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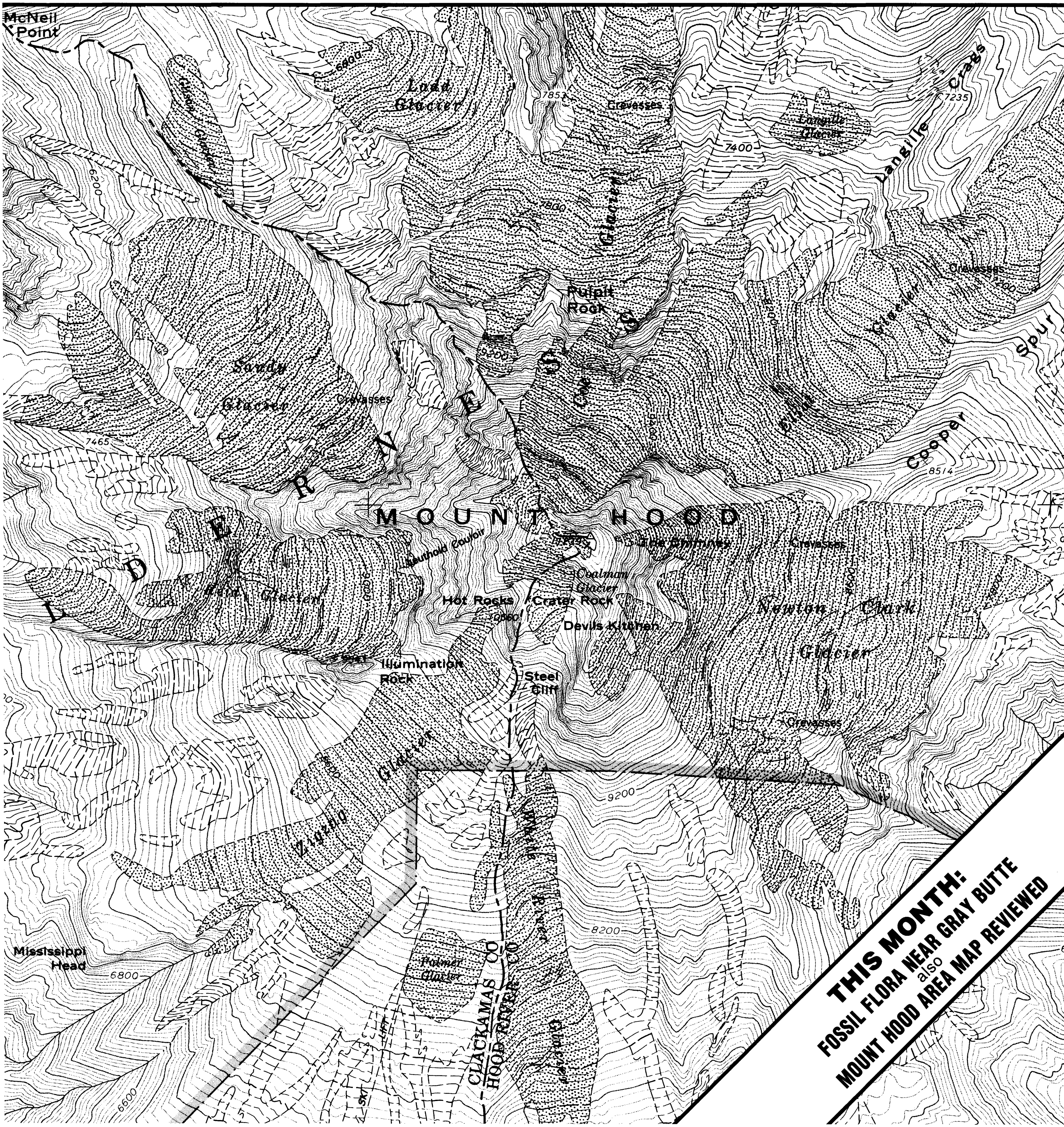

THIS MONTH:
FOSSIL FLORA NEAR GRAY BUTTE
also
MOUNT HOOD AREA MAP REVIEWED

OREGON GEOLOGY
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Information for contributors

Oregon Geology is designed to reach a wide spectrum of readers interested in the geology and mineral industry of Oregon. Manuscript contributions are invited on both technical and general-interest subjects relating to Oregon geology. Two copies of the manuscript should be submitted, typed double-spaced throughout (including references) and on one side of the paper only. Graphic illustrations should be camera-ready; photographs should be black-and-white glossies. All figures should be clearly marked, and all figure captions should be typed together on a separate sheet of paper.

The style to be followed is generally that of U.S. Geological Survey publications (see the USGS manual *Suggestions to Authors,* 6th ed., 1978). The bibliography should be limited to "References Cited." Authors are responsible for the accuracy of the bibliographic references. Names of reviewers should be included in the "Acknowledgments."

Authors will receive 20 complimentary copies of the issue containing their contribution. Manuscripts, news, notices, and meeting announcements should be sent to Beverly F. Vogt, Publications Manager, at the Portland office of DOGAMI.

COVER PHOTO

Central portion of topographic map showing the Mount Hood, Oregon, volcano area, actual size. The map is described in review on page 58.

OIL AND GAS NEWS

NWPA to hold annual symposium

The Northwest Petroleum Association has scheduled its third annual symposium and field trip for May 15-16 in Olympia, Washington. The meeting, to be held at the Olympia Westwater Inn, will feature several speakers from government and industry, and the field trip will include the Centralia Coal Plant, Satsop Nuclear Plant, and stops to see the Lincoln Creek and Astoria Formations. Details are available from Barbara Portwood, (503) 287-2762.

Columbia County to hold lease sale

June 11 is the date set by the Columbia County Board of Commissioners for its next oil and gas lease sale. The sale, to be held in the Old Courthouse, First Street, St. Helens, Oregon, will start at 10 a.m. and will offer 68,000 acres for lease. The lease term is 10 years with a 3/16 royalty. Additional information is available from the Board of Commissioners, (503) 397-4322.

Gas storage project clears dispute

Oregon Natural Gas Development Corporation (ONGD) plans to convert to gas storage two depleted pools in the Mist Gas Field. An agreement has been reached out of court between the company and Columbia County over the County's interest in the Bruer and Flora pools. ONGD will pay Columbia County $550,000 for mineral interests in the proposed storage pools, covering an area of 940 acres and extending to the base of the pools.

