J. A., 1976, Paleocurrent trends and petrologic variations in Mesozoic strata near South Fork of John Day River, central Oregon [abs.]: Geological Society of America, Abstracts with Programs, v. 8, no. 3, p. 368-369.

Irwin, W. P., 1964, Late Mesozoic orogenies in the ultramafic belts of northwestern California and southwestern Oregon: U.S. Geological Survey Professional Paper 501-C, p. C1-C9.

Mobley, B. J., 1956, Geology of the southwestern quarter of the Bates quadrangle, Oregon: Eugene, Oreg., Univeristy of Oregon master's thesis, 66 p.

Mullen, E. D., 1978, Geology of the Greenhorn Mountains, northeastern Oregon: Corvallis, Oreg., Oregon State University master's thesis, 372 p.

Oles, K. F., and Enlows, H. E., 1971, Bedrock geology of the Mitchell quadrangle, Wheeler County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 72, 62 p.

Packard, E. L., 1928, A new section of Paleozoic and Mesozoic rocks in central Oregon: American Journal of Science, 5th Ser., v. 15, p. 221-224.

Peterson, G. L., 1967, Upper Cretaceous stratigraphic discontinuity, northern California and Oregon: American Association of Petroleum Geologists Bulletin, v. 51, no. 4, p. 558-568.

Popenoe, W. P., Imlay, R. W., and Murphy, M. A., 1960, Correlation of the Cretaceous formations of the Pacific Coast (United States and northwestern Mexico): Geological Society of America Bulletin, v. 71, no. 10, p. 1491-1540.

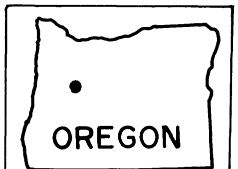
Wheeler, G. R., 1976, Geology of the Vinegar Hill area, Grant County, Oregon: Seattle, Wash., University of Washington doctoral dissertation, 94 p.

Wilkinson, W. D., and Oles, K. F., 1968, Stratigraphy and paleoenvironments of Cretaceous rocks, Mitchell quadrangle, Oregon: American Association of Petroleum Geologists Bulletin, v. 52, no. 1, p. 129-161. □

Geology and mineral deposits of the Quartzville mining district, Linn County, Oregon*

*by Steven R. Munts, Geologist, U.S. Bureau of Mines, E. 360 Third Avenue, Spokane, Washington 99202**

The Quartzville district, located in the Western Cascade Range, Linn County, Oregon, has produced an estimated $300,000 to $800,000 worth of metals, primarily gold and silver, since 1861. Production has occurred from both lode and placer deposits.



Location Map

Bed rock consists in part of the Tertiary Sardine Formation. This calc-alkaline suite is composed of a sequence of basalt, andesite, and dacite, overlain by intermediate to felsic interstratified flows and pyroclastic units. Also included are flows of dacite, rhyolite, and rhyodacite, as well as ash flow tuff and multilithic volcanic breccias. Together, these lithologies display multiple depositional cycles of basic to intermediate or intermediate to felsic rocks, each successive cycle more felsic than the last.

The only major fold in the area is the Sardine Syncline. Local steep dips of beds near small plugs and arcuate faults are interpreted to be related to subvolcanic magmatism and subsidence, respectively. Local unconformities are present.

Felsic plutons of probable Miocene age intrude the volcanic pile. The more than ten small plugs present consist of diorite, quartz diorite, granodiorite, quartz monzonite, and felsic aplite. The most felsic plugs occur in the most intensely mineralized central portion of the district.

The Quartzville district appears to be on the eastern edge of a volcanic complex. Evidence includes (1) variations in thicknesses of regional lava and pyroclastic flows, (2) flow directions, and (3) clast-size gradations in pyroclastic deposits. Flow lithology, dikes terminating in flows, plutonic rocks, mafic plugs, dike swarms, ignimbrites, vitrophyre dikes, tuff dikes terminating in ash flow deposits, diorite sills, and arcuate structures are other volcanic-plutonic features.