The settlement to the county will be shared among the local taxing districts. A specific value was not determined for the remaining gas in place. The operator will now move forward with plans for several injection-withdrawal wells into the pools for possible gas storage in 1987.

MMS hearing on offshore 5-year oil and gas plan

The Mineral Management Service (MMS) has released the Draft Environmental Impact Statement for the Proposed 5-Year Outer Continental Shelf (OCS) Oil and Gas Leasing Program January 1987-December 1991 and held three public hearings in April to receive comments on the draft. At the April 10 hearing in Portland, nine persons testified in favor of leasing the OCS, while four opposed leasing. Various suggestions were made on how to modify the proposed program. Arguments in favor of leasing included meeting energy needs, reducing foreign imports, and supplying jobs, while statements against the leasing schedule centered on damage to the environment, the need for more base-line scientific studies on the OCS, and the low potential for hydrocarbons off Oregon and Washington. The next step in the process is the writing of a Final Environmental Impact Statement in early 1987. □

Roberts, King retire from DOGAMI

Two staff members of the Oregon Department of Geology and Mineral Industries have recently left the Department to enjoy their well-earned retirement: June Roberts, Administrative Assistant, had served the Department for over 45 years. She lives in Portland. William L. King joined the Department in 1981 as Petroleum Geologist to work on the growing task of oil and gas development and regulation. He currently resides in Beaverton. □

Fossil flora near Gray Butte, Jefferson County, Oregon

by Jerome J. McFadden, former Camp Hancock student, 411 S. Morain St., Kennewick, Washington 99336

ABSTRACT

Fossils of the Sumner Spring flora found at Gray Butte in Jefferson County, Oregon, indicate a temperate climate. Although occurring in an area previously mapped as Eocene Clarno Formation (Robinson and Stensland, 1979), the low diversity and species composition of the Sumner Spring floral assemblage suggest closer similarity to the known Oligocene floras of the John Day Formation.

INTRODUCTION

Gray Butte is a prominent feature rising to an elevation of 1,557 m above the Crooked River flood plain in Jefferson County. It is located about 4 mi northeast of Smith Rock State Park and 15 mi south of Madras. Fossil plants have been collected from the surrounding area since the 1930's (Vance, 1936). Collections of Gray Butte fossils are housed at the Oregon Museum of Science and Industry (OMSI) in Portland and the Museum of Paleontology, University of California at Berkeley, as well as in a number of private collections. The source locality of these fossils has not been published or recorded with the museum collections.

Renewed field work in the area has resulted in the discovery of several fossil plant localities on the flanks of Gray Butte and the rediscovery of the original diggings referred to by Vance (1936). Ashwill (1983) published a preliminary account of each of the Gray Butte assemblages and called attention to their varying floral compositions. He recognized three distinct assemblages, which he named the Nichols Spring, Sumner Spring, and Canal floras. This report focuses on the Sumner Spring fossil flora of Gray Butte, in an effort (1) to clarify its floral composition, the age of the flora, and the formation to which it belongs, and (2) to determine the climatic conditions during its deposition.

SUMNER SPRING FLORA

Two main outcrops containing the Sumner Spring flora are discussed in this study. The first, OMSI locality 78, represents the original collection site of A.W. Hancock and R.W. Chaney, which was mentioned by Vance (1936) and rediscovered by M. Ashwill and S. Manchester in 1980. It is situated in NE¼ NE¼ sec. 26, T. 13 S., R. 13 E., Opal City quadrangle. The matrix is gray-green, very hard shale. The strata are covered with top soil except in shallow collection pits. Fossils are not abundant and require much effort to extract.

The second outcrop, OMSI locality 75, is situated half a mile east of locality 78 in SW¼ SE¼ sec. 24 and in adjacent NE¼ NW¼ sec. 25, T. 13 S., R. 13 E., Gray Butte quadrangle. This site was discovered by Ashwill in 1979. Fossils were collected south of the power line on the south-facing slope of a knoll adjacent to Gray Butte. Most of this author's collecting was in the weathered surface shales and slump blocks not exceeding 1 m in diameter. Collections were also taken from a stream-bed exposure at the southern base of the knoll. Collecting, erosion, and slumping have all but obliterated this stream-bed exposure. Although no exposed contacts between the fossiliferous sediments and the overlying and underlying strata were found, the vertical thickness of the fossiliferous sediments appears to be at least 15 m. Matrix from the site ranges from pale yellow to green. Surface shales are highly fractured. Larger blocks are well indurated and sometimes brittle. OMSI locality 75 underlies a basalt flow that caps the knoll.

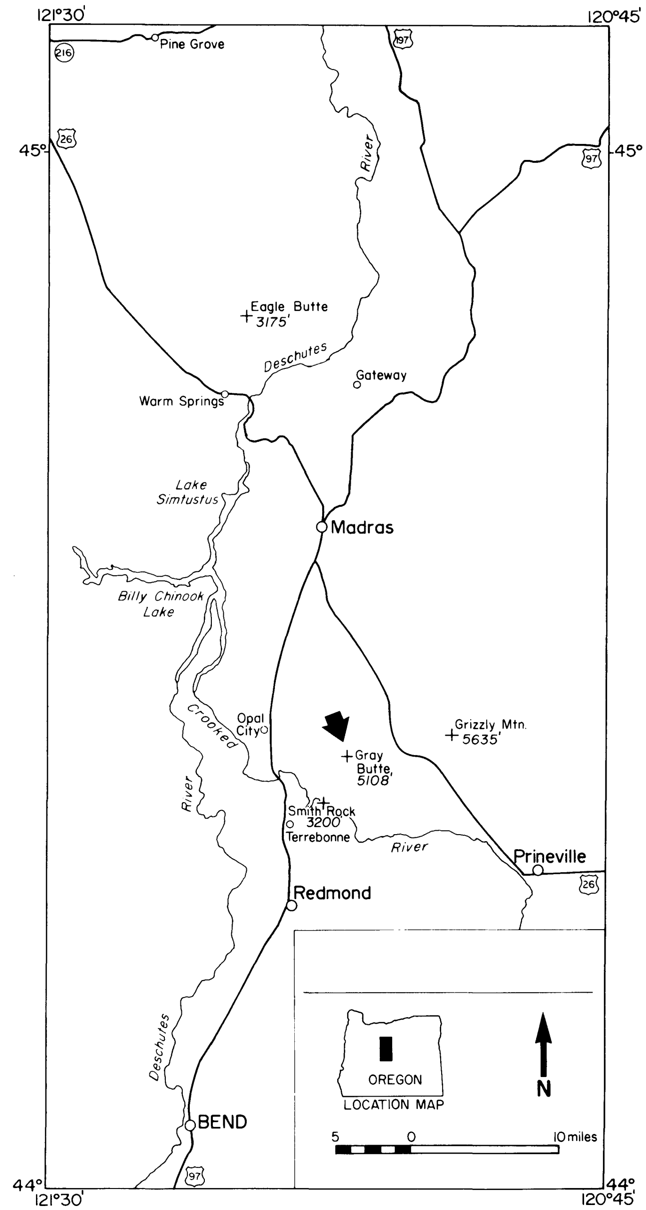

Figure 1. Map showing locality of Gray Butte, Jefferson County, Oregon.

Studies of the fossil flora composition are based on collections made by the OMSI summer paleoecology teams of 1980 and 1981, Melvin Ashwill, and the author. The sum of these collections exceeds 250 specimens. All specimens figured in this paper are housed in the Paleobotanical Collection at Indiana University, Bloomington, Indiana.

GEOLOGY

Gray Butte and its surroundings seem to represent a large block of crust uplifted to the northwest and dipping to the southeast. Williams (1957) interpreted the feature as one slope

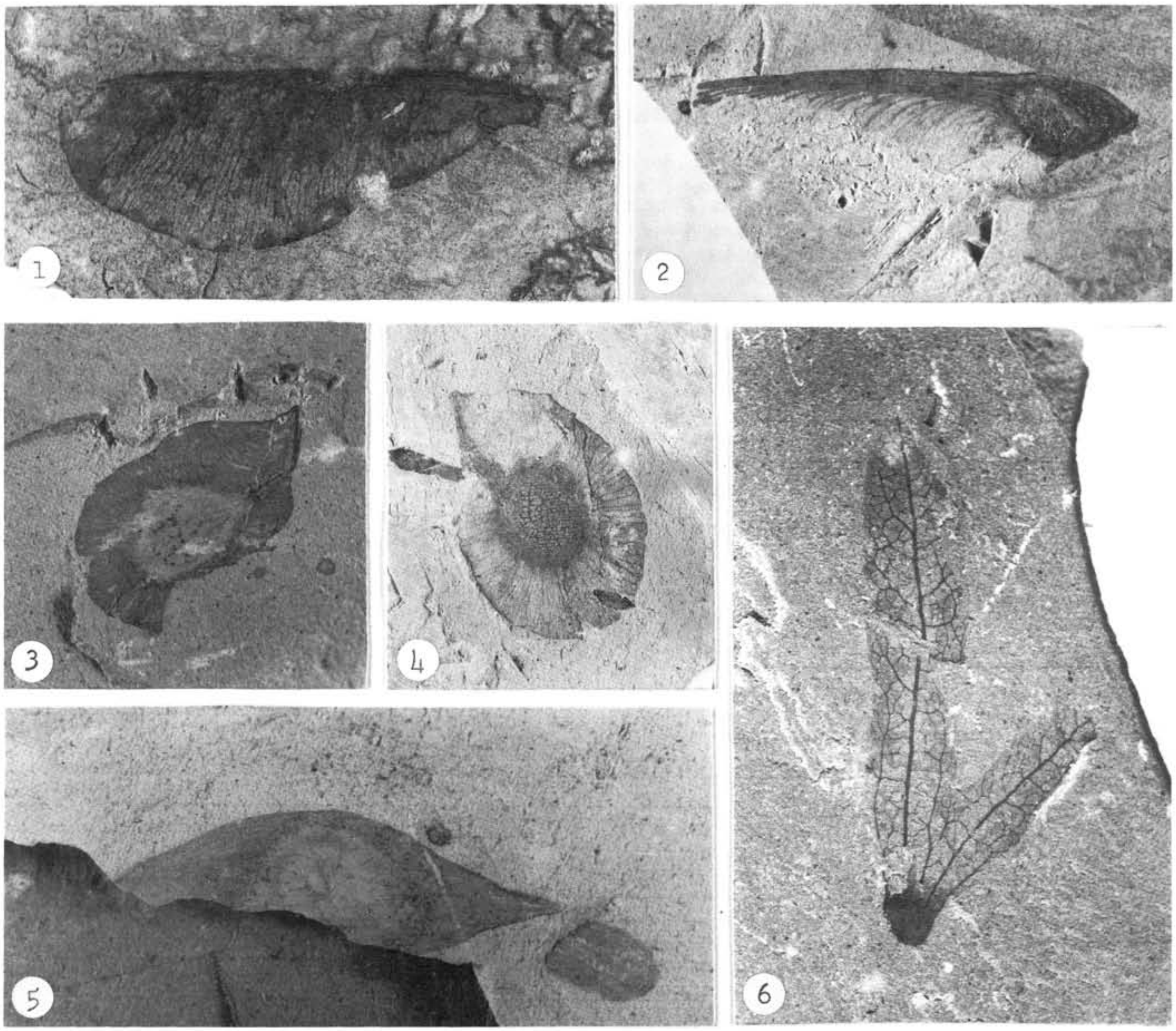

Figure 2. Sumner Spring flora: 1 and 2, winged fruits of Acer *(maple), X2; 3 and 4, winged fruits of* Dipteronia*, X3; 5, winged fruit of* Ailanthus *(tree-of-heaven), X4; 6, winged fruit of* Engelhardia *(walnut family), X4.*

of an anticline trending northeast-southwest and plunging to the southwest. The formations and their strata are exposed in progressively younger sequence from the northwest to the southeast (Robinson and Stensland, 1979), culminating in the Columbia River Basalt Group southeast of Lone Pine Flat and in the Miocene-Pliocene Deschutes Formation (Newcomb, 1970) and Pleistocene lake terraces (Brogan, personal communication, 1970) in the Prineville basin.

The occurrence of marble of possible Paleozoic age (Ashwill, 1979) and the discovery of a Permian fusulinid in a cobble from a dry creek bed at the base of Gray Butte (Thompson and Wheeler, 1942) suggest that the area is more complex tectonically than is suggested by the most recent regional geologic map (Robinson and Stensland, 1979).

The Sumner Spring localities occur in lacustrine shales mapped as Clarno Formation by Robinson and Stensland (1979). Although the Clarno Formation is Eocene throughout most of its extent in north-central Oregon, a whole-rock potassium-argon date of about 31 m.y. (Oligocene) was obtained from basalt attributed to the Clarno Formation on the north side of Gray Butte (unpublished data by P.T. Robinson and E.H. McKee, cited *in* Fiebelkorn and others, 1983, p. 23).