Vein-type mineralization is widespread primarily in the volcanic rocks, although plutonic dikes often parallel veins or form one wall of a vein. Gold has been the most valuable metal produced to date; veins also contain copper, lead, and zinc sulfides at depth. Associated gangue minerals include quartz, calcite, barite, stibnite, and pyrite. The veins display two prominent trends, N. 20° W. and N. 45° W. The most intense mineralization occurs sporadically above the most silicic plutonic rocks, near to silicic volcanic rocks, and near the most intense alteration.

At least two tourmaline breccia pipes and three tabular tourmaline breccia zones formed contemporaneously with vein mineralization. The pipes are ellipsoidal to circular in shape and vary in size from 2 to 30 m (7 to 100 ft) in diameter. The clasts display varied volcanic and plutonic lithologies with varied types of alteration. Breccia zone clasts are derived from local country rock. Country rock and some clasts may be partly or completely replaced by a tourmaline-silica ± sericite-pyrite assemblage. An admixture of quartz ± clay, tourmaline, and pyrite cements the breccias. The large pipe grades upward into a shatter breccia of highly fractured rock with minor displacement, and both pipes are interpreted to have formed by solution collapse.

Propylitic alteration is widespread throughout the district in both volcanic and plutonic lithologies. Argillic and quartz-sericite alteration locally occurs as concentric zones in the Dry Gulch area. Here, too, both volcanic and plutonic lithologies are affected.

Zonation is also evident in volcanic and plutonic lithologies, gangue minerals, and laterally zoned ore minerals. Abundances of trace elements in volcanic and plutonic host rocks indicate a distinct zonation of base metals. Precious metals also appear to be zoned. Anomalously high concentrations of lead, zinc, and copper occur progressively inward toward Dry Gulch. Anomalous molybdenum occurs interior to some copper anomalies and near several gold anomalies. This zonation is crudely centered upon the phyllic alteration zone.

Hydrothermal alteration and mineralization of the district are related to the plutonic-volcanic complex. Evidence includes the close association of all Western Cascades mineral districts with felsic intrusives, chemical and mineral (ore and gangue) zonation within the districts, proximity to felsic vent volcanic rocks, and structural features related to these intrusions. Geologic and geochemical evidence implies that only the higher levels of the hydrothermal system are exposed. Evidence includes alteration patterns, breccia pipes and dikes, and mineral (ore and gangue) and trace element zonation. Implied is the possible existence of porphyry-type mineralization at depth, with a possible near-surface limonite-precious metal oxide cap. ☐

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* This article summarizes work done for a University of Oregon master's thesis entitled "Geology and Mineral Deposits of the Quartzville Mining District, Linn County, Oregon" (1978).

New USGS open-file reports released

The following open-file reports that may be of interest to our readers have been released by the U.S. Geological Survey. They are available for inspection at the library of the Oregon Department of Geology and Mineral Industries, on the ninth floor, State Office Building, Portland, or may be purchased for the indicated prices from the Open-File Services Section, Branch of Distribution, U.S. Geological Survey, Box 25425, Federal Center, Denver, Colorado 80225; phone (303) 234-5888.

79-1691 — Seismic studies at the Mt. Hood volcano, northern Cascade Range, Oregon: by S.M. Green, C.S. Weaver, and H.M. Iyer; 40 p.; price — fiche $3.50, paper $5.00.

80-6 — Summaries of technical reports, v. IX — National Earthquake Hazards Reduction Program: by J.F. Evernden; 598 p.; price — fiche $3.50, paper $77.50.

80-51 — U.S. Geological Survey activities in New York, 1979: compiled by A. Finch and P. Gori; 124 p.; price — fiche $3.50, paper $16.75.

80-66 — Research and development program for Outer Continental Shelf oil and gas operations — Technical report, 1979: by J.B. Gregory, compiler; 39 p.; single copies free upon request from: Research Program Manager, USGS, Mail Stop 640, Reston, VA 22092.