FLORAL COMPOSITION

Introduction

Although more than 250 specimens have been collected, only 11 species have been identified to the genus level. Five additional taxa can be distinguished but remain unidentified. Many specimens still require identification, but most of the floral assemblage appears to be represented in this paper. The fossil remains include leaves and reproductive structures. Most of the fossil fruits and seeds were winged species, which may represent a bias toward deposition of wind-carried debris in the lake environment.

Ten of the species found at Sumner Spring occur in the Nut Beds and/or in the West Branch Creek localities of the Clarno Formation. Nine of the species occur in the Bridge Creek flora or other classical Oligocene floras. Six species of the Sumner Spring

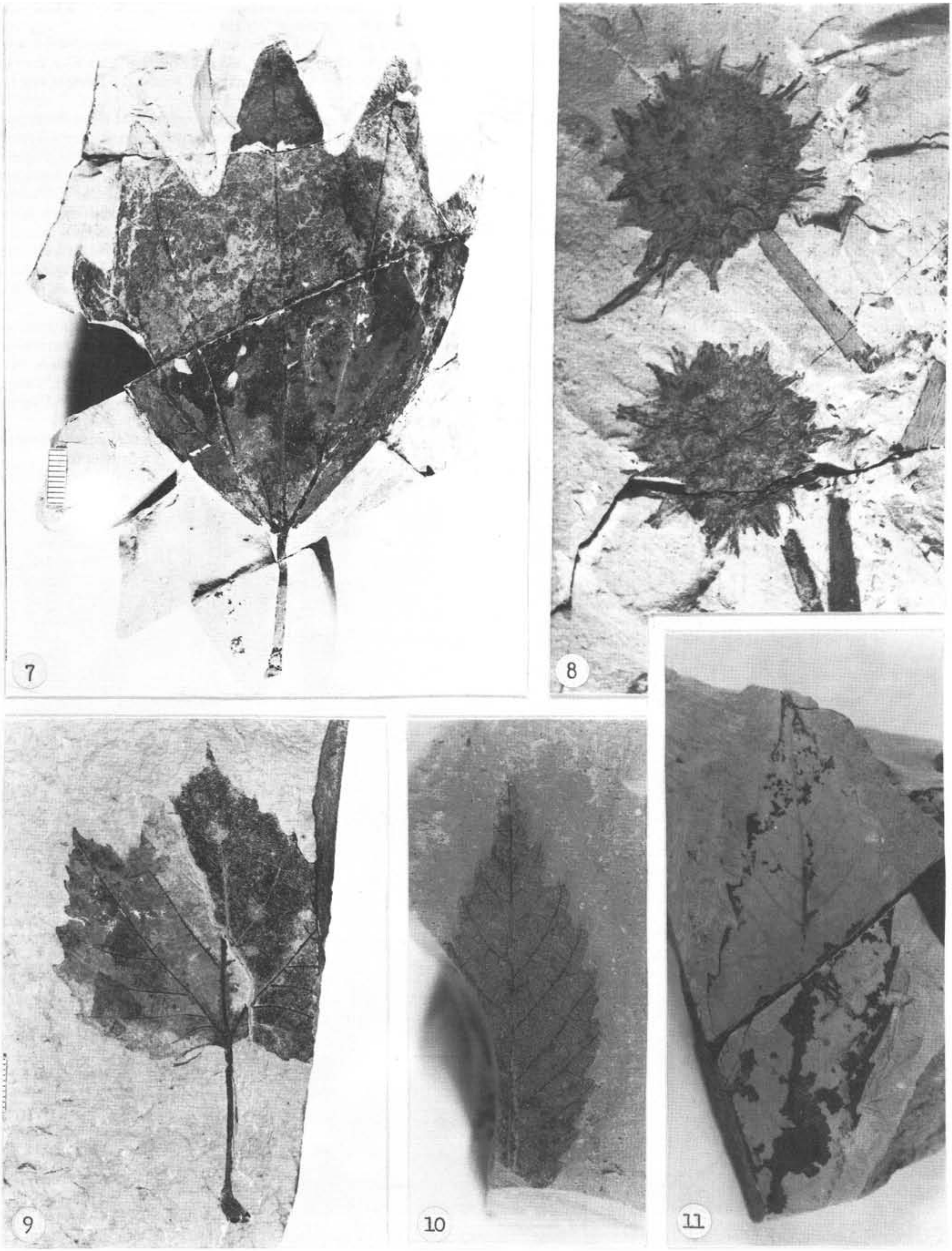

Figure 3. Sumner Spring flora: 7, Platanophyllum whitneyi *leaf, an extinct type of sycamore, X1; 8, fruiting bodies associated with the* Platanophyllum whitneyi *leaves, X3; 9,* Platanus *sp. similar to those of modern sycamore, X1; 10,* Zelkova *sp. (elm family), X3; 11,* Quercus simulata *(oak) X1.*

flora occur in both the Clarno and John Day Formations. A systematic list of floral composition is given in Table 1, and specimens are shown in Figures 2, 3, and 4.

Pteridophyta

A three-dimensional fragment and several compressed stems of *Equisetum* have been recovered by Ashwill from the Sumner Spring flora.

Gymnospermae

Site 75 has yielded seeds resembling *Picea* (Pinaceae) (Figure 4, no. 14) and a cone scale of the genus *Pinus* (Pinaceae) (Figure 4, no. 13). A fossil branch belonging to the family Taxodiaceae was also found there (Figure 4, no. 12).

Angiospermae

In addition to leaves, numerous winged fruits and flowers representing five species have been identified in the fossil flora. Samaras of at least one species of *Acer* (Aceraceae) are present (Figure 2, nos. 1 and 2). Although *Acer* is common in the John Day Formation, it has not been reported in the Clarno Formation. Fruits of the related genus *Dipteronia* (Aceraceae) are present in the flora (Figure 2, nos. 3 and 4). *Dipteronia* has not been previously recorded in the literature from either the John Day or Clarno Formations but has been found recently in sediments of the Clarno Formation at Dry Hollow.

The walnut family (Juglandaceae) is represented by tri-winged fruits of the genus *Engelhardia* (Figure 2, no. 6). It is well represented in both the Clarno and John Day Formations in Oregon.

Most abundant among specimens found at Gray Butte are foliage and associated fruiting heads of *Platanophyllum whitneyi* (Platanaceae), an extinct member of the sycamore family (Figure 3, nos. 7 and 8). Baldwin (1976, Figure 6.10) illustrates an example of a sycamore leaf from OMSI locality 78. The same kinds of leaves and fruits occur in the Eocene Chalk Bluffs flora of California (MacGinitie, 1941), but this is its only known occurrence in Oregon. One leaf fragment of *Platanophyllum angustiloba* possessing several teeth along the margin was collected from OMSI locality 75. Also found were several leaves of *Platanus* sp., or true sycamore (Figure 3, no. 9).

Fossil leaves that have been tentatively identified as *Quercus simulata* Knowlton (Fagaceae), an evergreen oak, occur in shales of the Sumner Spring flora (Figure 3, no. 11). *Q. simulata* occurs in the Miocene Blue Mountain localities of Oregon (Chaney, 1959) but has not been recorded previously in the Clarno Formation.

One winged fruit of the genus *Ailanthus* (Simaroubaceae)

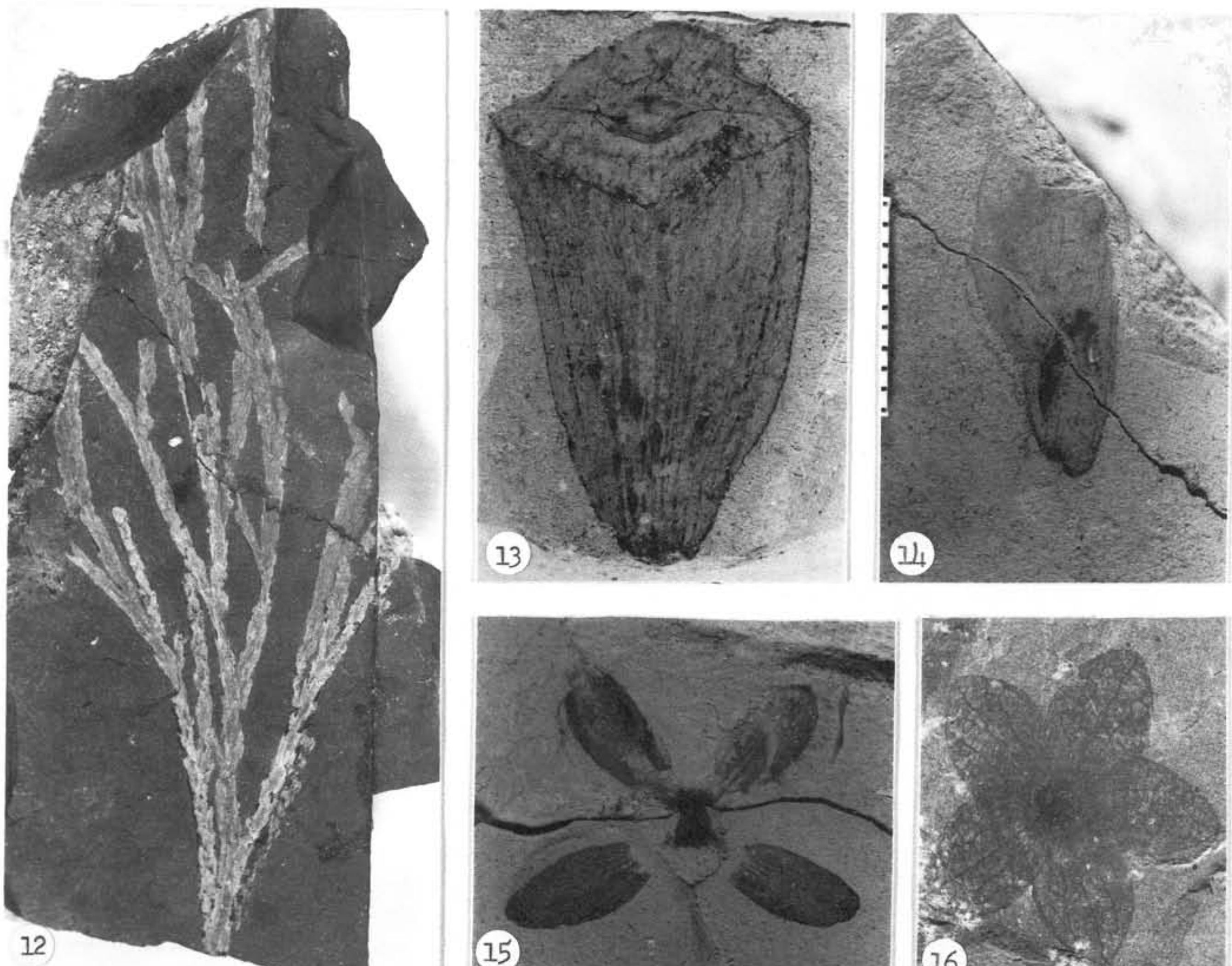

Figure 4. Sumner Spring flora: 12, Taxodiaceous foliage (sequoia family), X2; 13, cone scale of Pinus *(pine), X3; 14, winged seed of* Picea *(spruce), X3; 15, Four-winged* Tetrapteris-*like fruit, X3; 16,* Holmskioldia-*like flower, X2.*

Table 1. *Fossil plants of the Sumner Spring flora and their occurrence in floras of the Clarno and John Day Formations*

Gray Butte taxa	Nut Beds: Eocene Clarno Formation	West Branch Creek: Eocene Clarno Formation	Bridge Creek: Oligocene John Day Formation
Pteridophyta			
Equisetum sp.	X	X	X
Gymnospermae			
Picea sp.	——	——	——
Pinus sp.	——	X	X
Taxodiaceae	X	X	X
Angiospermae			
Acer sp.	——	——	X
Ailanthus sp.	——	X	——
Dipteronia sp.	——	——	——
Engelhardia sp.	X	X	X
Holmskioldia sp.	——	X	X
Platanophyllum angustiloba	X	X	——
Platanophyllum whitneyi	——	——	——
Platanus sp.	——	——	X
Quercus simulata	——	——	X
Tetrapteris sp.	X	X	——
Typha sp.	X	——	——
Zelkova sp.	——	X	X

(tree-of-heaven) has been recovered from OMSI locality 75 (Figure 2, no. 5). *Ailanthus* is found in the Eocene Clarno Formation but not in the younger sediments of the John Day Formation.

A small *Zelkova* (Ulmaceae) leaf has been identified from OMSI locality 75 (Figure 3, no. 10). It is found in both the Clarno and John Day Formations.