80-234 — Reflectance and thermal infrared aircraft scanner images of Newberry caldera, Oregon: by S. Miller, C. Nelms, and K. Watson; 44 over-size sheets; price — fiche $3.50, paper $11.25.

80-453 — Proceedings of Conference XI: Abnormal animal behavior prior to earthquakes, II: by J.F. Evernden, compiler; 242 p.; price — fiche $3.50, paper $31.25.

80-467 — Bibliography of the geology of the Oregon-Washington continental shelf and coastal zone, 1899 to 1978: by G. Luepke, 27 p.; price — fiche $3.50, paper $3.50.

80-471 — Probabilistic estimates of maximum seismic horizontal ground motion on rock in the Pacific Northwest and the adjacent Outer Continental Shelf: by D.M. Perkins, P.C. Thenhas, S.L. Hanson, J.I. Ziony, and S.T. Algermissen; 40 p., 7 oversize sheets; price — fiche $7.00, paper $17.75.

80-490 — Geothermal resources and conflicting concerns in the Alvord Valley, Oregon: by C.E. Wassinger and D.M. Koza; 22 p.; price — fiche $3.50, paper $3.00.

80-521 — Lithologic log of drill cuttings for DOGAMI heat flow hole CR-SB, Mount Hood, Oregon: by K.E. Bargar; 10 p.; price — fiche $3.50, paper $1.25.

80-532 — Preliminary report on the Lakeview uranium area, Lake County, Oregon; by G.W. Walker; 59 p., 2 over-size sheets, scale 1:48,000; price — fiche $4.50, paper $13.00.

80-593 — Mount St. Helens ash fall in the Bull Run watershed, Oregon, May-June 1980: by M.V. Shulters and D.G. Clifton; 11 p.; price — fiche $3.50, paper $1.75.

80-625 — Proceedings of Conference IX: Magnitude of deviatoric stress in the Earth's crust and upper mantle: by J.F. Evernden, convener; 1010 p., in 2 volumes; price — fiche $3.50, paper $131.25.

80-645 — Outer Continental Shelf oil and gas activities in the Pacific (southern California) and their onshore impacts: A summary report, May 1980: by G.S. Macpherson and J. Bernstein; 134 p.; price not yet released.

80-737 — Chemical and isotopic data for water from thermal springs and wells of Oregon: by R.H. Mariner, J.R. Swanson, G.J. Orris, T.S. Presser, and W.C. Evans; 50 p.; price not yet released.

80-740 — Mount St. Helens ash fall in the Bull Run watershed, Oregon, March-April 1980: by M.V. Shulters and D.G. Clifton; 9 p.; price — fiche $3.50, paper $1.00.

80-801 — Proceedings of Conference X: Earthquake hazards along the Wasatch and Sierra-Nevada frontal fault zones: by J.F. Evernden, compiler; 688 p.; price — fiche $3.50, paper $89.25.

80-839 — Geochemical data for rock, stream sediment, and panned concentrate samples, Mount Hood Wilderness Area, Oregon: by T.E.C. Keith, M.H. Beeson, K.E. Bargar, and S.P. Marsh; 12 p., 5 tables, location map, scale 1:62,500; price — fiche $4.00, paper $7.00.

80-842 — Summaries of technical reports, v. X, prepared by participants in National Earthquake Hazards Reduction Program, June 1980: by T.R. Rodriguez, W.H. Seiders, and M.L. Turner, compilers; 643 p.; price — fiche $3.50, paper $84.00.

80-843 — Proceedings of Conference XII: Earthquake prediction information: by P.D. Andriese, compiler; 328 p.; price not yet released.

80-846 — Mineral resources of the Lost Forest Instant Wilderness study area, Oregon: by G.W. Walker and E.L. McHugh; 22 p., 1 over-size sheet, scale 1:62,500; price — fiche $4.00, paper $4.50.

80-877 — Volcanic stratigraphy and alteration mineralogy of drill cuttings from EWEB 3 drill hole, Clackamas County, Oregon: by T.E.C. Keith and J.R. Boden; 16 p.; price — fiche $3.50, paper $2.00.