Abundant four-winged fruits (Figure 4, no. 15) that have not yet been identified are present in both exposures. Wings radiate from a central nutlet in cruciform orientation. The wings are up to 5 mm wide and 10 mm long and are obovate to spatulate with constricted and decurrent bases and rounded apices. Venation is parallel but flares slightly toward the apex of each wing. These fruits resemble those of *Tetrapteris simsoni* (Malpigiaceae) (Brown, 1940) but are about a third as large and differ somewhat in wing shape from *T. simsoni.* Numerous five-sepaled flowers have been recovered from the Sumner Spring flora (Figure 4, no. 16). These remain unidentified but are similar to those of *Holmskioldia.*

In addition to the dicots discussed above, several portions of monocot lamina resembling *Typha* (Typhaceae) have been found in the fossil flora. Palms have not been recovered.

CONCLUSION

The Sumner Spring flora shows similarities in composition to classical localities of the Clarno and John Day Formations, as represented by the Nut Beds and West Branch Creek and Bridge Creek floras (Table 1). The lack of plants of true tropical nature, such as palms, and the relatively low diversity of the flora seem to indicate a temperate climate. The presence of *Acer* and *Platanus,* which elsewhere are lacking in the Clarno Formation but present in the John Day Formation, suggests that the Sumner Spring flora is younger than the Nut Beds and other typical Clarno localities. Although the Sumner Spring localities are mapped as Clarno Formation (Robinson and Stensland, 1979), these floral considerations suggest that the Sumner Spring localities are younger than typical Clarno flora and perhaps closer in age to floras known from the lower part of the John Day Formation. Possibly the Sumner Spring flora is Oligocene in age.

ACKNOWLEDGMENTS

Many thanks are due to Melvin S. Ashwill, Madras, Oregon, for assistance with the geology of the area and in collection and donation of fossil specimens; Steven R. Manchester, Department of Geology, Indiana University, Bloomington, Indiana, for help and advice; OMSI summer paleoecology teams of 1980 and 1981 for collections; and Mr. and Mrs. Hugh J. McFadden, Kennewick, Washington, for monetary support.

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(Continued on page 58, ***Fossil flora)***

ABSTRACTS

The Department maintains a collection of theses and dissertations on Oregon geology. From time to time, we print abstracts of new acquisitions that we feel are of general interest to our readers.

THE UNITY RESERVOIR RHYODACITE TUFF-BRECCIA AND ASSOCIATED VOLCANIC ROCKS, BAKER COUNTY, OREGON, by John W. Reef (M.S., Washington State University, 1983)

Previous work concerning the volcanic breccia at Unity Reservoir has been restricted to brief and varied descriptions of the unit. It was believed that the breccia was similar to and continuous with the widespread volcaniclastics to the north (Clarno conglomerate). Prior to this study an origin for the breccia had not been presented.

This investigation has shown that the Unity Reservoir tuff-breccia forms a distinct lithologic unit within the Unity, Unity Reservoir, and Hereford quadrangles. It is locally overlain by a rhyodacite flow, and a small exposure of an upper breccia locally overlies the flow. Both breccias consist of a homogeneous assemblage of volcaniclastic debris of rhyodacitic composition in which angular to subangular blocks make up approximately 35 percent of the unit. The blocks in the main breccia have phenocrysts of plagioclase, basaltic hornblende, orthopyroxene, and clinopyroxene in a hyalopilitic groundmass of plagioclase, magnetite, and glass. The upper breccia has phenocrysts of plagioclase, quartz, orthopyroxene, clinopyroxene, and biotite. The matrix of both breccias consists of angular to subrounded lapilli and ash-sized fragments similar in composition to the blocks. Poor fossil evidence suggests an Eocene age for the breccia.

The breccia is greater than 300 m thick. Throughout most of the unit, the blocks and matrix are randomly distributed, but near the top of the unit, variations in the proportions of blocks to matrix impart a crude stratification to the deposit. The homogeneity; poorly developed stratification; angularity of the blocks and matrix; and the absence of pumice, glass shards, brecciated dikes or vent structures, lateral grading, gravity sorting, or features indicating emplacement at high temperatures indicates that the breccia is of laharic origin.

The Clarno conglomerate, found north of the study area, is separated from the breccia by a younger rhyolite flow that prevents direct correlation. The Clarno conglomerate, however, consists of blocks of dacite, basalt, andesite, and rhyolite and is clearly different from the homogeneous rhyodacites of the Unity Reservoir tuff breccia.

Dooley Rhyolite is reported to overlie the rhyodacites of the study area, but it has not been previously described. It has been found during this investigation to consist of three distinct ignimbrite flow units. Each unit is welded and believed to represent an incomplete section of a layer-2 deposit. Analyses show that each ignimbrite unit can be distinguished from the others on the basis of petrographic and chemical characteristics.

THE QUEEN OF BRONZE COPPER DEPOSIT, SOUTHWESTERN OREGON: AN EXAMPLE OF SUB-SEA MASSIVE SULFIDE MINERALIZATION, by Mark Randall Sorensen (M.S., University of Oregon, 1983)

The Queen of Bronze is a copper-rich massive sulfide deposit located in the western Paleozoic and Triassic belt of the Klamath Mountains. Field and petrochemical evidence is consistent with formation of the igneous host rocks in an oceanic setting, perhaps a back-arc basin. There are two types of hydrothermal alteration: (1) ore-related envelope alteration; and (2) hydrothermal metamorphism, which occurred after envelope alteration. The strong enrichment of altered rocks in FeO and depletion in SiO_2, as well as locally abundant cobaltite in the ores, suggest that mineralization proceeded at high temperatures (near 400°) and low pressures. Ore from the mine differs from typical massive sulfide ores in having abundant, early euhedral quartz. The bulk of the geologic evidence implies that mineralization occurred due to cooling of hydrothermal solutions in large open spaces, probably fissures, in the sub-sea floor.

THE "TOPS" OF PORPHYRY COPPER DEPOSITS — MINERALIZATION AND PLUTONISM IN THE WESTERN CASCADES, OREGON, by Sara G. Power (Ph.D, Oregon State University, 1984)

The mining districts of the Western Cascades and their associated epizonal plutons and locally extensive zones of hydrothermally altered rocks are roughly parallel to the northerly trend of the Quaternary High Cascades. The volcanic rocks range in age from Oligocene (Washougal and Bohemia districts) to mid-Miocene (North Santiam, Detroit Dam, Quartzville, and Blue River districts). These volcanic rocks are intruded by numerous plutons of intermediate composition. Both plutonic and volcanic rocks have calc-alkaline affinities, and the chemical composition of the intrusions resembles that of plutons from island-arc terrains. Ages of plutons in the Washougal (20 m.y.), North Santiam (13 m.y.), Blue River (13 m.y.), and Bohemia (22 m.y.) districts are consistent with the geology of these areas. Ages of hydrothermal alteration in the Washougal (19 m.y.) and North Santiam (11 m.y.) districts suggest a direct genetic relationship between mineralization and spatially associated plutons of granodiorite and quartz diorite porphyries and porphyritic granodiorite, respectively.

Hydrothermal alteration of plutonic and volcanic host rocks in and adjacent to the mining districts of the Western Cascades is dominated by the propylitic assemblage. Argillic and phyllic assemblages are more local and are controlled by structure, especially near the base and precious-metal-bearing vein deposits. Potassic alteration is associated with porphyry-type mineralization in the Washougal and North Santiam districts and with a one-sample Cu-Mo anomaly in the Bohemia district. Vein-type mineralization is largely defined by subequal amounts of Cu and Zn together with lesser quantities of Pb, whereas that of the porphyry-type is dominated by Cu.

Sulfur isotope compositions of the sulfide minerals range from 5.1 to 5.0 permil and average about 1.7 permil. This relatively narrow range of $\delta^{34}S$ values near 0 permil is consistent with a magmatic derivation for the sulfur. Isotopic temperature estimates indicate sulfide deposition in veins at 200° to 500° C and up to 675° C in porphyry-type environments. Homogenization temperatures and salinities of fluid inclusions in vein quartz range from 167° to 319° C and from 0 to 18 wt percent NaCl, respectively. In contrast, those of halite-bearing inclusions associated with breccia pipes and potassically altered plutons exceed 386° C and 30 wt percent NaCl. The depth of cover at the time of mineralization is estimated to range from 740 m in the North Santiam district to 1,800 m in the Washougal district.

Geologic and geochemical evidence collectively suggest that porphyry-type copper and molybdenum mineralization may underlie many if not all mining districts of the Western Cascades. □

GRC announces meetings

Annual Meeting: The Geothermal Resources Council (GRC) will hold its 1986 Annual Meeting September 29 to October 1 at the Americana Canyon Hotel in Palm Springs, California. The meeting is intended to provide a forum for exchange of new and significant information on all aspects of the exploration, development, and use of geothermal resources.

The meeting's program will offer presentations at oral and poster sessions, field trips, and special events. Announcement of the program will be made at a later date. The deadline for papers for the meeting and subsequent publication in the GRC *Transactions* is April 25, 1986.

In conjunction with the meeting, the GRC will hold its 10th annual photography contest to recognize artistic ability in photographing geothermal development and to augment the GRC photo library. Winning entries will be displayed at the meeting. Entries for the contest must be received in the GRC office by August 15, 1986.

Direct-use workshop at OIT: A topical workshop on the direct (nonelectrical) uses of geothermal energy has been announced by its sponsors, the Geothermal Resources Council (GRC), the Geo-Heat Center of the Oregon Institute of Technology (OIT), and the Pacific Northwest Section of the GRC. The workshop will be held May 20-22, 1986, in the Mount Shasta Complex of the geothermally heated OIT campus at Klamath Falls.

The workshop will include approximately 40 short presentations, a panel, and a round-table discussion, all concerning direct-use development, applications, and equipment. A display/exhibit area for interested manufacturers, suppliers, institutions, or agencies will be set up near the meeting room. There will also be a field trip to tour various geothermal sites to inspect direct-use equipment and applications.

The comprehensive fee for the course is $150; stuents may attend for a fee of $5 per day. Optional college credit for the workshop is offered for an addition al fee of $58.

For more information and registration contact the GRC, P.O. Box 1350, 111 G Street, Suite 29, Davis, CA 95617-1350, phone (916) 758-2360. □

USGS employees receive service awards at Western Region convocation

Department of Interior service awards for outstanding achievement in their respective fields were presented to U.S. Geological Survey (USGS) employees on the staff of the Survey's Western Region headquarters at a recent convocation in Menlo Park, California. Two of the awards will be of particular interest to *Oregon Geology* readers.

William Porter Irwin, USGS geologist from Menlo Park, California, received a meritorious service award for his achievements as a geologic mapper and as an innovator of new scientific concepts. His geological studies, initially on the northern California Coast Ranges and later in the Klamath Mountains, are credited with being instrumental in developing concepts leading to important interpretations of oceanic plate movement and tectonic analysis. In the words of the citation, "he was the first to understand that the Klamath Mountains are made up of a series of thrust sheets, each composed of different materials that record highly varying geologic histories. The separate entities were designated 'terranes' and were recognized to be the fundamental building blocks out of which the continental crust of the Klamath Mountains was assembled."

A 40-year length of service award was given to geologist George Walker of Los Altos, California, identified to his geologic colleagues as "Mr. Oregon Geologist." Walker, who holds A.B. and M.S. degrees from Stanford University, was commended for his mapping and studies of the geology of Oregon "on all scales and from many angles."

USGS Associate Director Doyle Frederick of the National Center, Reston, Virginia, presented the awards and gave the principal address. George Gryc, Western Region director's representative, presided at the ceremonies.

— *USGS press release*

First reports commissioned by Gorda Ridge Task Force released

Four open-file reports reviewing existing biological data on the Gorda Ridge and vicinity off the coast of southern Oregon and northern California have been prepared by the Oregon State University (OSU) College of Oceanography and released by the Oregon Department of Geology and Mineral Industries (DOGAMI). The reports all have the general title, *A Summary of the State of Scientific Information Relating to the Biology and Ecology of the Gorda Ridge Study Area, Northeast Pacific Ocean.* Open-File Report 0-86-6 reviews literature on benthos, 0-86-7 on nekton, 0-86-8 on plankton, and 0-86-9 on seabirds.

The reports are the first results of a series of studies commissioned by the joint Federal-State Gorda Ridge Technical Task Force during March 1985. The Task Force was formed in February 1984 and is charged with conducting a technical analysis of the economic and environmental implications of leasing the Gorda Ridge for the mining of polymetallic sulfide minerals. Funding was provided by the U.S. Minerals Management Service. The reports are intended for use in identifying appropriate research to support decision making for possible development on the outer continental shelf.

Open-File Report 0-86-6, *Benthos,* was written by Michael A. Boudrias and Gary L. Taghon. The 58-page report summarizes the available literature on all bottom-dwelling organisms in the study area and includes a section on the species found surrounding hydrothermal vents elsewhere in the Pacific.