80-921 — Columbia River basalt: 1978-1979 sample data and chemical analyses: by T.L. Wright, K.N. Black, D.A. Swanson, and T. O'Hearn; 109 p.; price — fiche $3.50, paper $14.00.

80-925 — Preliminary aerial photographic interpretative map showing features related to the May 18, 1980, eruption of Mount St. Helens, Washington: 1 blackline sheet, map scale 1:62,500; price — fiche $.50, paper $3.50.

80-936 — Geophysical studies of the chromite deposits in the Josephine ultramafic complex of northwest California and southwest Oregon: by J.C. Wynn and W.P. Hasbrouck; 48 p.; price — fiche $3.50, paper $6.00.

80-989 — Mineral resource potential of the Pine Creek (RARE II) area, Oregon: by G.W. Walker; 14 p.; price — fiche $3.50; paper $1.25.

80-891 — Volcanic stratigraphy and alteration mineralogy of drill cuttings from EWEB 4 drill hole, Clackamas County, Oregon: by T.E.C. Keith and J.R. Boden; 9 p.; price — fiche $3.50, paper $1.00. □

80-1243 — Geology of the igneous complex at Tincup Peak, Kalmiopsis Wilderness Area, southwestern Oregon: by F. Gray; 72 p., map, scale 1:12,000; price not yet released. □

Oregon's southernmost glacier named for hypothermia expert

On October 2, 1966, Theodore G. Lathrop, Oregon City physician, well-known expert on hypothermia, and author of the book *Hypothermia—Killer of the Unprepared*, looked down from the summit of Mt. Thielsen, which he had just climbed, and spotted a snow field on the precipitous North Face. Noting two horizontal parallel cracks on the snow field, he began to wonder if it might actually be a glacier that had never been reported before. Later investigations proved he was correct, making this glacier, located on Mt. Thielsen 77 mi north of the California border, Oregon's southernmost glacier.

The ice mass is on the north side of the mountain and owes its continuing existence to the fact that it is protected from the sun by the shadow of the mountain and fallen debris from the main spire. Following Lathrop's discovery, small parties, often including Lathrop's nephew Ralph H. Nafziger, visited the glacier nearly every year to measure and observe it, publishing their findings in the papers listed at the end of this article.

Ted Lathrop died May 29, 1979, at the age of 65. On June 21, 1980, at the suggestion of Nafziger, Leonard Delano proposed to the Oregon Board of Geographic Names that the glacier be named after Lathrop. The Board approved the name and forwarded it to the U.S. Geological Survey, who have since confirmed it. Future USGS topographic maps will use the new name of Lathrop Glacier.