Open-File Report 0-86-7, *Nekton,* was written by James T. Harvey and David L. Stein. It is 131 pages long and summarizes available knowledge on shrimps, cephalopods, fishes, and marine mammals in the study area. Biological data, including abundance, distribution, reproduction, growth, migration, food habits, and commercial exploitation, are summarized for each species for which there is information.

Open-File Report 0-86-8, *Plankton,* was written by Steven G. Ellis and Jonathan H. Garber. This 47-page document summarizes phytoplankton and zooplankton abundance and distribution and discusses the feeding ecology of major zooplanktonic groups in the study area.

Open-File Report 0-86-9, *Seabirds,* is 27 pages long and was written by Lynn D. Krasnow. It discusses seabird densities and movements at sea, colony sites, population estimates, feeding habits, growth, and behavior and contains a list of species of seabirds known or thought to exist in the Gorda Ridge study area.

The reports are now available for sale at the Oregon Department of Geology and Mineral Industries, 910 State Office Building, 1400 SW Fifth Avenue, Portland, OR 97201-5538. Purchase prices of the reports are as follows: 0-86-6 (*Benthos*), $5; 0-86-7 (*Nekton*), $7; 0-86-8 (*Plankton*), $5; and 0-86-9 (*Seabirds*), $4. Orders under $50 require prepayment. □

DOGAMI hires industrial minerals geologist

Ronald P. Geitgey has joined the staff of the Oregon Department of Geology and Mineral Industries (DOGAMI) as industrial minerals geologist. He is a graduate of the College of Wooster in Wooster, Ohio, and the University of Virginia at Charlottesville and has done additional graduate work at the University of New Mexico at Albuquerque. Geitgey was employed as geologist by Leonard Resources, Albuquerque, New Mexico, and as senior geologist for industrial minerals exploration by Duval Corporation, Tucson, Arizona.

Ronald P. Geitgey

During his career, Geitgey has directed exploration and drilling operations in borates, coal, oil and gas, potash, sulfur, uranium, and zeolites, with additional experience in exploration and evaluation of cement rock, clays, diatomite, geothermal resources, magnesite, perlite, phosphate, sodium sulfate, and trona. He has worked with numerous analytical techniques and has had experience in establishing and coordinating industrial minerals analytical programs.

His responsibilities with DOGAMI will be to conduct geologic investigations of nonmetallic mineral deposits of probable economic potential and to serve as the Department's information source on nonmetallic mineral resources and markets. He is currently involved in an evaluation of bentonite in Oregon, a part of the Department's new program to define markets and to evaluate the industrial mineral resources of the state. □

New USGS topo maps of Mount Hood area have many features

Two multicolored topographic maps of the Mount Hood, Oregon, volcanic area, printed back-to-back on the same sheet and containing a wide variety of topographic, hydrologic, and geographic information, have been recently published by the U.S. Geological Survey (USGS).

One side of the Mount Hood-area sheet contains a map printed at a scale of 1:24,000 (1 in. on the map represents about 2,000 ft on the ground) and depicts about 235 sq mi of land surface in Oregon. The other side has a map printed at a scale of 1:100,000 (1 in. represents about 1.6 mi) and shows a much larger area of about 4,550 sq mi of Oregon and Washington.

The Mount Hood maps, which were prepared cooperatively by the USGS National Mapping Division and the USGS Water Resources Division, are printed on both sides of a 30- by 60-in. sheet. The 1:24,000-scale map can be used by land-use planners, administrators, government and industry, and also by hikers, campers, and other outdoor enthusiasts as a detailed guide to areas on and immediately around Mount Hood, including the Mount Hood Wilderness. Trails and campgrounds are depicted, along with streams, lakes, snowfields, glaciers, roads, and cultural features. Contours and elevations are shown in feet.

For the first time on a USGS map, the 1:24,000-scale map portrays and tabulates the volumes of ice locked in the glaciers and permanent snowfields on Mount Hood. The USGS Water Resources Division tabulated the ice volumes by individual basins in order to analyze potential mudflow and flood hazards during possible volcanic eruptions of Mount Hood.

USGS hydrolologists estimated that about 12.2 billion cu ft of ice is on Mount Hood in glaciers and permanent snowfields. That is equal to more than half the water normally in Lake Bonneville on the Columbia River. The total includes 8.6 billion cu ft for the Hood River basin, 1.7 billion cu ft for the Sandy River, 1.4 billion cu ft for the Zigzag River, and 500 million cu ft for the White River.

The three major rivers in the Mount Hood region — the Columbia, Deschutes, and Sandy, generally mark the boundaries of the 1:100,000-scale map. The area's two major public-supply surface-water reserves — the Bull Run for Portland and the Dalles for the city of The Dalles — are outlined.

The 1:100,000-scale map includes areas likely to be affected by mudflows, flooding, and other volcanic hazards. It also provides information on federal lands, including the Mount Hood National Forest, and indicates areas of responsibility for land management by federal and state agencies. In addition, it shows contours and elevations of peaks and other places in meters.

As an aid to forest visitors, both sides of the map use the U.S. Forest Service road-numbering system. Roads are designated as primary or secondary roads or trails.

The "Mount Hood and Vicinity" map sheet is available in a folded edition either by mail or over the counter for $6 from the Portland office of the Oregon Department of Geology and Mineral Industries. It is also available from usual USGS and commercial outlets. □

***(Fossil flora,** continued from page 55)*

U.S. Geological Survey Miscellaneous Geologic Investigations Map I-587.

Robinson, P.T., and Stensland, D.H., 1979, Geologic map of the Smith Rock area, Jefferson, Deschutes, and Crook Counties, Oregon: U.S. Geological Survey Miscellaneous Investigations Series Map I-1142.

Thompson, M.L., and Wheeler, H.D., 1942, Permian fusulinids from British Columbia, Washington, Oregon, and Idaho: Journal of Paleontology, v. 16, p. 700-711.

Tidwell, W.D., 1975, Common fossil plants of western North America: Provo, Utah, Brigham Young University Press, 197 p.

Vance, A.D., 1936, With Dr. Chaney in eastern Oregon: Geological Society of the Oregon Country, Geological Newsletter, v. 2, no. 16, p. 2-4.

Williams, H., 1957, A geologic map of the Bend quadrangle and a reconnaissance geologic map of the central portion of the High Cascade Mountains: Oregon Department of Geology and Mineral Industries Quadrangle Map. □

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