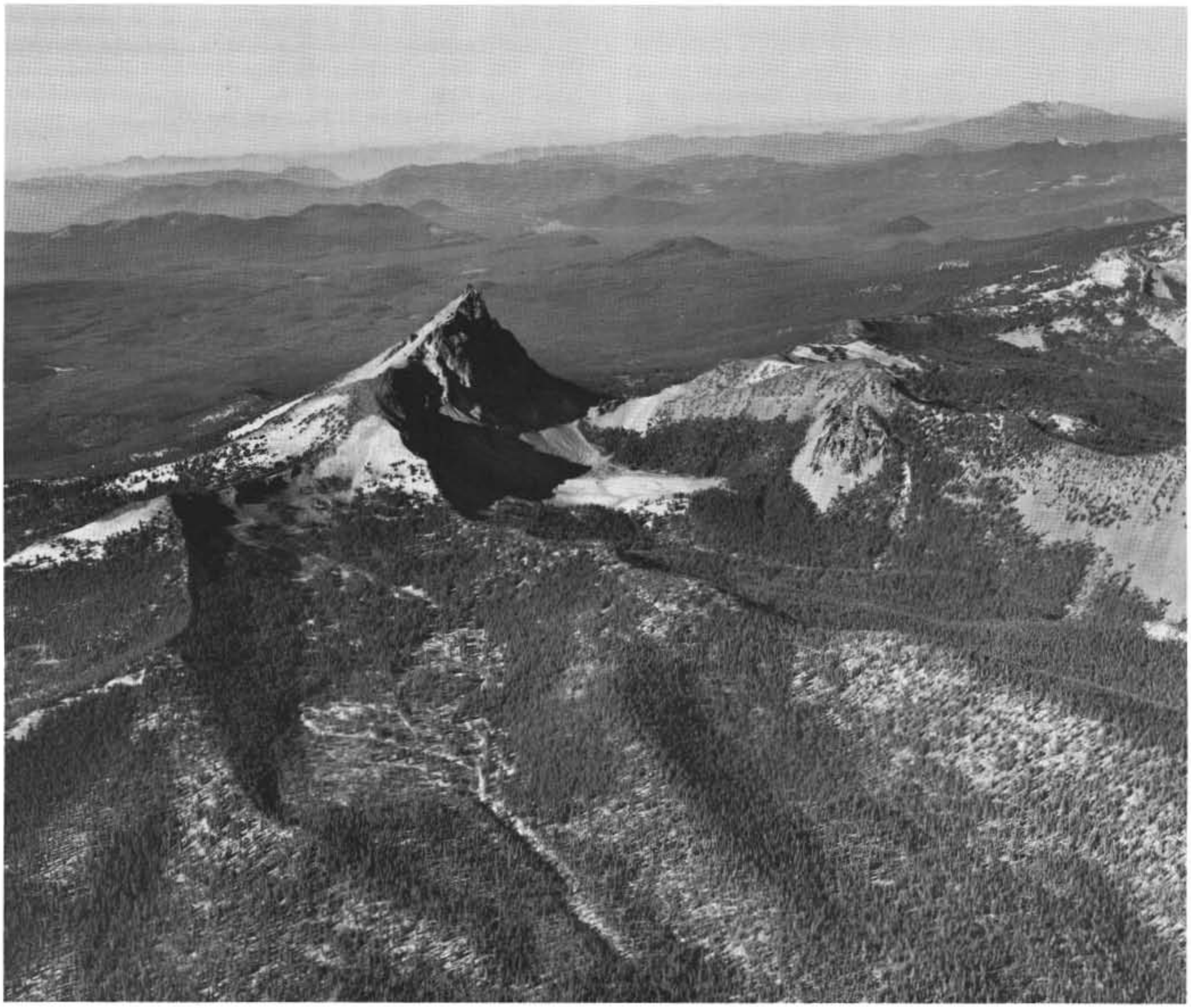
References

Lathrop, T.G., 1968, Return of the Ice Age?: Mazama, v. 50, no. 13, p. 34-36.

Nafziger, R.H., 1971, Oregon's southernmost glacier: a three-year report: Mazama, v. 53, no. 13, p. 30-33.

——— 1974, The geology of Mt. Thielsen: from Pliocene to present: The Geological Newsletter, v. 40, no. 11, p. 73-75. □

Northeast side of Mt. Thielsen, elevation 9,173 ft, which lies on the line between Klamath and Douglas Counties in southern Oregon. Newly named Lathrop Glacier is in the shadows on the extensively glaciated north face of the mountain. (Copyrighted photograph courtesy Delano Photographics, Inc.)



Oil and gas exploration spreading to other parts of state

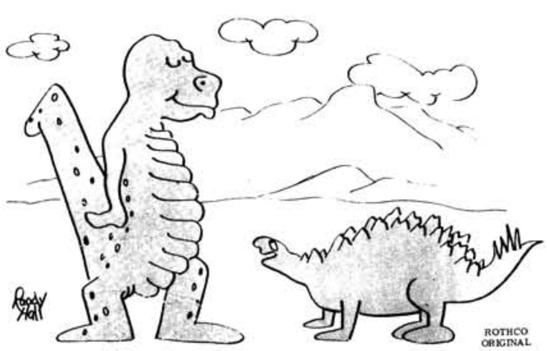
The Oregon Department of Geology and Mineral Industries has issued twelve oil and gas drilling permits since August 1980. Exploration interest has spread from Columbia County and the surrounding area, which accounted for only a third of the recent applications. The Willamette Valley, Lincoln County on the coast, and Crook County in central Oregon were the sites of the remaining applications. The table below lists the recent permits issued.

The March 1981 issue of *Oregon Geology* will contain a summary of the 1980 drilling and production activity.

Table 1. *Oil and gas drilling permits issued since August 1980*

Permit number	Date issued	Company	Lease name	Location
164	9/5/80	American Quasar Petroleum Co.	Investment Management 20-21	NW¼ sec. 20 T. 6 N., R. 4 W. Columbia County
165	9/11/80	American Quasar Petroleum Co.	Wilna, Inc., et al. 6-43	SE¼ sec. 6 T. 6 N., R. 4 W. Columbia County
166	9/22/80	Texaco, Inc.	USL-OR 17-1	NE¼ sec. 17 T. 19 S., R. 20 E. Crook County
167	9/23/80	Ehrens Petroleum and Development Co.	Longview Fibre 1	NE¼ sec. 20 T. 9 S., R. 11 W. Lincoln County
168	9/23/80	Ehrens Petroleum and Development Co.	Longview Fibre 2	NE¼ sec. 28 T. 9 S., R. 11 W. Lincoln County
169	10/15/80	Reichhold Energy Corp.	Columbia County 14-34	SW¼ sec. 34 T. 7 N., R. 5 W. Columbia County
170	10/3/80	Quintana Petroleum Corp.	Watzek et al. 30-1	NW¼ sec. 30 T. 6 N., R. 6 W. Clatsop County
171	11/7/80	John T. Miller	Bork 1	SE¼ sec. 26 T. 8 S., R. 5 W. Polk County
172	11/14/80	American Quasar Petroleum Co.	Hickey 9-12	NW¼ sec. 9 T. 12 S., R. 2 W. Linn County
173	11/14/80	American Quasar Petroleum Co.	Henschel 17-34	SE¼ sec. 17 T. 10 S., R. 3 W. Linn County
174	11/14/80	American Quasar Petroleum Co.	M and P Farms	SW¼ sec. 33 T. 11 S., R. 4 W. Linn County
175	11/18/80	American Quasar Petroleum Co.	Wilna et al. 5-23	SW¼ sec. 5 T. 6 N., R. 4 W. Columbia County

□



"Not the *Tyrannosaurus Rex!"*

Correction

Part of the Tualatin River was in the wrong location in Figure 1, page 4, in the January 1981 issue of *Oregon Geology*. The course of the river should have continued more to the east, entering the Willamette River from north of Petes Mountain. Our thanks to the several eagle-eyed readers who called this error to our attention.

Smithson said, "You know, one pebble moving a foot in two million years is enough action to keep me really excited."

Ewart M. Baldwin retires

A professional comment...

Over 60 alumni, faculty, and friends attended a retirement dinner for Ewart and Margaret Baldwin in Eugene, Oregon, on December 8, 1980. Widely known around the Pacific Northwest for his contributions to Oregon geology, Professor Baldwin retired at the end of 1980 after 33 years at the University of Oregon.

Baldwin received his B.S. and M.S. degrees in geology from Washington State University and his Ph.D. from Cornell. In 1943, he returned to the Pacific Northwest and worked for the next four years with the Oregon Department of Geology and Mineral Industries in Portland, starting first with a study of the geology and coal resources of the Coos Bay area. As he himself said, "When I first came to Oregon to work on the Coos Bay coal formations, I looked in all the mines and mapped the coal beds." That work initiated his interest in the geology of the entire state.

In 1947, Baldwin joined the staff of the University of Oregon and began a long project of mapping the Coast Range, particularly in Coos County. He also began teaching his Geology of Oregon courses, which he later used as a basis for his book, *Geology of Oregon*, now in its third edition.

Several of Ewart's colleagues and friends spoke at the retirement dinner. Gifts presented to him during the evening included a framed stratigraphic column from Wil and Joyce Eaton with each bed bearing a well-known "Baldwinism," a bound volume of letters with tributes from faculty and alumni, and a grandfather clock with a plaque inscribed, "Presented to Ewart Baldwin by faculty, alumni, and friends in appreciation of a career devoted to the Department of Geology and students at the University of Oregon."

Ewart responded warmly and expressed his pleasure at seeing so many old friends who had traveled many miles to be present. He stated that although he plans to keep up his contact with the University and to continue his interest in Oregon geology, he and Margaret also expect to travel extensively, with Europe, China, New Zealand, and Africa high on the list. His immediate move is not so far afield, however, for he will teach for one year at Whitman College in Walla Walla, Washington, as Arnold Professor of Geology.

The evening ended as it had begun, with people circulating informally from group to group around the banquet hall, reminiscing and generally enjoying the opportunity to get together and reflect upon the fruitful career of a well-loved friend and colleague. There was no sadness, for we all felt confident that this was only a milestone in a scholarly career which would extend well into the future.

—Norman F. Savage, Professor of Geology
University of Oregon, Eugene, Oregon

A personal comment...

The soft rocks of Oregon will be able to sleep better at nights now that Ewart Baldwin has retired. All those rocks won't be hammered on with his G-pick, given names and ages, and assigned a color on a map. After 37 years of tramping up every major—and many a minor—watercourse on the west side of the Cascades, after slogging through the brush of the heavily vegetated hillsides that obscure so much of the geology of Oregon's Coast Range, Dr. Baldwin is taking off his field boots. And Professor Baldwin has given his last lecture and posted the final grades for his last classes at the University of Oregon.

Baldwin at his retirement dinner.

During his 33 years at the University of Oregon, Baldwin was famous for his Geology of Oregon classes—and for both his formal and his informal field trips, which he dearly loved to lead. In fact, the lure of a field trip was so strong that he rarely considered the weather. A normal rainy day was rated as "good," and the dry ones were either "salubrious" or "bodacious," the latter term usually referring to a trip replete with flat tires, missed turns, bad roads, downed trees, and low water bridges under high water conditions.

During the summers, Baldwin habitually headed for the Coast Range, where he mapped the poorly exposed geology. Some of the work was in cooperation with the U.S. Geological Survey and some with the Oregon Department of Geology and Mineral Industries. Teaching and turning out numerous maps and publications on the geology of western Oregon was not enough to keep him occupied, and in 1964 he produced the much-needed *Geology of Oregon*, which he continued to revise as new information came along. His latest revision came off the press just as he was giving his final exam at his last class at the U. of O. and will be reviewed in an upcoming issue of *Oregon Geology*.

Professorial sabbaticals come and go, and Ewart Baldwin always went. His lectures have literally been heard around the world, not once but repeatedly, for he and his wife Margaret have gone on several floating campus cruises where he lectured and she served as librarian. Other trips have taken them to most of the far corners of the world, and not surprisingly, the Baldwins have plans for more travel.

Baldwin's ability to dredge up names, dates, and past events has always been a source of wonder to his many friends scattered over the West. He is also well known to both friends and students for his flow of epigrams, snatches of quotations, and bits of poetry which he releases at appropriate moments. He is an outstanding teacher; perhaps the most telling tribute of his impact on his students came from one of them who said that of all his professors Dr. Baldwin was the only one who was willing to share his understanding of a problem with him and to outline exactly how he had arrived at his conclusions.

Indeed, Baldwin's contributions to Oregon's geology have been many. We suspect, too, that after a bit of teaching and traveling, he will be back to do more geologizing—perhaps returning to some as yet unmapped area to awaken a few more of those soft rocks from their long sleep with his hammer.

—Ralph S. Mason, Retired State Geologist
Oregon Department of Geology and Mineral Industries □

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